EVALUATION OF ESET PLATE VERSUS SORGHUM PLATE FOR SUGARBEET PRODUCTION

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Introduction/Objectives

The standard recommended plates used with the JD MaxEmerge II Vacuum planter has been the large size for small pelleted seeds, like mini pellets, or the sorghum plate for larger seed sizes, such as Xtreme. Recently, a new plate and unit referred to as eSet, developed by Precision Planting, has been introduced for sugarbeet and other row crop production. It is reported to offer excellent planting ability and additionally eliminates switching seed plates back and forth to accommodate different seed sizes. The eSet planter unit used with the eSet sugarbeet plate purports to plant many different sizes of seed with fewer doubles and skips. Another advantage to this system is that it could eliminate the need for seed companies to regulate seed size to the same exacting standard that is necessary with the planter units and plates currently available. This would save time and money for the seed industry, which could be transferred to sugarbeet growers as reduced seed costs.

The two systems (eSet planter unit and standard John Deere planter unit) were evaluated on the planter test stand in the winter of 2008 and again in 2009. Visual observations on the grease belt indicated little or no differences between the two units in terms of speed, seed size, and seed spacing accuracy. With this in mind, a field study was established at Prosper, North Dakota during the 2009 growing season to evaluate the new eSet System versus the standard vacuum plate and planter unit.

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. Planting was arranged in a randomized complete block design with four replications. Individual treatment plots measured 11 feet wide by 30 feet long. Soil nitrogen levels were adjusted with pelletized urea to approximately 130 lbs N/acre of available residual soil test plus fertilizer N. Soil tests reports indicated that phosphorus and potassium levels were sufficient and thus did not require additional fertilization.

Twelve planter plate treatments were established in this experiment. Precision Planting provided converted eSet John Deere (JD) planter units and corresponding large eSet sugarbeet plates. As a control, the conventional JD vacuum planter unit with JD sorghum plate was used. Finally, as a test of the planter units, we included a final treatment in which the sorghum plate was used in the eSet planter unit. This gave a total of three planter unit/plate combinations: 1) eSet planter unit with eSet precision plate; 2) eSet planter unit with sorghum plate, and 3) standard JD planter unit with sorghum plate. Four pelleted seed size treatments were tested with each planter unit/plate combination: mini, regular, and Xtreme pellets and a pellet mixture consisting of an equal blend of the three pellet sizes (mini, regular, and Xtreme). Because the eSet plate has 60 cells and the JD plate has 45 cells, we adjusted the planter sprocket settings according to the plate cell number and target seed placement. Different vacuum settings were used according to the plate and seed size being tested. Vacuum settings for the eSet Unit with eSet plate are as follows: mini pellets 12, regular pellets 14, Xtreme 15 and mixed 13 inches of vacuum. For the sorghum plate in the eSet units, vacuum setting for mini pellets, regular pellets and the mixed seed was 3 inches of vacuum and for Xtreme size, 4 inches of vacuum. The same vacuum settings were used for the sorghum plate in the standard planter setup. The vacuum settings used in this trial were followed according to the recommendations of Precision Planting and the Sugarbeet Production Guide published by North Dakota State University and University of Minnesota Cooperative Extension Service. We should mention that we did not add talc or graphite to the seed, which is a recommended practice for the eSet plates. This could have created a static issue for the eSet plates.

Rhizomania resistant variety, Crystal 539 RR, in the above specified pellet sizes was planted on May 19, 2009. Sugarbeet was placed 1.25 inches deep, and was planted to stand at a 4.5-inch in-row target 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 for weed control and hand labor was used to control resistant canola. 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

In general, the eSet precision plates resulted in seed populations that were higher than optimal. Overplanting sugarbeet will result in uneven beet sizes and problems with harvestability, including poor defoliation and smaller beets that are not lifted properly. Plant population and stand can also affect sugar content and impurity levels in sugarbeet production. In most cases, seed populations were 20 to 40% higher for eSet plate treatments than sorghum plate treatments. The eSet plates performed well in the field and at planter test stand clinics and did not have obvious design problems, so it seems likely that simply fine-tuning the calibration of planter vacuum settings or sprocket settings will increase the accuracy of seed metering and improve final stand and related properties. Based on the results of this study, it may be necessary to re-evaluate planter settings. Results are based on one year of data. Another year of field research would improve our evaluation of eSet plates and provide more opportunity to identify planter settings that will optimize use of the plates.

For the discussion of results, it will be understood that the eSet precision plates were tested only with the eSet planter unit. Since sorghum plates were tested in both the eSet planter unit and the standard unit, we will specify plate/planter unit combination for the sorghum plate only. Sugarbeet yields and recoverable sugar were significantly affected by plate type (Table 1). eSet precision plates yielded statistically equal root yields as sorghum plates when used to seed mini and Xtreme sized seeds, but yielded lower root tonnage compared to the sorghum plate (with either the eSet or the standard JD planter unit) when regular pellets or mixed pellet sizes were seeded. The lower tonnage associated with the eSet precision plate/mixed seed treatment was offset by higher percent sugar than other treatments. As a result of high percent sugar and low sugar loss to molasses, the eSet plate/mixed seed size treatment resulted in the highest net sugar and recoverable sugar per ton (RST) measurements in this study. The lower tonnage in this treatment was probably associated with a plant population that was too high.

