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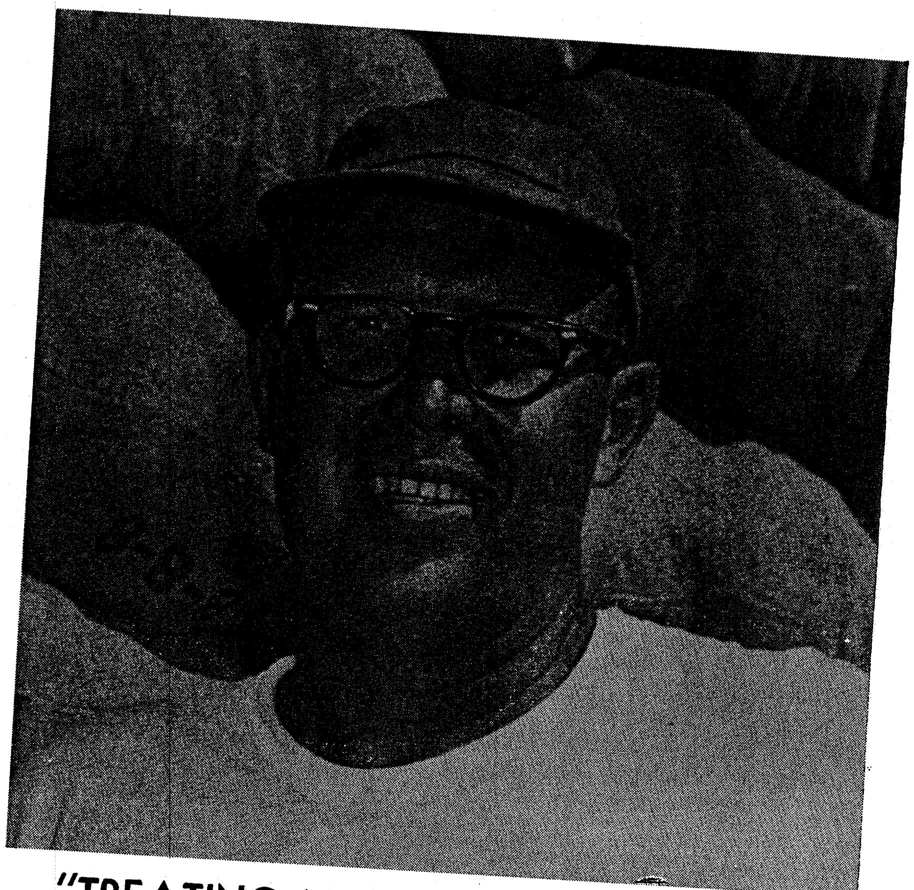

PRODUCTION OF QUALITY POTATOES FOR FRESH MARKET

HUGH J. MURPHY AND PAUL N. MOSHER[1]

A good quality potato for fresh market consumption must be of desirable size for intended market outlet, and have an external appearance that is eye-appealing to the prospective consumer. In addition a good quality potato must have acceptable internal characteristics such as mealiness, nutritiousness, absence of after-cooking darkening discolorations, and above all the *flavor* that is distinctive of the potato.

Good quality in potatoes has always been important, but in recent years people have become quality conscious thereby creating a demand for good quality potatoes. As processed potato products become more available the fresh potato will probably have to be of better quality to meet the requirements of the quality conscious housewife.

Potatoes are grown under a wide range of soil, climatic, and cultural conditions. Best quality potatoes, however, can be produced only in those areas where growing conditions are most favorable.

Even in these areas certain factors of production should be recognized by the potato grower as the necessary components to produce a good quality potato. Some of these factors are beyond grower control such as temperature, day length, and perhaps moisture. Other production factors over which the grower has some influence must therefore be used prudently in the production of good quality potatoes.

CLIMATIC FACTORS NECESSARY FOR PRODUCTION OF QUALITY

Temperature

In general the best quality potatoes can be produced in areas where the mean temperature during the growing season does not exceed 70° F. Frequent periods of high day and night temperatures can be very adverse to the ultimate goal of good quality and high yields per acre.

Moisture

Coupled with cool temperatures it is necessary to have at least 16 acre inches of natural rainfall or its equivalent as irrigation distributed throughout the growing season. Lack of sufficient moisture usually results in poor external and internal quality. Distribution of moisture is probably more important than the total amount since excessive amounts at either end of the growing season can be harmful to yield or quality.

Day Length and Light Intensity

Potato growing areas that have long days for plant development, followed by shorter days for tuber development and maturity produce the highest yields and best quality potatoes.

SOILS AND THEIR MANAGEMENT

In general soils of the loam, sandy loam, and gravelly loam textures with adequate organic residues are satisfactory for production of good quality potatoes if they also have satisfactory depth and good internal drainage. Heavy textured soils should be avoided since they lack good physical condition and may harbour disease producing organisms. In choosing a potato soil one must remember that as potato tubers enlarge a large volume-displacement of soil takes place and many respiratory by-products must be exchanged to the atmosphere. If the potato soil is not friable and porous the tubers will probably

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be mis-shapen, unattractive in external appearance, and of poor quality.

Management of soils for potatoes for all practical purposes consists of the maintenance of good structure by frequent additions of organic matter and adjustment of soil reaction (pH) and fertility to desirable levels.

CULTURAL PRACTICES FOR PRODUCING QUALITY POTATOES

Crop Rotations

No general recommendations can be made about the best crops to grow in rotation with potatoes as these combinations are subject to great variation. In general rotations allow for frequent additions of organic matter as green manure, crop residues, or cover crops all of which have a very beneficial effect on potato yield and quality by improving the physical condition of the soils used.

A satisfactory rotation will improve tuber appearance in terms of skin brightness and tuber shape, and eliminate many internal and external defects attributed to soil borne diseases.

In general either legumes or non-legumes are satisfactory crops for inclusion in the potato rotation. The ultimate choice is dependent on adaptation and economics of crop to be grown and particularly upon the quantity and quality of dry matter produced for plowing under.

Seedbed Preparation

Seedbed preparation varies to some extent dependent on the equipment available and other crops grown in rotation with potatoes. As a rule seedbed preparation for potatoes consists of plowing or deep tillage to loosen the soil followed by pulverizing and smoothing enough to accommodate the planting, fertilization, and other equipment where some penetration occurs.

In general the more porous and friable the seedbed the deeper the seedpieces can be placed, indirectly reducing sunburn of tubers by encouraging tubers to set at a lower level in the soil.

Also a more friable seedbed provides for more readily available soil to build the row or hill later in the season, thus reducing sunburn and improving the external appearance of tubers.

Variety to Plant

Choice of variety is primarily a matter of which variety will produce the highest yield of good quality potatoes within a restricted climatic area. It is also necessary in most areas for each grower to plant more than one variety in order to extend the planting and harvesting season. In areas where the average growing season is short, varieties are usually limited to those which will mature prior to harvesting and keep well in storage.

Seedpiece Size and Handling

In general seed sets that weigh 1½ to 2 ounces are most satisfactory. This applies to whole or cut seed, regardless of production area. Smaller seedpieces are sometimes used, but under adverse weather conditions the larger seedpieces will insure a more uniform stand of plants and subsequently better yield and quality.

Whole seed is preferred where seedpiece decay is a problem but if cut seed is properly suberized seedpiece decay will usually be at a minimum.

Most seed potatoes are cut by hand but mechanical seed cutters are becoming more widely used. Regardless of method, it is good practice to use uniformly sized, blocky seedpieces, that have from one to three eyes per seedpiece.

Post-cutting handling of seed consists of seed treatment in some cases, followed by immediate planting or storage under conditions ideal for suberization of freshly cut surfaces to reduce spoilage.

Seed treatment with antibiotics and fungicides to discourage soil-borne diseases such as scab, rhizoctonia, and fusarium rots may be helpful under adverse conditions at planting time. However, in northern climates the value of such seed treatments is questionable. In Maine there have been occasions where seed treatment deterred suberization thus resulting in seedpiece spoilage by soft rot and fusarium organisms.

Row and Seedpiece Spacing

Row spacing of potatoes grown for fresh market varies in the United States from 30 inches to 40 inches with 34-36 inches probably the most usual. Distance between rows is dictated primarily by row spacing necessary for other row crops grown in rotation with potatoes and for convenience in use of mechanized equipment used in field production.

Seedpiece spacing depends on variety grown, size of tubers desired, and type of seed used. Varieties that genetically set a large number of tubers should be spaced further apart than varieties which set fewer tubers per hill. Where whole seed is used, seedpiece spacing should be wider because of the tendency to get more stems or plants per hill than with cut seed. To some extent tuber size can be kept within certain limits by seedpiece spacing. If oversize is a problem in certain areas or the grower requires a higher percentage of small size tubers, closer seedpiece spacing will help to attain that goal.

In general for fresh market potatoes, seedpieces of round white varieties are spaced 8 to 10 inches apart while a few varieties need 12 inch spacing. Long type varieties require 14 to 18 inch spacing unless being grown for seed purposes.

Time of Planting

Time of planting in any area depends primarily on prevailing climatic conditions. In an area like Maine, the growing season is relatively short, therefore planting as early as the land can be prepared is very necessary in order to harvest a mature crop. In climates where moisture and temperature are critical factors, planting is timed in order to avoid or minimize exposure of growing crop to protracted periods of heat and drought. In either extreme mentioned it is customary to select a planting date that will provide the most favorable climatic conditions during the period of tuber development.

Depth of Planting

No specific depth of planting will give equally good results under all conditions. For varieties that develop tuber-bearing stolons rather high on the stalk, the practice of planting seedpieces 2 to 3 inches below ground level is encouraged. Planting deep, shallow covering at planting, and building the hill or ridge properly will reduce sunburn and thus improve quality and marketable yield.

Fertilization

Fertilizer constitutes one of the highest items of cost in producing potatoes. Fertilizer affects both yield and quality, therefore close attention to analysis, rate, and placement is necessary. Since satisfactory answers to fertilizer problems require first hand knowledge about the soil and previous treatment no specific suggestions will be made in this article.

In most states soil testing services are available that furnish recommendations based on soil analysis, crop response, and numerous fertilizer comparisons. Local county agents should be consulted for specific advice on kind, amount, and ratio to use.

In general potato plants should be supplied with ample quantities of plant nutrients to insure steady growth and good tuber development. In some areas where soils contain large reserves of plant nutrients too much fertilizer is sometimes used, enhancing yield but degrading quality by delaying maturity.

Fertilizer placement varies depending on nutrient reserves, soil texture, and moisture conditions. However in most areas the most effective placement is in bands about 2 inches to each side and slightly below the seedpiece. In some areas favorable response to side-dressed, foliar, and pre-planting applications of fertilizer, especially nitrogen, has been reported.

Current fertilizer recommendations in Maine call for about 150 to 160 pounds of nitrogen per acre in a 1-1-1 or 2-3-3 ratio for most varieties and most soil conditions. Minor variations are made depending upon different crop rotations, varieties, soil analyses, and tuber quality desired. All of the fertilizer is placed in row-bands with no supplemental fertilizer added except where irrigation is used. All potato fertilizers contain magnesium in addition to nitrogen, phosphorus and potassium.

Chemical Weed Control

The use of chemical weed control is one of the biggest labor saving practices used in modern potato growing. Use of chemicals to control weeds has many advantages dependent on climatic area and soil conditions. When used in combination with good cultivation practices, annual broadleaf weeds and grasses can be controlled adequately by a single pre-emergence application of chemicals.

Almost all potato growing areas have definite recommendations as to chemicals to use, timing of application, and rates of application patterned for specific soil, climatic, and cultivation conditions. Chemical weed control should not be considered as a substitute for cultivation since cultivation is used for purposes other than weed control. Herbicides which leave toxic residues in tubers should be avoided.

Cultivation

Cultivation of potatoes has the primary objectives of weed destruction, soil aeration, and in some areas to build the rows to provide soil covering for the developing tubers. Cultivation starts when the soil is prepared for planting. Good seedbed preparation reduces the number of cultivations needed.

Equipment used for cultivation varies depending on whether level or ridge culture is practiced. Regardless of type of cultivation used every efoort to prevent damage to roots, stolons, and growing plants should be made.

Where ridge culture is practiced the ridges should be built gradually with the ultimate ridge being large and wide. Narrow, shallow ridges will allow tubers close to the sides of the ridges to sunburn. The larger the hill the less chance for sunburned or "light struck" potatoes.

