

# ***PLANTER PERFORMANCE IMPACTS ON QUALITY AND YIELD***

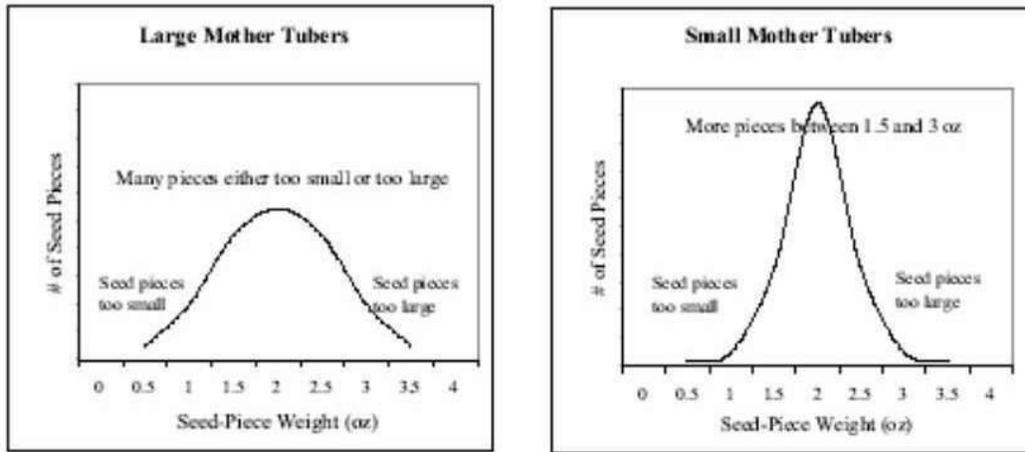
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## **INTRODUCTION**

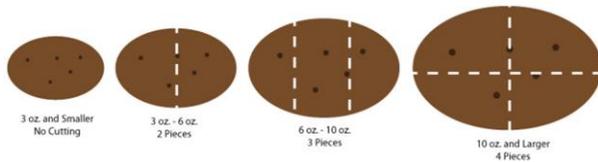
According to the Idaho Ag Statistical Service, research has shown that a decrease in stand from 100% to 90% will decrease yield by about 8%. Every fall, according to reports, it is estimated that the 75% stand reported for potato fields has resulted in an average of 16% yield loss. As a "rule of thumb", *yields are reduced an additional 5 percent if there are gaps of 4 to 6 feet in the row and an additional 2 percent for gaps of 1 to 3 feet.* The purpose of this publication is to emphasize how potato planter performance is dependent on several key factors such as seed piece size and planter speed. These factors play a dynamic role in the outcome of potato yield and quality. Potato plants tend to rapidly fill in the blank spots, masking the effects and below ground behavior of poor stand that result in undersize tubers and lower the overall yield. For over twenty-eight years, the Elmore County Extension Educator, in cooperation with growers and industry, has conducted ongoing evaluations of potato planter performance and seed evaluation. Based on our data, *missing plants and clumped seeds can result in an economic loss of 9-27% for the growers.* Usually 85 to 95% of the missing hills in a potato field are due to a lack of seed pieces. Our research has demonstrated the positive impacts on potato yield and quality by focusing on *higher planter efficiency, seed size and seed quality.*

Potato seed size distribution profiles for different growers provided a very good visual comparison of desired seed size for uniform size and better planter efficiency. Most of the growers maintained their seed distribution charts above the 70% desired size. Potato planters will place seed pieces more evenly when the pieces are uniform. It is recommended that the seed pieces be smaller whole pieces (*1.5-3 ozs. Figure 1*) rather than oversized tubers cut into pieces with fewer eyes. These larger pieces usually result in reduced stand. Our study indicated that the smaller pieces can produce higher vigor, increased tuber set and less disease. Eliminating seed-cutting will reduce the risk of spreading tuber-borne disease since there are no cut-exposed surfaces. (*Figure 2*)

