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QUALITY OF FLORIDA POTATOES AND SOME OF THE FACTORS AFFECTING QUALITY

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The five southeastern states of Florida, Alabama, South Carolina, North Carolina and Virginia began in 1947 a regional study under the Research and Marketing Act of "Marketing Early Irish Potatoes." Work has been devoted to a subproject "Spoilage in Marketing Early Irish Potatoes" to determine the causes of losses in handling potatoes. The states have been assisted by the Bureau of Plant Industry, the Bureau of Agricultural Economics, the Federal Inspection Service, the Railroad Perishable Inspection Agency, the Western Weighing and Inspection Bureau, cooperating receivers in terminal markets, and shippers and farmers in various potato producing areas.

To obtain data on factors causing losses in handling potatoes, special lots were followed from the time they were dug in the field, through the grading and packing shed, to the terminal market, and in many cases through retail stores. Records were obtained on weather conditions at time of digging and practices in handling potatoes both in the field and in the packing sheds. Samples were collected at various points in the marketing process to

measure the extent of damage and where it was occurring. These data provide a record of usual practices in handling potatoes and the effect of these on losses and quality.

Study of Grade Qualities of Potatoes in Retail Stores

In the above study, it was possible to follow only a small percentage of the test lots through retail stores. Data on these lots gave some information on the condition and quality of potatoes in stores but it was felt that additional data were needed. Therefore, a special study was conducted in Pittsburgh in 1950 to determine the grade qualities of potatoes displayed for sale to consumers in retail stores. The Pittsburgh market was chosen for the study because the Bureau of Agricultural Economics had in progress a fruit and vegetable survey in 30 stores selected to represent various conditions in that market. They consisted of small, medium and large stores and represented various types of independent and chain stores. It was thought that the results of the two studies would supplement each other.

In the study of grade quality, samples were collected and examined from lots of potatoes displayed for sale in the cooperating stores. Each store was visited twice a week from March 1 to

June 30, 1950, and a 10 to 15 pound sample purchased from each display of potatoes. For example, if Maine potatoes were offered for sale in both bulk and consumer packages, a sample was purchased from each lot. Samples were collected from Monday through Friday of each week and 12 stores were visited each day. The schedule for visiting the stores was designed to give a representative sample of potatoes on display throughout the day and for various days of the week. The stores were visited so as to include a sample by size and type each day and visits to individual stores would rotate as to the day of the week and time of day. All samples were carried to a central laboratory and each was graded by a Federal Inspector according to Federal grading standards. Each potato was sized and analyzed in detail for external and internal defects, each type of defect being scored separately. The degree of severity of each type of defect was estimated and recorded as *serious damage*, *damage* or *injury*. After each lot was graded, all defects were cut out and the amount of material removed was weighed to get an objective measure of loss due to defects.

During the study over 3,000 samples of potatoes were collected and examined.

The data are now in the process of being analyzed. Results presented here are preliminary and cover only the period March 13 to June 2, 1950. They are based on a simple average of all samples collected as samples for individual stores have not been weighted by volume of potatoes sold in the store. The period covered includes the bulk of the movement from Florida. In this paper, I would like to discuss the average grade defect of Florida potatoes and show how they compared with other potatoes on the market during the same period. Next, I would like to discuss the type of defects in different varieties of potatoes from Florida and, from our previous work, show some of the things we found that caused some of the damage.

Average Grade Defects

Five hundred and fifteen samples were collected between March 13 and June 2, 1950, from lots of Florida potatoes displayed for sale in the 30 cooperating stores. The average grade defects of these potatoes was 16 percent, of which 5 percent was scored as serious damage and 11 percent as damage (Table 1). In addition to grade defects, 6 percent was scored as injury, making a total of 22 percent for all defects. The average

TABLE 1.
AVERAGE PERCENTAGE TOTAL GRADE DEFECTS AND OTHER FACTORS, BY STATES OF ORIGIN,
FOR POTATOES IN 30 RETAIL STORES IN PITTSBURGH, PENNSYLVANIA, MARCH 13-JUNE 2, 1950.