Cultivation should be completed or discontinued as the plants come into full bloom or when the vines fill the rows. If weeds still persist on sides or between the ridges the use of a "spade" with adjustable wings will remove these weeds without disturbing soil close to plants and root system.

Disease and Insect Control

Spraying or dusting is a universal practice used to effectively control leaf diseases of potatoes and to destroy or control insect pests. Without good control of foliage blights and harmful insects, both internal and external quality can be ruined.

Many effective insecticides and fungicides are available commercially for use on potatoes. In general the organic compounds have gained precedence over the copper materials for early and late blight control. The organic phosphates predominate for insect control but new systemic insecticides look very promising for future use. The specific insecticide to use depends on problems of the individual potato grower. The primary caution in any spray program is to keep foliage well covered with the spray material because inadequate control of diseases and insects will result in decrease of both yield and quality by shortening the growing season and permitting the development of late blight of tuber rots and insect damage.

Vine Killing

The practice of vine killing is a necessity in potato areas where maturation of vines and tubers has been delayed by over fertilization, excess moisture, by excellent control of insect pests or where potatoes are commonly harvested when immature.

Vine killing is used to minimize late blight tuber rot, to control tuber size, to allow maturation of tubers, and to facilitate the harvesting operations. In general, vine killing for any one or all of these above reasons helps in the production of a better quality potato for fresh market use.

Method and timing of vine killing varies considerably, depending on primary purpose of vine killing in any particular area.

In some areas, vine killing is a combination of chemical and mechanical methods. Chemical sprays are used as vine dessicants and to destroy any blight spores on foliage or surface of soil over potatoes. The choice of a chemical for this purpose depends on how rapidly and thoroughly the foliage must be destroyed. If mechanical means are used for destroying the vines, care should be taken that late blight spores are completely destroyed by use of a fungicide before the vines are chopped or pulverized.

In most areas today, dessicants to dry up leaves and stems are applied 10 to 15 days prior to the expected harvest date, followed by mechanical flailing or chopping of vines just prior to the harvesting operation. In some areas, rolling of ridges prior to or immediately following, application of vine killer to fill in cracks in soil has reduced number of sunburned and greened tubers.

Regardless of method used for vine killing, timing must be such as to have vines completely dead and dried before harvesting. It is also important to follow label directions for chemical used, to prevent harmful residues from getting on the surface or into the flesh of tubers.

Use of Sprout Inhibitors

The decision of using sprout inhibitors on potatoes that are to be stored under warm storage temperature conditions and on potatoes to be stored under warm storage temperature conditions and on potatoes to be marketed in seasons or areas where high temperatures are common should be made by each individual grower.

Two materials, maleic hydrazide (MH30) and isopropyl -N- chlorophenyl carbamate (CIPC) "Sprout Nip" are available commercially for sprout control.

MH-30 is applied by spraying the foliage at least 3 weeks before vines are to be killed, or shortly after blossom-drop. This material has given successful control of sprouting when application is followed by favorable weather for at least 24 hours. MH-30 can be applied in combination with most of the regular spray materials used for insect and disease control.

Sprout nip, a recently approved material for potato sprout control, is a chemical applied to potatoes in storage containers. Application consists of injecting this gaseous material into the air stream used for ventilating the storage area. This material, if properly applied, will give complete sprout inhibition for long periods of time.

Every caution should be taken in using these materials around seed potatoes in the field or in storage.

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FACTORS AFFECTING THE PROCESSING QUALITY OF POTATOES FOR FROZEN, DEHYDRATED, AND CANNED PRODUCTS

R. H. Treadway[1]

QUALITY ATTRIBUTES

The criteria of high quality in judging a processed potato product are the same as for freshly cooked potatoes in the various forms. The consumer first notes the *color* of the prepared potatoes. Custom in the U. S. dictates that the cooked potato flesh should be white or cream colored in all products except those that have been fried. Fried products having a uniformly golden brown color are preferred by most Americans. Next, the consumer expects a pleasant, characteristic *aroma* to be associated with the vapor emanating from the warm potato preparation. These first two attributes having been met, the consumer then puts a portion of the potato product in his mouth. Now he expects to encounter the desired *flavor* of potatoes, accentuated by addition of salt, butter, and perhaps other flavor-enhancing agents. Finally, with his taste buds satisfied, the consumer presses the potato tissue against the roof of his mouth with his tongue to determine if the *texture* is what he expects in the particular type of product.

POTATO CHARACTERISTICS ASSOCIATED WITH PROCESSING QUALITY

This review is to be confined to dehydrated products, canned potatoes, and to frozen products other than those prepared by frying. The quality requirements of potatoes for chips and other fried products were amply covered by Dr. Ora Smith in the article "Potato Chip Processing" in the 1960 Potato Handbook.

We have enumerated the attributes that a high quality potato product must have; these are good color, aroma, taste, and texture. What are the potato characteristics and properties associated with these attributes? Attaining good color is principally concerned with avoiding conditions that would lead to product discoloration on cooking.

Aroma of potatoes is a complicated subject of which we know little at present. Aroma has to be studied along with some type of objective measurements, such as those obtained with vapor phase chromatography. We may introduce some sort of off-odor during the growing of potatoes, such as from a spray chemical, or an off-odor may develop during processing or storage of the processed product. Otherwise, the normal aroma of potatoes seems to vary little from lot to lot.

Flavor, like aroma, is difficult to define as to its causative factors. It is the sum total of the taste of all the soluble constituents of the potato in the proportions in which they occur and modified by the chemical reactions taking place during processing and storage of a processed product. Some believe that the unique flavor of potatoes and potato products is due mainly to the fact that a large part of the nitrogenous material is present as free amino compounds. Another point to consider is the relatively high content of inorganic material, particularly potassium salts

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and phosphates. Extensive studies on potato composition are in progress at the Eastern and Western Utilization Research and Development Divisions of the United States Department of Agriculture and elsewhere. It is hoped that these studies will lead to information that will aid in growing more nutritious potatoes and also raw material better suited for processing.

The underlying factors influencing the texture of potatoes also are hard to define precisely. With potatoes containing only a small amount of sugars, high total solids content (often called dry matter, and proportional to specific gravity) is correlated better with texture than is any other single property of the potatoes. High total solids means high starch content. A large quantity of starch grains in the potato cell leads to development of high internal pressure during cooking, as the starch absorbs a great quantity of water during its gelatinization. Distention causes groups of cells to shear apart from one another. This leads to an open structure that appears dry and mealy in the mouth. Conversely, a lesser quantity of starch grains in the cell develops only moderate internal pressure during cooking. The cells remain together and the structure and feel of this type of cooked potato are such that the texture has been described as "waxy."

Potatoes stored for several months or longer at 40° F. or below may have had up to one-third of the original starch converted to sugars. When such potatoes (without reconditioning or curing) are cooked, only the starch on gelatinization develops pressure within the cell. Not only do the sugars fail to contribute to mealiness but they also may cause processing difficulties as will later be discussed. However, potatoes containing 15% starch and only a trace of sugars will give virtually the same value in a specific gravity test as those containing 10% starch and 5% sugars. Hence, one must have at least an estimate of the sugars content of potatoes to be considered with the specific gravity value in order to predict processing quality.

PRODUCTION OF POTATOES

No single phase in potato production will be considered in minute detail because horticultural aspects are more properly covered in other articles in this Handbook. Some statements will represent merely what seems to be the consensus or normal finding. Because of space limitation, exceptions to what seems to be the general rule may not be given.

Variety. Intelligent production begins with procurement of good seed of a variety known to be suitable for processing. Low solids potatoes are acceptable for canning and are perhaps as good as any other for boiled or steamed potatoes to be frozen in a platter, meat-vegetable pie, or prepared dish. However, for every other type of processed product, high solids potatoes give a better yield and generally better texture and other desired qualities.

It can be said that almost any variety good for tablestock is also well adapted for processing. Katahdin potatoes are widely used for processing. The high solids Russet Burbank is popular with processors in Idaho, Washington, and Oregon. Irish Cobbler is generally held in high favor. Previously there was some feeling that redskin varieties were inferior for certain types of processing. However, it seems that this belief has been largely dispelled and varieties such as Red Pontiac are now commonly used. The relatively new Kennebec has gained much favor as a processing potato and the new variety Saco shows promise of attaining high solids in the East. Varieties for processing, in addition to needing high solids, must yield well, have disease resistance, and preferably have a good shape and smooth surface to facilitate peeling.

Growing Conditions. While some potato varieties inherently have higher total solids than others, all can be influenced by environmental conditions. It is important that processing potatoes be mature. Hence, it is well to plant early to lengthen the growing season and provide for higher degree of maturity and higher total solids content at harvest. More significant, of course, than date of planting is the date of plant emergence. Emergence may be delayed by dry soil or cold weather, and manufacture of food by photosynthesis does not begin until the plant is above ground and in the sunlight.

In modern potato production, the plants are protected during the growing season by insecticides and fungicides. Hence, they are in healthy condition as the time approaches that harvest must take place in the Northern states. The vines are killed by mechanical or chemical means. Rapid killing of the vines prevents translocation of sugars from stems and leaves to the tubers where it is transformed to starch. Therefore, it is better to kill the vines slowly or as late in the season as possible to bring about maximum maturity in the tubers. In practice, it is necessary to plan so that harvesting takes place before cold weather begins.

Most of the Southern-grown potatoes are harvested in a rather immature condition. This is true largely because marketing conditions dictate it so. In the North, potatoes to be stored throughout the winter should be mature. The skin should be thick and protective instead of thin and feathery. In leaving potatoes in the field as late in the season as possible in the North, one must take care that they not be exposed to chilling and freezing.

Soil. Total solids content of potatoes is influenced by the type of soil in which they are grown. Fertility, structure, water-holding capacity, aeration, and drainage are all important factors. These factors may occur in complicating combinations, making it hard to draw conclusions as to their general effect on tuber solids. Then too, soil of high water-holding capacity is good for a dry season but poor for a wet season.

The ideal situation with respect to soil moisture is to have an adequate supply well distributed during the growing season. Adequate moisture results in a good yield. Beyond the limits of a great excess or a pronounced deficit, amount of moisture apparently has no effect on the solids content of the tubers. Under irrigation practice, however, it is well to withhold water late in the season to increase maturity at harvest.

Potato plants tend to produce tubers of high total solids when grown in an area in which the average temperature is moderate.

Fertilization. This discussion will be confined to the principal nutrient elements. In general, solids content of the tubers is decreased as soil fertility becomes higher than average. Unduly high applications of fertilizer, particularly nitrogen, result in decreased total solids content. Application of nitrogen increases yield and promotes extensive vine growth and long growing season. Application of phosphorus, while necessary, seems to have little effect on total solids. High rates of potassium applied as the chloride salt decrease total solids of the tubers; potassium sulfate, though, increases the solids content. There are sometimes complicating factors that cloud the validity of these generalizations.

There are other production factors that have no clear and pronounced effects on the total solids content of potatoes. These include crop rotation, cultivation, weed control, and spraying methods.

Discolorations. There are three principal types of discoloration that have to be dealt with in potato processing. One is enzymatic discoloration of raw, peeled potato. Another is the discoloration, more pronounced at the stem end of the tuber, that occurs in some potatoes after they have been cooked and allowed to cool. The third is non-enzymatic browning resulting from the reaction of reducing sugars and amino compounds during cooking, particularly frying.

"Black spot," encountered for a number of years, has also become prominent lately. "Black spot" occurs in raw as well as in cooked potatoes in small dark areas beneath the skin, often more numerous at the stem end.

Enzymatic discoloration is controlled in processing plants by destroying the enzyme system by blanching or by inhibiting the enzyme by sulfiting. After-cooking discoloration may eventually be controlled by altering cultural practices; at present, though, the only practical method of control is to dip potatoes, predisposed to this discoloration, in a dilute solution of an acceptable acid. Current research on sugars, enzymes, and amino compounds of the potato seeks to develop information on better control of non-enzymatic browning through altered cultural practices, changes in storage conditions, or in the processing plant. Research on the "black spot" problem has been active in several locations, with particular emphasis by the Cornell University and California Agricultural Experiment Stations.