**Figure 1: Distribution of Potato Seed**



**Figure 2: Uniform Seed Pieces**



**METHODS:**

Potato planter performance was evaluated by *seed spacing, planter speed, and seed depth*. Seed pieces in a 25 ft row were uncovered, counted, and the spacing between the seed pieces was measured. Distances were categorized as *under spaced (0-7 in)*; *acceptable (8-12 in)*; or *over spaced (>12 in)*. The number of spacings in the acceptable range was divided by the total and multiplied by 100 to obtain percentage planter efficiency. (Table 1)

**Table 1: Example: On-farm calculation of planter efficiency**

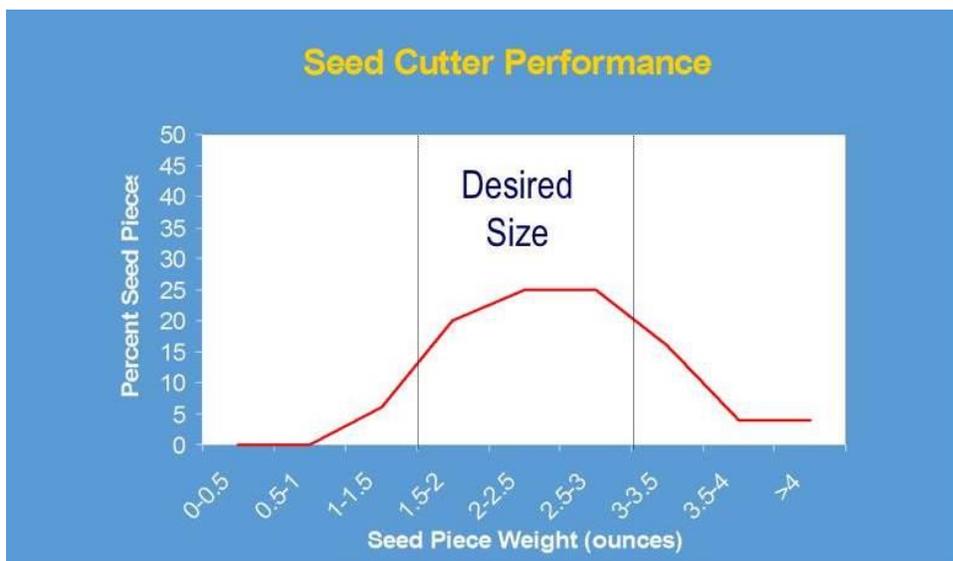
ROW A	ROW A SPACING	NUMBER	%	ROW B
	0-7"	4	40%	
9	8-12"	4	40%	9
19	13-24"	2	20%	10
10	OVERALL EFFECTIVENESS		40%	10
11				9
24	ROW B SPACING	NUMBER	%	11
6	0-7"	0	0	10
5	8-12"	10	100%	8
1	13-24"	0	0	9
10	OVERALL EFFECTIVENESS		100%	9

Seed evaluations included *seed source, disease, treatment, cutting, and the seed cutter performance*. Seed samples were taken from the grower’s lot to evaluate cutter performance. Factors taken into consideration included *the growing environment of the seed crop, seed storage, present seed condition, seed germination and physiological age and seed size distribution*. Seed piece size and seed cutter distribution profiles were evaluated as part of the overall planter evaluation dynamics. One hundred randomized cut seeds were taken from the cut-seed piles to be evaluated on the basis of seed weight: *desired size (1.5 to 2.5), less than desired size (<1.5), and more than desired size (>2.5)*. (**Tables 2, 3**)

**Table 2: Seed Cutter Performance**



**Table 3: Seed Cutter Performance**



The Elmore County Educator has repeatedly evaluated more than 85 cup, pick, and air cup planters at the growers' fields. In-row and plant spacing uniformity was evaluated at different potato fields, using the following procedures:

