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Development of Cultural Techniques for Production of Baby Potatoes

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Depressed fresh market potato prices have increased potato grower interest in the production of niche or specialty potato products. Small or baby potatoes recently gained limited entry into commercial markets, with attractive prices paid to growers. Research was conducted in 2001, 2002, 2003 and 2004 at the Intermountain Research and Extension Center to explore production of baby or small sized potatoes. The primary goals were: 1) to assess the yield and quality potential of baby potato production under Klamath Basin soil and climate conditions; and 2) to develop local cultural management recommendations for baby potato production. In these experiments, several candidate potato varieties were planted on varied planting dates, with staggered harvest dates for each planting. Planting seed densities were also varied.

With a wide planting bed concept, it was possible to produce total tuber yields approaching 400 cwt/acre. These high yields were attained less than 76 days after planting with the majority of harvested tubers sized at less than two inches in diameter. In the 2004 experiment, one variety produced 170 cwt/acre of tubers under 1¼ inch in diameter. These results provide estimates for the effects of variety, planting rate and harvest date on total yield and tuber size distributions. These estimates have been used to guide growers trying to meet specific, market determined tuber size targets.

2001

In 2001, two trials were conducted to determine the tuber size distribution of two yellow fleshed potato varieties grown for the production of small sized tubers. Three variety/seed treatments were evaluated in each trial: 1) Yukon Gold was planted as single drop seed; 2) Yukon Gold was planted as aged cut seed; and 3) the variety Santee was planted as cut seed. Whole drop seed is commonly used in Europe to produce small sized tubers. Likewise, seed aging may increase tuber set per plant and decrease the size of daughter tubers. Two trials were established: the first planted on July 6 and harvested on September 6; the second planted on July 27 and harvested on September 27. Individual plots consisted of two potato rows on 36 inch wide raised beds, 15.5 feet long. Treatments were replicated four times in a replicated complete block design. Plots were hand planted at a rate of 29,000 seed per acre. Plants were grown using normal irrigation practices and no fertilizer. Vines were chopped green two days prior to harvest.

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Tuber yield results for both planting dates are presented on figure 1. The highest tuber yield was attained in the first planting using the aged Yukon Gold seed (276 cwt/acre). The Yukon Gold yields were greater with aged seed than with single drop seed in both planting dates. Santee yielded slightly more than the single drop Yukon Gold in the first planting but significantly less than the single drop Yukon Gold in the second planting.