STORAGE OF POTATOES

Pertinent facts to be observed in the storage and handling of potatoes for processing were well summarized by Ora Smith in the 1960 Potato Handbook article previously cited. Potatoes should be maintained in the 45° - 75° F. temperature range during transit and holding. In the storage house, air circulation should be adequate to prevent condensation of moisture on the potatoes. Low temperature protects against sprouting but at the expense of accumulating reducing sugars. High temperature results in sprouting unless a sprout inhibitor has been used. The 50° - 55° F. range is ideal if this is practicable under the conditions.

Potatoes treated with a sprout inhibitor can be stored for several months at 55° F. or somewhat higher without sprouting. Potatoes that have built up a high reducing sugars content in cold storage must be reconditioned at about 75° F. for 2 to 3 weeks before use in most types of processing. During reconditioning, a major portion of the sugars is converted back to starch and a minor portion is lost through respiration.

PROCESSED FORMS

The National Potato Council estimates that the various food processing outlets consumed the following amounts of potatoes from the 1959 crop totaling 243 million hundredweights available for food, seed, feed, and industrial uses: chips, 28.2 million hundredweights; dehydrated products, 12; frozen products, 9; canned items, 2.5; flour, 2.2 million hundredweights.

The chip industry has enjoyed a continuous growth for many years. As a fraction of the whole quantity of potatoes processed, however, chips have given ground to frozen products and more recently to dehydrated products due to the rapid growth in these categories.

DEHYDRATED PRODUCTS

Growth in the manufacture of dehydrated mashed potato products (granules and flakes) has been nothing short of sensational in the past few years. In the last year or two, dehydrated dice and slices have gained much headway in consumer acceptance. The dice are reconstituted in hot or boiling water, drained, and then pan fried or used in salads and other prepared dishes. The thin dehydrated slices are sold for uses similar to the dice and are also formulated into scalloped potato mix and au gratin mix. The cook prepares these mixes by merely adding water, butter, and then baking.

Flour is a dried product containing the entire potato composition except the peel. More than 90% of the potao flour is used in the baking industry.

All of the potato granule production is in Idaho, with Russet Burbank used for all or nearly all of the raw material. The process consists of mixing fresh mash with previously-dried powder to obtain a mixture that granulates well after cooling, conditioning, and mixing. Research at the Western Regional Research Laboratory has resulted in product quality and process improvements in granules. The granulated mixture is then dried to a free-flowing powder.

Potato flakes, developed at the Eastern Regional Research Laboratory, are made in a number of locations over the country and have been produced from a wide selection of varieties. The effect of solids content of the raw material on yield of a dehydrated product will be shown, using flakes as an example. Potatoes containing 18% total solids (1.071 specific gravity) yield an 8 to 1 ratio of raw material to dried product. Potatoes containing 22% total solids (1.090 specific gravity) yield a 6.5 to 1 ratio. Potatoes are cooked, mashed, and drum dried in flakes manufacture.

Most of the dehydrated dice and slices are made in Idaho of Russet Burbank potatoes. Some of the dice production is in Maine, principally from Katahdin variety. Flour is made in Idaho from Russet Burbank potatoes and in the Red River Valley from Cobbler, Pontiac, Russet Burbank, and Kennebec varieties.

Frozen Products. Frozen potato products are processed in many areas of the country with use of many potato varieties. A concentration of this processing exists in Idaho and Oregon, where Russet Burbank potatoes are employed. Potatoes are frozen following cooking and preparation by virtually every method used with potatoes freshly cooked for the table. Where mealiness is desired, such as in frozen whipped potatoes or in frozen baked slices, high solids potatoes are preferred.

Canned Products. Much of the canning of potatoes takes place in Maine and the Southeast, particularly on the Delmarva Peninsula. Low solids potatoes provide good raw material for canning. High solids potatoes must be treated with a calcium salt, cooked in hard water, or processed in some special way to prevent sloughing or disintegration during processing.

CONCLUSION

The trend is clear that an increasing fraction of the food potatoes consumed by Americans are in processed forms. Thus, it behooves growers to regard processors' needs and do their best to grow, store, and handle potatoes that are suitable.

VINE KILLING REDUCES SKINNING

Killing potato vines with an arsenical 10 to 20 days before harvest reduced skinning significantly in tests conducted in Maine from 1952-1956. Skinning was reduced more if vines were killed 20 days before harvest than if killed 10 days before harvest. This was especially true when vines were killed relatively early in the season. — *Univ. of Maine Bull. 579.*

UTILIZATION OF 1959 IRISH POTATO CROP

Potatoes sold for table use from the 1959 crop amounted to 142,937,000 hundredweight, according to the Crop Reporting Board. Sales for table stock from the last three seasons' crops have not changed materially regardless of the size of production. Quantities used for the processing of potato food items, such as chips, frozen products, dehydration and canning have continued to increase. Forty million 200 thousand hundredweight were used from the 1959 crop compared with 34 million 100 thousand from the 1958 crop and 28 million 600 thousand from the 1957 crop. Sales for diversion, such as starch and livestock feed, varied according to the size of the crop. Utilization of potatoes for these two categories accounted for 14 million 300 thousand hundredweight for the 1959 crop, 37 million 300 thousand for 1958 and 21 million 600 thousand for the 1957 crop.

Processors of potato chips and shoestrings took about one-half of the potatoes processed for food items from the 1959 crop amounting to 20.2 million hundredweight compared with 17.1 hundredweight from the 1958 crop.

The number of potato chip and shoestring manufacturing plants in the country have increased proportionately (Table 1).

Processors of flakes, granules and other forms of dehydrated potatoes used 29% more potatoes from the 1959 crop than from the 1958 crop. Potatoes used for making frozen French fries from the 1959 crop exceeded by 19% the quantity used from the 1958 crop. Volume of potatoes used from the 1959 crop for canning, including hash, stews, and soup, was slightly less than from the crop of 1958 (Table 2).

A relatively smaller volume was used for making starch and flour from the 1959 crop, only 7.7 million hundredweight compared to 18.4 million from the 1958 crop. Sales for livestock feed from the 1959 crop were estimated at 6.6 million hundredweight, only a third of the 18.9 million used from the 1958 crop.

On a fiscal year basis (July 1, 1959 to June 30, 1960) potato chippers used 19.9 million hundredweight compared with 17.7 million for the previous 12 months.

USDA; A.M.S. Crop Reporting Board, September, 1960.

Table 1.—*Number of potato chip plants and potatoes used for chipping by areas and total U. S.. and potatoes used for shoestring potatoes, U. S. July 1-June 30, 1958, 1959, and 1960.*

	Number of plants	July 1, 1957 to June 30, 1958	Number of plants	July 1, 1958 to June 30, 1959	Number of plants	July 1, 1959 to June 30, 1960
	Number	100 lb. sacks (000)	Number	100 lb. sacks (000)	Number	100 lb. sacks (000)
New England Me., N.H., Vt., Mass., R.I., Conn.	25	682	24	775	25	918
Eastern Del., Md., N.J., N.Y., Pa., Va., D.C.	107	4,356	99	4,914	113	5,293
North Central Mich., Ohio, W. Va.	69	2,498	72	2,689	71	2,917
Mid-Central Kans., Mo., Nebr.	38	904	36	927	30	1,028
Midwest Ill., Ind., Iowa, S.D., Minn., N.D., Wis.	53	2,674	55	2,867	54	3,288
Southeast Ala., Fla., Ga., Ky., La., Miss., N.C,. S.C., Tenn.	31	1,446	29	1,650	29	2,030
Southwest Ark., Texas, Okla.	42	931	38	971	35	1,072
Rocky Mountain Colo., Idaho, Mont., N.Mex., Utah, Wyo.	29	742	28	821	29	931
West Coast Ariz., Calif., Nev., Oreg., Wash.	30	1,906	30	2,083	29	2,457
Total U. S. chip plants	424	16,139	411	17,697	415	19,934
Shoestring		350		385		461
Total Used for Chips and Shoestring		16,489		18,082		20,395

Table 2.—*Utilization of the 1957, 1958, and 1959 crops.*

Utilization items	1957 Crop		1958 Crop		1959 Crop	
	1,000 cwt.		1,000 cwt.		1,000 cwt.	
A. Sales						
1. Table stock		143,763		*144,874		142,937
2. For processing						
a. Chips and shoestrings	17,356		17,063		20,224	
b. Dehydration	3,776		5,917		7,656	
c. Frozen French fries	4,215		7,352		8,745	
d. Other frozen products	612		911		1,173	
e. Canned potatoes	1,216		1,250		1,185	
f. Other canned products (Hash, stews, soups)	1,390		1,614		1,262	
g. Starch and flour	12,691		*18,387		7,718	
Total		41,256		*52,494		47,963
3. Other sales						
a. Livestock feed	8,950		18,918		6,607	
b. Seed	13,775		*13,314		13,725	
Total		22,725		*32,232		20,332
Total sales		207,744		229,600		211,232
B. Non-sales						
1. Seed used on farm where grown	7,626		* 7,134		7,253	
2. Household use	10,558		*10,433		9,771	
3. Feed	2,686		* 3,896		3,038	
4. Shrinkage and loss	10,925		*14,666		11,987	
Total non-sales		31,795		*36,129		32,049
TOTAL PRODUCTION		239,539		265,729		243,281

*Revised.

NUTRITIONAL VALUE OF POTATOES

One medium potato, boiled or baked, furnishes 100 calories, no more than

- 1 medium apple
- 1 large orange
- 1 medium banana
- ½ grapefruit
- 1 serving green lima beans
- 1 serving yellow corn
- 1 large serving green peas

One medium potato provides *one-third* of a person's daily need for *Vitamin C,* and important amounts of the B-vitamins and iron.

Potatoes supply more nutrients, in important amounts, along with their modest calories, than most other foods, and *at lower cost.*

Potatoes are a good buy, nutritionally and financially.

DEPARTMENT OF HOME ECONOMICS, DOUGLASS COLLEGE
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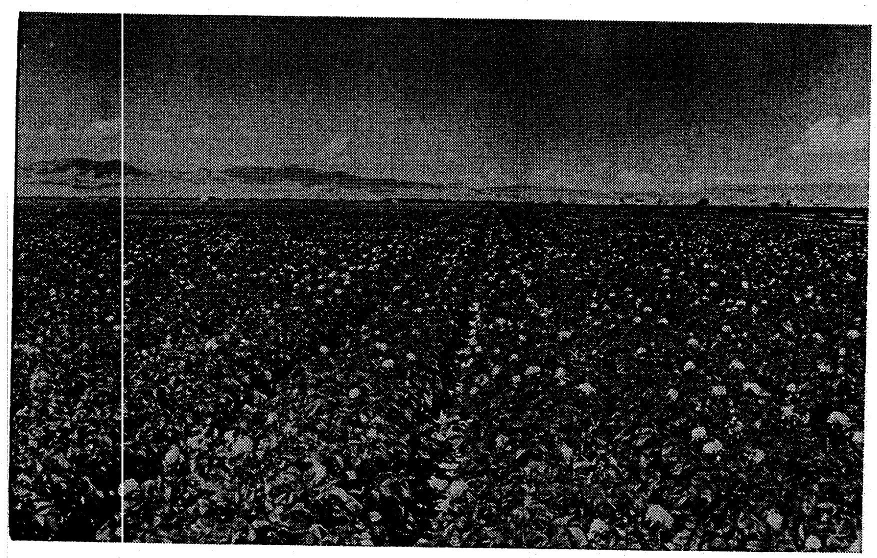

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QUALITY IN THE NEW ERA OF POTATO USE

PAUL J. EASTMAN[1]

As the lowly spud finds its place in the colorful array of attractively packaged instant foods, potato men must come to use a new definition for quality. No one really knows what portion of the nation's potato crop is destined to find its way into one of these new forms, but most will agree that in the next 10 years, well over half of the total will never reach the produce counter in any way resembling the form in which they grow. They will be transformed into some sort of form ranging from powder to chips to frozen and in no case will the housewife need to do anything but open the package and perform a few simple tasks and she will have as delicious a dish as she ever tasted. This revolution in potato use takes the determination of potato quality away from the housewife and puts it in the hands of the trained specialists who buy potatoes for processing. These people will not rely upon general appearance but will have at hand an assortment of scientific tests with which to determine whether or not a given lot of potatoes has the quality to make a product which thousands of housewives are buying because they like it. The processor will buy only the potatoes which will meet his needs.