- 1) *Seed pieces in a 25" row were uncovered, counted, and spacing between the seed pieces was measured.*
- 2) *Distance between the seed pieces was categorized as under spaced (0-7"), acceptable (8-12"), and over spaced (>12").*
- 3) *Number of spacing in the acceptable range was divided by the total and multiplied by 100 to calculate planter efficiency percentage.*

Planter speed was evaluated by measuring the distance from the middle of the back tire, and timing the distance. (*Example: Table 4*)

**Table 4: Planter Speed Calculation Formula**

<p><b>Actual planter speed</b></p> <p><b>Ft. traveled X 1 mile X 3600 sec.</b>  <b>Sec. traveled 5280 ft. 1 hr.</b></p> <p><b>= Ft. traveled X .682 = mph</b>  <b>Sec. traveled</b></p>	<p><b>Example 1:</b></p> <p><b>Traveled 100 ft. in 23 sec.</b>  <b>100 X .682 = 3 mph</b>  <b>23</b></p> <hr/> <p><b>Example 2:</b></p> <p><b>3mph desired speed</b></p> <p><b>34.1 = 11.4 sec. to travel 50 ft.</b>  <b>3</b></p>
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## **RESULTS AND DISCUSSION**

Our planter performance evaluations indicate that planter maximum speed is an important factor in achieving optimal planter performance. Small deviations (1-2") from the acceptable speed range (8-12") still produced good intended spacing and uniform potatoes. Planter skips and clumped seed pieces were responsible for 92 percent of missing plants. Overall, new planters performed better at higher speeds than older models. However, performance also depends on planter maintenance. Some older, well-maintained planters performed as well as the newer models. (*Tables 5, 6, 7, 8, 9, 10*)