When mini or regular size pelleted seed were planted, eSet precision plates yielded lower total sugar compared to sorghum plates in the standard JD planter unit. This could, again, be related to the high population observed in precision plate treatments, which, in turn, result in uneven sugarbeet sizes and suboptimal sugar content. There was no difference in sugar loss to molasses (SLM) as a result of plate used, but beets grown from mini sized pellets resulted in greater sugar loss to molasses than other seed sizes. Although the eSet plate with mini pellets provided high yield (33.4 ton/a), the lower percent sugar and high SLM observed in mini pellets resulted in significantly lower net sugar for this treatment than any other treatment (Table 1). Recoverable sugar per acre (RSA) was also affected by plate size. The lowest RSA in this study (significant at $P<0.05$) was determined for eSet precision plates with regular size pelleted seeds. The lowest RST was determined for eSet precision plates with mini sized pellets; the eSet plate with other seed sizes (regular, Xtreme, and mixed pellet sizes) produced RST that was statistically the same as those obtained with sorghum plates.

Sugarbeet plants were counted on June 16, almost one month after planting. Stand counts varied substantially among treatments, and it appears that the mini sized pellets had the lowest overall emergence regardless of plate type. 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. The eSet precision plate did the best overall job of planting mini sized pellets as evidenced by the relatively higher stand count for the precision plate relative to the sorghum plate treatments, but the lower percent sugar and higher SLM for mini pellets in all treatments indicate that it is not the best size to use for the conditions of this study. The eSet precision plate resulted in more seeds being planted and emerging, but the final results for tonnage and sugar content indicate that eSet precision plates did not outperform the sorghum plate under the conditions of this study.

Table 1. Effect of plate and seed size on sugarbeet yield and quality. Treatment abbreviations: eSet PP = eSet planter unit + eSet precision plate; eSet SP = eSet planter unit + sorghum plate; Std SP = standard John Deere MaxEmerge II planter unit + sorghum plate. Least significant difference (LSD) designated for alpha = 0.95 ($P<0.05$).

Plate Type	Seed Size	Tons	Sugar %	SLM	Net Sugar	RSA	RST	Plants per 100' (June 16th)
eSet PP	Mini	33.4	14.40	1.5425	12.86	8590	257.15	249
eSet PP	Reg	31.2	14.58	1.4500	13.12	8187	262.50	276
eSet PP	Xtreme	32.9	14.63	1.4625	13.16	8671	263.25	323
eSet PP	Mixed	31.9	15.40	1.3200	14.08	8959	281.60	272
eSet SP	Mini	33.3	14.75	1.5450	13.21	8751	264.10	185
eSet SP	Reg	34.5	14.97	1.4033	13.56	9361	271.27	210
eSet SP	Xtreme	33.9	15.23	1.3600	13.86	9387	277.30	234
eSet SP	Mixed	33.9	15.13	1.4150	13.71	9295	274.20	227
Std SP	Mini	33.7	15.18	1.4400	13.73	9195	274.70	160
Std SP	Reg	32.4	15.20	1.3700	13.83	8946	276.60	193
Std SP	Xtreme	33.2	15.30	1.3700	13.93	9224	278.60	218
Std SP	Mixed	33.6	15.25	1.4225	13.83	9307	276.55	205
LSD ($P<0.05$)		1.34	0.70	0.1205	0.8023	391	16.05	11

Measurements of variability in seed spacing were made on the middle two rows of each treatment. Fifteen feet of each row were counted. The histograms for each treatment and seed size are shown in Figures 1-12. The target spacing was 4.5 inches between seeds and a range of 3.5-5.5 inches is considered acceptable.