Item	Florida	Alabama	California	Maine		Idaho	
				Prepacked	Bulk	Prepacked	Bulk
Number of samples	515	114	210	595	255	117	328
Average percentage defects:							
Percent serious damage	5.5	10.5	11.5	5.6	7.4	7.1	11.8
Percent damage	10.9	10.0	4.7	7.8	12.3	13.1	19.4
Percent total grade defect	16.4	20.5	16.2	13.4	19.7	20.2	31.2
Percent injury	5.8	3.6	1.0	3.7	5.8	6.0	7.3
Percent total defects	22.2	24.1	17.2	17.1	25.5	26.2	38.5
Percent waste	4.4	8.9	8.9	4.0	6.1	5.9	9.0
Average retail price (cents)	6.91	7.22	5.93	4.19	5.07	7.16	7.25

grade defects for potatoes displayed from certain other states during this same period was 20 percent for Alabama, 16 percent for California, 13 percent for Maine in consumer packages and 20 percent in bulk, and 20 percent for Idaho in consumer packages and 31 percent in bulk. The percentage of waste due to defects as shown by the material that was cut out varied in relation to total grade defects but was affected by the proportion classified as serious damage and damage. For example, the average grade defects of Florida and California potatoes was the same, 16 percent. The proportion scored as serious damage and damage was reversed being 5 percent serious damage and 11 percent damage for Florida potatoes and 11 percent serious damage and 5 percent damage in California potatoes. The average percentage waste amounted to 8.9 percent in California but only half as much, or 4.4 percent, in Florida potatoes. The average waste in potatoes from other states was 8.9 percent for Alabama, 4.0 percent for Maine prepackaged and 6.1 percent for bulk potatoes, and 5.9 percent for Idaho prepackaged and 9.0 percent for bulk potatoes.

Variation in Grade Defects of Florida Potatoes by Varieties

The average grade defects of Florida potatoes varied considerably by varieties. Pontiac with grade defects of 12 percent was lowest, Red Bliss was second with 16 percent and Sebago highest with 23 percent. The average waste due to defects was 3 percent in Pontiac, 5 percent in Red Bliss and 6 percent in Sebago. With the exception of Maine potatoes that were prepackaged at the shipping point, the average amount of waste in each of the varieties from Florida was less than in potatoes from other states on the market during this period.

This study showed one interesting

thing as far as the Red Bliss and Pontiac varieties from Florida are concerned. Although the average grade defects for Pontiac was only about 70 percent and the average waste 60 percent as much as in the Red Bliss variety, the average retail price for Pontiacs was .53 cents per pound less. The amount of Pontiacs sold in these stores was much less as shown by the fact that only 124 samples were collected for this variety in comparison with 318 samples of Red Bliss. From these data, it is impossible to say what caused this price differential.

Type of Defects Found in Different Varieties

The kind of damage scored as defects varied considerably by varieties. Cuts and bruises accounted for 70 percent of the average grade defects in Red Bliss but only 53 percent in Pontiac and 20 percent in Sebago. In defects scored as injury, cuts and bruises made up 79 percent of the total in Red Bliss, 48 percent in Pontiac and 42 percent in Sebago. Insect damage was the second most important grade defect in both the Red Bliss and Pontiac varieties being 12 and 17 percent, respectively. This defect amounted to only 2 percent in the Sebago variety. Greening and external discoloration due to sunburn, browning, sun scald and sticky scald amounted to 5 percent each for Red Bliss and 3 and 4 percent for the Pontiac variety. These were the two most important defects scored in the Sebago variety. Greening amounted to 43 and external discoloration 30 percent of the total grade defects. External discoloration also amounted to 42 percent of the defects scored in the injury classification in this variety. Soft rot amounted to only six-tenths of 1 percent grade defect in the Sebago variety but less than one-tenth of 1 percent in both the Red Bliss and Pontiac varieties. The

three most important defects in the Red Bliss variety were cuts and bruises, insect damage and external discoloration; in Pontiac, cuts and bruises, insect damage and second growth; and in Sebago, greening, external discoloration and cuts and bruises. These three defects made up 87, 78 and 93 percent, respectively, of the total grade defect scored in each of these varieties.

