EVALUATION OF THE MODIFIED CURVED SEED TUBE VERSUS THE STANDARD STRAIGHT SEED TUBE

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Introduction/Objectives

The straight seed tube has been the recommended standard tube for sugarbeet planters for many, many years. John Deere introduced a new curved seed tube that is supposed to have significant advantages over the previous curved seed tube that has been available to sugarbeet growers. Growers and John Deere Dealerships have been asking if the new curved seed tube can be left in the planter and used for all the crops they plant in hopes of eliminating one more step when switching from one crop to another.

The new curved seed tube was evaluated on the planter test stand in the winter of 2006-2009. It was found that with visual observations on the grease belt that there seemed to be little or no differences between the straight and curved seed tubes as far as speed, seed size and seed spacing accuracy was concerned. With this in mind, a field study was conducted at Prosper, North Dakota during the 2007 and 2009 growing seasons to evaluate the new "improved" curved tube versus the straight seed tube.

Materials and Methods

A field experiment was established on a Beardon Perella silt loam (coarse-silty, frigid Aeric Calciaquoll) at a research site near Prosper, ND. The trial was planted into a smooth, moist, firm seedbed. Planting was arranged in a randomized complete block design with four replications. Individual treatment plots measured 11 feet wide and 30 feet long. Soil nitrogen levels were adjusted with fertilizer to approximately 130 lbs/acre of available residual soil test plus added fertilizer N.

Eight treatments were established in this experiment. The treatments consisted of straight vs. curved seed tubes, mini vs. Xtreme seed size and 4 vs. 6 mph planting speeds.

Rhizomania resistant variety, Crystal 539 RR, was planted on May 18, 2009 with a John Deere MaxEmerge II planter. Sugarbeet was placed 1.25 inches deep, and was planted to stand at a 4 ½ -inch in-row seed spacing. A 22-inch wide row spacing was used. Counter insecticide was surface band applied at 10.9 lbs/A, and incorporated with a drag chain at planting. Stand count and distance between seed measurements were taken after germination. Round up was applied three times and hand labor was used as needed for weed control. Two fungicide applications, Eminent and Headline were applied for Cercospora leaf spot control.

Harvest of the middle two rows of each six row plot, was completed on September 30/2009. Yield determinations were made and quality analysis performed at the American Crystal Sugar Quality Lab, East Grand Forks, MN.

Results and Discussion

Table 1 shows all treatment effects considered in this study (tube type, seed pellet size, and planting speed) on sugarbeet yield and sugar quality. Yield was not significantly affected by the combined treatment effects. Gross sugar was lowest for the straight tube/mini pellets/4MPH and the curved tube/Xtreme pellets/6MPH treatment combinations. The reduced gross sugar determined for these two combinations is not completely explained by lower plant stand since only one of the treatments (straight tube/mini pellets/4MPH) had statistically lower plant stand than other treatments. Plant population and evenness analysis (Figures 1 and 8) show that both of these treatments were characterized by good in-row seed spacing (>45% of counted seeds were within the target spacing range) and about the same number of doubles and skips as other treatments. Sugar loss to molasses (SLM) did not differ among treatment combinations, however the same treatments that were lowest for gross sugar (straight tube/mini pellets/4MPH and the curved tube/Xtreme/6MPH) also shared two of the highest values for SLM. There were no significant differences among treatments for recoverable sugar per acre (RSA). As expected, the same two treatments that resulted in lowest net sugar (straight tube/mini pellets/4MPH and the curved tube/Xtreme/6MPH) also resulted in lowest recoverable sugar per ton (RST) of harvested beet roots. The combined analysis of tube type, seed pellet size, and planting speed revealed highly significant differences in sugarbeet stand, as measured on June 16 and shown in greater detail in the histograms below. Essentially, the curved tube/mini/6MPH treatment resulted in the lowest stand count of all treatments and, in general, mini pelleted seeds displayed lower sugarbeet seed emergence than did the Xtreme pelleted seeds.

