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Evaluation of Cultural Practices to Control Hollow Heart in Premier Russet

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The newly released potato variety, Premier Russet, has demonstrated tremendous potential as a replacement variety for Russet Burbank in the Klamath Basin and elsewhere in the Pacific Northwest. In Regional trials, Premier Russet consistently out yielded Russet Burbank with greatly improved pack-out percentages. This new variety has low sugars, high solids with good processing and culinary characteristics. The one major potential weakness of this new cultivar is its susceptibility to hollow heart, a physiological disorder that results in the formation of a hollow cavity in the center of the mature tubers. Hollow heart development may be encouraged by periods of very rapid or discontinuous tuber growth (slow then fast). Such growth patterns can result from excessive fertilization, improper irrigation or excessively wide plant spacing. A large field research experiment was conducted at the Intermountain Research and Extension Center in Tulelake, California to determine if appropriate variety specific cultural practices might be used to reduce hollow heart incidence in the Premier Russet variety.

Potato Management Trial

This large field experiment had a multi-factor design with two potato varieties, three irrigation scheduling treatments, three nitrogen fertilizer levels and three plant spacing's. Each level of each factor was applied with each level of the other factors in a factorial design. Two replicate plots were established for each irrigation, fertilizer, spacing, and variety combination. As a result, the experiment had 108 individual experimental plots. The potato seed was planted into 36" wide raised beds with a custom built two-row potato planter. Seed spacing's of 7, 10 and 13" were evaluated. All of the plots received the same amount of initial nitrogen preplant/starter fertilizer at 50 lbs per acre and the same amount of late season nitrogen fertilizer through the sprinklers at 22 lbs per acre. All per plot differences in nitrogen levels were made using differential amounts of ammonium sulfate shanked into the sides of the beds at lay by. The resulting seasonal total nitrogen rates evaluated were 132, 172 and 264 lbs/acre. The Irrigation treatments were three separate irrigation schedules based on three levels of allowable soil depletion between irrigations (dry = 1.5 inches, medium = 1.2 inches and wet = 0.9 inches). All other cultural practices were applied uniformly across all plots. At maturity, two potato rows 30 feet long were harvested for each plot and evaluated for tuber yield, grade, size, and internal and

external qualities. The planting date, harvest date, seed spacing, nitrogen rates, and allowable irrigation depletions for both varieties are listed below.

Planting Date	Harvest Date	Seed Spacing (in)	Nitrogen Rates (lbs N/Acre) 6/23/2008	Allowable Irrigation Depletion (in)
5/12/2008	10/10/2008	7.1	132	0.9
		10	172	1.2
		13	264	1.5

Results

As in previous studies at IREC Premier Russet out yielded and had better packout percentages than Russet Burbank. Averaged over all treatments, Premier Russet yielded 448 cwt/A with 87% US #1 grade tubers with 63% carton count size. Russet Burbank, on the other hand, produced 396 cwt/A, with 72% US #1 grade and only 23 % carton count tubers. The biggest performance difference between the two varieties was the ability of the Premier Russet to produce tubers in the larger size categories.

The yield response to fertilizer and irrigation management treatments was similar for the two varieties. In this experiment neither variety was particularly responsive to increasing nitrogen fertilizer rates (figure 1 and 2). Apparently, under the conditions present in this experiment the lowest fertilizer rate tested was sufficient to produce near top yields. High soil organic matter content, luxuriant crop rotation practices and a short growing season may have contributed to lack of N fertilizer response.

Similarly, the irrigation treatments had little overall effect on the yield of either variety. Wet and dry irrigation cycles (i.e. low and high allowable depletions) produced nearly identically yields to the standard irrigation scheduling (see figure 3 and 4). The high water holding capacity of IREC soil (> 5" of water per foot of soil) and excellent soil drainage may have minimized the impact of longer irrigation cycles and of overly wet periods due to frequent irrigation.

In contrast to the other management treatments, plant density did impact the yield of both varieties, but with significant different economic impacts. Both varieties produced their highest total yields at the closest plant spacing (7.1 inches); but, the wider spacing of 13 inches between plants resulted in the production of increased large tubers (figure 5 and 6). With the relative inability of Russet Burbank to produce size, the increase in larger tubers with the 13" spacing more than offset the total yield advantage of the closer spacing's. On the other hand for Premier Russet, closer spacing was advantageous as it increased total yield and decreased the number of oversized tubers while having little effect on carton count tuber yields.

