

NEWS AND REVIEWS

Short Communications

QUALITY-TESTING FACILITIES FOR GROWER USE AT THE POTATO RESEARCH LABORATORY

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Introduction

Potato growers, brokers, and processors are acutely aware of the importance of specific gravity, or percent solids, and chipping quality, especially color, on the stability of their product.

Specific gravity directly influences chip yield; high specific gravity potatoes produce more chipped product (2, 7). Because of recent trends in nutrition that stress the need to reduce fats and oils in the American diet, specific gravity takes on new importance. Specific gravity directly influences chip oil content; higher specific gravity potatoes produce chips with lower oil content (2, 7). Therefore, the reliability of measurement of specific gravity also becomes more important. Confidence levels for various sample sizes have been established for determination of specific gravity (2).

Potato quality, particularly chipping quality, varies with the age of the tuber. Optimum color is observed with freshly harvested potatoes. The sucrose rating test is used to indicate suitable times for vine kill, harvesting, and storage based on their effects on chipping quality (5, 6). However, the small-scale chipping test gives the final physical and visual assessment of quality. It tells the grower what the immediate quality is at harvest, during storage, and at sale time. This test must be simple, easily conducted, and reproducible.

In this report, we describe the facilities for and give directions for the determination of specific gravity and a test of chipping quality that are available at The Potato Research Laboratory for use by growers, brokers, and others in the industry.

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Materials and Methods

For the past several years, area potato growers have utilized a simple chipping potato slicer and a fryer for quality testing at the Potato Research Laboratory (Shaw, R.L., unpublished information). The slicer (Figure 1) was specially designed and constructed of heavy-duty plexiglass with a removable blade set to cut at the thickness of 0.127 cm (0.050 inch). The fryer (Figure 2) is a 220-volt unit modified with a propeller-type oil stirrer and is equipped to submerge a single bulk fry basket containing 10 potato tissue slices for 100 sec and subsequently surface the basket from the hot oil, by simply pressing an automatic timer button.

Recently, we have further modified the equipment and expanded the facilities to provide a complete test station for specific gravity and chipping quality determinations (Figure 3). A compartmentalized basket was fabricated with 20 compartments (Figure 1) to contain the slices for frying. The compartmentalized basket (a) provides uniform frying, (b) eliminates the manual stirring required when the slices were fried in bulk, (c) prevents the sticking together of slices, (d) and produces a less oily chip because of the vertical orientation of the slices in the compartments.

Detailed instructions are posted that include photos showing the step-by-step procedures (Tables 1 and 2) for carrying out the tests and properly operating the equipment. Also posted (Figure 3) are the new "Fry Color Standards for Potatoes for Chipping" (3), and the "Chipping Potato Disease/Defects Chart" (4) produced by the Potato Chip/Snack Food Association (Crystal Square 3, 1735 Jefferson Davis Highway, Suite 903, Arlington, Virginia 22202). A data form and calculator are provided to simplify the weight-in-air/weight-in-water calculations for specific gravity.

TABLE 1. — *Step-wise instructions (less photo illustrations) that are posted for determination of specific gravity.*

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1. For a given lot of potatoes, select 3 representative potato samples approximately 5000 grams (about 11 pounds) each.
 2. Check zero of balance and be sure water container is full.
 3. Wash and dry sample
 4. Accurately weight the sample and record grams-in-air.
 5. Place sample in basket, weigh in water, and record grams-in-water.
 6. Calculate $\frac{\text{grams-in-air}}{(\text{grams-in-air}) - (\text{grams-in-water})} = \text{specific gravity}$
 7. Repeat steps 2 through 6 for second and third sample and average the 3 readings.
 8. Record water and pulp temperature, and correct the average specific gravity (plus or minus) using the posted correction table.
 For example: 50°F water and 45°F pulp temperatures require a minus 0.0006 specific gravity correction. An uncorrected specific gravity of 1.0900 would have a corrected average specific gravity of 1.0900-0.0006 = 1.0894.
 9. Clean the area.



FIG. 1. Potato slices are cut with a custom-made slicer, washed, and then placed in the compartmentalized basket for frying. The basket cover is in the background. Note that the operator is wearing a stainless steel mesh safety glove.