Mini pellets were found in both this study and the eSet planter plate study to display lower plant stand and higher sugar loss to molasses (SLM) than other seed pellet sizes. The reason for this could be a number of factors, together or in concert, including lower vigor, shallower planting depth (due to lower density of seeds), and/or poorer seed-to-soil contact resulting in reduced or staggered germination rate. Reduced performance by mini pelleted seed could be related to the poor seedbeds prepared in spring 2009, which were the result of wet conditions in fall 2008 which prevented adequate fall tillage activities. Higher SLM might be related to poor defoliation, which can result from planting depth above or below the optimum depth. The effect of seed size can be examined more closely by averaging over the tube style and planting speed treatments (Table 2). From this analysis of the data, we found that stand counts were about 17% higher for Xtreme pelleted seeds than for mini pelleted seeds. Stand count (BEETS/100’) was the only sugarbeet production parameter affected by sugarbeet pellet size. Furthermore, when simple effects of planting speed and tube style are analyzed by averaging over other treatments (Tables 3 and 4), we find that beet stand counts (BEETS/100’) did not significantly differ as a result of any factor other than seed pellet size. Therefore, we conclude that the difference in stand is the result of sugarbeet pellet size, not planting speed or seed tube style. Planting speed (Table 3) and tube style (Table 4) did not result in a significant treatment effect for any of the sugarbeet yield and quality parameters measured in this study.

Figures 1 – 8 display the effects of tube type, seed pellet size, and planting speed on sugarbeet seed placement. Figure 1 shows that seed placement for the straight tube/mini/4MPH treatment combination resulted in good seed placement, but slightly more skips than other treatments. Figure 2 reveals that the straight tube/mini/6MPH treatment was essentially the same seed placement pattern as the straight tube/mini/4MPH treatment. Figures 3 and 4, Straight tube/Xtreme at 4 ad 6 MPH, respectively, display more precise seed placement than the same treatment with mini sized pellets. Figures 5-8 reveal the same pattern of more precise seed placement with lower variability in Xtreme compared to mini pellets. Additionally, the histographs suggest that speed influences uniformity of planting regardless of tube type or seed size. Results were not statistically significant, but there were more seeds within the target range for the 4 MPH treatment compared to the analogous 6 MPH treatment for all treatment combinations.

Therefore we conclude that the new curved tube did not result in any measureable difference in sugarbeet yield or sugar content compared to the conventional straight tube. We determined from this study that Xtreme pellet size resulted in about 17% greater sugarbeet seed stand relative to mini pelleted seeds. Finally, seeds were placed with greater accuracy by the planter at the 4 MPH velocity than at 6MPH.

Final Comments

The results of this study show that the new curved seed tube being offered for sale by John Deere seems to be much improved compared to the old curved seed tube. The old curved tube had obvious projections of pieces of plastic into the tube interior that interfered with seed drop and frequently caused a serious lack of uniformity in seed placement as well as more doubles and skips. This lack of seed uniformity at times resulted in lower stands and poorer defoliation at harvest. We would certainly be willing to repeat this study in 2010 in an attempt to verify these results. Every attempt would be made to reduce the CV’s further in another experiment. Results to this point would appear to indicate that the new curved seed tubes perform about as well as the straight tube for yield and quality parameters.

Table 1. Effect of tube style, pelleted seed size, and planting speed on sugarbeet yield and sugar quality values; SLM=Sugar Loss to Molasses; RSA=Recoverable Sugar per Acre; RST=Recover Sugar per Ton. Least significant difference (LSD) designated for alpha = 0.90 (P<0.10).

