

## RECENT RESEARCH WITH POTATOES

Dr. Andrea Mackey, Professor, Home Econ, Research  
School of Home Econ., Oregon State University, Corvallis

This report deals with highlights of our potato research program. We have been working mostly with the Russet Burbank variety for the fresh market, but we have done a little work with processed products, I'll tell you about both.

First, the work with fresh potatoes. The Russet Burbank potato, when grown in the Northwest, has a characteristic mealiness, and because of this is marketed throughout the nation as a premium quality baking potato. It is also called Nette Gem, and when grown in Idaho, is frequently referred to as the Idaho Baker.

This important variety is harvested in the early Fall, and since it stores very well, it is the major variety found in Northwest markets from harvest season in September or October through the winter and spring months. In these months, it is by far the largest-volume seller. Some of the Fall-harvested potatoes may still be found in the grocery stores in late June.

Research on potatoes was started because homemakers complained that potatoes did not cook the way they would like, -especially, they fell apart when they were boiled.

As part of this research project, we felt the need to know a number of things about the consumer's purchases, uses, and satisfactions with potatoes. We carried out a questionnaire study in Oregon, in which we asked homemakers questions about how often they served potatoes, how they prepared them for different meals, whether the cooking quality was satisfactory, and others. We learned that half the homemakers served potatoes often, from five to seven times per week, and usually at the main meal of the day.

We also asked whether they preferred fresh, froze, canned, or dehydrated potatoes for specific purposes, such as for mashing or use in scalloped dishes. Almost unanimously, they voted for fresh. There were two exceptions. First for making French Fries. If homemakers prepared them, many said they used the frozen Fries. The dehydrated form of potatoes was often used when the family was going on a camping or hiking trip, and some homemakers said they kept some dehydrated potatoes on hand for emergency use. A few said they liked to use them for preparing little bits of servings, as for a baby's meal.

The preference for most purposes, then, was for fresh. Eight or nine months of the year, this would usually mean that homemakers were using the Russet Burbank variety. Although this variety is generally considered the be THE baking potato, we found that homemakers do not bake potatoes as often as they boil or mash them. Just

plain boiling was the most frequently used method of cooking reported by Oregon homemakers. Nearly 30% of the potatoes served were cooked by this method; next was mashing, 26%, followed by baking, 22%, frying, 14%, and in casseroles, 8%.

We asked about the size potato the homemaker preferred for different methods of cooking. For baking, half the homemakers expressed a preference for the eight-ounce size. One-fourth liked really large potatoes for baking, preferring the twelve-ounce size. For mashing and frying, the larger sizes were preferred; while for boiling, both large and small potatoes were preferred. When homemakers said they wanted the large sizes for boiling, they prepared them by cutting them up; those preferring the small sizes planned to leave them whole.

Complaints about the cooking quality of fresh potatoes were almost always concerned with the mushing or falling apart of boiled potatoes. Some boiled Russet Burbank potatoes are shown in Figure 1. The breaking up when they are boiled is highly correlated with the specific gravity, i. e. high solids content. Though the high specific gravity potatoes were not really suitable for boiling, they would be excellent for baking or for French Fries. Too much sloughing or mushing during boiling is undesirable, even for potatoes that are to be mashed, since the separated cells tend to form a potato paste from which water cannot be drained. Those that remained whole when boiled were low specific gravity, and would be excellent for such uses as salads, stews, casseroles, or serving with roasts.

Since specific gravity was so closely correlated with cooking quality, we were interested in learning more about the specific gravity of the whole crop of potatoes grown in Oregon. We carried out a survey through the potato-growing areas, gathering samples from many farms in each county. We found that the average specific gravity of Russet Burbank potatoes from the main growing areas was high, being 1.092, but that a wide range of specific gravities was represented in the sample. We found that tubers ranged from a low 1.070 to an extremely high 1.120. About seven-eighths of the crop fell in the specific gravity classes, 1.085 to 1.105. The percentage of potatoes in each specific gravity class is shown in Figure 2.

There were differences in specific gravity of potatoes from each grower, between growers, and between growing areas. The kind of variation we observed within and between growers may be seen in Figure 3.

Notice that grower A had potatoes of very high specific gravity. Grower E had potatoes of low specific gravity. Grower H had potatoes ranging all the way from a very low to a very high specific gravity. This means that any sack of potatoes purchased by the homemaker could be expected to contain potatoes having different cooking quality.