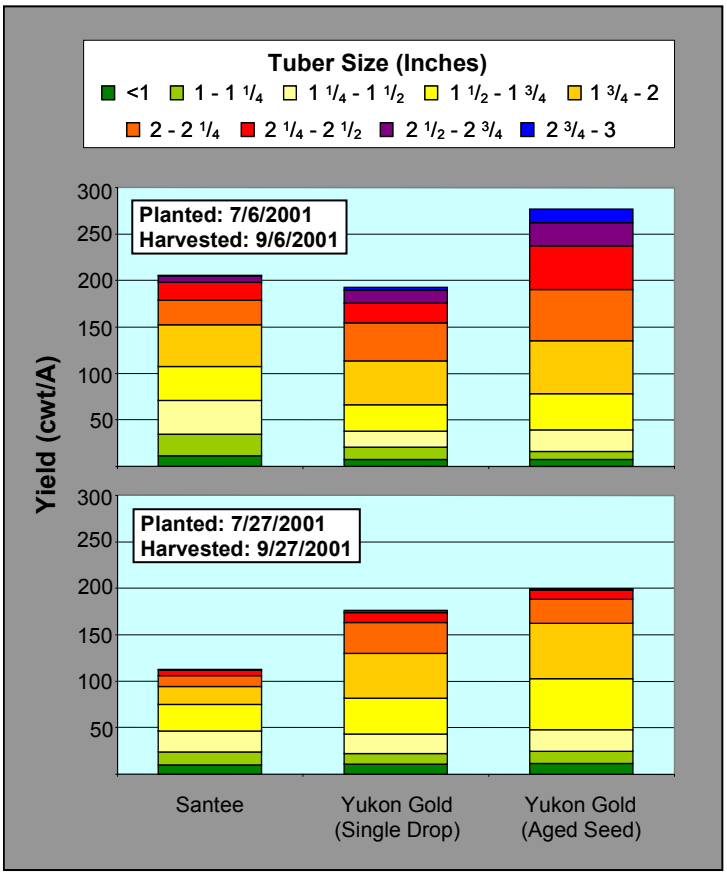

Figure 1. Tuber yield and size distribution for two trials

None of the plantings produced a high proportion of small sized potatoes. The highest yield of smallest sized potatoes, <1¼ inch in diameter, was only 35 cwt/acre produced by the first Santee planting. All other plantings produced less than 25 cwt in this small sized tuber category.

2002

To improve on the yield of small tubers observed in the 2001 plantings, we evaluated two additional varieties in 2002 using a high density seeding method. In theory, increasing plant density should increase tubers produced per acre and reduce average tuber size. We adopted a planting methodology common in the United Kingdom for production of small or "salad" potatoes. That is, we planted three seed lines on a 72 inch raised bed. In this way, we were able to test four high seeding densities ranging from 26,000 to 65,000 seed per acre. These seeding rates are approximately 1.5 to 4 times the typical commercial potato seeding rates used in the Tulelake region. The two varieties evaluated were Morning Gold, a yellow fleshed variety and Carlingford, an Irish breed, salad type potato with white skin and flesh.

To evaluate the effect of length of growing season on resultant yields and tuber size, we established multiple plots of each variety/seeding rate combination to accommodate five separate harvest dates. Individual plots were 6 feet wide by 15 feet long with three seed lines on a 72 inch raised bed. Irrigation was supplied as needed though solid-set sprinklers. No fungicide or insecticide treatments were required. Potato vines were killed successively 53, 58, 63, 68 and 73 days after planting (DAP) — one plot for each combination of variety/seeding rate. Vine killing was accomplished by first rolling the vines then spraying with a desiccant, followed by a second desiccant application five days later. Tubers were allowed to mature and set skin for 21 days after vine killing and were then harvested by hand, graded and weighed.

Early stand loss was observed in the Morning Gold plots due to black leg disease. This stand loss compromised Morning Gold yields, which are not reported in this summary.

