"MAXIMIZING POTATO SEED CUTTER AND PLANTER PERFORMANCE"

by
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Getting more profit from potato production by maximizing seed cutter and planter performance without increasing costs is still possible. Understanding how the cutter handles whole seed of various weights and the size distributions when cut may influence grower preferences in seed buying. Selecting and achieving the correct cut seed size profile is a prerequisite to precision planting. How planters are operated and adjusted is also critically important to properly spaced plantings. A refined technique for evaluating and adjusting the cut size profile and performance of the planter has greatly reduced the incidence of skips and doubles and improved the seed spacing uniformity with all types of planters. This has resulted in significantly improved stands, better quality, and higher yields without added expense.

INTRODUCTION

Columbia Basin potato growers are now making better management decisions than ever before. Part of these improved decisions result from more attention to detail. Closer attention to details has become increasingly important. These, seemingly, insignificant aspects often produce substanial improvements. The criteria you base your seed selection on, your specifications for cut seed, and the kind of job your planter does could possibly benefit if more attention was given to the right details. Some of the things we have been doing at PureGro Co. with Columbia Basin Growers in recent years have improved their potato programs substantially.

Let me start by making a bold statement:

"Nothing in potato production is more important or deserves more attention to details than a good job of planting and no amount of corrective action will compensate for a poorly planted stand."

METHODS AND PROCEDURES

Let's look at what it takes to get the job done right. In addition to the qualities you look for including disease free, good condition, genetics, and physiologically young seed, the size of the whole seed potato must be suitable to give an acceptable cut seed size profile (Fig. 1). Seed can and often is cut better than this but this is required as a minimum for a planter to do the job it is mechanically capable of.

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I want to illustrate how a modern mechanized cutter handles potatoes of different sizes. In this graphic series, we are using a cutter set up to cut a 2 ounce average seed size profile.

The important things to note are listed in Table 1 below.

Table 1. The characteristics of cut seed from different size whole potatoes.

Fig 2	(4 oz Potatoes)	76% OK	18% discard and 6% recut
Fig 3	(6 oz Potatoes)	81.5% OK	13.5% discard and 6% recut
Fig 4	(8 oz Potatoes)*	82.1% OK	6% discard and 11.3% recut
Fig 5	(10 oz Potatoes)	75.4% OK	8% discard and 16.6% recut
Fig 6	(12 oz Potatoes)	58.9% OK	11.5% discard and 29.6% recut

* Best size profile

With the cut seed size profile required by all the different planter mechanisms tested (Fig. 7), we find it is normally not possible to achieve our planter goals with seed lots with a 12 oz. top size and often not with a 10 oz. top size. The whole or mother tuber size distribution of your seed lot has a major impact on your planters performance. This suggests you may want to rethink your seed purchase specifications. Smaller seed mother tubers also have other advantages like fewer blind pieces, fewer cut surfaces, more eyes per seed piece, and it feeds better in planters. If I were to recommend seed size specifications, I would limit it to an 8 or 9 oz. top size.

Lets consider what we want from our planter. Our goal is to get 75% of the seed in the row spaced in what I will call the "Acceptable Interval" (8 to 13 inches apart). This provides a latitude of 2-3 inches on either side of the precise spacing desired, in this case it is 10 inches. We make this allowance on the side of practicality and yet realistic in terms of the planters capability. When seed is dropped by the planter and rolls over, as it often does either ahead or back, just a half revolution, we have a 2 inch deviation from our targeted seed spacing interval. Within this framework, we will also accept up to 15% of the seed located closer to its neighbors than 7 inches. On the other side of the "Acceptable Interval" we allow up to 10% of our seed to be spaced more than 14 inches apart (Fig. 8).

We can, and generally do, end up with results better than this. Our best planter performance in 1987 is shown in Fig. 9. This kind of performance is just short of hand planting precision. Although we were not able to achieve this level of precision in every case, I suspect it is probably possible with every type and brand we tested in the Columbia Basin.

The second requirement for optional planting performance concerns the planter itself. All the components involved in handling seed must be in like-new condition. Damaged mechanisms can and do limit performance.