TUBE	SEED SIZE	PLANTING SPEED	YIELD (tons)	SUGAR (%)	SLM (%)	NETSUG (%)	RSA (lb/a)	RST (lb/ton)	BEETS/100'
STRAIGHT	MINI	4	35.1	14.37	1.4875	12.89	9000	257.75	216
STRAIGHT	MINI	6	33.2	15.27	1.4350	13.84	9167	276.80	211
STRAIGHT	XTREME	4	32.4	14.92	1.4925	13.43	8653	268.65	242
STRAIGHT	XTREME	6	32.1	15.32	1.4175	13.91	8919	278.15	236
CURVED	MINI	4	34.0	15.12	1.4125	13.71	9279	274.25	205
CURVED	MINI	6	31.9	15.30	1.4325	13.87	8857	277.35	194
CURVED	XTREME	4	33.9	15.30	1.4725	13.83	9345	276.55	256
CURVED	XTREME	6	33.9	14.62	1.5350	13.09	8859	261.80	235
LSD (P<0.10)			**NS**	**0.55**	**NS**	**0.6554**	**NS**	**13.11**	**14**

Table 2. Main effect of seed pellet size averaged across planter speeds and seed tube types on sugarbeet yield and sugar quality values

Seed Size	YIELD	SUGAR	SLM	Net Sugar	RSA	RST	BEETS/100'
Mini Pellets	33.5	15.02	1.4419	13.58	9076	271.54	207
Xtreme Pellets	33.1	15.04	1.4794	13.56	8944	271.29	242
LSD	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**11**

Table 3. Main effect of planter operating speed averaged across tube type and seed pellet size on sugarbeet yield and sugar quality values

PLANTING SPEED	YIELD	SUGAR	SLM	Net Sugar	RSA	RST	BEETS/100'
4MPH	33.8	14.93	1.4662	13.46	9069	269.30	230
6MPH	32.8	15.13	1.4550	13.68	8950	273.52	219
LSD	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**

Table 4. Main effect of seed tube averaged over planting speed and seed pellet size.

Seed Size	YIELD	SUGAR	SLM	Net Sugar	RSA	RST	BEETS/100'
STRAIGHT	33.2	14.98	1.4581	13.52	8935	270.34	226
CURVED	33.4	15.09	1.4631	13.62	9085	272.49	223
LSD	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**

Measurements of variability in seed spacing were made on the middle two rows of each treatment. Fifteen feet of each row was counted.