In general, the internal qualities which are needed by the processors are pretty much the same qualities needed in a good fresh potato for good eating. Sound mature potatoes with fairly high dry matter are generally better for all purposes than are the opposite kind. The various processes involved in the manufacture of the new convenient forms do introduce other factors such as sugar content, color, etc., which have not been too important in the fresh market. The factor of general appearance is not important at all to the processor so long as it does not require added labor or occasion larger shrinkage in the processing line. The processor is interested in the quality of his end product and the costs involved in making it. He must produce a product which will sell and produce it as economically as possible. The growers who learn to produce the raw material for processing the most efficiently will be the most successful. It is possible that the potatoes found to be the most efficient source of raw material for the processor would not be at all acceptable for the fresh table market. They could be of a variety which produced no tubers smaller than 4 inches in diameter and with a skin jet black in color.

SEED PRODUCTION CHANGES

This revolution in potato use will also affect the seed grower and the potato breeder. Freedom from disease and genetic purity will continue to constitute the fundamentals of seed quality. However, the new potato uses will undoubtedly complicate the variety situation. Specific varieties will be developed which are particularly suited for the manufacture of certain of the new products. Seed buyers, caught in the "economic squeeze" will demand and get seed which is tailor-made for their requirements. Seed will either be closely sized for mechanical cutters or be pre-cut ready to dump into the planter. Evidence seems to indicate that sizing and/or cutting can be done more economically at the seed area than in the final producing area.

[1]Chief, Division Plant Industry, Maine Department of Agriculture, Augusta, Maine.

The seed grower is going to be forced into growing more varieties and doing more seed preparation in addition to maintaining his job of disease control. With these changes, there is a possibility that seed growing will tend to become a more specialized job with the seed growers' whole crop being marketed as seed. The seed grower may continue to market some sizes and grades on the fresh table market, but seed production will not likely lend itself to producing for the processor along with the seed crop. Conscientious seed growers will be even more important to the industry because they will be called upon to grow some varieties which carry little disease resistance. They must change varieties often and they must supply quality seed, tailor-made for planting.

Fresh market quality may not change by definition but buyers will probably become more quality conscious. With the new competition from processed forms of potato, the consumer has a much wider choice. If the fresh potatoes are not satisfactory, the housewife can serve almost any form of potato she desires from a processed product. She can still serve potatoes without patronizing the fresh counter.

This situation constitutes a challenge to fresh producers. The areas which meet this challenge with fresh potatoes attractively graded and packaged with the internal qualities necessary for an appetizing food will continue to sell fresh successfully. Producers who do not recognize this challenge will lose their markets to the packaged products. The days when a mediocre to poor pack of fresh potatoes will sell for a good price are numbered.

Total yield of potatoes may be sacrified to some extent in order to improve the internal quality of the crop. How far this will go depends upon the economics involved since potato production will become more competitive. The advent of large-scale processing may tend to concentrate production in larger units. The inefficient producer will find it increasingly difficult to stay in business. Integration is likely to become more general with large processors controlling more and more of the production.

Getting back to the subject of quality, it is probable that the new era of potato use will focus more attention on the internal qualities of the potato as a food. General appearance will become less important as a quality factor except for those potatoes sold on the fresh market. The net effect will be that the average serving of potatoes on the American dinner plate will be more appetizing and available in a larger variety of forms. Potatoes will be easier for the working and busy housewife to serve. Total per capita consumption will increase and potatoes will continue to be the king of vegetables.

POTATO CHEESE PUFFS

- 2 eggs, separated
- 1⅓ cups mashed potatoes, hot or cold
- 3 tbsp. hot milk
- ⅓ cup grated cheese
- ¼ tsp. each salt, paprika, celery salt
- ½ tsp. finely chopped onion
- 1 tsp. chopped green pepper

Beat egg yolks: add potatoes, milk and cheese and beat until fluffy. Season and add the chopped pepper and onion. Fold in the stiffly beaten whites. Place batter in mounds on greased pan; brush tops with melted table fat. Bake at 350° F. for 20 minutes.

BREEDING POTATOES FOR QUALITY

Robert V. Akeley[1]

INTRODUCTION

Breeding potato varieties for quality is a broad field of endeavor. It includes attention to all desirable characteristics that can possibly be combined into a new variety. Important characteristics generally related to potato quality will be considered here.

The ultimate goal of the potato breeder is to create a new variety adapted to one or more production areas and possessing as many favorable quality characteristics as can be combined in one variety. The problem is complex because the genetic factors which control quality characteristics, except those causing immune reactions to diseases, vary greatly in their expressions depending upon the immediate environmental conditions. Despite improvements in potato breeding, it is highly unlikely that a variety uniformly acceptable to growers in all areas, to consumers for all culinary purposes, or to processors of all products, will ever be released.

The chances are better for obtaining a variety that is satisfactory to growers, consumers, and processors within one area than in various areas. One of the goals of most potato breeders is to produce locally adapted varieties. Nevertheless, it is desirable to evaluate seedling varieties in as many production areas as possible in order to obtain widely adapted varieties, such as Katahdin, Kennebec, and Irish Cobbler. A widely adapted variety has more value to everyone in the potato industry. Such a variety tends to keep the number of varieties at a minimum and everyone concerned becomes familiar with it and its particular values.

[1]Horticulturist, Crops Research Division, Agricultural Research Service, United States Department of Agriculture, Beltsville, Maryland.

Potato breeders over the country recognize the demand for super- varieties possessing certain cooking and processing qualities. They continually test and evaluate their best potato selections by comparing them with standard varieties in their production areas. Chip quality includes ability to recondition after storage as well as chipping qualities when newly harvested. Measuring suitability for French fries by frying tests is a standard procedure. Baking quality is measured partly by determining total solids, but actual baking tests also are necessary. Potatoes high in solids tend to be better for baking and processing, those medium in solids for boiling and making potato flakes, and those low in solids for canning.

We may not consider resistance to potato diseases and to insect and nematode injuries as characters affecting potato quality. Our judgments are usually based on processing, cooking, marketing, and production qualities. It is known that tuber necroses due to viruses, especially that due to current-season infection with leafroll virus, that due to the wilt diseases, and that due to heat and frost damage often make the tubers unmarketable. For instance, the Green Mountain and Russet Burbank varieties, which are susceptible to tuber necrosis due to leafroll virus, will produce fewer marketable tubers per acre in production areas of Maine, Idaho, and Washington. This necrosis in the tubers of susceptible varieties grown in these States makes the crop unfit for culinary or processing uses.

PROCESSING QUALITIES

The quantity of potatoes for processing has continued to increase. Processors used 40.2 million hundred weight, or 30 per cent of the potatoes sold in 1959 as table stock for processing as compared with 34.1 million of the 1958 crop, and 28.6 million of the 1957 crop. Approximately 50 per cent of the potatoes processed in 1959 were made into potato chips. and shoestring potatoes.

The predictions are that the increase in potato processing will continue. The processor is more than ever concerned with the internal and external qualities of potato tubers to be processed. The most important factor influencing prossessing quality is the variety. Within an area, several varieties are often used for processing, but one or perhaps two are usually preferred because of their greater suitability. The greatest challenge to potato breeders today is to develop varieties that meet the needs of the rapidly expanding processing industry.

Processors of chips and frozen French fries cook the blanched slices in oil. They prefer raw material high in solids content because it absorbs less oil in cooking, the net return is greater, and the keeping quality of the product is better. Varieties vary in solids and reducing-sugar content, ease of conditioning after storage at 40° F. or lower, and their frying qualities. Kennebec and Irish Cobbler are examples of varieties that consistently produce processed products of acceptable quality when grown over a wide environmental range. Other varieties often used for chipping are Cherokee, Chippewa, Katahdin, Pungo, and Russet Rural.

Internal discolorations of tubers from heat exposure, storage, temperatures, net necrosis, wilts, and internal blackspot can be controlled to some extent by growing the proper variety. Selection of variety will depend upon the seriousness and the type of the discoloration. Katahdin, Cippewa, and Kennebec seldom show heat necrosis or tuber necrosis caused by leafroll virus. Pungo is very resistant to discoloration associated with corky ringspot. Sebago has some resistance to brown rot. Red Pontiac is less susceptible to internal black spot than most other varieties.

Processors particularly need varieties relatively high in solids content, relatively low in reducing-sugars, easily conditioned after storage, with good storage characteristics including a long dormant period, and resistant to more than one of the tuber discolorations that make the potatoes undesirable for processing. These characters are presently available in the common potato. The potato breeders must combine as many of them as possible into a commercially acceptable variety.

COOKING QUALITIES

Cooking quality of varieties is usually thought of in terms of suitability for baking, boiling, or frying. When grown under the same environmental conditions, varieties and seedlings show differences in cooking qualities that can be easily determined. Although cooking qualities are generally controlled, the fact remains that environmental conditions have a determining influence on the amount of starch or total solids that a potato variety possesses. Hence, cooking quality depends as much on environment as on variety.

Often a variety known for its relatively high percentage of total solids, and usually considered a good baker, when grown in one area of the country will be low in solids when grown in another area. This difference is generally due to environmental and cultural conditions. Differences in solids of a variety are also evident between years within the same area and they may also occur at times between locations within a State.

Varieties with 19.7 per cent total solids or higher are usually considered bakers. Most of our leading domestic varieties could be classified as bakers if grown properly in areas where high-starch content potatoes are usually produced.

A discoloration known as after-cooking darkening may occur in cooked tubers. The color may range from shades of gray to almost black. Many workers have studied this problem of after-cooking darkening, but there is still much to be learned about physiological conditions and chemical reactions that favor its occurrence. Apparently inherent differences occur among varieties grown under similar conditions.

Internal black spot of potatoes is a discoloration apparently due to a physiological disorder. Since 1939 this defect has been a real problem to Long Island potato growers. Similar disorders are now present in crops grown in the major production areas of this country. The annual losses to growers and processors due to internal black spot of the tubers are serious. Since varietal differences do occur, the selection and testing of seedlings from parents known to have resistance to internal black spot offer one of the best methods for controlling this disorder.

Potato breeders continually evaluate their selections for the many characters that determine which ones will be superior cooking varieties in the future.

The market quality requirements of potatoes vary with utilization of the tubers. Some markets demand potato varieties with specific skin and flesh colors, tuber length and thickness, depth of eye, shape, size, uniformity, and freedom from external and internal discoloration. Any one or all of these characteristics can have a pronounced influence on the market acceptance in certain areas.

In the United States the general demand is for varieties with white skin and white flesh. To date little market demand has developed for varieties with yellow flesh. Katahdin, Irish Cobbler, Kennebec, and White Rose are the most popular varieties in the white group. Russet-skinned varieties are used for special markets and the 3 varieties of this type, in order of demand, are Russet Burbank, Early Gem, and Russet Rural. Red Pontiac, Red LaSoda, Red McClure, and Early Ohio, respectively, are the varieties in the red-skinned group most commonly found in the trade.

Potato breeders are fully aware of the market qualities demanded in varieties in these 3 groups. Introduction of superior varieties in all categories is urgently needed because all the important varieties mentioned possess some undesirable characteristics.

PRODUCTION QUALITIES

Today, seed potato growers can successfully grow varieties susceptible to most potato diseases. However, growing susceptible varieties can reduce market quality and decrease the overall yield. The newer varieties with disease resistance help the farmer to avoid the hazards of potato diseases and to grow a higher quality crop more economically.

Katahdin, Kennebec, Chippewa, Sebago, and Cherokee are examples of varieties with disease-resistant characters that are in demand for seed and table stock production. They are all resistant to field infection by mild mosaic virus and to tuber net necrosis due to current-season infection by the leafroll virus. Kennebec and Cherokee are also immune from infection by the common races of the late blight fungus; and they, as well as Sebago, have partial field resistance to infection by all races of the late blight fungus. Katahdin has some field resistance to leafroll, Sebago to yellow dwarf and brown rot, and Cherokee to the common races of potato scab. If not controlled, all the diseases listed reduce the quality as well as decrease the yields.