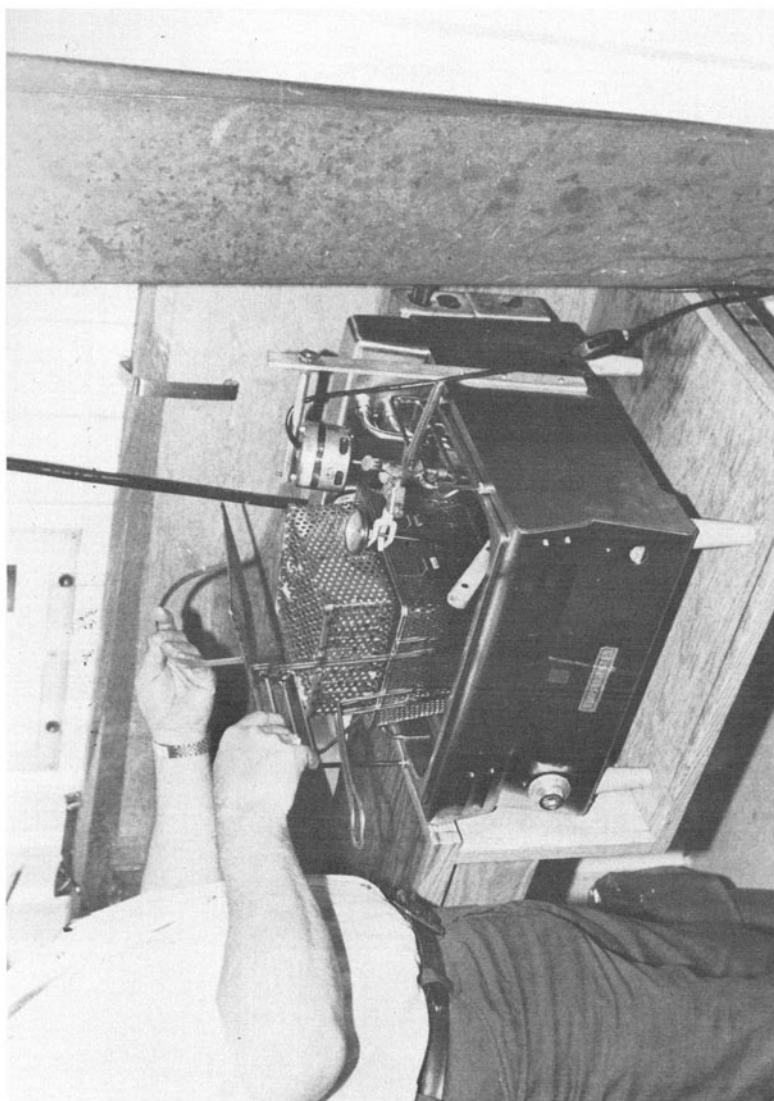


FIG. 2. A modified 220-volt chip fryer equipped with a propeller-type oil stirrer, an automatic fry timer, and a compartmentalized basket (with cover) that is being set into the submergible bulk basket.