Another factor that concerned us was the effect of storage. This is important since these Fall-harvested potatoes are sold from storage eight to nine months of the year. Potatoes of different specific gravity were stored and tested over a period of six months. These potatoes were used for boiling, baking, and for chips. After they were stored, potatoes did not slough as badly when boiled, even though the specific gravity had not changed. A comparison of the degree of sloughing for freshly harvested potatoes and those stored two and six months is shown in Figure 4. Although high specific gravity potatoes always sloughed quite badly, those of intermediate specific gravity improved considerably when stored.

The color of potato chips was also found to be related to specific gravity and storage. The color of chips from fresh and stored potatoes is indicated in Figure 5. Light color of chips indicated by the lower numbers, and dark by high numbers. Colors having scores from three to six are light, golden brown, and are preferred by chip manufacturers. Under the same conditions of storage and frying we found that high specific gravity potatoes were lighter in color when fried. The higher solids content would also result in the added advantage of a larger yield. As storage period was prolonged, the color of potato chips from stored potatoes became lighter.

Storage time at 40°F. followed by 2 wk. conditioning	Specific Gravity	
	1.080	1.100
1 mo.	6.85	5.93
2 mo.	5.87	4.20
3 mo.	5.70	4.00
4 mo.	4.50	3.67
5 mo.	4.64	2.63

Fresh potatoes don't come to the market with cooking directions. In order to meet homemaker's wishes for cooking quality suited to her needs, it seems best to send the potatoes to market after separating them by specific gravity, and labeling them according to their best cooking uses. The method of separating is simple. In Figure 6, a jar filled with dilute salt solution is shown. In it, potatoes of lower specific gravity are floating while those of higher specific gravity are sinking. The dividing line between potatoes that can be boiled satisfactorily and those not suitable for boiling is usually taken at 1.085. A salt solution having this specific gravity contains about 1-1/2 cups of salt to 12-1/2 cups of water.

We have carried out some market trials of specific gravity separated potatoes, and hope to do more. Our first trials were in local markets. The potatoes were offered for sale in two stores, under the labels, "Bakers" and "Boilers," and with signs suggesting their best uses. Four thousand pounds of potatoes were sold in this way.

Bakers sold faster than boilers. This might be different in different seasons of the year. Another market trial was carried out in Portland stores. Retailers and customers were very enthusiastic about them.

We may hope that in the future potatoes will be separated by specific gravity and marketed according to their best cooking uses.

We published a paper recently on the microbiology of fresh, frozen and dehydrated potatoes purchased from retail stores.

Our special interest in the microbiology of these products arose from inquiries we received from restaurants about off-flavors that developed when potatoes were held after cooking. We thought that one possibility might be the growth of bacteria.

The general plan of this part of the project was to determine numbers of bacteria in the uncooked product, after cooking according to package directions, and after holding at room and serving temperature. Fresh potatoes were mashed and baked.

All products were found to contain micro-organisms. The lowest counts were for finish-cooked French Fried potatoes, Tots and Treats. The highest counts were found in some frozen, partially-cooked products (frozen Boats, shredded patties).

After cooking, many products had zero counts. These were ones that became quite hot when prepared (about 90°C. or higher). The mashed, dehydrated potatoes and the frozen boats did not get so hot; in fact, the temperatures for these products ranged from 51°C. to 70°C., and viable micro-organisms remained in the cooked products.

The counts increased during holding of the products after cooking. No off-flavors or odors were noticed within 4 hours after cooking for any of the dehydrated or frozen products. Fresh potatoes were held only one hour after cooking, and they had no off-flavor or odor.

Figure 1



Figure 2

Distribution of Oregon Potatoes by Specific Gravity,

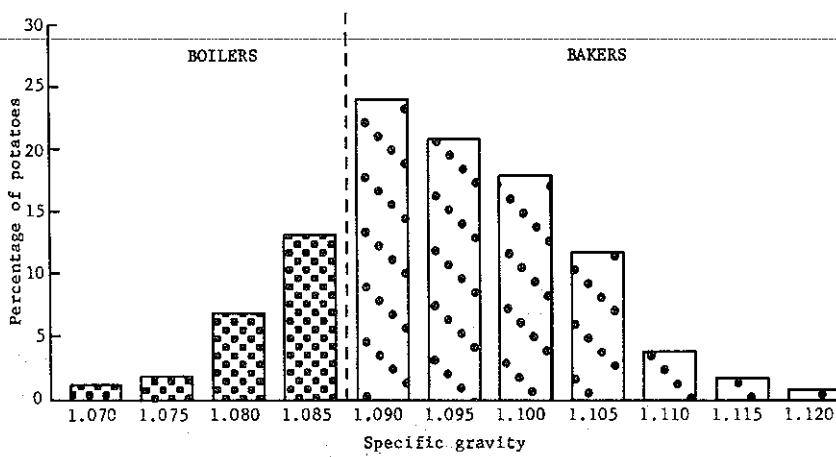


Figure 3  
variation in Specific Gravity  
of Oregon Potatoes.