As for hollow heart development, the overwhelming result of the study was the extreme incidence of hollow heart in the Premier variety. Averaged over all of the cultural management treatments, 25% of 10-14 oz Premier tubers displayed hollow heart symptoms; while, less than 1% of similarly sized Russet Burbank tuber developed hollow heart (figure 7). As expected,

tighter seed spacing did seem to reduce the incidence of hollow heart in Premier but by no means, enough to be economically acceptable (figure 8). The hollow heart response of Premier to irrigation management and nitrogen fertilization was less clear with the highest levels of hollow heart at theoretically optimum irrigation treatment and fertilizer levels (figures 9 and 10). One might speculate that sub-optimum irrigation (too wet or too dry) may have reduced growth rates at critical times, therefore reducing hollow heart incidence. Possible explanations for the response to fertilizer are less clear. Irrespective of the speculation management treatments may have had on hollow heart incidence in the Premier variety, the overall conclusion is clear. The propensity of Premier to develop hollow heart under Tulelake growing conditions is too great to further pursue this cultivar as a potential commercial fresh market variety.

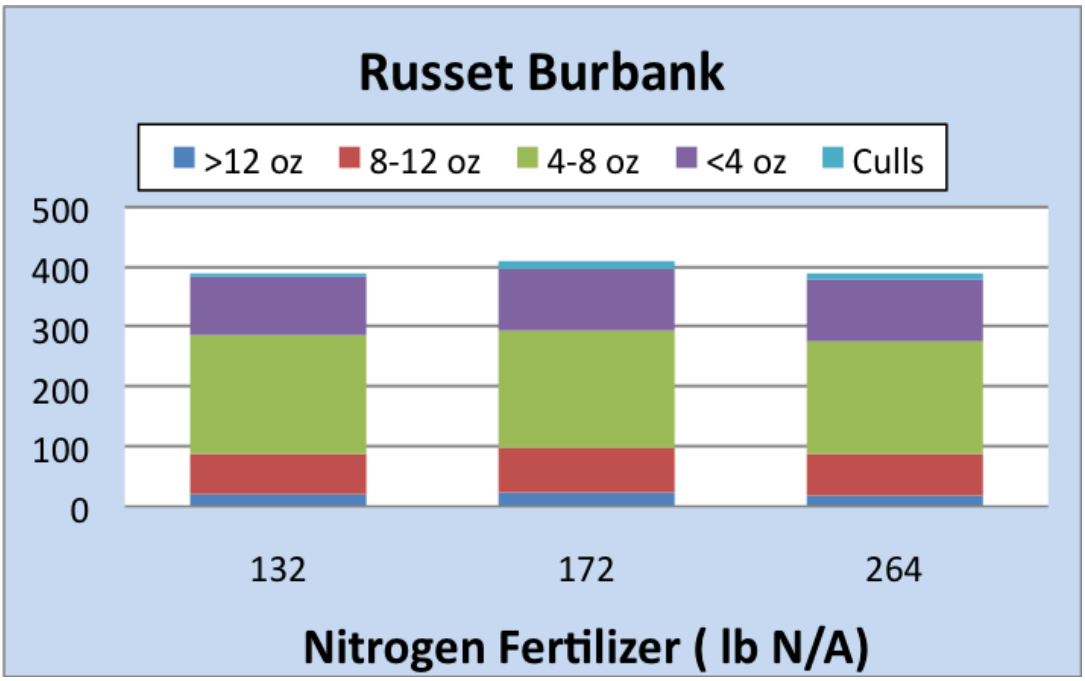

Figure 1. Effect of nitrogen fertilizer rate on the yield and tuber size of Russet Burbank