Seed certification agencies have set up a "no tolerance" allowance for ring rot in seed potatoes, and this disease has become a major problem to seed growers. Teton and Merrimack are the only commercial varieties released

by potato breeders, so far, that are highly resistant to ring rot. Both varieties are immune from mild mosaic virus in the field. Merrimack is also resistant to corky ringspot virus. Several ring rot-resistant seedlings with resistance to or immunity from one or more of the late blight races in their vines and tubers have been selected, increased, and evaluated for their yielding ability, processing qualities, and resistance to other diseases. The need for an acceptable variety with multiple-disease resistance including ring rot resistance, is national in scope. The indications are that selections with superior processing and cooking qualities combined with disease-resistance should soon be available.

Table stock growers are primarily interested in disease-free seed of varieties that will produce maximum yields. Their markets require varieties with either red, white, or russet skin and round to long tuber types having shallow eyes and with high dry matter content, palatability, and processing qualities. These requirements vary with production areas and seasonal demand. Several varieties are needed to satisfy all requirements. In order of importance, on the basis of seed-certification acreage, Katahdin, Russet Burbank, and Red Pontiac with white, russet, and red skin, respectively, are in the greatest demand by growers and buyers.

SUMMARY

The objective of a potato-breeding program is to create new varieties that have one or more processing, cooking, marketing, or production qualities superior to those of varieties now being grown. They should be adapted to one or more potato-production areas and be resistant to or immune from common potato diseases.

Potato breeders are continually working for new high-yielding varieties with combined resistance to the virus diseases including spindle tuber, mosaic, leafroll, net necrosis, and corky ringspot; to the fungus diseases late blight, early blight, common scab, silver scurf, and verticillium wilt; and to the bacterial diseases ring spot and brown rot. Resistance to injury from aphids, leafhoppers, flea beetles, and nematodes are also being considered since they too influence quality.

Many important characteristics of commercial value for quality improvement are available in potato breeding stock. Combining these to produce acceptable commercial sorts with more desirable multiple characters will make future varieties more valuable to growers, consumers, processors, and others concerned with the potato trade.

POTATOES WILL NOT MAKE YOU FAT

Never Omit Potatoes When You Can Omit Desserts

Potatoes	Calories	Desserts	Calories
Baked, medium	100	Chocolate cake, 2″ wedge	400
Creamed, ½ cup	100	Apple pie, medium piece	500
French fries, 8 strips	100	Apple pie, a la mode	625
Hasth-browned, ½ cup	170	Mince pie, medium piece	650
Mashed, ½ cup	100	Chocolate sundae, one	425
Salad, ½ cup	200	Chocolate candy bar	450
Scalloped, ½ cup	100	Donut, one average	200
Chips, 12 large	115	Sweet roll, with icing	350

Mary B. Wood and Mrs. Lola T. Dudgeon, of Cornell University, worked out these comparative calorie figures to prove to themselves that potatoes are man's (and woman's) best friend.

QUALITY

- Michigan Potato Seed Stocks are up-land grown.
- Indexed . . . Tuber Unit . . . Foundation grown to support the Certified Program.
- All Potato Seed Stocks are Southern Field tested.
- Certified Fields are inspected at least twice.
- Certified Seed is bin inspected.
- Certified Seed is Federal-State inspected for shipping.

MICHIGAN CERTIFIED SEED

* *Plant Michigan Certified Seed.*

for complete list of growers, write:

Michigan Crop Improvement Association

Michigan State University • East Lansing, Michigan

EFFECT OF STORAGE ON POTATO QUALITY

P. H. HEINZE[1]

Potatoes are stored to prolong the period during which they will maintain an acceptable quality for a specific purpose. The late-crop potatoes grown in the Northern tier of states constitute the bulk of potatoes that are placed into storage. Although most of the Southern early crop moves directly from harvest into marketing channels some consideration of storage of these potatoes is justified. The conditions of storage affect both cooking and general market quality primarily through three factors; temperature, humidity, and ventilation.

STORAGE TEMPERATURE

For years a storage temperature of 40° F. has been recommended as a good compromise between a lower temperature which may control sprouting more effectively and a higher temperature which would lessen chemical changes in the tubers. Potatoes stored at 40° will usually remain free of sprouts for 5 to 7 months after which sprout growth proceeds very slowly unless the tubers are transferred to higher temperatures. At 40°, however, definite noticeable changes occur in the composition after a few weeks of storage. For most home uses, such as baking, boiling and mashing, the chemical changes are not pronounced enough to cause the potatoes to be entirely unsatisfactory. A number of recent studies have shown that late-crop potatoes change less in composition when stored at 50 to 55° than at other temperatures and in general have better cooking and processing qualities. Temperatures below 50° frequently cause potatoes to be unsatisfactory for processing into chips, French fries, or dehydrated products unless subjected to a curing or reconditioning period at a higher temperature of approximately 70° before processing. The response to higher temperature may often be erratic and unpredictable, thus making the use of potatoes from low temperature storage for processing a questionable procedure.

Low storage temperatures near the freezing point of potatoes may have injurious effects besides actual freezing damage and compositional changes. Mahogany browning is one form of injury that may appear in varieties such as Chippewa and Katahdin if they are held near 32° F. for 20 weeks or longer.

It has been shown that Southern early-crop potatoes can be stored for 2 or 3 months at 50° to 60° F. If longer storage is desirable a temperature of 40° should be provided to minimize losses due to shrinkage and decay, however, a storage at 40° should be preceeded by a curing period of at least 4 days at 60° to 80°. When early-crop potatoes are used for processing, particularly for chip making, it has been found that their storage temperature requirements differ considerably from those for late-crop potatoes.

Compositional changes affected by temperature. The starch-sugar equilibrium is probably the most sensitive compositional change that is affected by temperature. When late-crop potatoes are stored at 50° to 55° F., there is usually very little change in starch and sugar content. Below 50° the equilibrium is shifted toward increased sugar content which makes the potatoes unsatisfactory for many processing purposes and causes the texture of boiled, mashed, and baked potatoes to be less mealy. In

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some instances enough sugar may be present to give the cooked product an undesirable sweet taste. When the potatoes are transferred to higher temperature storage, some of the sugar is enzymatically resynthesized into starch and some is used in the respiration process which proceeds at a higher rate as the temperature is raised.

The starch-sugar equilibrium in the early crop differs from that of the late crop in its response to temperature. Starch is converted to sugar rather rapidly at 50° to 55° F., a temperature which normally causes the least change in the late crop. Experiments with potatoes grown in Florida, Alabama, and California indicate that temperatures around 70° are required to maintain the minimum amount of change of starch to sugar in the early crop. Since many of the same varieties are produced as an early and late crop indicates that the difference in response to storage temperature is propably due to climatic differences during growth and conditions during the harvesting of the crop.

Potatoes are a good source of ascorbic acid. Although their ascorbic acid content is not as high as that of many other vegetables, the consistent use of freshly cooked potatoes in the diet can furnish a substantial portion of the human daily vitamin C requirement. Potatoes are usually higher in ascorbic acid content at harvest than at any time during the storage period. The losses of ascorbic acid are substantial during the storage period at all ordinary temperatures and frequently amount to 50 per cent or more after a few months. Temperatures of 50° to 60° F. are usually conducive to the highest retention of ascorbic acid. Lower storage temperatures cause a more rapid loss. Transferring the potatoes to either higher or lower temperatures after a period of storage frequently results in temporary increases in ascorbic acid content. A storage atmosphere of pure oxygen appears to cause a more rapid and complete disappearance of ascorbic acid while storage in nitrogen for a few weeks tends to stabilize the amount present and results in a higher level of ascorbic acid content during the remainder of the storage period. There appears to be no practical application at this time for the use of storage atmospheres other than air to improve the retention of ascorbic acid of potatoes.

Potatoes contain relatively small amounts of nitrogen-containing compounds. Generally, those with higher nitrogen content are of lower quality for baking, mashing, boiling, and for certain processing purposes such as chip making, French frying, dehydrated products, and for flour and starch manufacturing. Those containing more than the average amount of nitrogen are usually better for salad making and for canning whole. Storage conditions have not been found to exert any pronounced effect on the major nitrogen constituents of potatoes. Very little change occurs during the first few months of storage at temperatures of 35° to 50° F. During later stages of storage and during sprouting, several investigators have observed increases in some soluble nitrogen fractions. Others have noted decreases in amino acid content at reconditioning temperatures of 75°. No changes of any importance in quality have been correlated with the few observed changes in nitrogen content during storage.

Considerable work has been done to determine whether quality is related to the pectic materials in potatoes. In general, no close association has been found between pectic constituents and quality, nor has there been any appreciable change noted in the pectic constituents at ordinary storage temperatures. Some work in India showed considerable change in the pectic-materials in potatoes during storage at temperatures (78° to 86° F.) higher than normal storage temperatures for potatoes in the U. S.

Most white-fleshed varieties of potatoes contain some yellow pigments that are usually not particularly noticeable. After a number of months of storage at temperatures below 40° F. or a short holding period at 90° or above, the yellow color may be intensified considerably. No quantitative data are available on this change during storage. The pigments involved have not been identified.

There is little or no evidence to indicate that temperature during storage has any effect on other cnstituents such as minerals, fiber, or vitamins, other than ascorbic acid.

Market quality as affected by storage temperature. While the compositional factors discussed above may affect the market quality of potatoes for specific purposes, they are not considered when potatoes are graded to meet U. S. Standards. However, storage temperature can have other effects upon these grades. Temperatures during the first week or ten days of storage should be 50° F. or higher to promote wound healing and prevent shrinkage and decay unless the crop is affected with late blight or leak. If either of these two diseases is present, it may be advisable to cool the potatoes to 40° or below as soon as possible and market th crop before serious losses occur.

The temperature of the potatoes at the time of removal from storage also can affect market quality. Cold potatoes crack and bruise much more easily than do those that have been warmed before handling and grading. Warming of potatoes before loading may also improve the market quality by preventing freezing during transit.

Sprouting may affect grade and market quality. Low storage temperatures (36° to 40° F.) are very effective for delaying sprouting, but are detrimental to the quality for many purposes. Storage at higher temperatures (50° to 55°) with applied sprout inhibitors, offers a possibility of providing better quality potatoes, particularly for processing. No data are available to indicate that sprout inhibitors affect decay to any appreciable extent unless they are used on potatoes that have unhealed wounds. In these instances decay may be increased because the sprout inhibitor frequently interferes with wound barrier formation. Tolerances have been established by the Food and Drug Administration for the use of maleic hydrazide (MH) and isopropyl N (3-chlorophenyl) carbamate (CIPC) on potatoes to control sprouting.

HUMIDITY

All potatoes shrink during storage because of the loss of solid material due to respiration and moisture due to transpiration. The amount of shrinkage is related to a considerable extent to the humidity within the storage bin, but factors such as condition of the potatoes, storage temperature, and ventilation also have an influence. Specific gravity, one of the most practical measures of eating quality, can be influenced by shrinkage during storage. If the losses of solid material and water are in the same proportion as the original content of the potatoes, no change in specific gravity will occur during storage. At relative humidities of 85 to 90 per cent, the shrinkage losses do not appear to change the specific gravity of the potatoes.

As the relative humidity in the storage bins is lowered the loss of moisture from the tubers increases at a faster rate than the loss in solid material. This frequently results in a measurable change in specific gravity. However, these changes are seldom great enough to have any detectable effect on quality as evaluated by taste panels.

The control of humidity in storages poses problems because of condensation on walls and ceilings, especially during the colder portions of the storage season. Condensed moisture dripping on the potatoes may cause rot-

ting and excessive losses. If there is inadequate insulation to prevent condensation under high humidity conditions, it may be advisable to either lower the humidity or provide a means for the moisture to condense without getting on the potatoes.

In general the least shrinkage and best quality potatoes result if the relative humidity is maintained near 85 to 90 per cent. In years when severe disease problems occur, particularly late blight, black leg and leak, it is usually advisable to maintain low humidity which would tend to keep the rot relatively dry and reduce its spreading to other potatoes. No attempt will be made here to describe methods of controlling the humidity in storages. However, recent reports have emphasized the importance of observing two principles when adding moisture to storage atmospheres. All added water droplets should be completely vaporized in the storage atmosphere and the moisture should be added to the air before it comes into contact with the tubers.