Figures 1 – 4 display the seed placement of three seed sizes individually and a mixture of seed sizes using the eSet precision planter plate used in the eSet planter unit. Figure 1 supports the previous observation that mini sized pellets used with the eSet precision plate resulted in most seeds being placed at 2.5 to 4.0 inches between seeds, resulting in higher than optimal seed population. Figure 2 shows that regular sized pellets were also over planted with the eSet precision plate, resulting in most seeds being placed 2.5 to 4.0 inches apart. Figure 3 shows that Xtreme size pelleted seed had less variability in seed placement relative to minis or regulars and fewer seeds were spaced at wider than optimal spacing, but similar to minis and regulars, the eSet plate spaced Xtreme sized seeds closer together than the targeted range. The physical configuration of the plates, vacuum, and singulater should eliminate doubles with the eSet plates, particularly for large seed sizes, like the Xtreme. We believe this data may overestimate the actual number of doubles present in the eSet/Xtreme treatment combination. Figure 4, displaying the seed spacing of the eSet precision plate when seed sizes were mixed (one-third each of minis, regulars, and Xtremes), shows that just as when sizes are maintained separately, the mixed seed sizes were consistently placed too close together; most seeds were placed just 2.5 to 3 inches apart. With proper calibration or revised planter settings, the eSet plates can probably be used with very good results, but when used at the planter settings described above, the result is likely to be seed spacing that is too close together. Figures 5-8 display seed placement of three seed sizes individually and a mixture of seed sizes using a sorghum plate in the eSet planter unit. Figure 5, describing the seed placement of mini sized pelleted seed with the sorghum plate in the Eset planter unit, shows that the sorghum plate still placed seed closer than the optimal spacing, but the average seed spacing was closer to the targeted range than the same seed size planted with the eSet precision plate. Figure 6 shows regular sized pelleted seed spacing when a sorghum plate is used in the eSet planter unit; the values are much closer to the targeted range compared to the eSet precision plate, which placed regular sized seeds too close together. Figure 7 shows that Xtreme sized

pelleted seed planted with a sorghum plate in the eSet planter unit gave good seed placement, with 57% of seeds placed at 3.5 to 5.5 inches. Figure 8 shows that a mixture of seed sizes planted with a sorghum plate in the eSet planter unit resulted in good seed spacing, with 58% of seeds placed at 3.5 to 5.5 inches apart.

Acknowledgement

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Figure 1. eSet Precision Plate + mini size pelleted seed; seed spacing is measured in inches between seeds