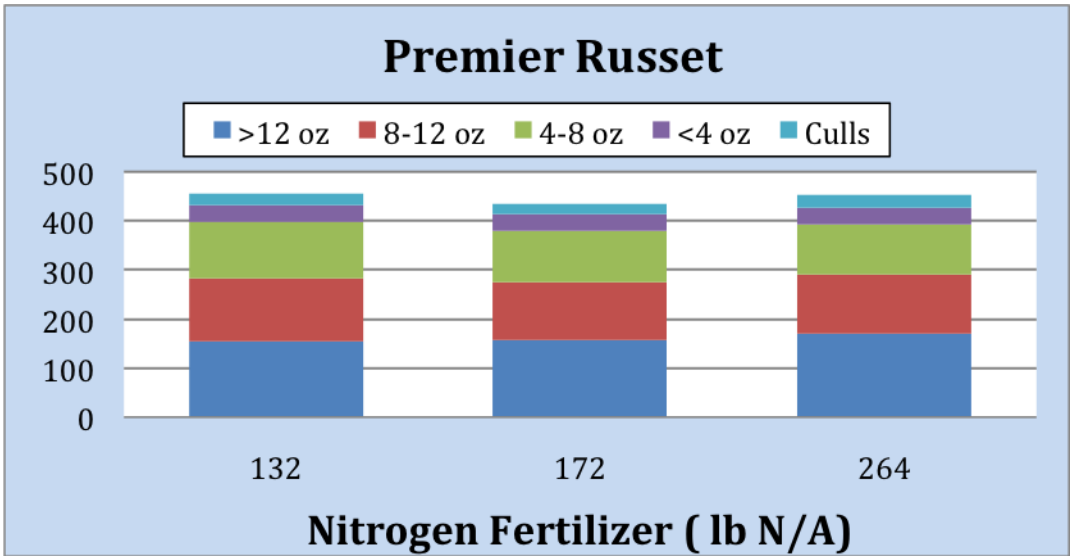

Figure 2. Effect of nitrogen fertilizer rate on the yield and tuber size of Premier Russet

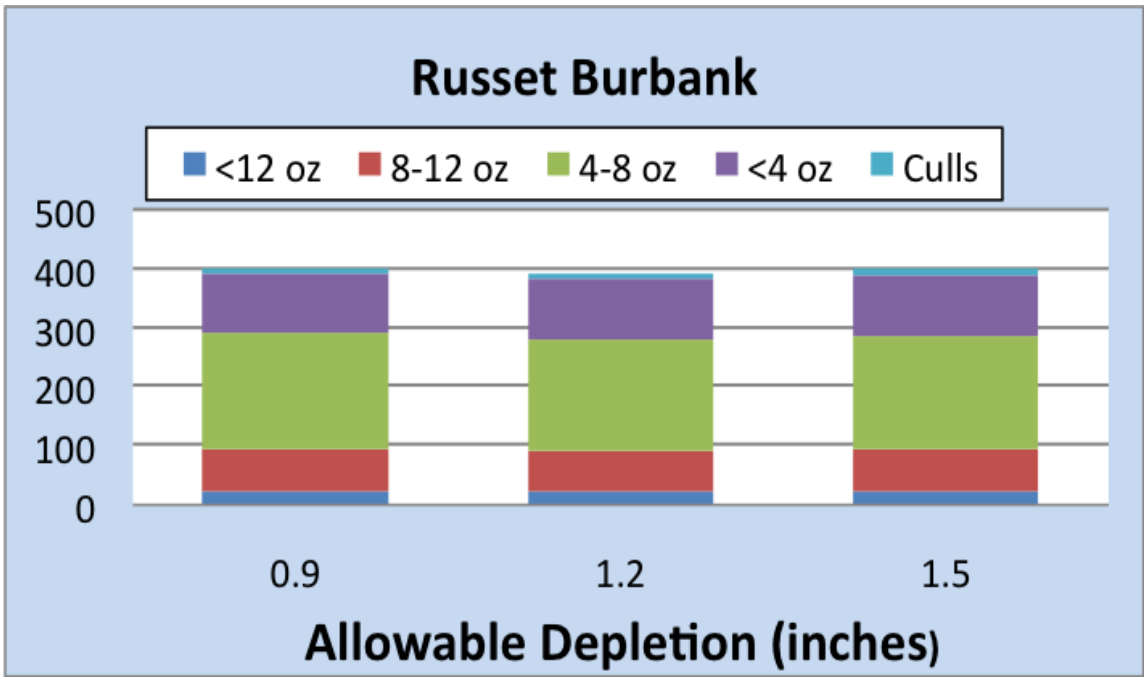

Figure 3. Effect of irrigation scheduling (allowable depletion) on the yield and tuber size of Russet Burbank