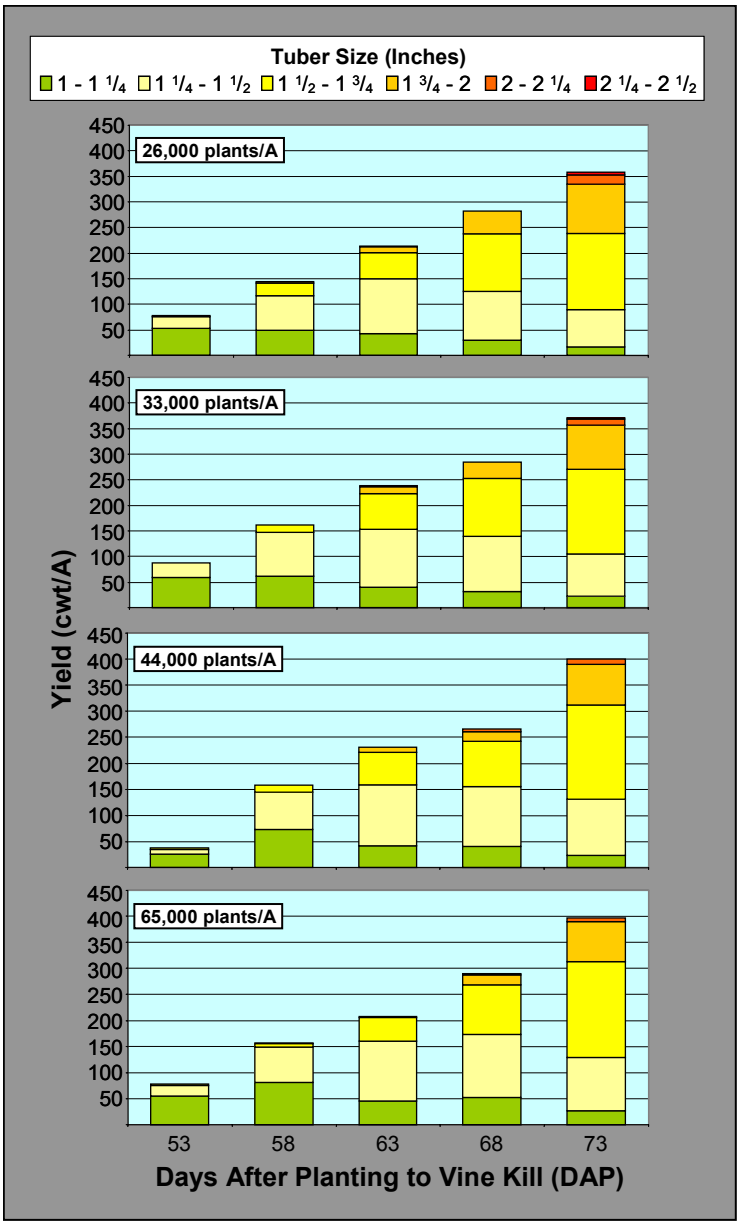

Figure 2. Yield and tuber size distributions of Carlingford grown for 53 to 73 days in 2002 experiments.

The 2002 tuber yield and size distribution results for all Carlingford planting densities and harvest dates are presented in figure 2. Tuber yields increased with increasing days of vine growth with the top yields occurring at 73 DAP. After 58 days of growth, increases in yield were primarily due to the increased yield of tubers over 1½ inches in diameter. There was a slight increase in total yields with each increase in planting density and an increase in the production of the smallest tubers (less than 1¼ inch in diameter). The production of the smallest sized tubers topped out after 58 days of growth. The highest total tuber yield was produced 73 DAP at the 44,000 seed per acre planting rate. The highest measured production in the smallest tuber category was 81 cwt/acre, which occurred 58 DAP with the highest plant population (65,000 seed/acre). This more than doubled the production of small tubers produced with normal planting methods the previous year.

2003

The 2003 trial was very similar to the 2002 study. The Carlingford variety was again evaluated along with Bintje, an old variety very popular in Europe. This test again included four seeding levels ranging from 25,000 to 52,000 seed per acre with three seed lines on a 72 inch wide raised planting bed. The individual plots were 6 by 15 foot with multiple plots planted to accommodate seven sequential harvest dates for each combination of seeding rate and variety. The 2003 plots were planted with a research adapted assist feed cup planter. Cultural practices, vine killing and hand harvest were all similar to the 2002 trial.

The yield results from the 2003 trial were much more erratic than observed in 2002; but, the general yield trends were very similar. The tuber yield results are presented in figure 3. Yields increased with increased growing days up to about 78 DAP. After that the yield results were inconsistent but appeared to plateau between 400 and 450 cwt/acre. For Carlingford, yields of the smallest size category (<1 ¼ inches) where highest in the first two harvests (64 and 69 DAP) and topped out around 40 cwt/acre.