VENTILATION

Ventilation affects the quality of potatoes in storage primarily because of its relation to temperature and humidity of the storage atmosphere. Ventilation may imply the introduction of outside air or merely the circulation of air within the storage. The introduction of outside air is frequently a quick means to change temperature and humidity in a storage. With motor-operated thermostatically controlled ventilators, storage temperature can be controlled to a considerable degree under suitable outdoor weather conditions. Ventilation usually tends to lower relative humidity surrounding the potatoes unless the incoming air or recirculated storage atmosphere is near saturation. Ventilation can have a considerable effect on the quality of the potatoes in storage. Storage operators should be aware of the influence of ventilation on the humidity surrounding the tubers as well as in providing a more uniformly desirable temperature.

References for additional reading on storage and potato quality

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POTATOES SHOULD BE STORED IN A COOL PLACE

Potatoes keep best in a dark room where a temperature between 38° and 40° and a relative humidity of 85 per cent can be maintained. When stored below 38° the potatoes usually become sweet, but by storing them at ordinary room temperatures for a few days the natural flavor will be restored. We also find that most basements often are warmer than 40° and potatoes usually sprout and shrink at these temperatures. However, chemicals can be obtained to prevent sprouting of potatoes sored in the home.

BUY YOUR CERTIFIED SEED FROM THESE GROWERS

Varieties available are listed under growers' names.

Bill Borchard Co.
P. O. Box 281
East Grand Forks, Minnesota

Red Pontiac, Red LaSoda, Cobbler, Kennebec, Norland and Early Gem.

Lucien Bouchard
Upper Frenchville, Maine

Kennebec

Monroe Brown & Sons,
Foundation Seed
Williams, Minnesota

Russet, Early Gem, Kennebec, Red LaSoda, Red Pontiac, and Chippewa

Carter Seed Farms
Washburn, Maine

Cobbler, Katahdin, Kennebec, Chippewa, Pungo, Keswick, Rural Russet, Bliss Triumph (Red) and Plymouth

H. C. Greenlaw
Millville, New Brunswick, Canada

Sebago, Keswick, and Kennebec

Mehlenbacher Farms, Inc.
Wayland, New York

Katahdin and Kennebec

New York Potato Growers Cooperative, Inc.
P. O. Box 211
Bouchville, New York

Katahdin, Kennebec, Chippewa and Sebago

Thomas C. Norman
RFD #1
Saranac Lake, N. Y.

Chippewa, Katahdin, Green Mountain, Kennebec and Russet Burbank

Sylva D. Ouellette & Son
RFD #2
Fort Kent, Maine

Kennebec

Ben Picha
Box 816
Grand Forks, North Dakota

Erlired, Redkote and Kennebec

J. D. Swan
Swanee Farms
Saxon, Wisconsin

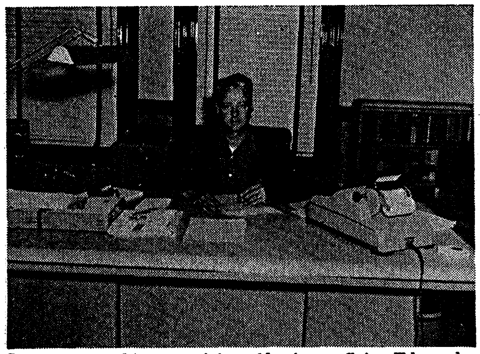
Russet Burbank, Tawa and Norland

Peter & Henry Van Erkel
Box 126
Hollandale, Minnesota

Cobbler, Red LaSoda, Norland, Red Pontiac and Kennebec

Verdoorn Brothers
Delavan, Minnesota

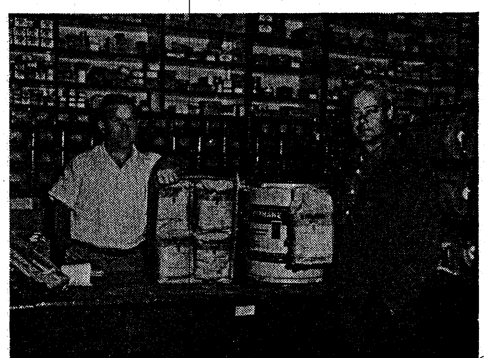
Cobbler, Cherokee and Red LaSoda



In attending to his many civic and business affairs, Edmunds finds that a neat and efficient office is a necessity.

Rohm & Haas field representative Bill Hughson joins Edmunds in a look at one of the water hazards on the new golf course.

Edmunds checks proper dosage of DITHANE M-22 *as McQuade fills sprayer. Both like the easy mixing of this 80% maneb fungicide.*



Edmunds discusses his DITHANE M-22 *needs with Raymo Howard, Manager of the John Watson Co. store Fort Fairfield.*

Maine's E. Perrin Edmunds certified seed potato crop

DITHANE M-22...now 80% maneb ...from your partner in crop protection

DITHANE *is a trademark, Reg. U.S. Pat. Off. and in principal foreign countries.*

◀ *Judy, 5, and "Mike", 8, join their father on the front steps of the family home in Fort Fairfield. Pet Siamese cat, "Sim", relaxes while German Shepherd, "Ears", shows how he got his name.*

ato farmer-businessman E. Perrin Edmunds instructs farmhand Henry McQuade which field to spray next in his continuing potato blight control program.

prevents blight on his with DITHANE M-22

E. Perrin Edmunds, Fort Fairfield, Maine, recently ended his third term as president of the National Potato Council.

He is typical of today's progressive farmer—active community, state and national leader, successful businessman, and hard-working farm manager.

Currently, he is also a bank director, member of the State Legislature, president of C. A. Powers & Co., the John Watson Co., and Powers Starch Co., and building committee chairman for the local country club . . . now working on a new 18-hole golf course on which Edmunds will somehow find time to play.

Potatoes thrive on 700 of the rolling acres which make up the C. A. Powers & Co. potato operation. The crop is sold as certified seed. Culls and rejects are diverted to the company's potato starch plant located in Monticello, Maine.

Like most of his fellow potato growers, Edmunds puts his faith in DITHANE M-22 (maneb) fungicide for protection from early and late blight.

Chemicals for Agriculture

ROHM & HAAS COMPANY

WASHINGTON SQUARE, PHILADELPHIA 5, PA.

ACREAGE OF CERTIFIED SEED POTATOES BY VARIETIES – 1960

Compiled by ORRIN C. TURNQUIST

	Acres Entered	Acres Passed
ANTIGO		
Wisconsin	56.00	56.00
BLANCA		
Colorado	126.20	97.00
Nebraska	4.00	4.00
Total	130.20	101.00
BLISS TRIUMPH		
South Dakota	209.00	122.00
Minnesota	99.00	99.00
Nebraska	78.05	78.05
Canada	80.00	59.75
North Dakota	46.00	46.00
Montana	50.00	38.00
Maine	44.00	21.00
California	13.00	13.00
Oregon	10.00	10.00
Wyoming	5.00	5.00
Idaho	1.00	1.00
Total	635.05	492.80
BOONE		
North Carolina	25.00	25.00
Tennessee	1.00	1.00
Wisconsin	1.00	1.00
Minnesota	0.25	0.25
Total	27.25	27.25
BOUNTY		
Nebraska	262.50	187.00
Wyoming	36.00	36.00
South Dakota	5.00	5.00
Colorado	4.33	2.00
North Dakota	0.92	0.80
Total	308.75	230.80
BURBANK		
Oregon	46.00	46.00
CANSO		
Canada	39.00	32.00
Nebraska	140.50	22.50
Total	179.50	54.50
CANUS		
Canada	5.75	5.00
CASCADE		
Oregon	1.00	1.00
CHEROKEE		
Minnesota	926.12	926.12
Canada	214.00	180.00
Maine	152.00	106.00
Michigan	100.00	*
North Dakota	21.50	21.50
New York	6.00	6.00
Wisconsin	2.00	2.00
California	1.00	1.00
Total	1,422.62	1,242.62
CHIPPEWA		
Maine	3,558.00	2,775.00
Wisconsin	312.00	247.00
New York	230.00	230.00
Canada	148.00	100.00
Minnesota	36.55	36.55
Vermont	26.50	12.00
New Jersey	19.50	*
Michigan	14.50	*
California	1.00	1.00
Total	4,346.05	3,401.55
COLUMBIA RUSSET		
Canada	39.00	27.00
DAZOC		
Nebraska	214.90	206.90
Minnesota	113.15	113.15
Colorado	53.00	53.00
Wisconsin	40.00	30.00
Wyoming	32.00	25.00
North Dakota	18.20	18.00
New Mexico	20.00	*
Michigan	3.00	*
Montana	2.00	2.00
Washington	1.00	*
Total	497.25	448.05
DELUS		
Maine	22.00	17.00
Colorado	2.00	2.00
Minnesota	1.00	1.00
Total	25.00	20.00

*Information not available.

EARLY GEM

	Acres Entered	Acres Passed
North Dakota	1,395.20	1,313.20
Wisconsin	781.00	628.00
Idaho	221.00	221.00
Nebraska	212.00	164.00
Canada	128.50	120.80
Wyoming	109.00	100.00
Minnesota	94.50	94.50
Oregon	56.00	56.00
New Mexico	20.00	*
Washington	12.00	*
Montana	10.50	10.50
Total	3,049.70	2,708.00

EARLY OHIO

	Acres Entered	Acres Passed
Minnesota	486.80	486.80
North Dakota	204.00	204.00
Canada	48.75	38.50
South Dakota	29.00	28.00
Wisconsin	*	12.00
Total	768.55	769.30

EARLY ROSE

	Acres Entered	Acres Passed
Canada	4.50	4.00

EXCEL

	Acres Entered	Acres Passed
Nebraska	9.25	9.25

GOLDEN CHIPPER

	Acres Entered	Acres Passed
Oregon	199.00	199.00
Michigan	112.00	*
Washington	8.00	*
Total	319.00	199.00

GREEN MOUNTAIN

	Acres Entered	Acres Passed
Canada	3,281.00	1,588.00
Maine	390.00	374.00
New Hampshire	36.50	36.50
New York	34.00	34.00
Vermont	42.50	31.50
Minnesota	9.08	9.08
Michigan	5.00	*
Total	3,798.08	2,073.08

HAIG

	Acres Entered	Acres Passed
Nebraska	527.99	78.74
Wyoming	22.00	22.00
Total	549.99	100.74

HOUMA

	Acres Entered	Acres Passed
Colorado	49.17	26.00
New York	14.00	14.00
Vermont	9.00	9.00
Maine	.65	.65
Total	72.82	49.65

*Information not available.

HURON

	Acres Entered	Acres Passed
Canada	108.00	101.75
Michigan	8.00	*
Wisconsin	4.00	4.00
Maine	2.00	2.00
Total	122.00	107.75

IRISH COBBLER

	Acres Entered	Acres Passed
Minnesota	12,845.53	12,845.53
Maine	2,621.00	2,411.00
Canada	2,008.00	1,788.00
North Dakota	2,148.00	1,516.00
South Dakota	127.00	127.00
Michigan	28.50	*
Colorado	24.50	24.50
New York	23.00	23.00
Wisconsin	19.00	19.00
Vermont	16.00	16.00
Total	19,860.53	18,770.03

KATAHDIN

	Acres Entered	Acres Passed
Maine	63,336.00	41,168.00
Canada	6,337.00	5,296.00
New York	879.00	879.00
Vermont	390.00	390.00
Wisconsin	436.00	315.00
Pennsylvania	234.00	234.00
Michigan	151.00	*
Colorado	93.30	82.60
New Hampshire	18.00	18.00
New Jersey	10.50	*
Washington	10.00	*
Minnesota	5.50	5.50
Oregon	4.00	4.00
California	1.00	1.00
Total	71,905.30	48,393.10

KENNEBEC

	Acres Entered	Acres Passed
Canada	6,598.00	5,499.00
Maine	6,479.00	4,989.00
Minnesota	4,145.24	4,145.24
North Dakota	2,799.30	2,590.30
Oregon	811.00	811.00
Washington	708.00	*
California	576.00	493.00
Wisconsin	487.00	461.00
Colorado	377.50	346.50
Idaho	281.00	266.00
New York	112.00	112.00
South Dakota	163.00	102.00
Pennsylvania	93.00	93.00
Nebraska	122.40	90.40
North Carolina	47.40	47.40
Wyoming	33.00	33.00
Utah	60.00	20.00
Michigan	9.25	*
New Hampshire	4.50	4.50
Montana	12.00	4.00
New Jersey	1.25	*
Virginia	.50	.50
Total	23,920.34	20,107.84

	Acres Entered	Acres Passed
KESWICK		
Canada	1,397.00	976.00
Maine	210.00	122.00
Wisconsin	9.00	9.00
California	2.00	2.00
Total	1,618.00	1,109.00
LASODA		
Oregon	9.00	9.00
MERRIMACK		
Minnesota	103.00	103.00
Maine	85.00	73.00
Michigan	22.50	*
Colorado	14.00	8.00
Wisconsin	3.00	3.00
California	2.00	2.00
Total	229.50	189.00
NAVAJO		
Colorado	17.50	4.50
Nebraska	5.00	5.00
Maine	1.00	1.00
Minnesota	0.20	0.20
Total	23.70	10.70
NEW WHITE		
Minnesota	4.00	4.00
NORGLEAM		
Minnesota	25.00	25.00
North Dakota	30.00	0.00
Total	55.00	25.00
NORLAND		
Minnesota	1,906.83	1,906.83
North Dakota	1,963.98	1,827.63
Canada	539.00	357.00
South Dakota	250.00	250.00
Nebraska	110.45	109.45
Wyoming	91.00	91.00
Wisconsin	54.00	54.00
Pennsylvania	35.00	35.00
Colorado	24.00	17.50
Washington	11.00	*
New York	8.00	8.00
Michigan	4.50	*
California	1.00	1.00
Montana	0.25	0.25
Total	4,999.01	4,657.66
ONAWAY		
Maine	778.00	482.00
Michigan	184.00	*
Total	962.00	482.00

*Information not available.