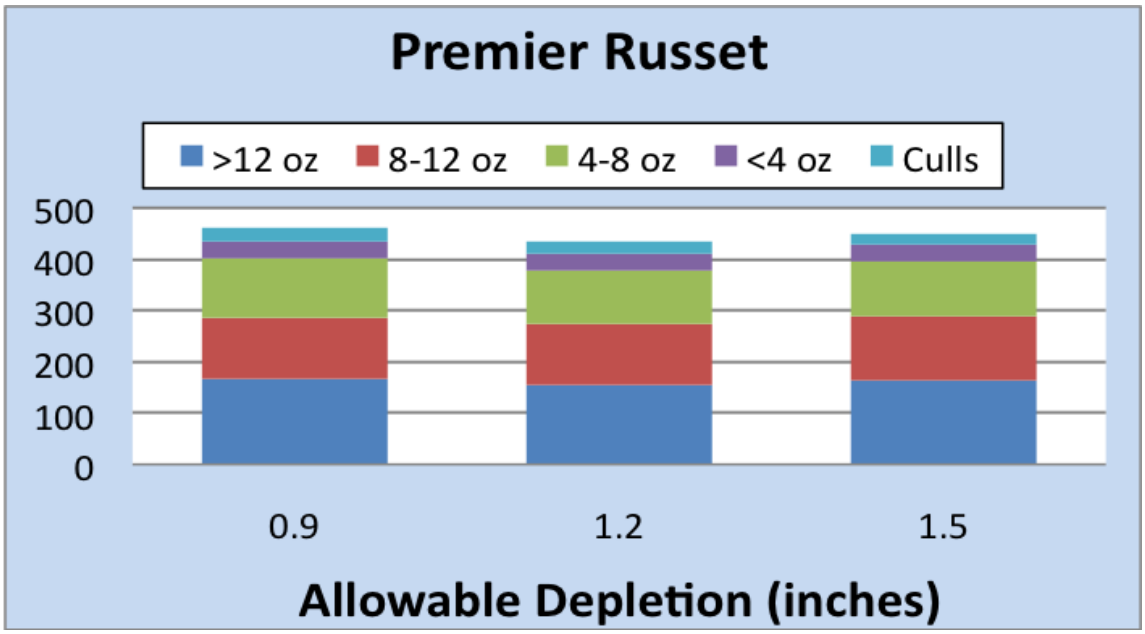

Figure 4. Effect of irrigation scheduling (allowable depletion) on the yield and tuber size of Premier Russet