Figure 1. Straight tube/mini/4MPH

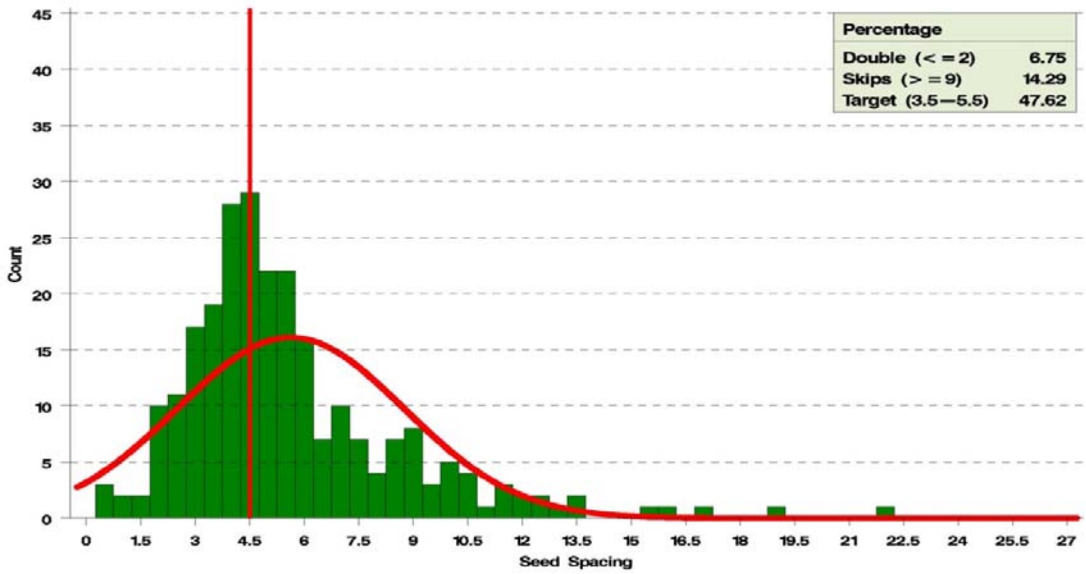

Figure 2. Straight tube/mini/6MPH

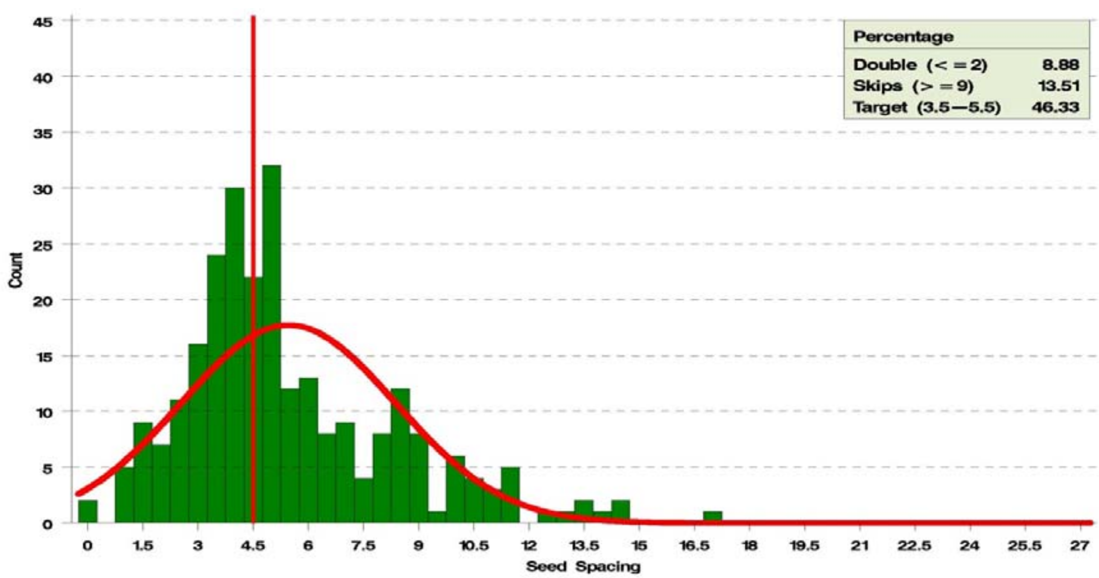