Factors Affecting Defects

The inspections of samples collected in retail stores and also the previous study of causes of losses in handling potatoes show that cuts and bruises is a major defect affecting the quality of potatoes from Florida, especially the red varieties. Cuts and bruises not only affect appearance and result in a loss to consumers, they also are potential points of infection in which certain diseases such as soft rot may develop if the potatoes are subjected to conditions favorable for their development. Work on the project "Spoilage in Marketing Early Irish Potatoes" showed that soft rot usually developed only in those shipments that traveled warm and contained a large amount of cut and bruised material unless it was a secondary infection following such things as blackleg, bacterial wilt and blight.

At least half or more of the cuts and bruises in potatoes in retail stores occur after they leave the shipping points in transporting them to market and handling in the terminal market and retail store. The increase in damage after leaving the shipping point is not subject to the control of the producer or shipper. However, it does not cause a loss to the producer in shipping to market as may be the case if a lot of cut and bruised material is present when they leave the shipping point. Rough handling of potatoes should be avoided at all times. They should be dug carefully and handled with equipment that protects them from cuts and bruises. This may involve re-

moving parts of the shakers, using rubber padding or rubber coated chains on the diggers, running the diggers more slowly and deeper, and using rubber coated picking baskets. The use of padding on graders and trucks, avoidance of dumping directly on wire chains, elimination of long drops in the grading equipment, padding of unavoidable drops, careful handling into padded bins or racks and careful operation of the washing and drying equipment will help in reducing damage.

The second most important defect in potatoes from Dade county was insect damage. Approved control measures for insects and diseases should be practiced to eliminate as far as possible defects or losses due to these pests. The capacity of the graders for removing defects during the grading process is limited so, if certain defects are reduced, more attention can be given to the removal of other defects.

Greening was the most important defect in potatoes of the Sebago variety. As is the case for cuts and bruises, the amount of greening increases after the potatoes leave the shipping point. Potatoes should be handled so as to move them through the market and to the consumer without too much delay and they should be stored so as not to expose them to direct light.

Browning, sunburn, sun scald and sticky scald spots was the second most important grade defect in the Sebago variety. These defects also caused 41 percent of the damage in the injury classification. This damage was due to exposing the potatoes to weather conditions favorable for developing these conditions. Producers are aware of the damage caused by leaving potatoes exposed on the ground for even short periods on hot days, and they are usually picked up promptly after digging. However, considerable damage will occur to potatoes in field containers, especially

field bags, if they are left in the field for long periods under certain weather conditions. In the Hastings area, potatoes are quite often left in the field several hours before hauling. In the study in 1949, one-third of the test lots studied in this area remained in the field five hours or longer between picking up and hauling.

Browning and scald spots are caused by rapid drying of the skinned areas of the potato. The rate of drying is determined by the amount of evaporation which varies throughout the day according to weather conditions. High temperature, low relative humidity, high wind velocity and intense sunlight all tend to increase the rate of drying and thus increase the amount of injury caused during a given period of exposure. In the study of losses in handling potatoes, records were obtained for each test lot showing when the potatoes were dug, how long they were exposed in the field before and after picking up and the rate of evaporation during each hour they were exposed. These data and also work with exposed samples in 1948 showed that the breaking point between serious injury and slight to no injury from exposure for the Sebago variety is an evaporation rate of about 3.0 c.c. per hour. The amount of damage to potatoes exposed to a rate of evaporation this much or higher increases with the length of exposure. The greatest increase is in sun scald. Although very little scald spots occur at a rate of evaporation less than 3.0 c.c. per hour, browning will develop and the amount increases with the length of exposure. On most days during the potato harvest in Florida, evaporation rates of 3.0 c.c. per hour or greater occur between 9:00 A.M. and 4:00 P.M. and often even later in the afternoon. Producers should plan not to allow potatoes to remain in the field for more than one hour during this period if they want to be reasonably sure of not having injury from exposure. In some cases this

will necessitate a closer co-ordination between digging and the operation of the packinghouses, for the rate of digging must be regulated more in line with the capacity of the houses to grade and pack potatoes. Damage from exposure not only results in physical losses but it affects the appearance of the potatoes and the consumer acceptance of the product.