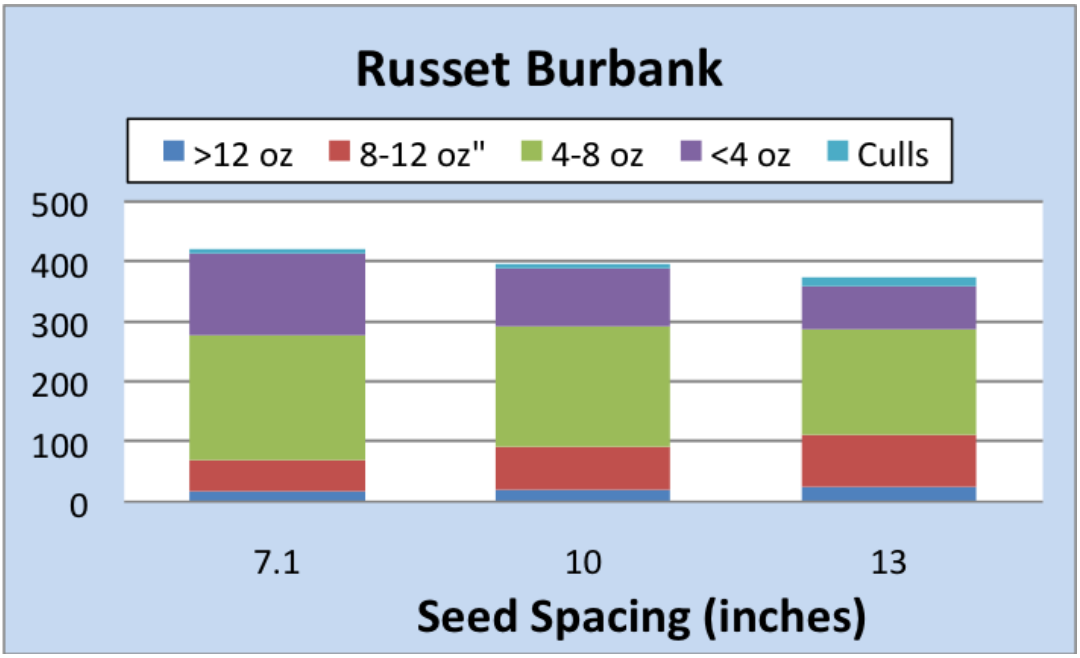

Figure 5. Effect of seed spacing on the yield and tuber size of Russet Burbank

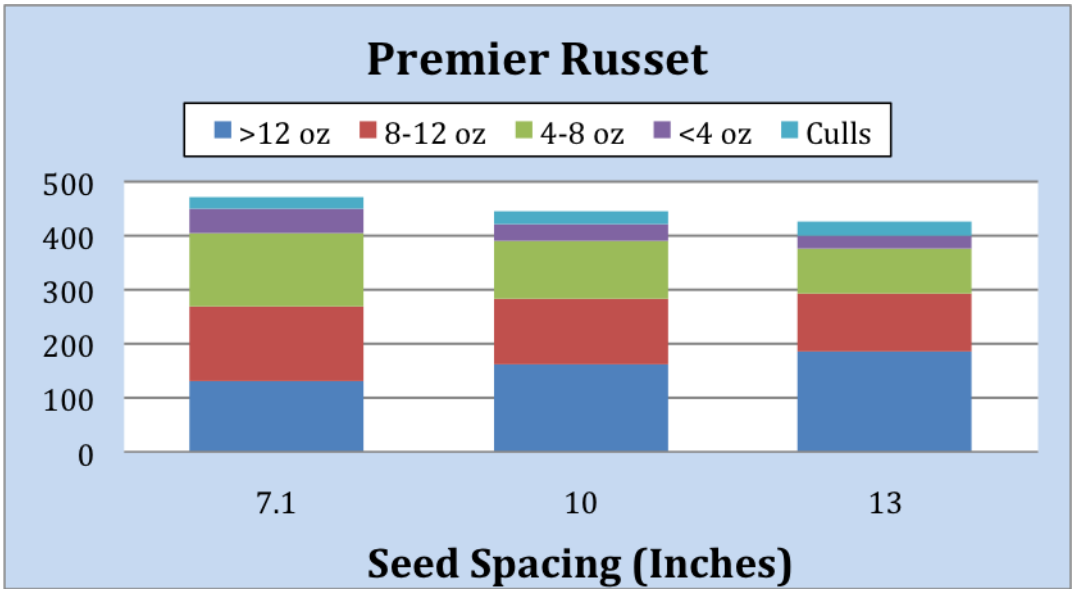

Figure 6. Effect of seed spacing