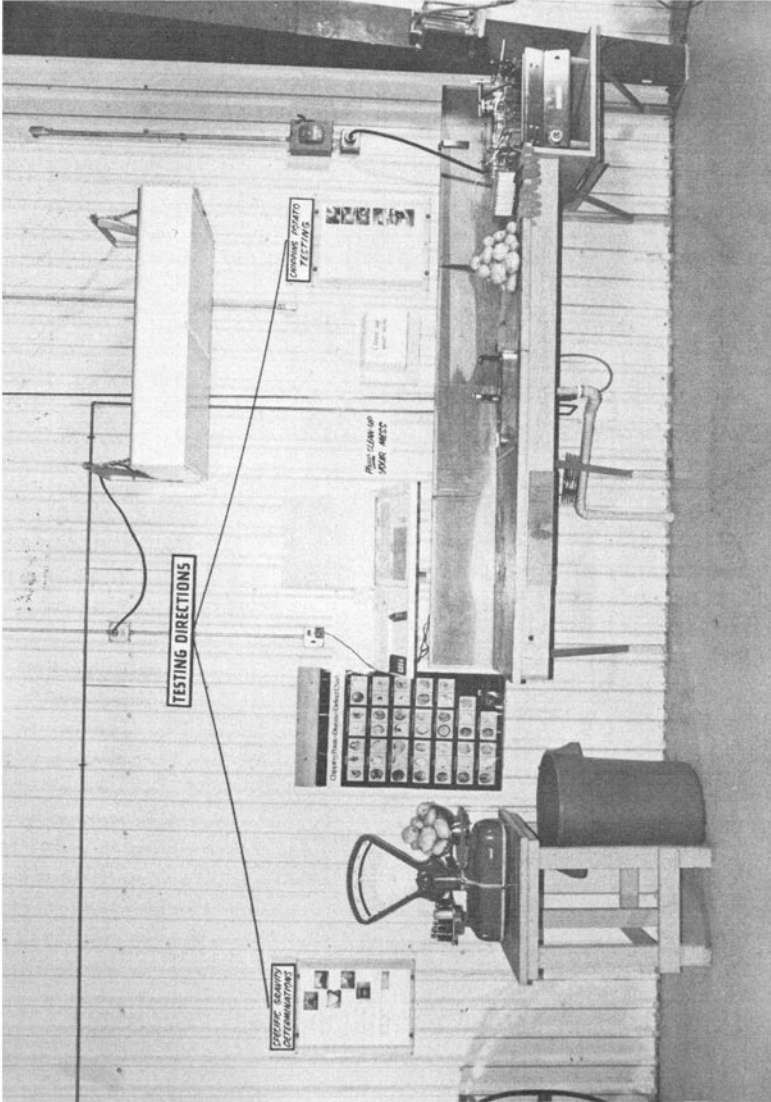


FIG 3. The complete testing facility for *Specific Gravity Determination and Chipping Potato Testing* including posted instructions with photographic illustrations and charts for quality evaluation.

TABLE 2. — *Step-wise instructions (less photo illustrations) that are posted for chipping quality testing.*

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1. Turn on fryer and wait for yellow heat light to go out; thermometer should now indicate 365°F.
 2. After washing sample, put on safety glove and cut 40 representative tubers in half lengthwise. Retain one of the halves from each tuber for testing and discard the other.
 3. While wearing safety gloves and using slicer, cut and discard the first 2 slices from each tuber half. Then cut and wash the third slice (0.05 inch thick) from each tuber half.
 4. After placing 20 slices in the slice holder compartments, place compartmentalized unit into bulk basket, replace its cover, and press button to fry (preset to 100 sec).
 5. Empty slice holder of chips.
 6. Repeat steps 4 and 5 for the second 20 slices.
 7. Turn off fryer.
 8. Evaluate color of the 40 fried slices with the color chart.
 9. Clean the area.
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These calculations include corrections based on tuber and water temperatures (1).

The posted procedures are based on those recently developed by the U.S. Department of Agriculture, Food Safety and Quality Service for potato inspectors (1). They are to be regarded only as suggestions for obtaining representative results. Chipping test results are only as representative as the sample examined. A good sampling plan is a necessity.

Discussion

The weight-in-air/weight-in-water method of specific gravity determination is used for two major reasons: a) both large and small samples can be accommodated and b) the method is inherently more accurate than the hydrometer, which requires calibration with an iron rod.

Each chipping plant is unique and individual plant operators vary processing parameters differently from lot to lot to obtain optimum chip quality. The variations needed to simulate these adjustments are not included in small-scale chip quality testing because they cause confusion and uncertainty for the grower or broker and the buyer. These procedures were simplified to avoid confusion in conducting the test and to avoid uncertainty in interpretation of results. This was accomplished by standardizing variables in slice thickness, oil temperature, and frying time, so that the main variable is the sample.

Summary

Facilities, including specially designed and fabricated equipment for quality testing are available at the Potato Research Laboratory for potato

growers, storage operators, and others in the potato industry to conduct their own specific gravity determinations and chipping tests. Instructions, complete with illustrations, are posted so that those interested can conduct these evaluations at their convenience. These testing facilities have been used extensively by potato growers and others in the industry.

Acknowledgments

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