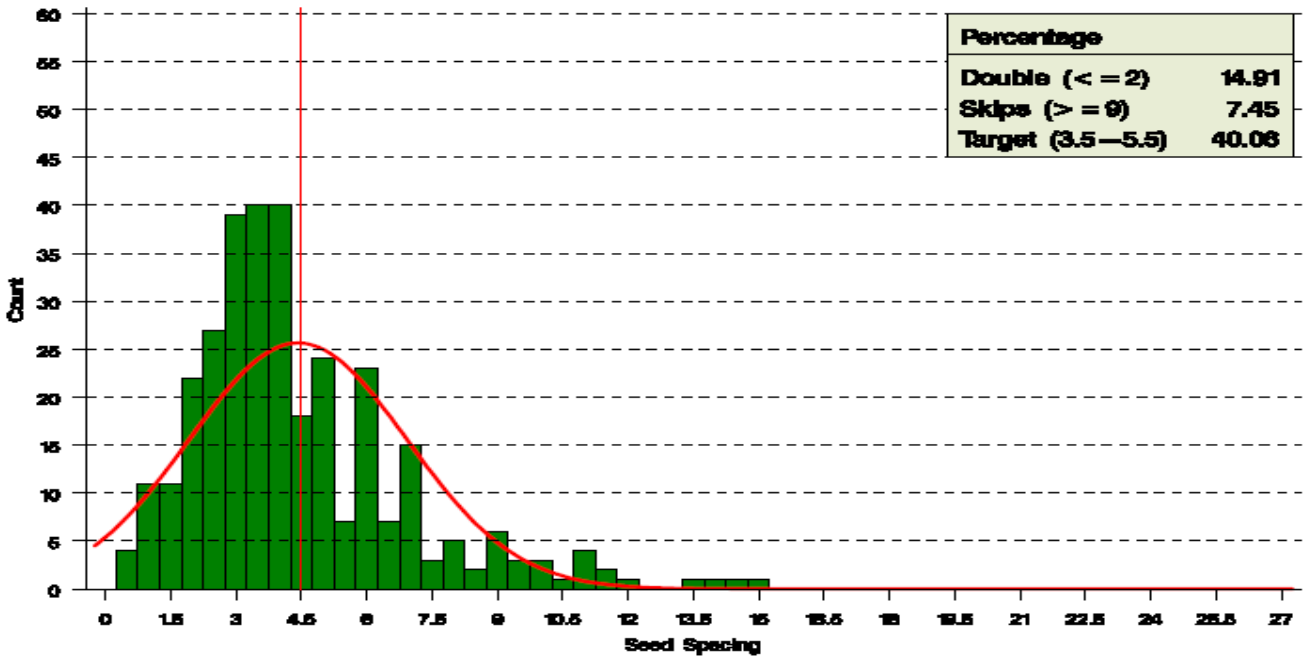

Figure 2. eSet Precision Plate + regular size pelleted seed

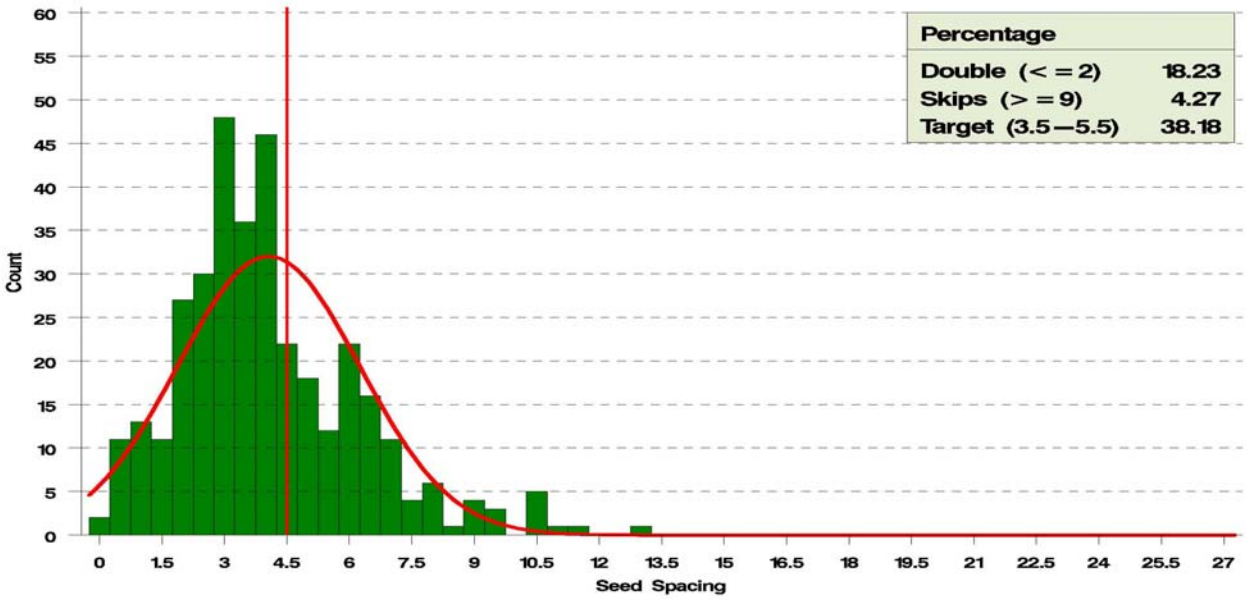

Figure 3. eSet Precision Plate + Xtreme seed

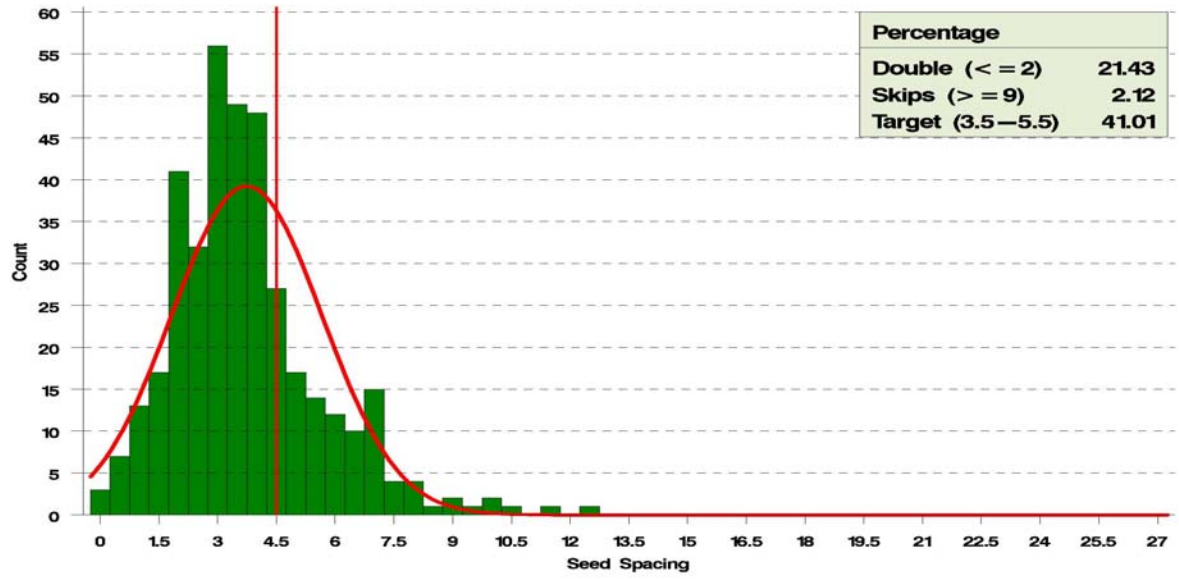