Grower	Specific gravity					
	1.075	1.080	1.085	1.090	1.095	1.100 & over
(Percentage of potatoes)						
	<u>BOILERS</u>			<u>BAKERS</u>		
A	--	--	--	--	8	92
B	--	7	7	14	29	43
C	--	--	--	13	20	67
D	--	5	29	28	29	9
E	50	38	12	--	--	--
F	--	--	--	23	15	62
G	--	33	33	21	13	--
H	7	8	23	8	31	23
I	4	9	52	4	22	9
J	--	9	45	5	23	18

Figure 4  
Effect of Storage Period on Sloughing

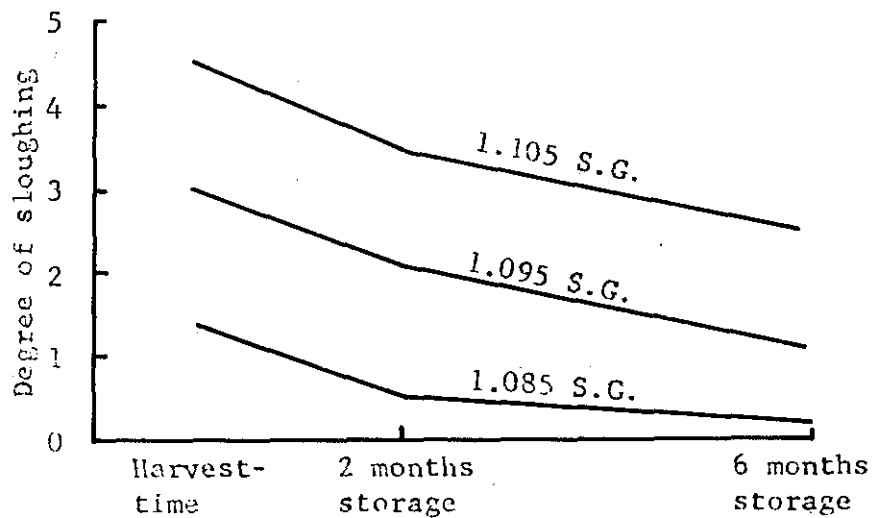


Figure 5

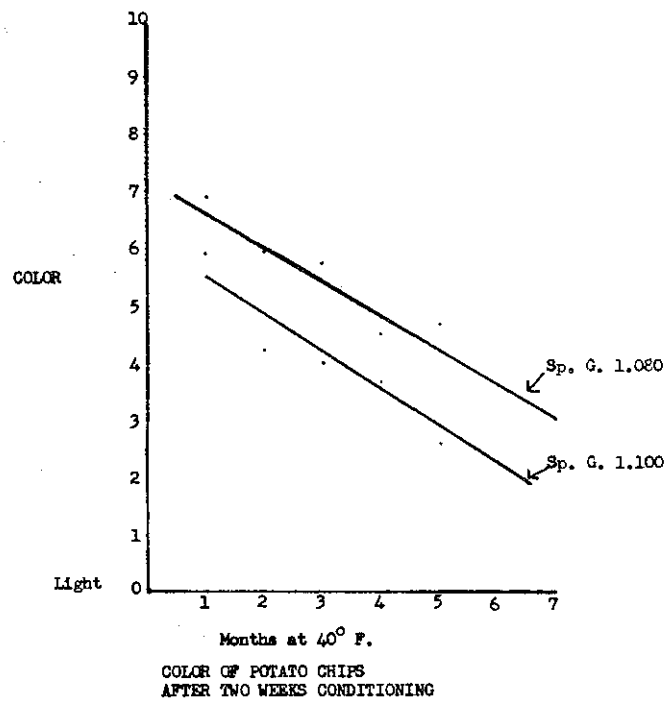


Figure 6