Most of the potatoes grown in Florida are packed in fairly modern packinghouses. However, abuses at times are allowed to creep into their operation which tends to reduce the effectiveness of grading and the preparation of the product. Too often, major attention is placed on volume even though this results in practices that reduce quality and increase losses. Crowding the washing and grading equipment beyond its intended capacity results in an increase in mechanical damage, inadequate drying and partially cleaned potatoes of poor appearance. Poor drying of the Sebago variety often causes lenticel infection that gives the potato a dark, spotty, undesirable appearance. Slowing down the speed of grading and packing may result in some increase in cost but this should be offset by an improvement in quality and appearance of the product.

Summary

Early Irish potatoes are highly perishable and need more careful treatment during harvesting and marketing than they often receive. The full cooperation of all agencies from the grower to the clerk in the retail store is needed to deliver potatoes to the consumer that are relatively free from defects. Potatoes from Florida compete with old potatoes and also with new potatoes from other producing areas. They are a low unit value farm product and the price of Florida potatoes is affected by both the supply of old and new potatoes. The amount of additional expense that can be in-

curred in improving the handling procedure is limited. In many cases both growers and shippers must develop a keener appreciation of the factors necessary to produce quality and cooperate in following those practices. Often a better

job could be done without increasing cost simply by paying more attention to the factors that affect quality. Additional research may also aid in developing more efficient methods of handling potatoes.

MULCHING VEGETABLE CROPS WITH ALUMINUM FOIL

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The practice of mulching plants is of very ancient origin and gardeners today employ the same techniques as were used several hundred years ago. Mulching consists of covering the soil around the base of a plant with a layer of undecomposed organic material which may consist of dry leaves, straw, weeds, or some other matter which is more or less refuse by nature. The use of mulches is limited mostly by their costliness when employed on a large scale. Good mulch material is bulky and thus difficult to gather, transport, and distribute. To be effective the mulch must be four to six inches deep which, of course, means that it takes a tremendous amount of material for areas of any size. The advantages of mulching are: (1) conservation of moisture, (2) reduction of soil temperature, (3) discouragement of weed growth, and (4) a resulting cleanliness of the crop. The disadvantages are: (1) the encouragement of the growth of soil fungi detrimental to the plant, (2) introduction of weed seeds, (3) increased soil acidity, (4) loss of nitrogen which accompanies the decomposition of some mulch materials, and (5) the fire hazard.

The development of aluminum foils¹,

obtainable in varying weights and widths, has brought to light a brand new category as regards mulch material. Here we have a material which is light in weight, easy to handle, impermeable to moisture, and reflective to heat rays. The foil also has a salvage value when gathered up, baled and returned to the company.

In the winter season of 1949-50 a preliminary experiment was initiated at the Vegetable Crops Laboratory to determine to what extent aluminum foil might be used as a mulch for vegetable crops. It was expected that the mulch might prove beneficial in the following ways: (1) by reducing soil and surface temperatures, increase the length of the harvesting season for some cold season crops that break down rapidly in warm spring weather, (2) increase yields in general by conserving fertilizer and moisture.

These first tests involved plots mulched with aluminum foil compared to non-mulched plots. The mulched plots were then divided as to fumigation for root knot control and fertilizer applied at 3 different rates with 2 side dress treatments. The EDB (Ethylene Dibromide 10 percent) was applied at the rate of 10 gallons per acre. The fertilizer, a 4-7-5, 25 percent organic, was applied as follows: (1) 750 lbs. per acre in the bed one week prior to setting + 750 lbs. as a side dressing one month after setting, (2) 1500 lbs. all at once in the bed one week before setting, (3) 1500 lbs.

¹ Reynolds Aluminum Co., Richmond, Va.