Sometimes the choice of components in the mechanism can also be very important to seed rate and placement. To illustrate this point, I'd like to compare pick length, pick arrangement and cup styles by using actual examples observed this past season. Comparing pick length, short vs. long, (Fig. 10 and 11) we found a 38% difference favoring the long pick length (Fig. 12). This is not to be interpreted that long picks length are always better. They are not. It says only that with this growers seed lot, as it was cut, long was better.

Pick arrangement, parallel vs. offset, can also be important (Fig. 13). In this case, 17% more seed was properly spaced between 8 to 13 inches when the picks were parallel or equidistant from the pick wheel shaft. Again parallel picks are not always the best arrangment. To know what is best for you, compare the options with your seed and let the results guide your decision.

Cup design or style can also be very important to planter results. In this comparison, 2 rows of a 4 row machine had new cups (1987 model) installed while the other 2 rows had the older style (pre 1987 model). In this instance only the cups' inside slope angle and depth were different. The old style cup (Fig. 14) rows were planting the desired 24 cwt. of seed per acre and doing quite well while the new style cups (Fig. 15) were planting over 40 cwt. per acre with a very high rate of doubles (approx. 80%) in the cups. In this example there was a 31% difference in the amount of seed correctly spaced between 8 to 13 inches in the row (Fig. 16). The old cup design was preferred here but with another cut seed size profile results might have been different. Again, the only way to know what is best is to check your performance in the field.

I have been asked many times which type of planter is best, the pick or cup? The answer is neither is better, both can do an equally good job but it takes different kinds of adjustments to get the best results from each. Typical examples of cup (Fig. 17) and pick (Fig. 18) are shown. In each case, with all other variables identical and only speed being changed, planter performance changes are great. Speed becomes important only after all other variables are adjusted optionally.

Another example that is unique is shown in Fig. 19. This is a pick design introduced to the Columbia Basin in 1987 for the first time. It too is equally sensitive to speed changes. In our evaluations, it was not capable of doing any better than any other machine design or make, but it was able to do as well at substantially faster ground speed. Our tests indicate this design functions at its best at a 25 to 30% faster ground speed than any other design. If planting more acres in a day is important enough to you to purchase a new machine, consider this one. Don't sell your older planter short, however. I have yet to find one, even 30 years old, that wouldn't do as well if set up correctly.

Fig. 20 illustrates the impact of changing seed lots and/or variety. In either case, the seed size profiles is likely to be somewhat different. Whenever a change in any one of the variables I have mentioned occurs, it is likely the others will have to be changed to achieve maximum planter performance.

In this instance, the correct planter speed for the Lemhi seed lot was not the same as for the Russet Burbank lot. In each case a 30% improvement occurred with only a 1/10 MPH speed change. It appears thus far that All planters are very sensitive to ground speed.

Fig. 21 is a composite of fifteen different grower planters that illustrate the similarities and differences found in the way the machines were being operated and how they were performing BEFORE we made any adjustment. Note that less than half of the seed (46% average) was found in our 8 to 13 inch "acceptable interval". Incidentally, all these growers were 30 plus tons per acre potato producers in 1986 so they were apparently already doing a better than average job.

The composite graph (Fig. 22) shows the best performance we were able to achieve for each of the same 15 growers. These results were achieved in just a few hours of effort in each case. Our average of 76% "acceptable spaced" seed, after adjustments were complete, is a 30% improvement over the before adjustment results. This was done also without disrupting the planting operation unless the grower chose to stop for changes in setup or to observe the results of each assessment.

The BEFORE and AFTER combined composite (Fig.23) includes additionally all the intermediate results of this somewhat trial and error field process. Note also the connecting lines between the results at the various speeds. Observe that the lines are close to horizontal at speeds above 3.2 MPH and also at speeds below 2.5 MPH. The conclusion one might draw is that speed is not especially important below 2.5 or above 3.2 MPH, however, for all but the new pick model, speed can be very important. We found that ALL planters, and I believe we looked at every major manufacture, tested in 1986 to 1987 were extremely sensitive to changes of only 1/10 MPH when in the speed range near their optimum. The nearly vertical lines seen between 2.5 to 3.2 MPH ground speed illustrates their sensitivity and how different performance can be with such small changes in ground speed.