on the yield and tuber size of Premier Russet

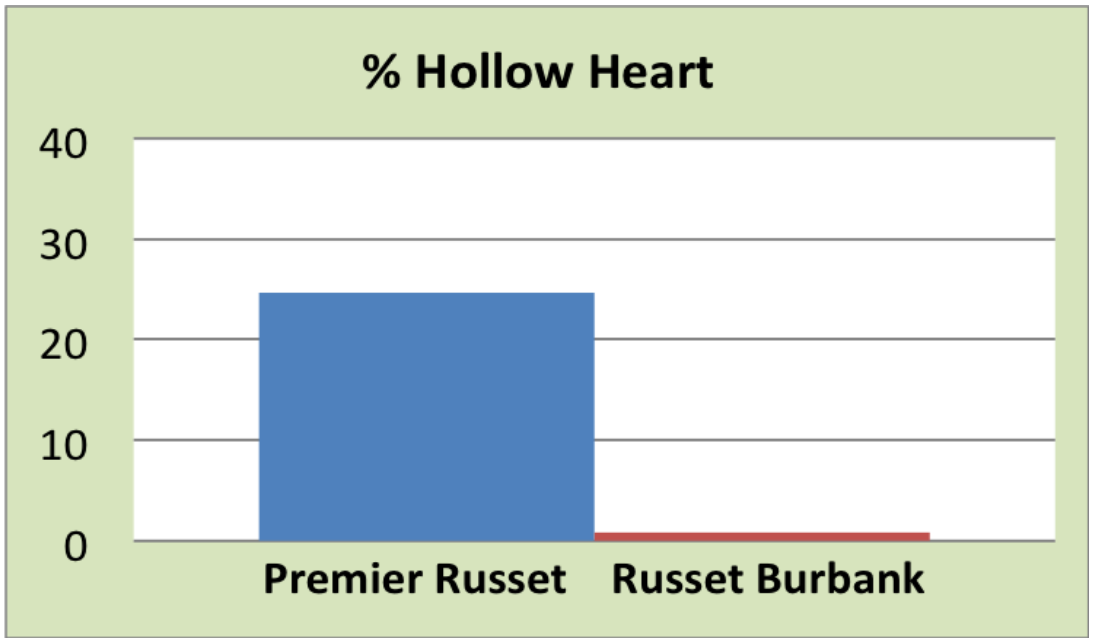

Figure 7. Average hollow heart percentage in 10 to 12 oz tubers of Premier Russet and Russet Burbank