Figure 3. Straight tube/Xtreme/4MPH

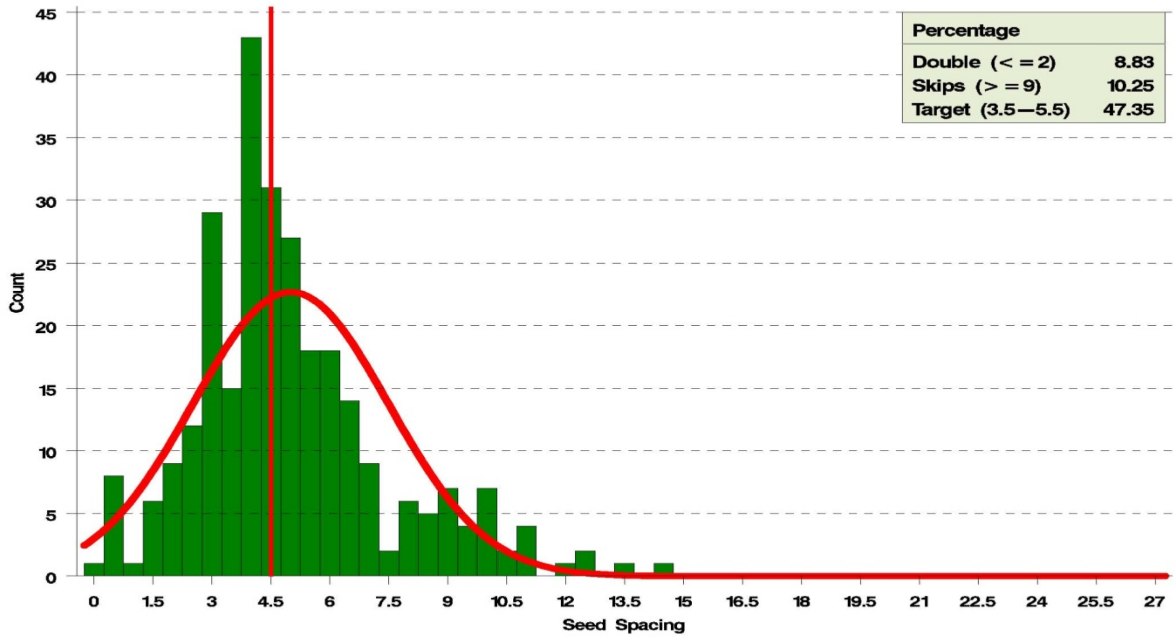

Figure 4. Straight tube/Xtreme/6MPH