Apparently the best speed for planters is generally somewhere in the 2.5 to 3.2 MPH range but you need to know more precisely what is correct for your planter. You will also need to be able to maintain speed control to 1/10 of a mile an hour or performance will fluctuate.

Another problem we found is the ability of the tractor operator to maintain a specific speed once it has been identified. The only way we found growers could accurately control their speed as precisely as is necessary was with a tractor mounted ground speed radar device. The benefits of optional planter performance will pay for the ground speed radar many times over in one fifty acre field in just one season. These units are also very valuable in the hilling operation to control soil movement onto the row and again at harvest when digger chains are timed in relation to ground speed. In this case, if the chain speed ratios are not matched to ground speed the harvester is out of time and bruise may be increased.

RESULTS

The proof of any benefits from planter timing should show up in the stand that emerges. We did stand counts on all fifteen fields included in the preceding figures. This data is illustrated in Fig. 24. The columns on the left side of the graph with between 82 and 89% stands are from the parts of the fields that were planted immediately prior to the beginning of our evaluations and adjustments.

The "BEFORE" planter adjustments average is an 86.6% stand which I have found is better than the average for growers throughout the Columbia Basin. The stand counts after our adjustments were complete ranged from 90-96% and averaged 93.6%. This is an average 7% improvement in stand without increasing the growers seed or planting costs significantly. In many cases, seed rates were actually reduced by planting fewer multiple drops, i.e., doubles and triples. The savings in seed planted usually exceeded the added costs of planting at a slower ground speed and taking longer to complete the job.

The bottom line by necessity is the harvested crop and the return on investment to the grower. I do not have all the results at this time as some of the acreage is still in storage. I do, however, have most of the results and they indicate a 5-10% yield increase, a 20% grade improvement, and a narrower size distribution i.e., fewer undersize and large potatoes.

On this basis it appears our efforts have been successful and the growers are very encouraged by their results. The services described in this presentation are currently being offered to PureGro customers at no charge as part of a larger season long "Full Service Package".

Figure 1. The minimum required seed piece size profile for planter performance to approach design limits.

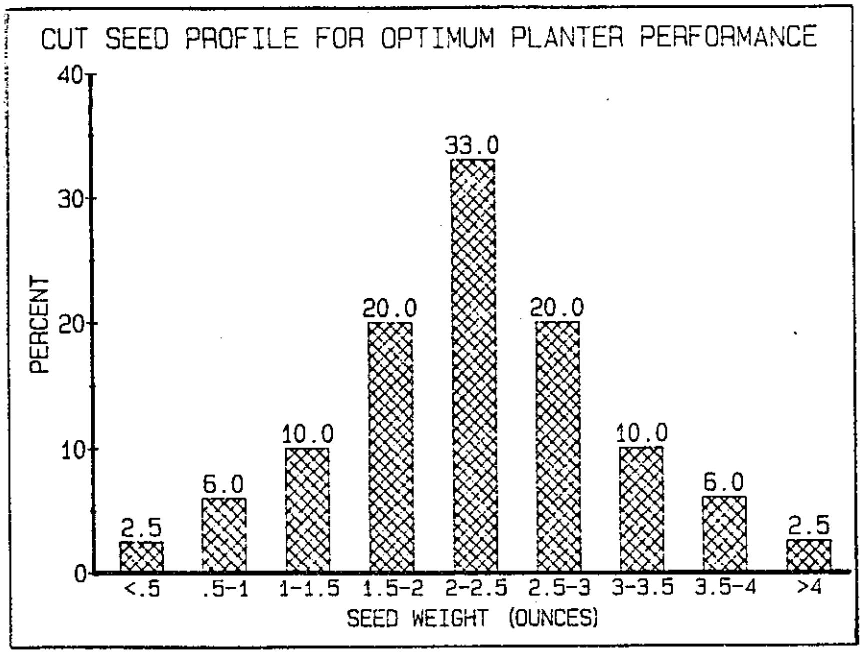

Figure 2. 4 ounce cut seed piece size distributions from 30 pounds of whole seed potatoes for each of five specific weight categories.

