

UNDERSTANDING TUBER BULKING RATES OF SIX POTATO VARIETIES

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Several years ago almost all potatoes planted in Idaho were the variety Russet Burbank, but now several other varieties are also produced. Potato producers began inquiring about the tuber bulking rates and duration of newer varieties wanting to know the best time to kill vines to maximize yield and still get the crop harvested before a hard freeze. No research had been completed on the bulking rate of Russet Burbank since the mid-1980's, and no bulking rate information was available on newer varieties. Consequently a bulking rate study was undertaken.

EXPERIMENTAL PROCEDURE

A two-year tuber-bulking rate study was conducted at the Aberdeen R & E Center. Russet Burbank, Russet Norkotah, Colorado Russet Norkotah #3 (CORN-3), Ranger Russet, Alturas, and Shepody were planted May 1, 2003 and April 28, 2004. Plots consisted of four 20-foot rows spaced 36 inches apart with a seed piece spacing of 10 inches. There were four replications. Yield samples from the center two rows were harvested at two-week intervals beginning July 1, 2003 and July 3, 2004, and ending September 25, 2003 and September 23, 2004 totaling 147 and 148 days from planting to last harvest in 2003 and 2004, respectively. Varieties were managed according to University of Idaho recommendations. The percent of dead vines (stems) was determined on the last three harvest dates in 2003 and on the last five harvest dates in 2004 by visually estimating the number of stems (not leaves) in the plot that were nearly or completely dead. The linear bulking rate was calculated by estimating the number of days between the date a variety attained 20 cwt. per acre to when it reached its maximum yield minus 20 cwt. and dividing the number of days into that production amount, i.e., maximum yield minus 40 cwt. divided by days. A statistical modeling program was used to generate the yield curves. To develop the bulking curves, it was assumed there was no yield on June 5, 2003 and June 3, 2004, so a zero value was used in the modeling program. A similar study was conducted at the Parma R & E Center, but details of that study will not be addressed in this article.

INTERPRETING DATA IN BULKING GRAPHS

Two bulking curves are presented for each variety (see figures accompanying this article), 2003 is shown in green and 2004 in blue. Also, graphs of the percent dead vines (orange line) on the sampling dates as discussed above are shown. The yield level at each sampling date is shown on the y-axis of the graphs while the percent dead vines are shown beneath the curves on each graph. Two vertical lines are presented on each graph

that represent the linear bulking period. The cwt./acre values shown just above the x-axis for the last five two-week sampling intervals indicate the amount of production attained between the two sampling dates.

RESULTS AND DISCUSSION

Four of the six varieties began bulking at about the same time each year (see figures accompanying this article). Russet Norkotah began bulking later in 2004 than 2003 even though planting date was earlier in 2004. CORN#3 began bulking more than a week later in 2003 compared with 2004. Note too that the linear bulking phase of all varieties extended later into the season in 2004 than 2003. For example, compare the ending of the linear bulking phase of Russet Burbank and CORN#3 in which the ending of the linear bulking phase was ten days to two weeks later in 2004.

With the exception of Russet Norkotah, yields were higher in 2004 than in 2003. Russet Norkotah had nearly identical yields both years. The higher yields in 2004 can be partially explained by growing-season differences. From planting through the last harvest, data collected from the Agrimet weather station at the Aberdeen R & E Center shows in 2003 there were 35 days with 90-plus degrees, but only ten days in 2004. Additionally, during July and August, 2003 there were ten consecutive days of over 90-degree temperatures followed by an additional six-day and a seven-day period. In 2004, the longest stretch of consecutive days with temperatures above 90 degrees was one three-day period in mid-August. Photosynthesis—the process responsible for plant and tuber growth—rate drops dramatically when leaf temperature exceeds 85°F, and this likely happened more often in 2003 than 2004.

The end of the linear bulking phase appears to be closely associated with the onset of vine death. We observed the bulking rate began to decline fairly rapidly as vines declined. For example, examine the bulking curve for Russet Burbank in 2004. You will see that the plots were rated to have 8 percent dead vines on August 26, yet the variety was within 20 cwt. per acre of its maximum yield shortly before August 26. The other varieties performed similarly with the exception of CORN#3. For CORN#3, in 2004 this variety was within 20 cwt. per acre of its maximum yield on the same date that the plots were rated to have 89 percent dead vines. However, in 2003 CORN#3 was within 20 cwt. per acre of its maximum yield when the plots had 29 percent dead vines.