Figure 4. eSet Precision Plate + mixed seed sizes

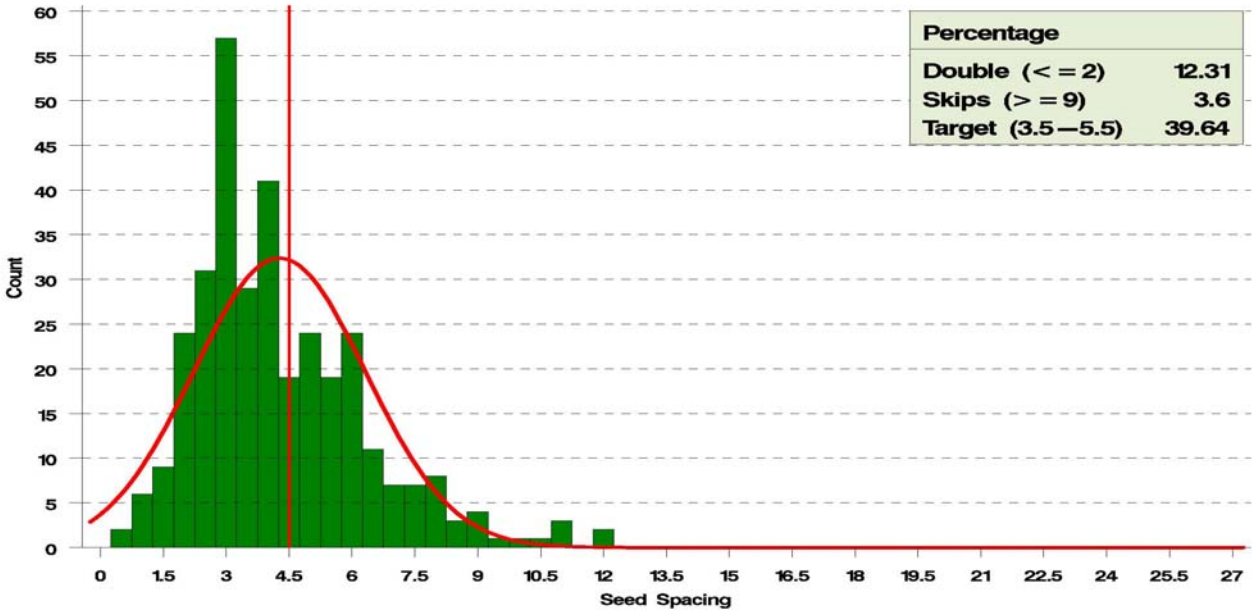

Figure 5. eSet planter unit with sorghum plate + mini sized pelleted seed

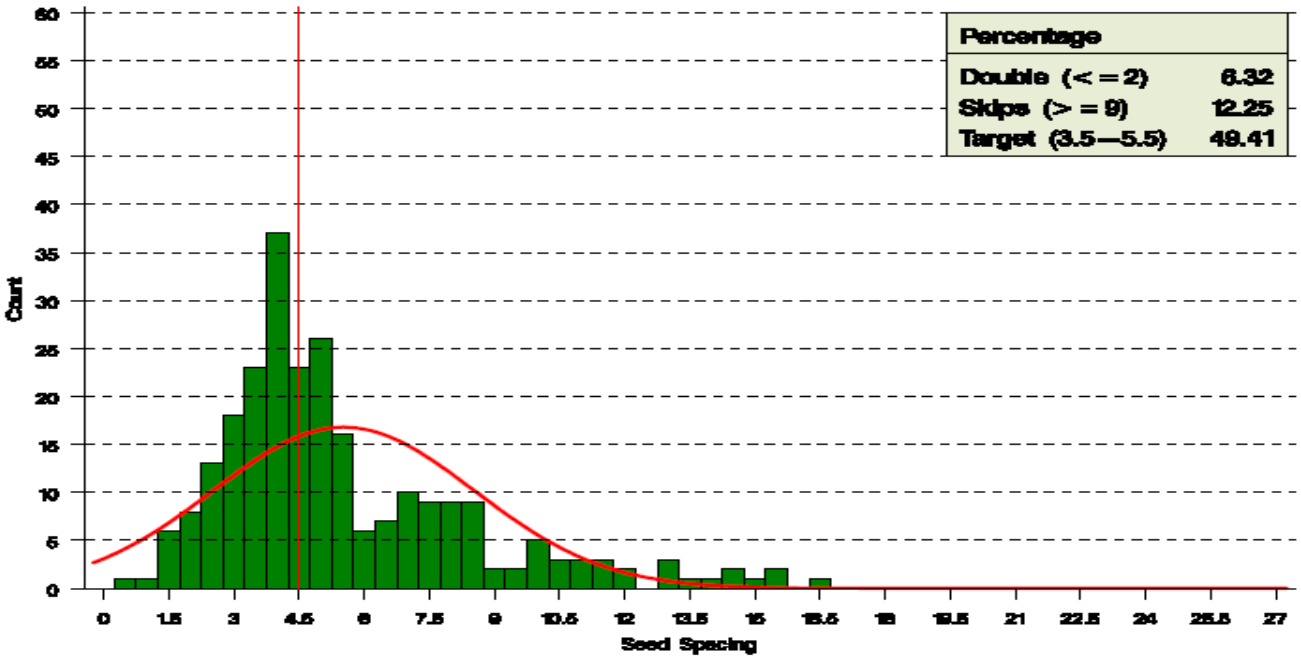

Figure 6. ESet planter unit with sorghum plate + regular sized pelleted seed