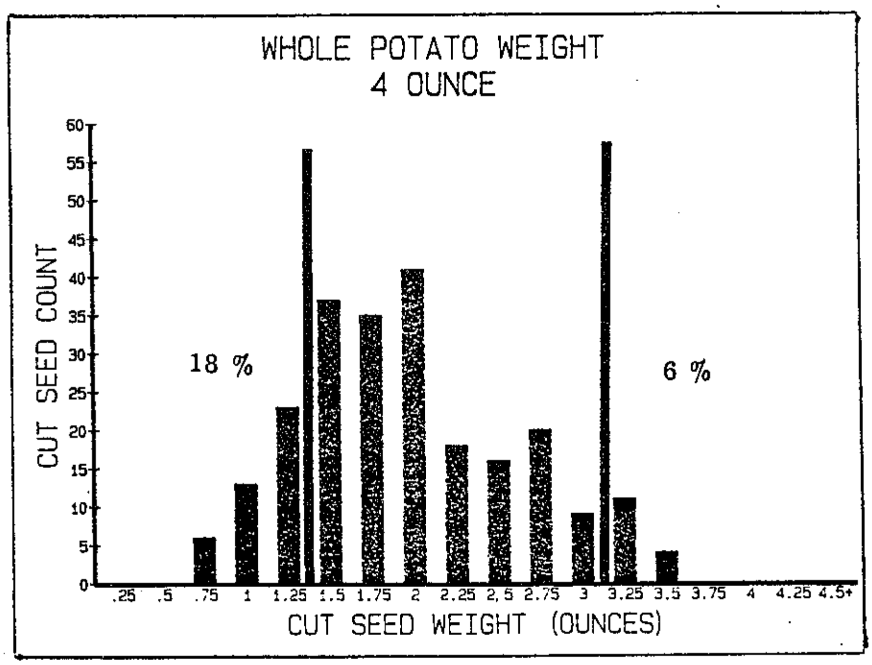

Figure 3. 6 ounce cut seed piece size distributions from 30 pounds of whole seed potatoes for each of five specific weight categories.

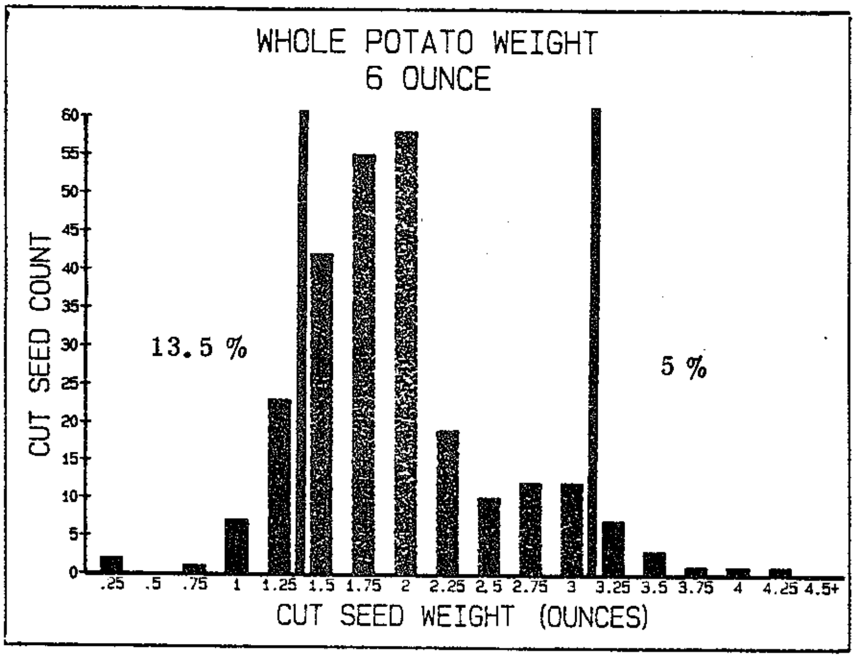

Figure 4. 8 ounce cut seed piece size distributions from 30 pounds of whole seed potatoes for each of five specific weight categories.