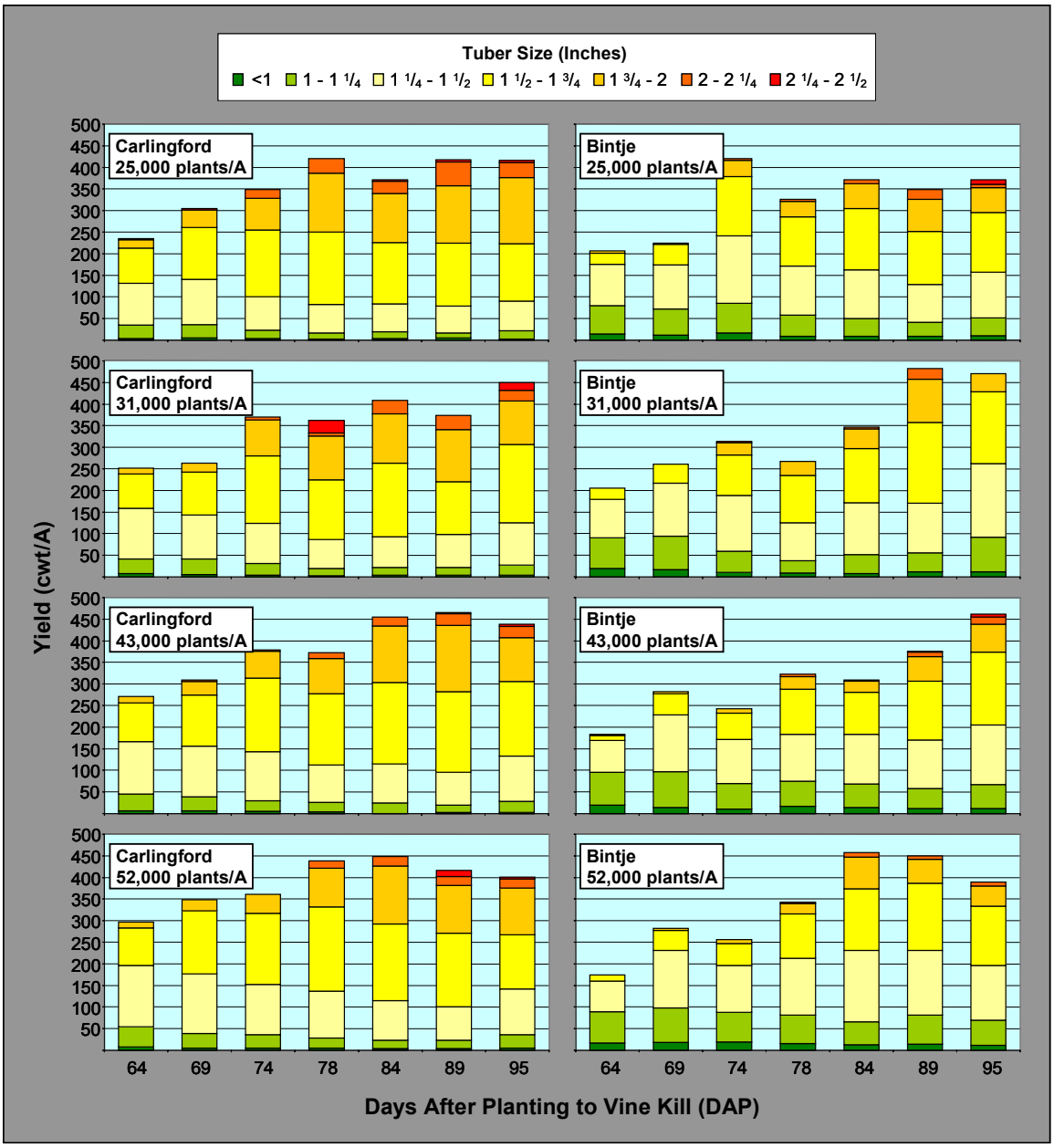

Figure 3. Tuber yield and size distribution of Carlingford and Bintje grown from 64 to 95 days in 2003

Interestingly, yields of these small sized tubers increased only slightly with increased seeding rates–the highest yield being 55 cwt/acre at the highest seeding rate, 64 DAP.

For the Bintje variety, the maximum production of tubers in the smallest sizes (below 1¼ inch in diameter) occurred with approximately 69 days of growth. The observed effects of plant populations on Bintje yields were even more erratic than harvest date effects, making it very difficult to draw conclusions. For example, the high yield of small tubers at 69 days was virtually identical in the plots planted with 31,000, 43,000 or 52,000 plants per acre. It is significant to note that the highest yields of small tubers in the Bintje plots (98 cwt/acre) were almost twice the highest yields of small tubers in the Carlingford plots.

2004

Because of the large differences in variety performance in the previous trials, ten different varieties were evaluated in the 2004 field test. Plot sizes, cultural practices and harvest practices were very similar to the 2003 study. However, in a break from the 2002 and 2003 procedures, each variety was planted at only one seeding rate, 32,000 seed per acre and two replicate plots were planted and harvested for each combination of variety/harvest date. The varieties evaluated included Carlingford as a standard and five other white fleshed varieties—Bintje, Nicola, Maris Piper, Exquisa and an experimental variety, A92584-3BB. The trial also included two red skinned varieties, Mazama and Modoc, and two yellow fleshed varieties, German Butterball and VC1002-3 w/y. The plots were planted on May 19. Two plots of each variety were vine killed 58, 64, 70 and 78 days after planting and hand harvested 21 days after vine kill. Harvest plot size was 6 by 25 foot and all data reported are the average of two replications.