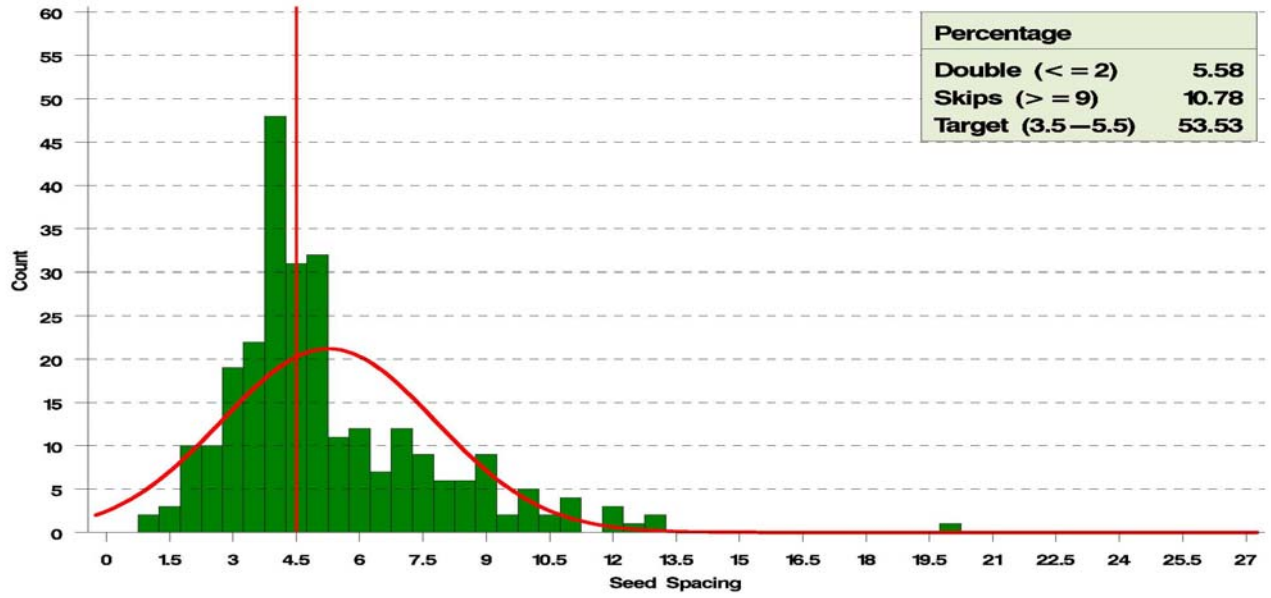

Figure 7. eSet planter unit with sorghum plates + Xtreme pelleted seed

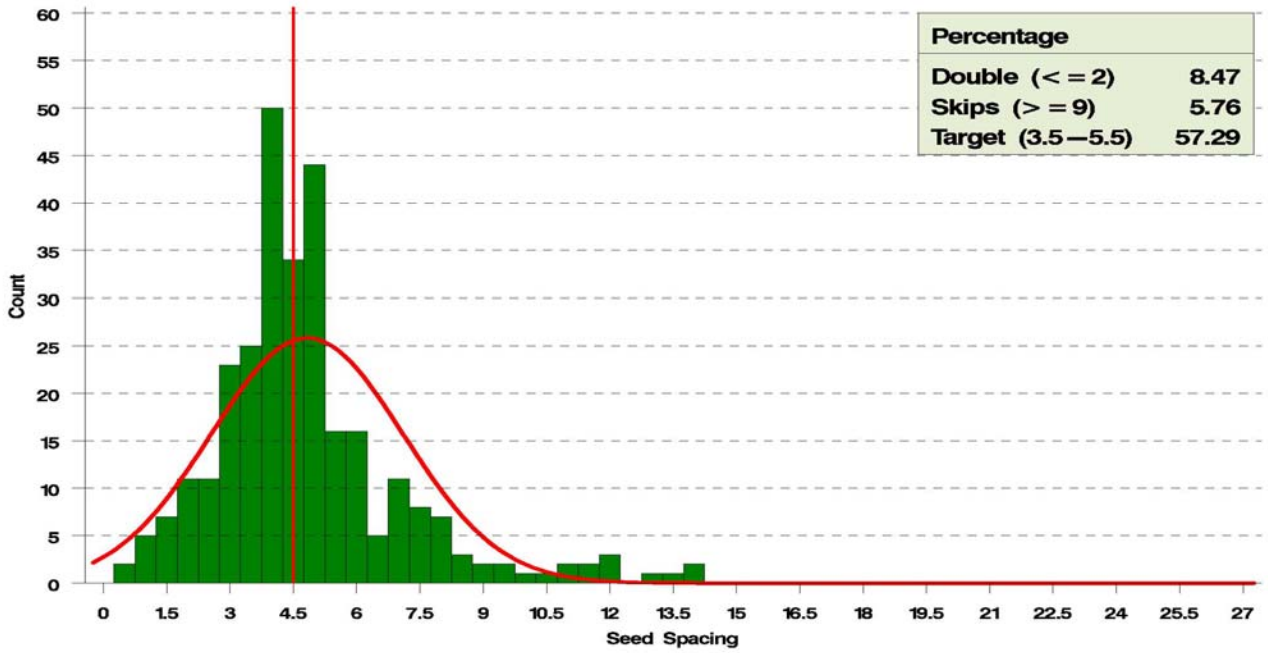

Figure 8. eSet planter unit with sorghum plate + mixed seed sizes