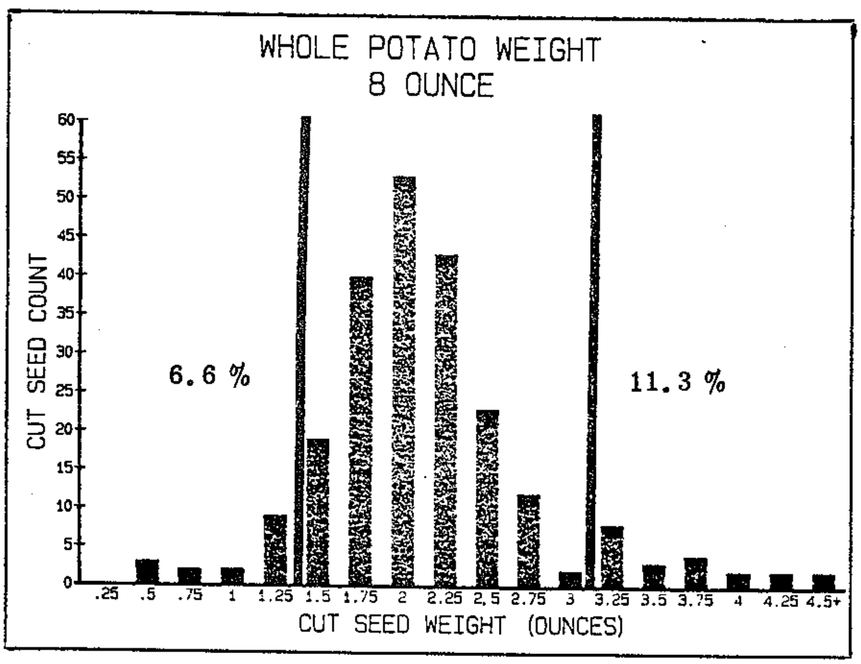

Figure 5. 10 ounce cut seed piece size distributions from 30 pounds of whole seed potatoes for each of five specific weight categories.

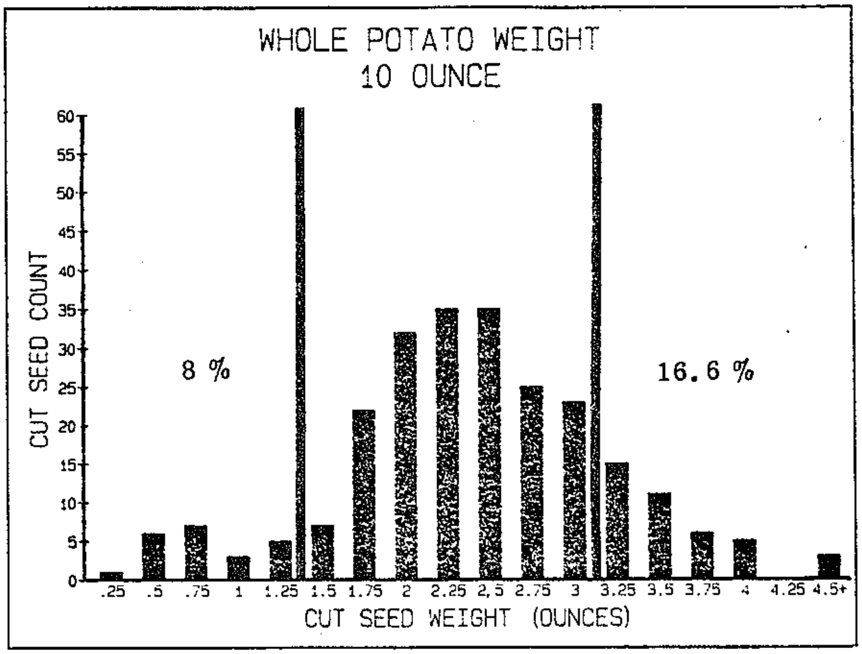

Figure 6. 12 ounce cut seed piece size distributions from 30 pounds of whole seed potatoes for each of five specific weight categories. Note: The cut size profile from 12 ounce potatoes is unacceptable.