The yield data is presented for each variety in a series of graphs in figure 4. Each of the varieties increased in yield with increased growing days. Most of the increased yield 64 DAP was due to the increased yield of larger tubers (> 1½ inch in diameter). There was one notable exception. Exquisa produced increased yields of small tubers up to 70 DAP with no net loss of small sized tubers up to 76 day of growth. The highest total tuber yields 76 DAP were produced by Carlingford, Nicola, Bintje and A92584-3BB respectfully, with Carlingfod tops at 344 cwt/acre. Based on higher total yields and small tuber size distributions, the varieties best suited for baby potato production were Bintje, Maris Piper, German Butterball and Nicola. Very poor total yields (less than 250 cwt/acre) were produced by Exquisa, Mazama, and Modoc. Interestingly, even with the low total tuber yield, Exquista produced the highest yield of the smallest sized tubers, (<1¼ inch in diameter) of all varieties tested (170 cwt/acre). This makes Exquista a good candidate for baby potato production, particularly if larger sized tubers have low market value. While neither red variety produced outstanding yields, Mazama appeared to be better suited for baby potato production.

Summary and Conclusions

With the wide bed concept it was possible to produce total tuber yields approaching 400 cwt/acre. These high yields were attained less than 76 days after planting with the majority of harvested tubers sized at less than two inches in diameter. In the 2004 experiment, one variety produced 170 cwt/acre of tubers under 1¼ inch in diameter. These results provide estimates for the effect of variety, planting rate and harvest date on total yield and tuber size distributions. High yields of small tubers were enhanced by physiologically aging seed, early vine killing (60-70 DAP), high planting densities, large planting beds and variety selection.

Economically optimum plant densities and the optimum length of growing season for baby potato production will depend on a number of factors — the most important being: individual variety characteristics, the cost of seed, the cost of handling and packing the various tuber sizes and the market premiums paid for small sized tubers. In figure 5, we present gross grower returns given some assumed market price estimates for the various size tuber categories (including a high, but realistic price of $60 per cwt for the very small size tubers). Calculations were based upon the tuber size distribution yield data from the 2002 experiment with Carlingford (for 44,000 seed per acre) and the assumed crop prices indicated on the graph. The figure does not account for differential seed or tuber handling costs. Given these assumptions, the highest