This data strongly suggests that the presence of some dead vines is a good indication that bulking rate is declining. However, vine death is likely not the only factor responsible for tuber bulking. Temperature and/or other environmental factors are likely at least partially responsible for bulking rates declining.

In that the onset of vine death coincides with slowing tuber bulking rates can also be seen by the amount of yield gain during each two-week period for the last 8 weeks of the growing season ending approximately September 23 as shown in the figures and in table 1. Russet Norkotah is an exception because it is an early maturing variety, and the bulking rate of this variety dramatically decreased by late July. The other varieties,

however, were bulking fairly rapidly until early to late August. Note that Russet Burbank produced 104 cwt. per acre the first 2 weeks of August when averaged over 2003-04, but decreased to only 28 cwt. per acre during the next two-week period. All varieties produced less than 20 cwt. per acre during the last two-week sampling period from September 11 to September 25 averaged over 2003-04.

Table 1. Yield gain over a two-week increment for the last 8 weeks of the growing season averaged over 2003-2004 at the Aberdeen R & E Center.

	Bulking Period (2003)*			
	7/31- 8/14	8/14- 8/28	8/28- 9/11	9/11- 9/25
Variety	-----cwt./acre-----			
Russet Burbank	104	28	5	1
Russet Norkotah	18	2	0	0
CORN#3	103	62	27	10
Alturas	141	107	46	15
Ranger Russet	117	69	30	11
Shepody	116	43	11	2

*2004 Dates – 7/30 – 8/12, 8/12 – 8/26; 8/26 – 9/9, and 9/9 – 9/23

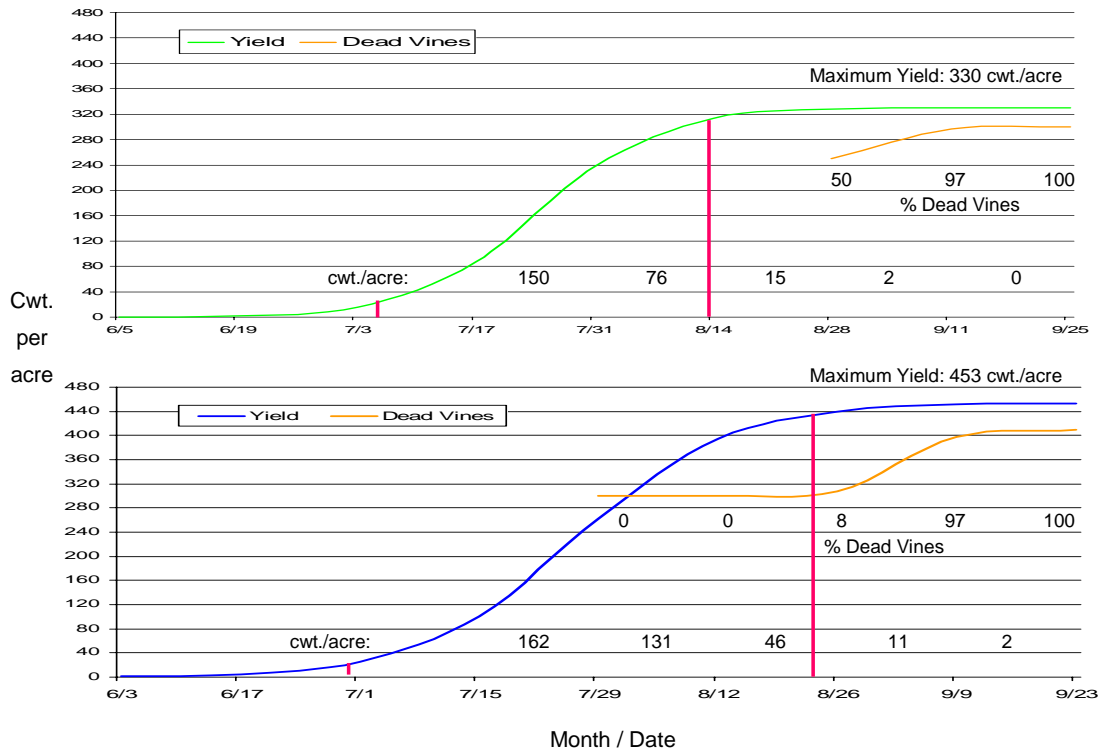
Potato yield is determined by two factors: production per day times the number of days. Two varieties could have similar bulking rates, but when grown in areas with different bulking period durations could have quite different final yields. This is seen by comparing the linear bulking rates and days of linear bulking obtained in 2003 at the Aberdeen and Parma R & E Centers shown in Table 2.