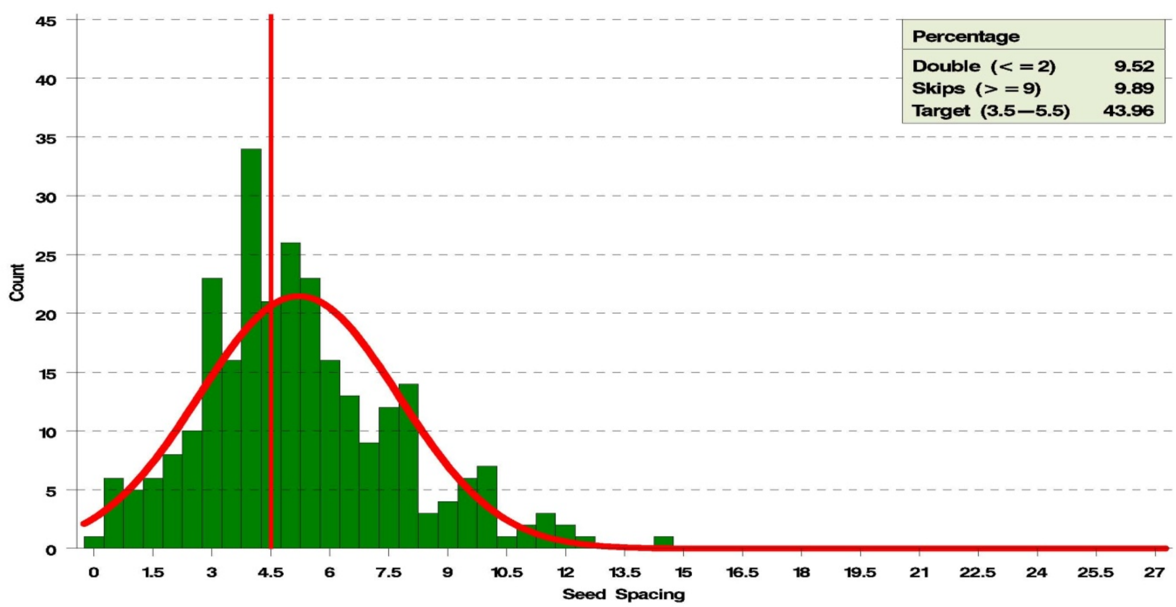

Figure 5. Curved tube/mini/4MPH

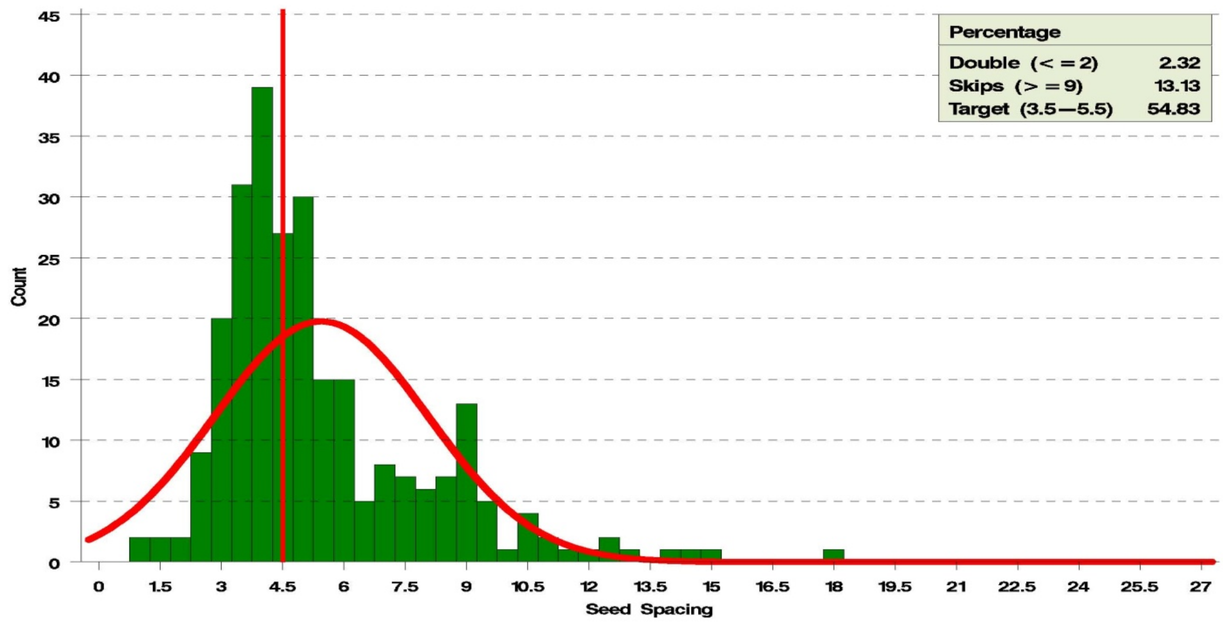

Figure 6. Curved tube/mini/6MPH