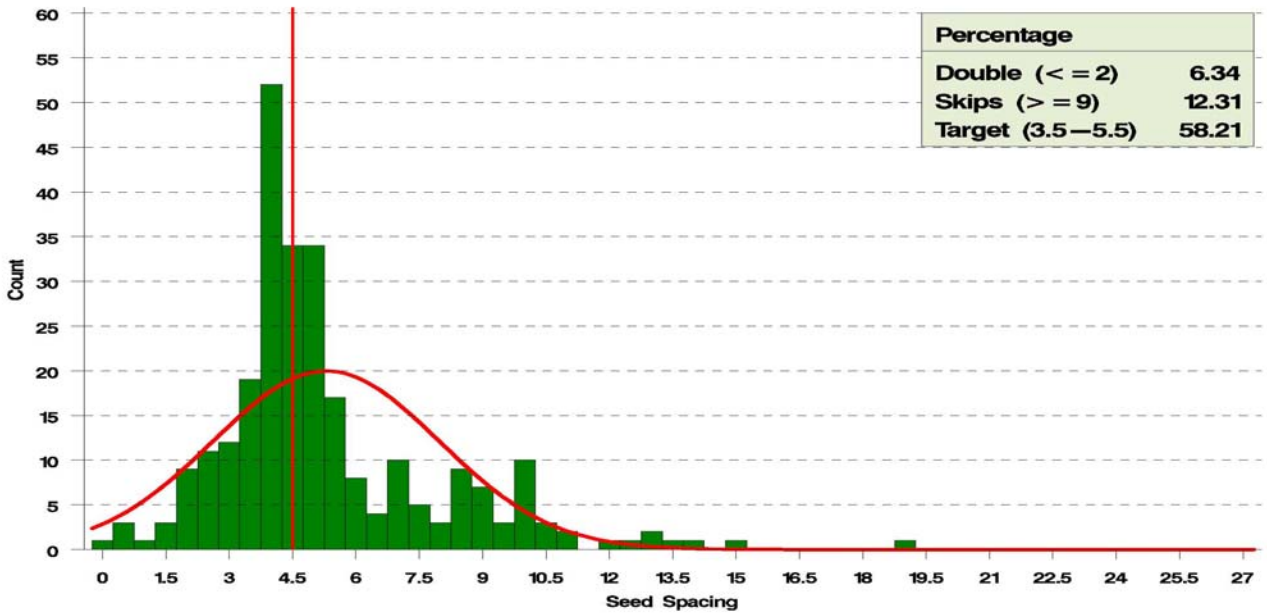

Figure 9. Standard JD planter unit with sorghum plate + mini sized pelleted seed

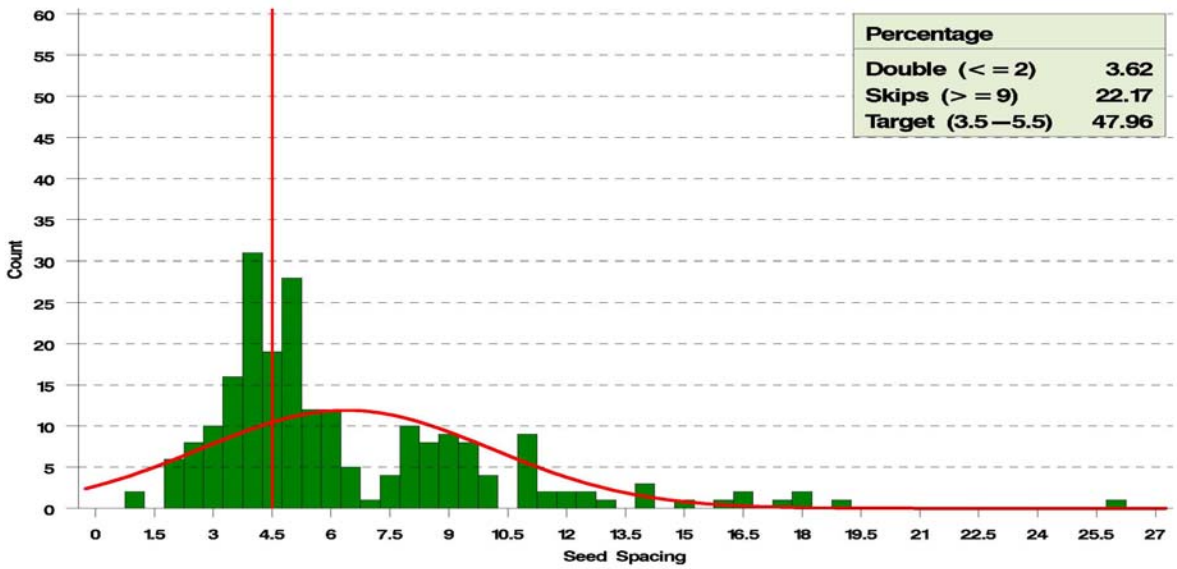

Figure 10. Standard JD planter unit with sorghum plate + regular sized pelleted seed