Table 2. Effect of location on linear bulking rate and days linear bulking of Russet Burbank and Ranger Russet in 2003 at Aberdeen and Parma R & E Centers.

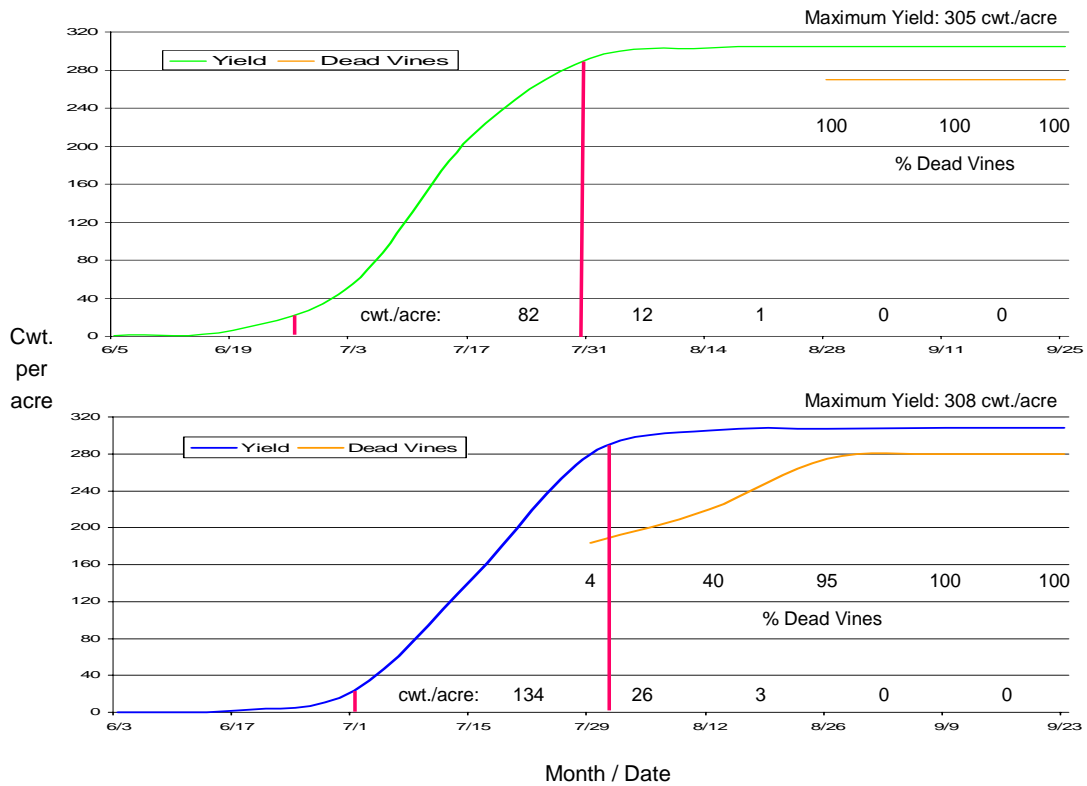
	Russet Burbank		Ranger Russet	
	Aberdeen	Parma	Aberdeen	Parma
Rate (cwt./a/day)	7.2	6.3	5.8	5.5
Days	40	103	72	102

This study was conducted at the Aberdeen R&E center, but was validated in 2004 through duplicate sampling in growers' fields in southeast Idaho. From this research, it appears it is important to keep potato vines green and healthy during the linear bulking phase in early July through mid- to late August, but having mostly green vines late in the season may not warrant continuing inputs of fertilizer and water in an effort to obtain additional yield. Moreover, in areas threatened by hard freezes during harvest, the later vines are killed, the greater the risk of having a freeze that will damage tubers. Producers need to carefully manage water and nutrients during the linear tuber-bulking period to maximize potato yield each year. In spite of best management efforts, the growing conditions will still have a substantial effect on the final yield.