Table 5: Performance per 25 ft. rows

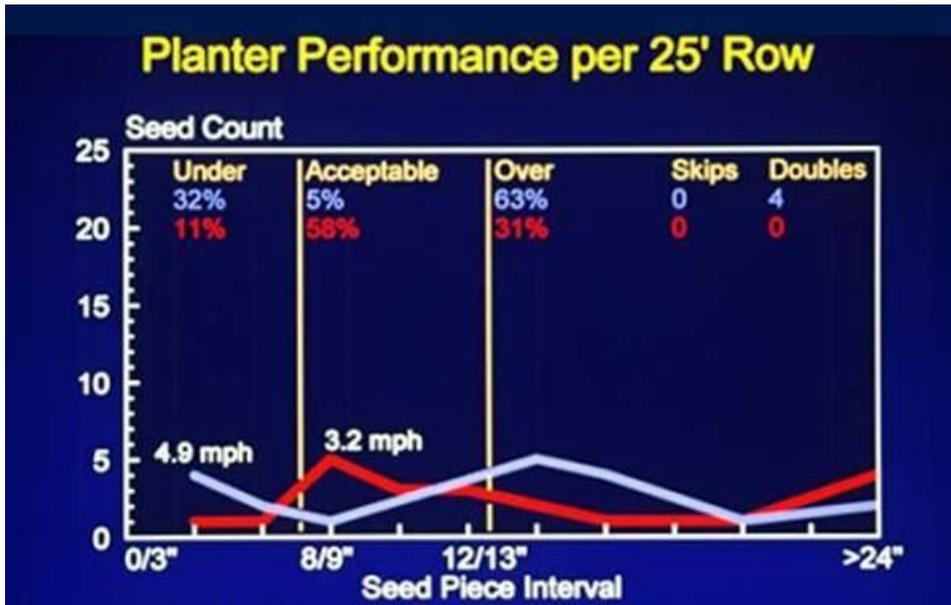
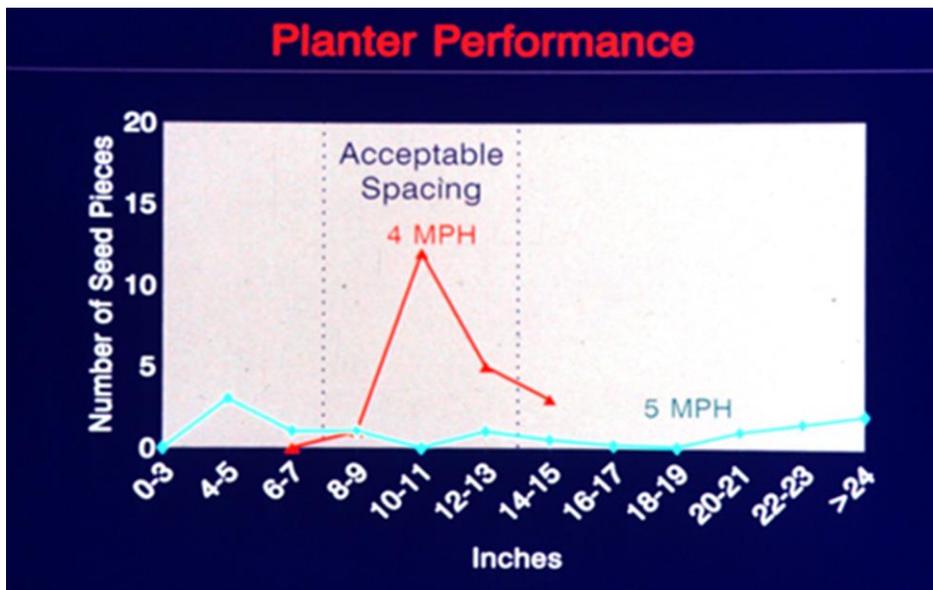
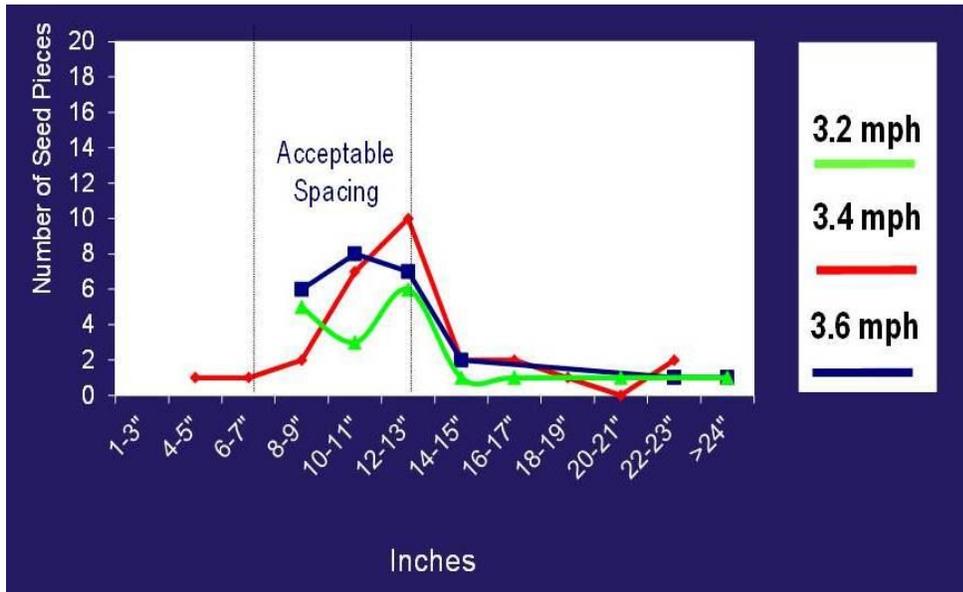


