Insert Ch12-06, p308 **What If element**

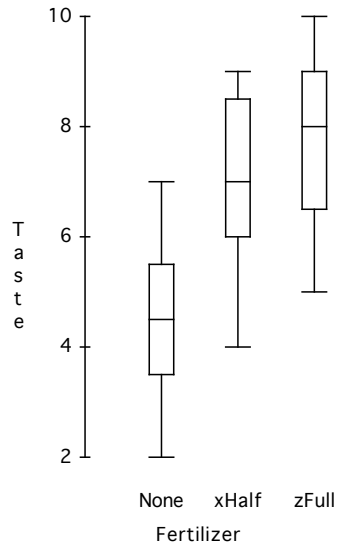
***WHAT IF*… some of the tomatoes do taste better?**

Suppose our backyard tomato experiment has run its course. We've sliced up a nice tomato from each of the 24 plants and had a neighbor who's something of a tomato aficionado taste them. Without knowing which tomatoes came from fertilized plants, she rated each one on a scale from 1 to 10, with 1 representing less than satisfactory taste and 10 meaning absolutely delicious. The data table and boxplots below display her evaluations.

<Insert Artwork Ch12-C>

Taste ratings of tomatoes from plants that had…		
no fertilizer	**half dose**	**full dose**
6	6	6
4	9	5
7	7	10
5	6	9
4	8	9
5	4	7
3	7	8
2	9	8

<Insert Artwork Ch12-D>

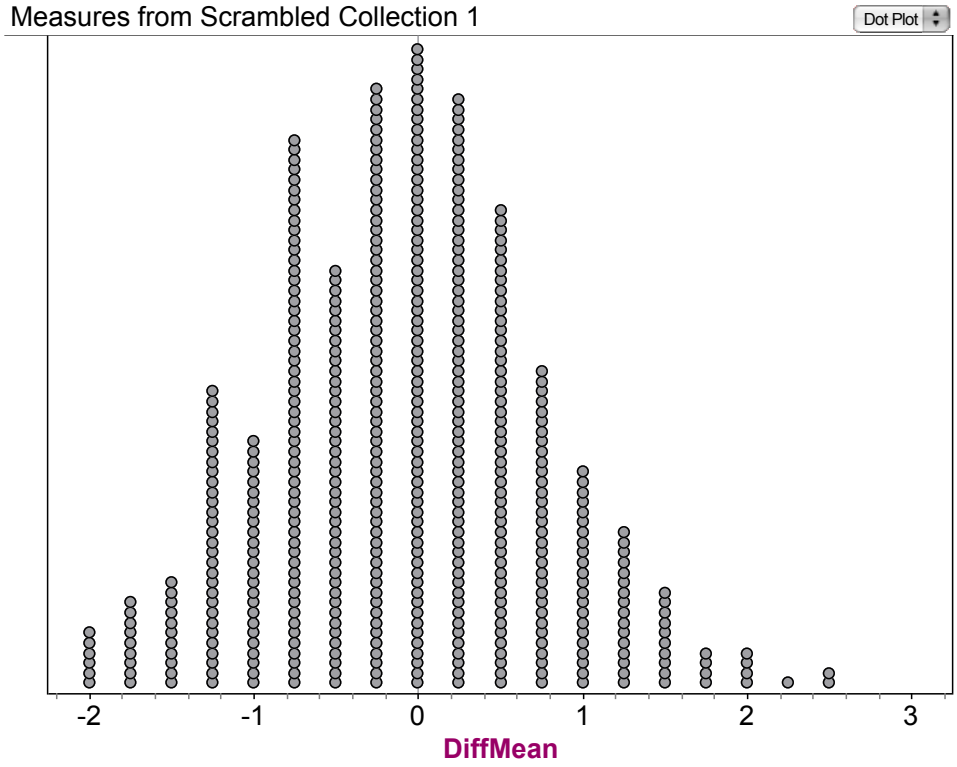


It certainly appears the fertilizer worked. Our tester rated both the tomatoes that got the half dose and those that got the full dose as much tastier than those that went unfertilized. Furthermore, it looks like the full-dose tomatoes were somewhat better than those from plants that got only half the fertilizer. In fact, the mean taste ratings for the three groups were 4.5, 7, and 7.75 out of 10, respectively. But is that ¾ -point difference between the two fertilized groups statistically significant? Did the extra fertilizer really help, or could

we just be seeing natural variability in tomato plants? To find out, we could randomly split those 16 ratings into two other groups of 8 and see how big a difference might occur by chance. Yes, it's time for another simulation!

In our first random split, Group A (6, 9, 4, 6, 9, 8, 7, 5) had a mean rating of 6.75, and Group B (7, 6, 9, 8, 10, 9, 7, 8) a mean of 8. That's an even bigger difference than what the extra fertilizer appeared to produce. Hmm.

Our simulation repeated this process a total of 500 times. The dotplot below shows the differences in means for the random groupings. **<Insert Artwork Ch12-E>**



That 7.75 to 7 mean taste-rating win for the fully fertilized tomatoes doesn't look very impressive now. In our simulation a difference of 0.75 points happened by chance a whopping 91 times in 500 trials – nearly 20% of the time. Such a difference is far from unusual; in other words, it's not statistically significant. Our neighbor's ratings don't

provide evidence that using a full dose of fertilizer instead of only half a dose will produce tomatoes that taste better.

If right now you're thinking that maybe even the apparently large difference between the tomatoes that got fertilizer and those that had none isn't significant either, good for you! Skepticism is the mark of a good statistician. To ease your mind, we checked that out for you. Instead of a simulation, though, we used one of the statistical tests we told you you'd learn about later in this course. That test revealed that a difference as large as the one we see between the mean taste ratings for tomatoes from fertilized vs non-fertilized plants could arise by chance only 1 time in 2000! Now, *that's* statistically significant. Based on these ratings, then, the OptiGro company would be on solid ground in asserting that its fertilizer produces tastier tomatoes. But it might also be tempted to warn customers that using only half the recommended amount wouldn't work as well. When you learn to think like a statistician, such claims made without evidence leave a bad taste in your mouth.