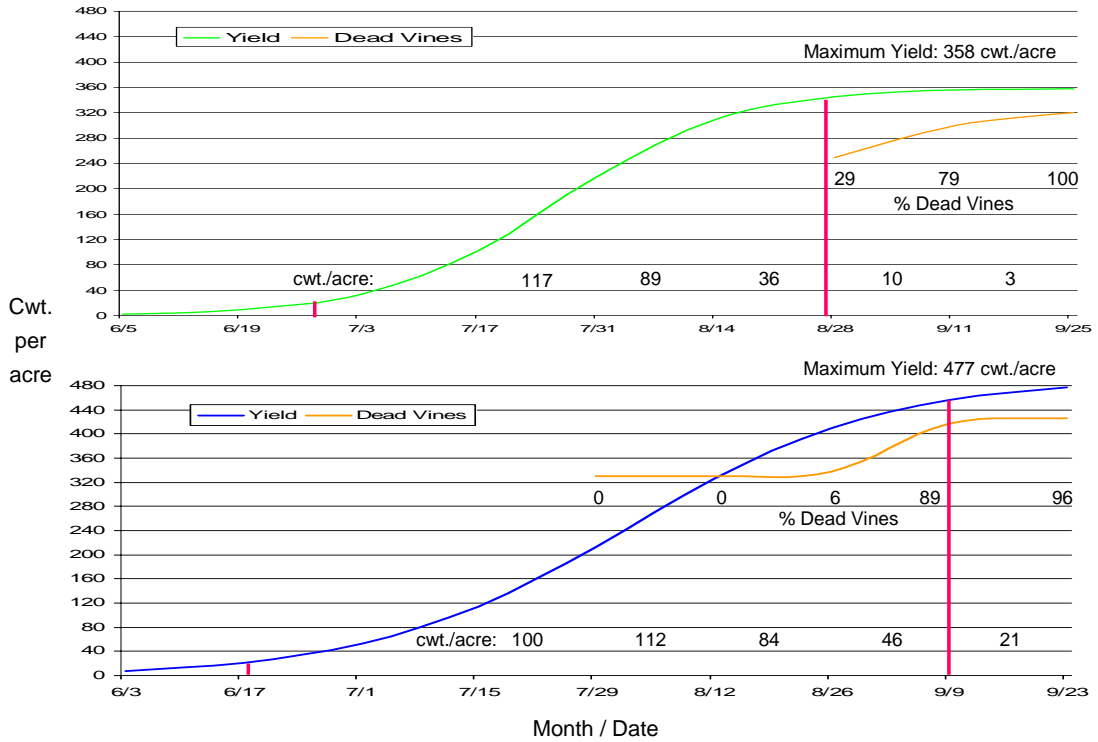
Bulking Pattern of Russet Burbank in 2003 and 2004 at the Aberdeen R & E Center



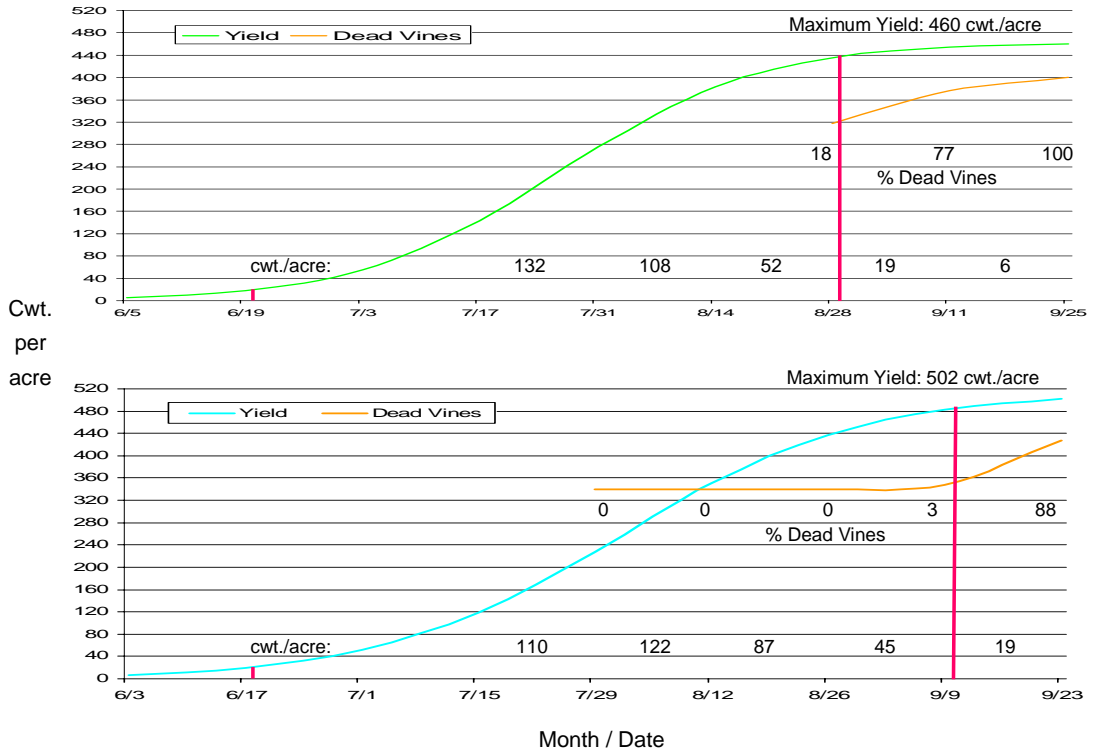
Bulking Pattern of Russet Norkotah in 2003 and 2004 at the Aberdeen R & E Center