Table 6: Planter performance: Example of different planter speeds



**Table 7: Planter performance: Example of different planter speeds**



**Table 8: Planter performance at 4.3 mph & 4.6 mph**

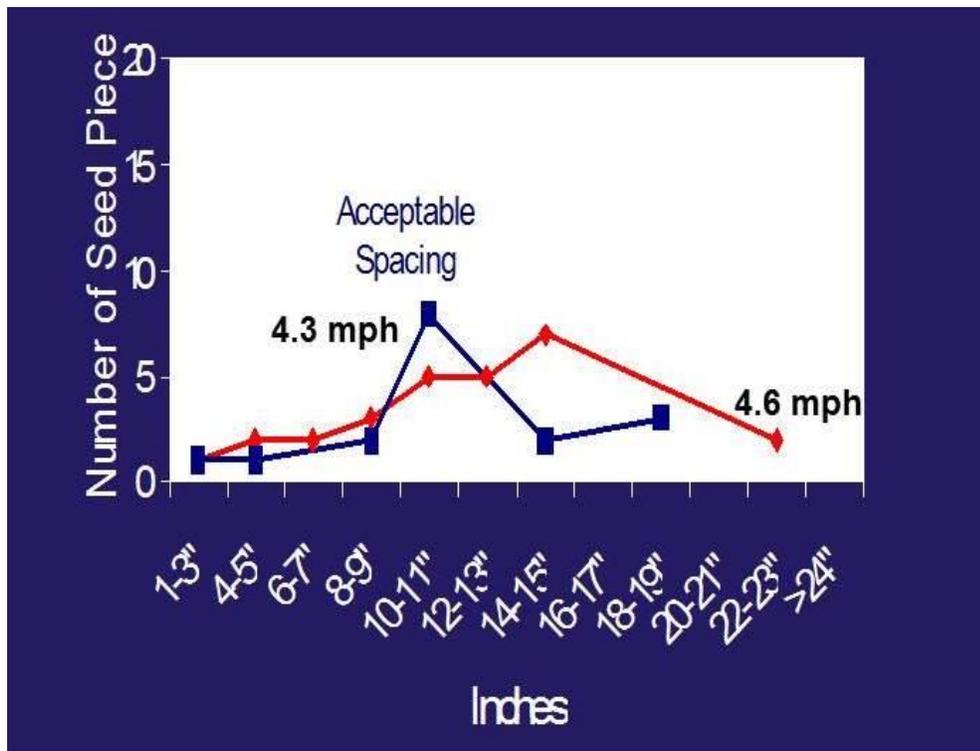


Table 9: Spudnik /Speed influence on different rows

Spacing Range	3.5 mph I-R1 M	I-R2 FL	3.9 mph	FR-1	FL
0-7"	18.5%	8%	8%	0%	0%
8-13"	51.8%	72%	73%	67%	85%
14" +	29.6%	20%	19%	33%	15%

Table 10: Kverland Results/Speed influence on difference rows

Spacing Range	FL-1	3.5 mph M
0-7"	0%	7%
8-13"	65%	85%
14" +	35%	7%

The economic loss of irregular spacing due to common planter errors indicated that growers are losing from \$8 to \$300 (0.3 to 11%) per acre of seed-cost-adjusted gross. Russet Burbank growers can lose an average of \$320 per acre due to planter performance skipping. Russet Norkotah growers are losing an average of \$240/acre. (Table 11)

**Table 11: Elmore County Planter Skip Survey**

<u>Russet Norkotah</u>		
Good uniform fields	-0.4% =	\$8.20/acre
Not-uniform fields	-12% =	\$240/acre
<u>Russet Burbank</u>		
Good uniform fields	-0.5% =	\$10.30/acre
Not-uniform fields	-13% =	\$320/acre

Based on growers' data from Elmore and Owyhee Counties, planter efficiency has increased since 1988 from as low as 32% to as high as 98% (**Tables 11-14**). The Extension Office and growers have recorded yield increases ranging from 15 cwt. to 140 cwt. per acre.