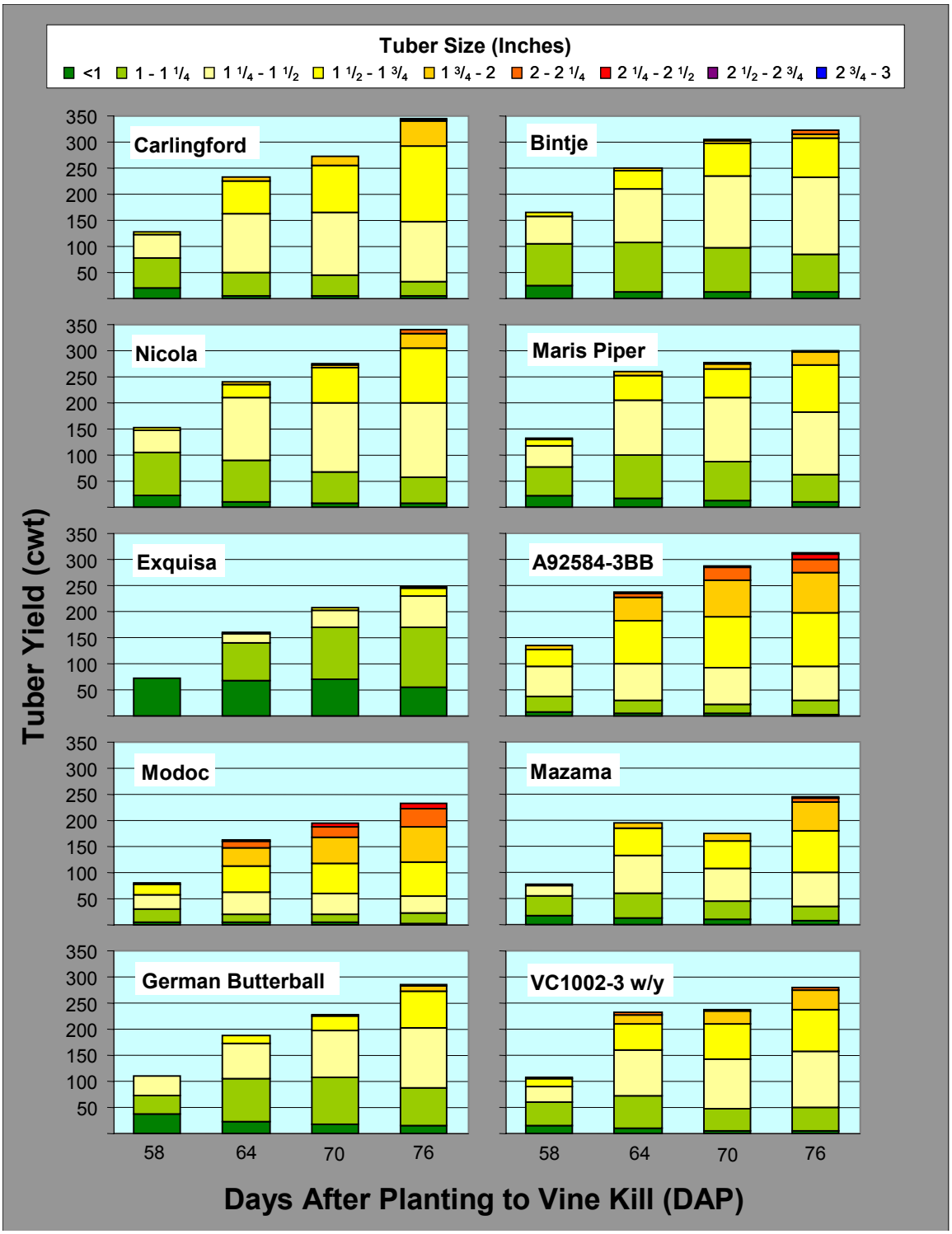

Figure 4. Tuber yield and size distributions for ten potato varieties grown 58 to 76 days in 2004 experiments.

gross grower income would occur with a 58 day growing season. Of course, lowering the price for small potatoes or improving the price for larger potatoes would shift the maximum returns toward a longer growing period.

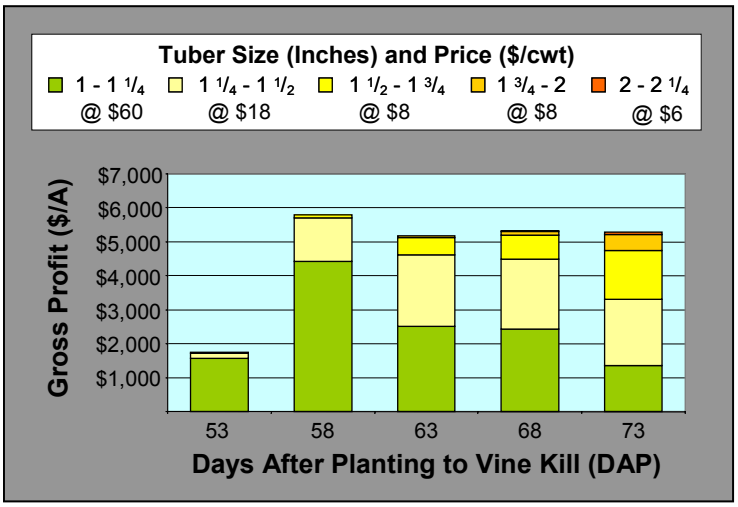

Figure 5. Potential gross profit from baby potato production assuming prices indicated.

A more detailed evaluation of the economic consequences of seed rate and length of growing season are beyond the scope of this report. However, the production data developed and presented here has been used to guide grower planting and harvest decisions, and may be used as the basis for a more detailed and comprehensive evaluation of the economics of baby potato production in Southern Oregon and Northeastern California.