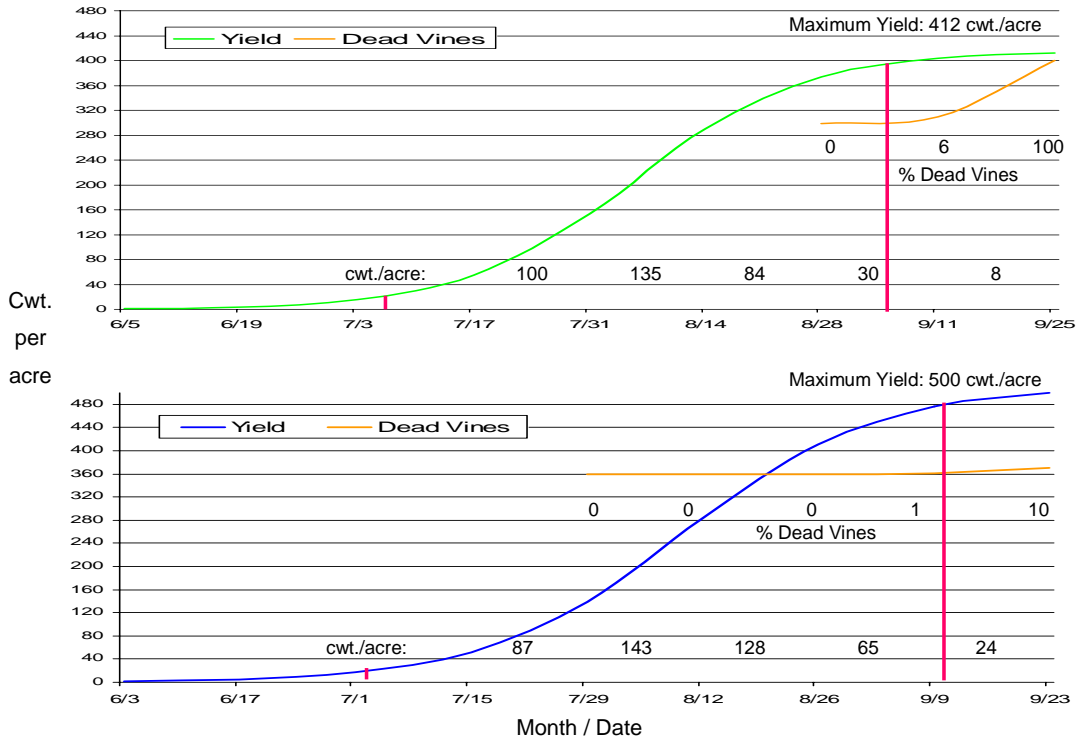
Bulking Pattern of CORN #3 in 2003 and 2004 at the Aberdeen R & E Center



Bulking Pattern of Ranger Russet in 2003 and 2004 at the Aberdeen R & E Center



Bulking Pattern of Alturas in 2003 and 2004 at the Aberdeen R & E Center



Bulking Pattern of Shepody in 2003 and 2004 at the Aberdeen R & E Center