**Table 11: Planter Performance-Glenns Ferry**

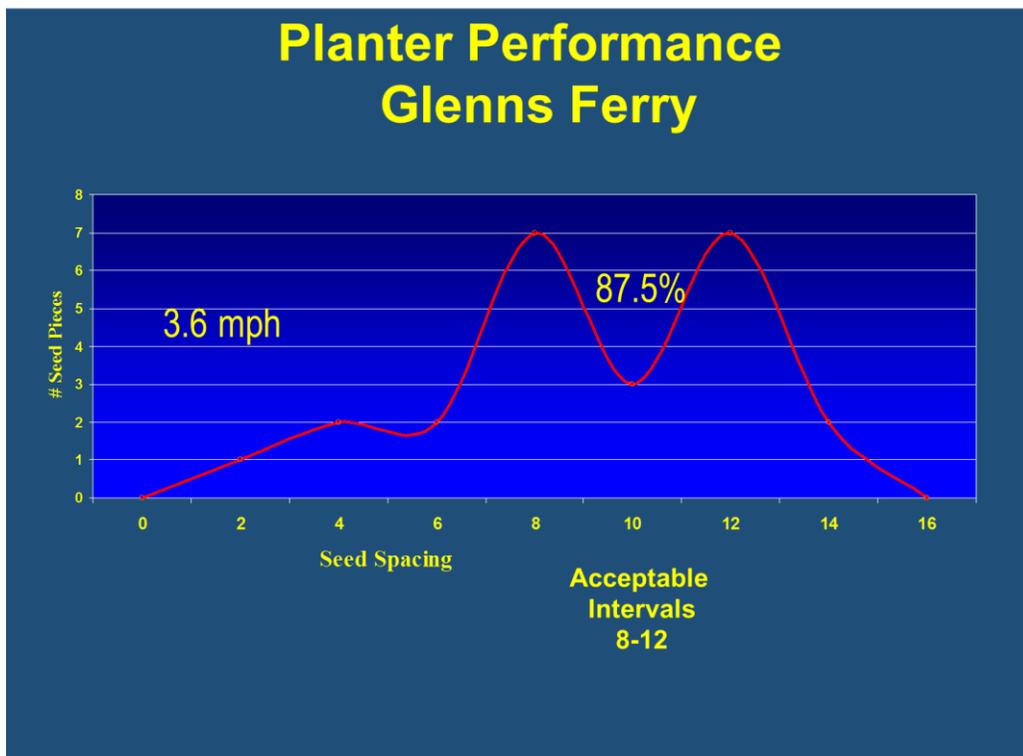


Table 12: Indian Cove