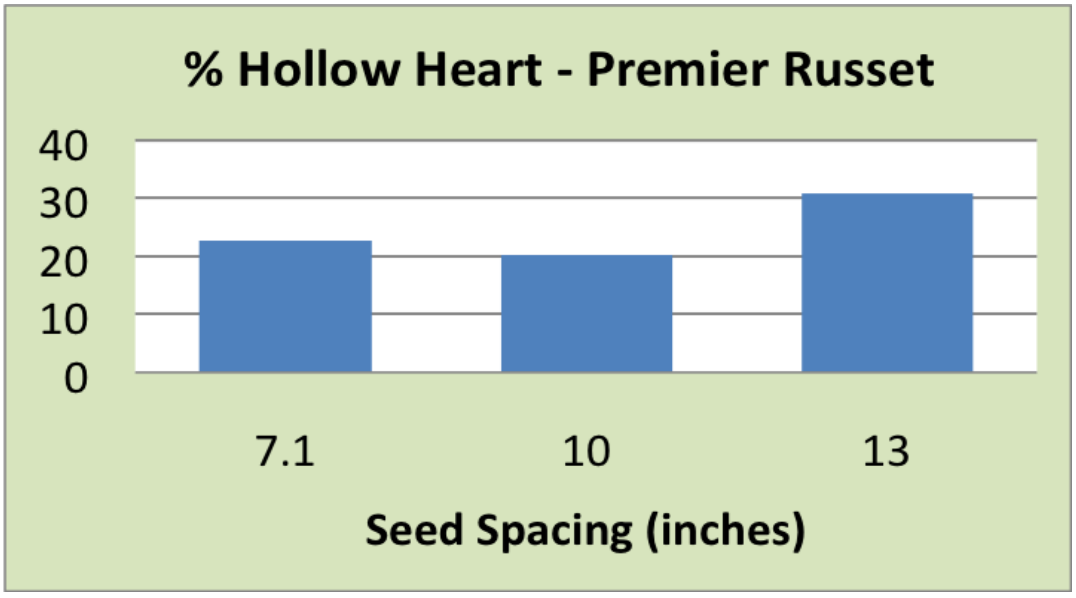

Figure 8. Effect of seed spacing on hollow heart percentage in Premier Russet

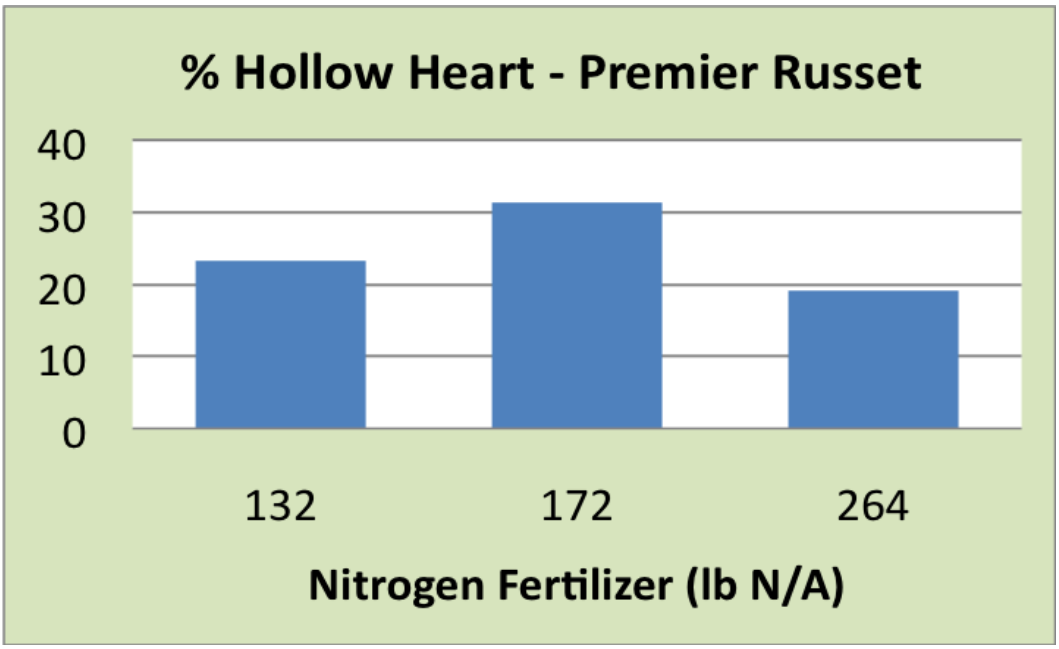

Figure 9. Effect of nitrogen fertilizer rate on hollow heart percentage in Premier Russet

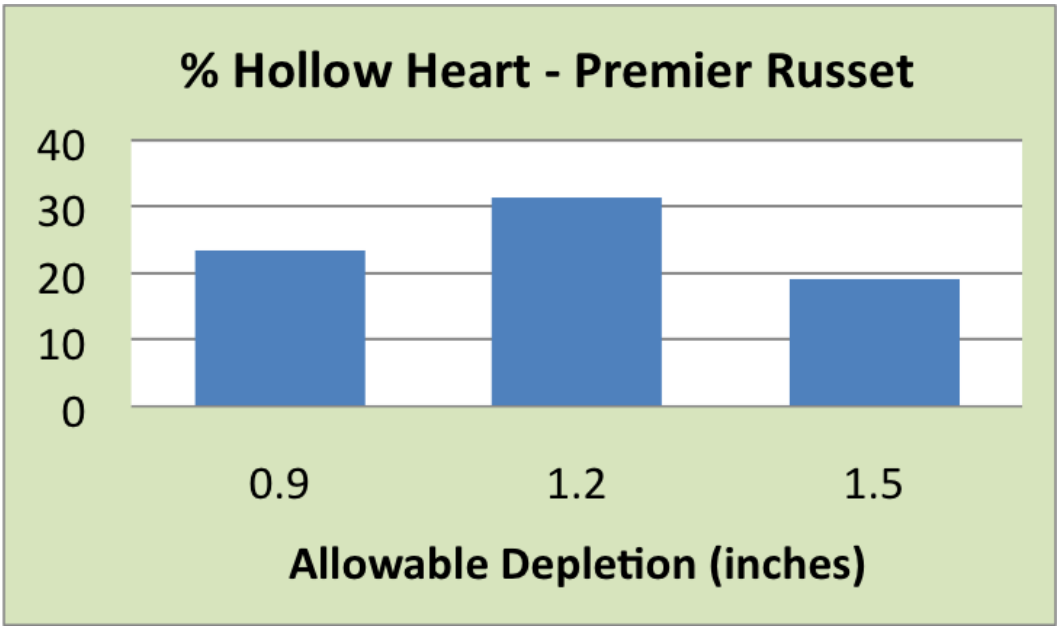

Figure 10. Effect of irrigation scheduling (allowable depletion) on hollow heart percentage in Premier Russet