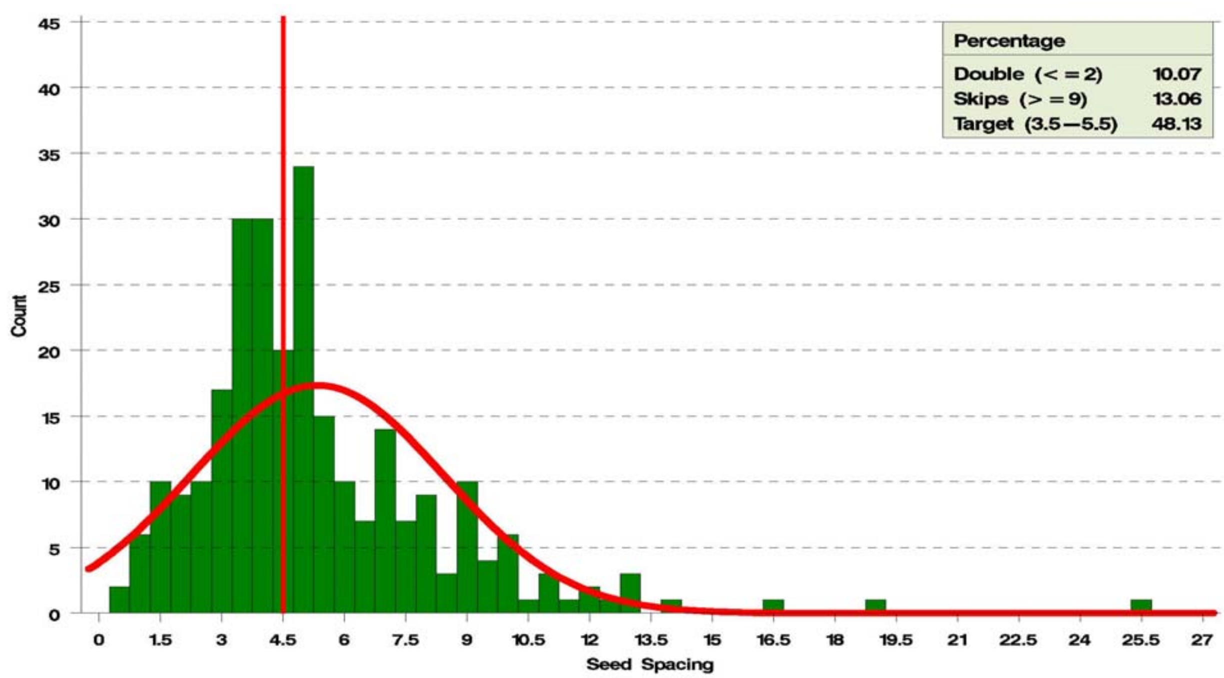

Figure 7. Curved tube/Xtreme/4MPH

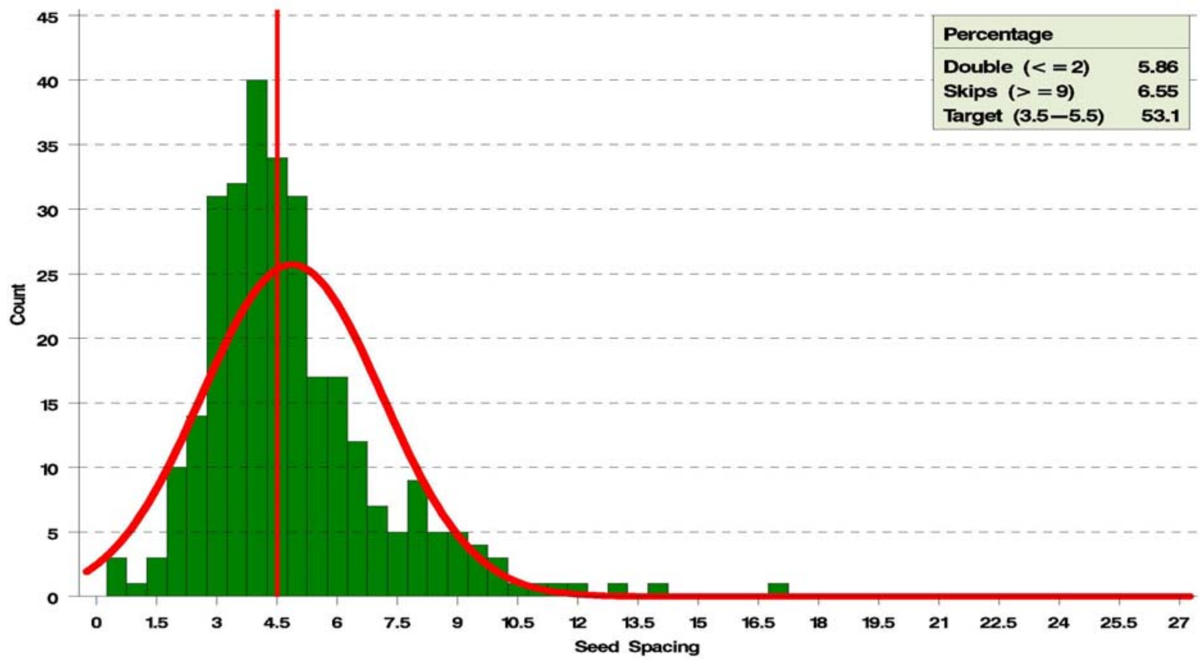

Figure 8. Curved tube/Xtreme/6MPH