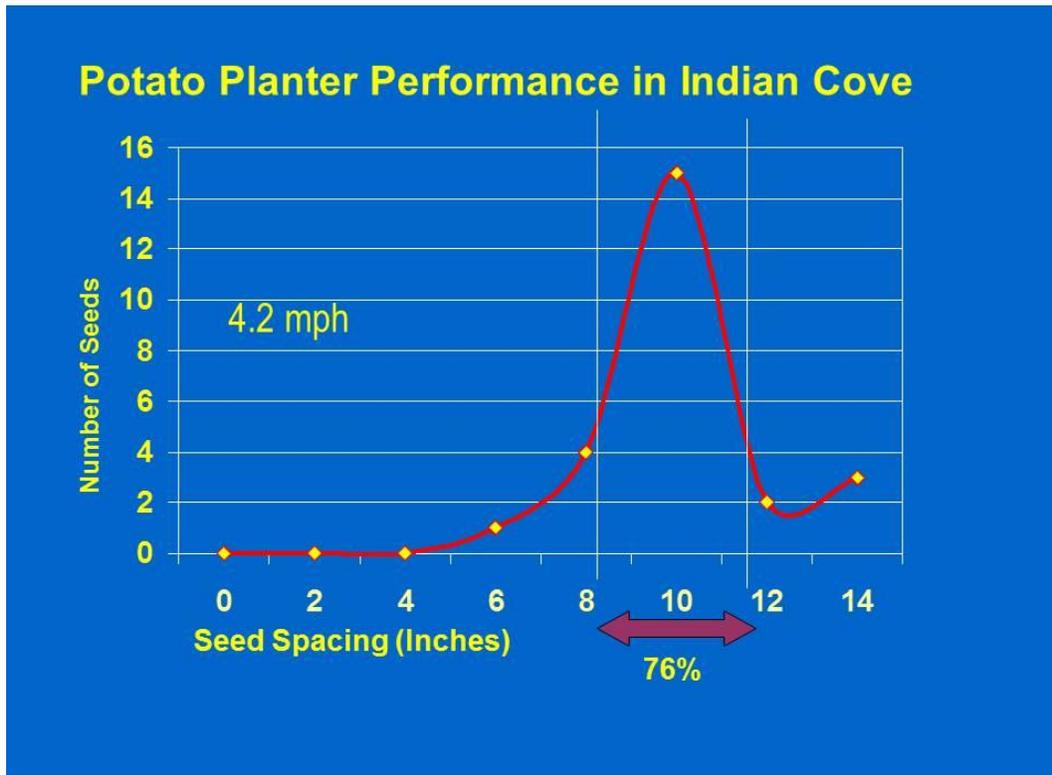
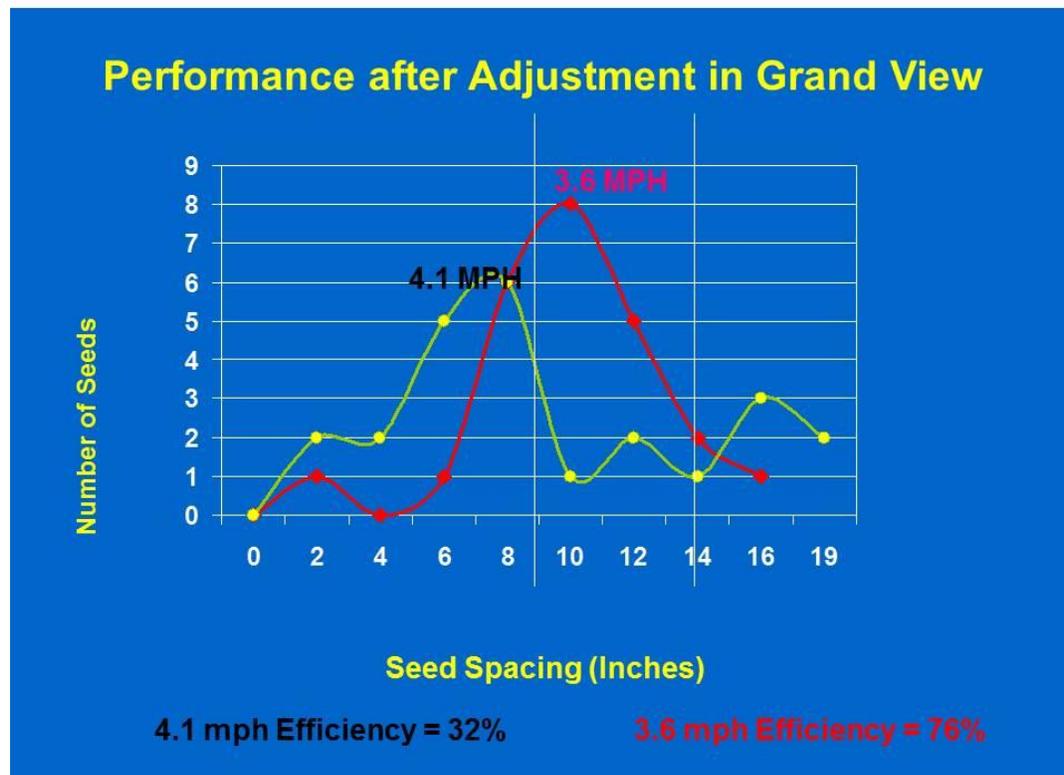
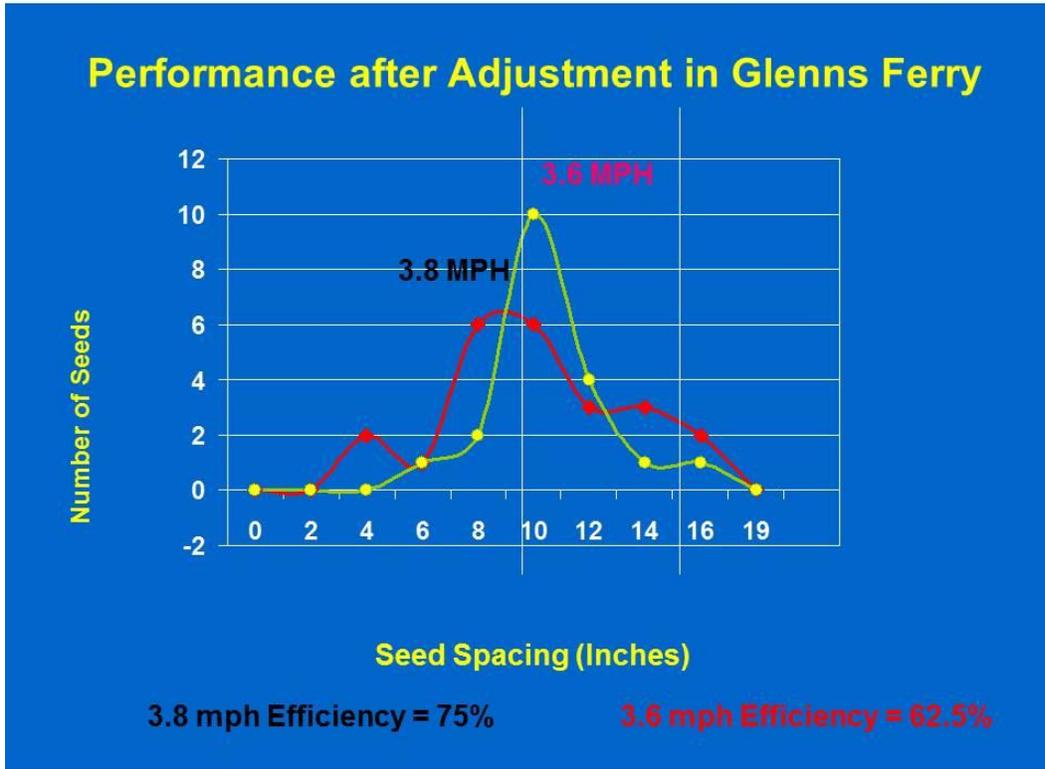