	Acres Entered	Acres Passed
ONTARIO		
Wisconsin	423.00	355.00
New York	59.00	59.00
Michigan	7.25	*
Total	489.25	414.00
OSAGE		
Minnesota	2.77	2.77
OSSEO		
Minnesota	5.00	5.00
PAWNEE		
Canada	1.00	1.00
PLYMOUTH		
Maine	361.00	336.00
Minnesota	120.10	120.10
Wisconsin	34.00	34.00
New York	13.00	13.00
Michigan	6.00	*
Total	534.10	503.10
PONTIAC		
Montana	36.00	36.00
Canada	31.00	30.00
Maine	4.00	0.00
Virginia	0.50	0.50
Total	71.50	66.50
PROGRESS		
Nebraska	278.75	144.75
Wyoming	23.00	5.00
Total	301.75	149.75
PUNGO		
Maine	895.00	850.00
California	1.00	1.00
Wisconsin	1.00	1.00
Total	897.00	852.00
RED BEAUTY		
Wisconsin	10.00	8.00
REDBURT		
Minnesota	15.00	15.00
RED KOTE		
Minnesota	11.25	11.25
RED LASODA		
North Dakota	2,056.30	2,004.30
Nebraska	1,703.72	1,452.42
Minnesota	1,396.10	1,396.10
South Dakota	643.00	490.00
Wisconsin	327.00	252.00
Wyoming	224.00	200.00
Colorado	156.00	109.00

	Acres Entered	Acres Passed
RED LASODA – Continued		
California	55.00	55.00
Washington	54.00	*
New York	38.00	38.00
Delaware	30.00	*
Maine	5.00	0.00
Total	6,688.12	5,996.82
RED MC CLURE		
Colorado	2,398.50	1,529.00
RED PONTIAC		
North Dakota	12,287.50	11,473.00
Minnesota	10,348.51	10,348.51
Canada	2,632.00	2,095.00
Wisconsin	510.00	449.00
South Dakota	842.00	228.00
Nebraska	200.35	162.85
Wyoming	135.00	130.00
Colorado	302.10	121.50
California	89.00	89.00
Oregon	39.00	39.00
Delaware	30.00	*
Utah	20.00	20.00
Maine	22.00	17.00
Washington	12.00	*
New York	3.00	3.00
Total	27,472.46	25,175.86
RED SKIN (DAKOTA RED)		
New Jersey	3.50	*
RED TRIUMPH		
Minnesota	156.50	156.50
RED WARBA		
Minnesota	188.33	188.33
North Dakota	38.00	38.00
Canada	31.25	31.00
Wisconsin	19.00	6.00
Total	276.58	263.33
RURAL NEW YORKER		
Colorado	216.11	163.11
RUSHMORE		
Maine	274.00	255.00
North Dakota	54.00	14.00
Wisconsin	23.00	18.00
Nebraska	19.00	19.00
Total	370.00	306.00
RUSSET BURBANK		
Idaho	22,126.00	19,462.00
Canada	4,708.00	3,956.00
Maine	3,374.00	2,699.00

*Information not available.

	Acres Entered	Acres Passed
Montana	2,780.00	2,743.00
Oregon	2,007.00	2,007.00
California	1,693.00	1,531.00
Minnesota	1,313.16	1,313.16
Wisconsin	1,019.00	881.00
Colorado	848.66	782.00
North Dakota	683.00	656.00
Washington	493.00	*
Utah	49.00	49.00
Wyoming	43.00	43.00
New Mexico	40.00	*
South Dakota	18.00	18.00
Nevada	25.00	5.00
Michigan	5.00	*
Total	41,224.82	36,145.16
RUSSET RURAL		
Michigan	532.00	*
Maine	274.00	260.00
New York	186.00	141.40
Colorado	166.90	141.40
Canada	43.50	41.00
Pennsylvania	25.00	25.00
Wisconsin	16.00	16.00
Total	1,243.40	669.40
RUSSET SEBAGO		
Wisconsin	506.00	465.00
Maine	65.00	57.00
New York	3.00	3.00
Minnesota	0.10	0.10
Total	574.10	525.10
SACO		
Maine	17.00	16.00
SEBAGO		
Canada	20,274.00	19,740.00
Wisconsin	698.00	631.00
Michigan	610.00	*
New York	227.00	201.00
Maine	159.00	151.00
North Dakota	110.00	40.00
Minnesota	34.50	34.50
Oregon	16.00	16.00
Vermont	4.50	4.50
California	2.00	2.00
Total	22,135.00	20,820.00
SEQUOIA		
North Carolina	66.70	66.70
Maine	16.00	15.00
Tennessee	10.50	10.50
Michigan	4.00	*
Total	97.20	92.20
SHERIDAN		
New Hampshire	1.00	1.00

	Acres Entered	Acres Passed
TAWA		
Minnesota	20.50	20.50
Wisconsin	23.00	15.00
California	2.00	2.00
Total	45.50	37.50
TETON		
Maine	255.00	227.00
Canada	13.00	12.00
Total	268.00	239.00
WARBA		
Canada	422.00	318.00
Maine	45.00	43.00
Minnesota	0.25	0.25
Total	467.25	361.25
WASECA		
Minnesota	341.66	341.66
Canada	170.00	79.00
North Dakota	110.00	55.00
Montana	3.25	.25
Total	624.91	475.91
WHITE CLOUD		
Wisconsin	10.00	10.00
Minnesota	4.00	4.00
South Dakota	4.00	4.00
Total	18.00	18.00
WHITE ROSE		
California	2,990.00	2,960.00
Washington	628.00	*
Oregon	433.00	433.00
North Dakota	309.50	309.00
Utah	154.00	148.00
Montana	125.00	125.00
Idaho	75.00	75.00
Canada	79.00	68.00
Nevada	24.50	4.50
Colorado	15.00	15.00
Nebraska	12.00	12.00
Wisconsin	12.00	0.00
Minnesota	7.00	7.00
Total	4,864.00	4,156.50
YAMPA		
Colorado	2.50	2.50
Minnesota	1.50	1.50
Total	4.00	4.00

*Information not available.

OTHER VARIETIES

	Acres Entered	Acres Passed
ALLEHANNA		
Pennsylvania	1.00	1.00
ARRAN VICTORY		
Canada	3.00	3.00
AVON		
Canada	30.00	28.50
Maine	0.72	0.72
Total	30.72	29.22
BLUE CHRISTY		
Maine	0.01	0.01
ERLIRED		
Minnesota	20.00	20.00
EARLY EPICURE		
Canada	29.00	28.75
FUNDY		
Canada	881.00	651.00
Maine	25.00	24.00
Total	906.00	675.00
GARNET CHILI		
Canada	3.00	3.00
GOLD COIN		
Canada	13.50	13.50
MANOTA		
Canada	148.00	21.00
McINTYRE		
Canada	8.00	8.00
MOHAWK		
Maine	1.00	1.00
TRIUMPH		
Wisconsin	2.00	2.00
WHITE RURAL		
Michigan	25.00	*
MISCELLANEOUS VARIETIES AND SEEDLINGS		
North Dakota	320.81	272.91
Wisconsin	53.00	53.00
Nebraska	32.00	32.00
Total	405.81	357.91

*Information not available.

PERSONS AND AGENCIES IN CHARGE OF POTATO SEED CERTIFICATION

Alaska

C. E. Logsdon, Alaska Agricultural Experiment Station, Palmer, Alaska.

California

H. W. Poulsen, Chief and John J. Adams, Supervising Inspector, Bureau of Fruit and Vegetable Standardization, Dept. of Agriculture, Sacramento 14, Calif.

Colorado

M. W. Felton, Potato Certification Service, Colorado State University, Fort Collins, Colorado.

Delaware

W. Robert Hickman, Delaware State Board of Agriculture, Dover, Del.

Idaho

T. C. Blackburn, Secretary-Manager, Idaho Crop Improvement Association, Inc., P. O. Box 2601, Boise, Idaho.

Iowa

Joe L. Robinson, Secretary, Iowa Crop Improvement Association, 112 Agronomy Building, Ames, Iowa.

Kentucky

B. W. Fortenbery, Manager, Kentucky Seed Improvement Ass'n. 929 So. Limestone St., Lexington 44, Ky. (Not certifying potatoes this year.)

Maine

Paul J. Eastman, Chief, Division of Plant Industry, Dept. of Agrciulture, Augusta, Me.

Maryland

L. O. Weaver, Plant Pathologist, University of Maryland, Agricultural Experiment Station, College Park, Md.

Michigan

D. L. Clanahan, Chief, Potato Certification, Michigan Crop Improvement Association, Michigan State College, East Lansing, Mich.

Minnesota

D. M. Coe, In Charge, Seed Potato Certification, Division of Plant Industry, Dept. of Agriculture, St. Paul Campus, Univ. of Minnesota, St. Paul 1, Minn.

Montana

Leonard A. Yager, Extension Horticulturist, Montana State College in cooperation with Montana Potato Improvement Ass'n., Bozeman, Mont.

Nebraska

Warren Trank, Certification Mangaer, Potato Seed Certification Association of Nebraska, P. O. Box 90, Alliance, Nebraska.

Nevada

G. G. Schweis, Division of Plant Industry, P.O. Box 1027, Reno, Nev.

New Hampshire

C. A. Lyon, In Charge, Seed Potato Inspection, Dept. of Agriculture, Concord, N. H.

New Jersey

William M. Cranstoun, Chief, Bureau of Seed Certification, Dept. of Agriculture, P. O. Box 1243, Trenton, N. J.

New Mexico

J. T. Stovall, Administrative Officer, New Mexico Crop Improvement Association, P. O. Box 425, State College, N. M.

New York

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Washington

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Wisconsin

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Wyoming

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Canada

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PUBLICATIONS OF INTEREST TO THE POTATO INDUSTRY

PERIODICALS

AMERICAN POTATO JOURNAL, 1924-1960. Published monthly by the Potato Association of America, New Brunswick, N. J.
Price, $4.00 per year, Foreign $5.00 per year (Includes membership).

THE AMERICAN VEGETABLE GROWER, Willoughby, Ohio. Published monthly. Editor, Richard T. Price, $1.00 per year, 3 years $2.00; Canada and foreign $1.50 per year.

THE BADGER COMMON TATER, Published monthly by the Wisconsin Potato Growers Association Inc., Editor, Harold H. Simons, Bank Bldg., Antigo, Wisconsin.
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BUCKEYE NEWS, Published monthly. Editor, V. E. Keirns, 4680 Indianola Ave., Columbus 14, Ohio.

COLORADO POTATO GROWER, Published monthly by the Colorado Potato Growers Exchange, Editor, W. W. Davis, 2401 Larimer St., Denver 5, Colorado.
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EUROPEAN POTATO JOURNAL, Published monthly by the European Association for Potato Research, W. H. DeJong, Editor, P. O. Box 20, Wageningen, Holland.