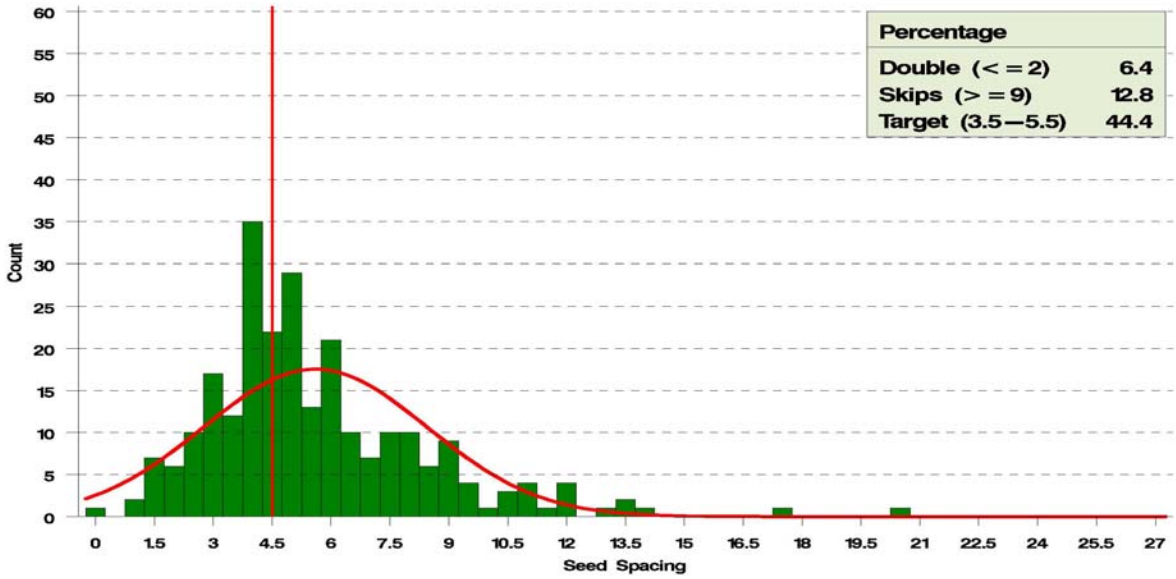

Figure 11. Standard planter unit with sorghum plate + Xtreme seed

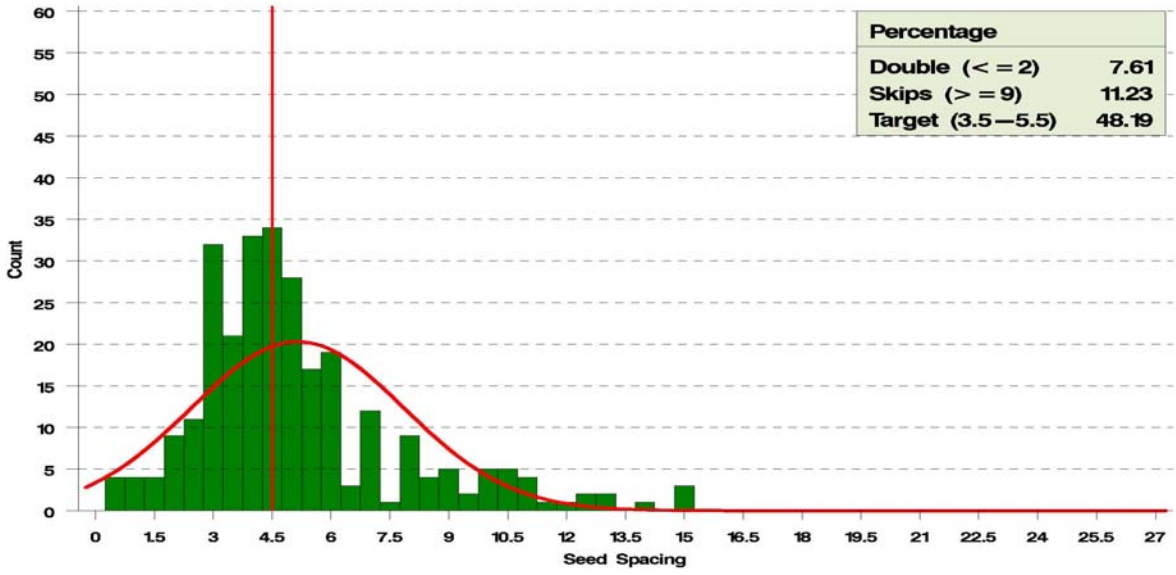

Figure 12. Standard JD planter unit with sorghum plate + mixed seed sizes