Table 13: Grandview



**Table 14: Glens Ferry**



Based on other researchers’ studies, we have also been able to use accurate recommendations to growers on seed spacing by potato varieties (**Table 15**).

Table 15: Recommended Seed piece spacing (inches)

BANNOCK RUSSET	8 TO 10	9 TO 11	6 TO 7
CHIPETA	NA	9 TO 10 (CHIPS)	6 TO 7
GEM RUSSET	11 TO 14	11 TO 14	7 TO 9
RUSSET NORKOTAH	11 TO 12	NA	7 TO 8
RANGER RUSSET	8 TO 10	8 TO 10	6 TO 7
RUSSET BURBANK	11 TO 13	11 TO 13	8 TO 10
SHEPODY	NA	8 TO 10	6 TO 7

### Summary:

In summary, the farmer's attentiveness plays an important factor in overcoming problems related to seed distribution and planter performance. Many mechanical planter-related problems can be eliminated in the off-season. Assessing seed storage conditions and seed-cutter evaluations will also contribute to better seed performance, quality, and yield. Also planter speed plays an essential result in planter performance. It should be evaluated more often during planting.

As a result of over 28 years of studies and field observation, coupled with increased farmer knowledge and cultural practices, growers have recorded yield increases ranging from *15 cwt to 140 cwt per acre*. The general consensus among growers is that higher planter efficiency and potato uniformity are determined by understanding the dynamics of the planter, growers' experience, and proper planter maintenance.

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