THE GUIDE POST, Published annually by the Pennsylvania Cooperative Potato Growers, Inc., Editor, D. M. Cresswell, 5235 North Front St., Harrisburg, Pa.
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HINTS TO POTATO GROWERS, Published monthly by the New Jersey State Potato Association, Editor John C. Campbell, N. J. Agricultural Experiment Station, New Brunswick, N. J.
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THE INDIAN POTATO JOURNAL, Published semi-annually by the Central Potato Research Institute, Editor Prem Nath, Indian Council of Agricultural Research, Queen Victoria Road, New Delhi 2, India.

MICHIGAN POTATO INDUSTRY COUNCIL NEWSLETTER, Published by Michigan Potato Industry Council, D. L. Clanahan, Editor, Agricultural Hall, Room 8, Michigan State University, East Lansing, Michigan.

NATIONAL POTATO COUNCIL NEWS, Published by the National Potato Council, Inc. 542 Munsey Bldg., Washington 4, D. C.
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THE PACKER, Published weekly, Editor R. V. Whiting, 201 Delaware St., Kansas City 5, Missouri.
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THE POTATO CHIPPFR, Published monthly by the Potato Chip Institute International, 946 Hanna Bldg., Cleveland 15, Ohio.
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POTATO COUNCILLOR, Published monthly by the Maine Potato Council, Leo M. Daigle, Editor, 364 Maine St., Presque Isle, Maine.
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POTATO FACTS, Published from time to time by the Agricultural Extension Services of North Dakota Agricultural College and the University of Minnesota, University of Minnesota, Institute of Agriculture, St. Paul 1, Minn.

POTATO HORIZONS, Published monthly by the Lockwood Grader Corp., Editor N. L. Morton, Box 177, Gering, Nebraska.
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POTATO NEWS, Published by the Empire State Potato Club, Inc., Editor H. W. Evans, Georgetown, N. Y.
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"POTATO PEELINGS", Published monthly by the Potato Section, Ontario Soil and Crop Improvement Association, Ont. Dept. of Agri., Toronto, Ont., Canada.

THE PRODUCE NEWS, Published weekly, Editor Allen E. Haglund, 6 Harrison St., New York 13, N. Y.
Subscription price $5.00 per year.

SPUD LINES, Published monthly by University of Maine Agricultural Extension Service, Paul Mosher, Editor, Orono, Maine.

THE UNITED SPUDLIGHT, Published weekly by the Potato Division, United Fresh Fruit & Vegetable Association, Editor Kris P. Bemis, 777-14th St., N. W., Washington 5, D. C.
For Association division members only: $25.00 per year to individuals and firms not eligible for membership.

THE VALLEY POTATO GROWER, Published semi-monthly by the Red River Valley Potato Growers Association, Editor Lyle W. Currie, Box 301, East Grand Forks, Minn.
Free.

VEGETABLE GROWERS MESSENGER, Published six times per year, Editor Max Chambers, Preston, Maryland.
Subscription price $1.00 per year.

BOOKS

AMERICAN POTATO YEARBOOK, Published annually by Macfarland Publications, 8 Elm St., Westfield, N. J. 1950-1954, Editor, John C. Campbell. 1955-1960, Editor, C. Stedman Macfarland.
Price $2.00 each edition.

POTATO BLIGHT EPIDEMICS THROUGHOUT THE WORLD, Agricultural Handbook No. 174, 1960. A. E. Cox and E. C. Large, Agricultural Research Service, U.S.D.A. Available from Supt. of Documents, Washington 25, D. C.

POTATO HANDBOOK, 1956-60,
1956—Seed Certification Issue, John C. Campbell, Editor.
1957—Disease Control Issue, John C. Campbell, Editor.
1958—Machinery and Equipment Issue, Cliff Hutchinson, Editor.
1959—Potato Variety Issue, Cliff Hutchinson, Editor.
1960—Potato Processing, John C. Campbell, Editor.
Published by The Potato Association of America, New Brunswick, N. J.
Price, $1.00 per copy or $4.00 for complete set, 1956-1960

POTATO PROCESSING, 1959, William F. Talburt and Ora Smith, Editors. The Avi Publishing Company, Inc., Westport, Connecticut.
Price, $9.50, U. S.; $10.50, foreign.

YEARBOOK OF THE POTATO GROWERS ASSOCIATION OF CALIFORNIA AND ARIZONA, Published annually, Editor Francis P. Pusateri, P. O. Box 83, Bakersfield, California.
Subscription price $10.00.

BULLETINS

An Analysis of Costs for Packing Potatoes in 10-Pound Bags in the Southeast. 1959. Agricultural Economics Mimeo Report No. 60-6, Department of Agricultural Economics, Florida Agricultural Experiment Station, Gainesville, Florida.

Consumption of Processed Farm Foods in the United States. Marketing Research Report. No. 409, U.S.D.A. Agricultural Marketing Service, Marketing Economics Division. Available from Supt. of Documents, Washington 25, D. C.

Factors Affecting Specific Gravity of White Potato in Maine. 1959. Maine Agricultural Experiment Station Bulletin No. 583, University of Maine, Orono, Maine.

Factors Affecting Yields, Specific Gravity and Maturity of Potatoes. 1959. Maine Agricultural Experiment Station Bulletin No. 579, University of Maine, Orono, Maine

Flume Design for Receiving and Handling Potatoes in Packinghouses. 1960. Florida Agricultural Experiment Station Circular No. S-119, University of Florida, Gainesville, Florida.

Fresh and Procesesed Potato Consumption in Milwaukee, Wisconsin. 1959. Idaho Agricultural Experiment Station Bulletin No. 318, University of Idaho, Moscow, Idaho.

Increasing Potato-Harvester Efficiency. 1959. Agricultural Handbook No. 171. USDA, Agricultural Research Service. Available from Supt. of Documents, Washington 25, D. C.

Pressures on Walls of Potato Storage Bins. 1960. USDA, Agricultural Marketing Service Bulletin No. 401, Supt. of Documents, Washington 25, D. C.

Storage of Fall Harvested Potatoes in Northeastern Late Summer Crop Area. 1959. USDA Marketing Research Report No. 370, Supt. of Documents, Washington 25, D. C.

INCREASED YIELD FROM SEED TREATMENT FOR POTATOES

Chemical treatment of cut potato seed gives good control of certian diseases and increases yields. This is particularly true under some conditions. For example, failure of treatment to increase yield when seed pieces are planted in an irrigated bed indicates that soil moisture is important in the parasitic activity of certain pathogens. This was apparent in the case of *Rhizoctonia solani.* Seed treated with "Semesan Bel" seed disinfectant and held even as long as a month was equal to or better than seed treated with any of the other standard commercial seed piece treatments held for the same time.

Of all the treatments used in this study, only "Semesan Bel" plus Agrimycin resulted in appreciably greater yield if the seed pieces were held for ten days. Since "Semesan Bel" and Agrimycin have been reported to be effective in the control of black leg, seed piece decay, *Rhizoctonia,* and *Verticillium* wilt, and since their use may result in better yields than is obtained from untreated seed, it is recommeneded that the combination of these two chemicals be used for treating potato sets in Idaho. — *Agricultural Experiment Station, University of Idaho.*

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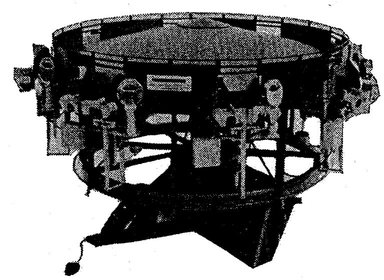

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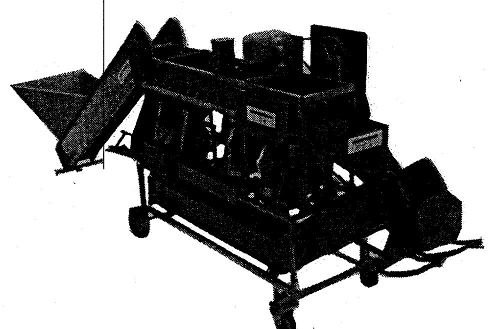

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FIVE NEW POTATO VARIETIES

Development of good-eating, high-yielding, disease-resistant potatoes reached a new high last year with release of four new varieties under the cooperative USDA-State National Potato Breeding Program. A fifth variety was released in Mexico jointly by USDA and the Rockefeller Foundation.

Catoosa, developed and tested by ARS and the Tennessee and Louisiana experiment stations, is the first red-skinned potato that has some resistance to both late blight and scab. It is superior to Pontiac in culinary qualities and compares favorably in yielding ability with standard varieties when grown in Alabama, Florida, Louisiana, Tennessee, and Texas.

Redskin was developed by ARS and released jointly with the Texas Agricultural Experiment Station. It yields as high or higher than standard varieties grown in most states, especially those in Maine, Pennsylvania, Delaware, Iowa, Florida, and Texas. It is resistant to scab and net necrosis due to leafroll.

Blanca and Navajo, sister varieties developed at Greeley, Colo., by ARS and released cooperatively with the Colorado Experiment Station, are baking potatoes and make good chips either before or after storing. Blanca is highly resistant to scab; Navajo has good resistance, producing less scab-infected tubers with fewer lesions than susceptible varieties grown in the same location. Both Blanca and Navajo were outstanding in yield and quality in tests in Colorado.

A U.S. breeding selection screened for resistance to late blight in Mexico was named Erendira after proving to be field resistant to the many races of the fungus that occur in Mexico. It is being used as a parent in ARS breeding work.

Erendira will be most useful to small farmers who grow potatoes as a basic food crop in the Mexican highlands.

NOVEMBER POTATO CROP REPORT

United States total potato production on November 1, 1960, was estimated by the Crop Reporting Service at 253,784,000 hundredweight. This is 10.5 million hundredweight above the 1959 production and 20.3 million hundredweight above the 1949-1958 average.

The 1960 United States *fall* potato crop is estimated at 171,499,000 hundredweight, 0.3% more than the October forecast and 4% above the 1959 crop. Declines from a month ago in Maine, Oregon, and California were more than offset by larger crops estimated for Wisconsin, Minnesota, and Colorado. Weather conditions during October were favorable for harvest and practically all acreage was dug by November 1. The average yield per acre of the fall crop, estimated at 181.7 hundredweight, is 0.5 hundredweight below the 1959 yield. Abandonment of acreage this year was very small – much below the abandonment in 1959.

The 1960 crop in the 8 Eastern States is placed at 60,967,000 hundredweight, 2.8 million above the 1959 crop. In the 9 Central States, production is placed at 45,452,000 hundredweight, 4.6 million above the crop of last year. In the 9 Western States, the 1960 production, at 65,080,000 hundredweight, is practically the same as a month ago but 0.7 million below the 1959 crop.

As of November 1, 1960, potato production in New England is estimated at 38,786,000 hundredweight, 2% more than 1959 production of 38,103,000 hundredweight and 3% less than the 10-year (1949-1958) average production of 40,017,000 hundredweight. The 1960 crop is made up of 644,000 hundredweight of late summer potatoes grown in Massachusetts and Rhode Island and 38,142,000 hundredweight of fall potatoes.

In Aroostook, Maine, unusually dry weather subsequent to about mid-July limited size of tubers and contributed to an early ripening off of the crop. Early artificial topkilling of vines was also common and harvest was mostly completed by early October. Tubers contain an unusually high proportion of dry matter and quality is outstandingly good. Maine potato production is estimated at 34,270,000 hundredweight, 1% more than the 1959 crop of 34,080,000 hundredweight and 4% less than the 10-year average of 35,570,000 hundredweight. The estimated average yield per acre for Maine of 230 hundredweight compares with 240 hundredweight per acre harvested in 1959.

In Upstate New York, quality of the 1960 crop is very good. On Long Island, harvest was nearing completion by November 1. Harvest in western Pennsylvania is completed but a few growers in eastern areas still had some acres to dig the last week of October. Record high yields were harvested in Ohio, Indiana, and Wisconsin. Yields in Minnesota and North Dakota were affected by dry weather in August but are above those harvested in 1959. In each of the important States of Idaho, North Dakota, Minnesota, and Colorado, production is above last year and substantially above average.

Potatoes will be made mealy if allowed to stand 20 minutes in hot water before they are put into the oven.

As potatoes get old add a little sugar to the water in which they are boiled. They will taste better.

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