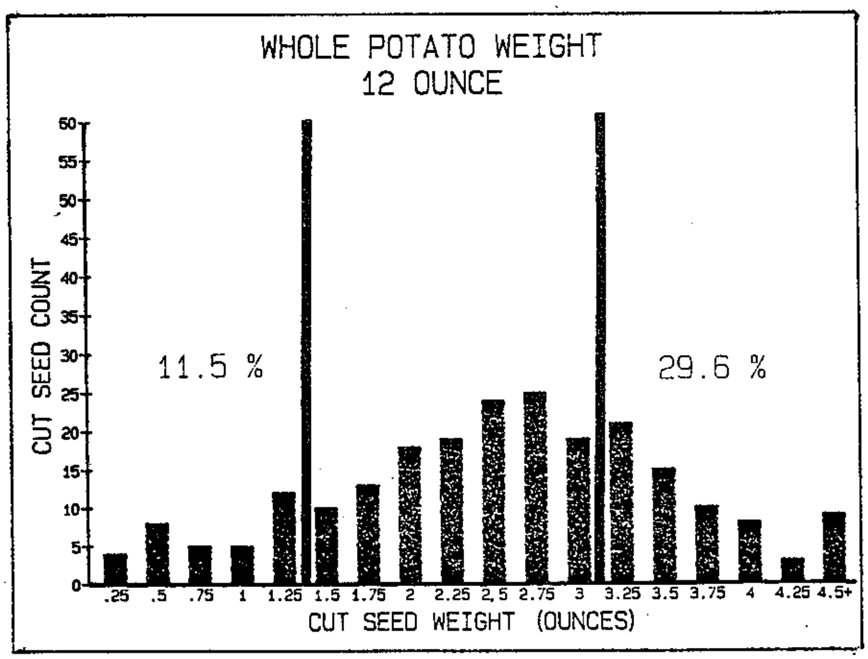

Figure 7. The preferred cut seed size range is 1.5 to 3.0 oz. for optimal planter performance. The column values below 1.5 and above 3.0 indicate the maximums which, when exceeded, cause a negative impact on planting to occur.

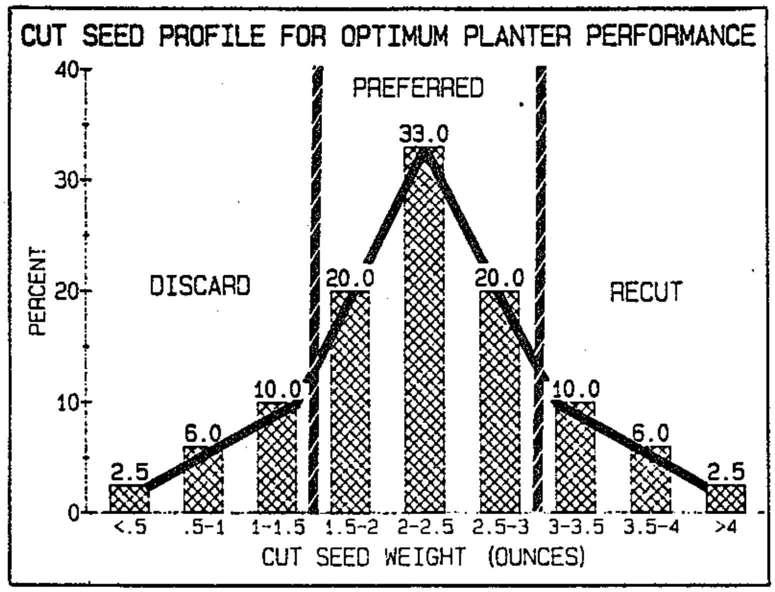

Figure 8. All types of planters tested were found to be capable of placing 75% of the seed within the 7 to 13 inch "acceptable interval" when properly adjusted. This became our performance goal.

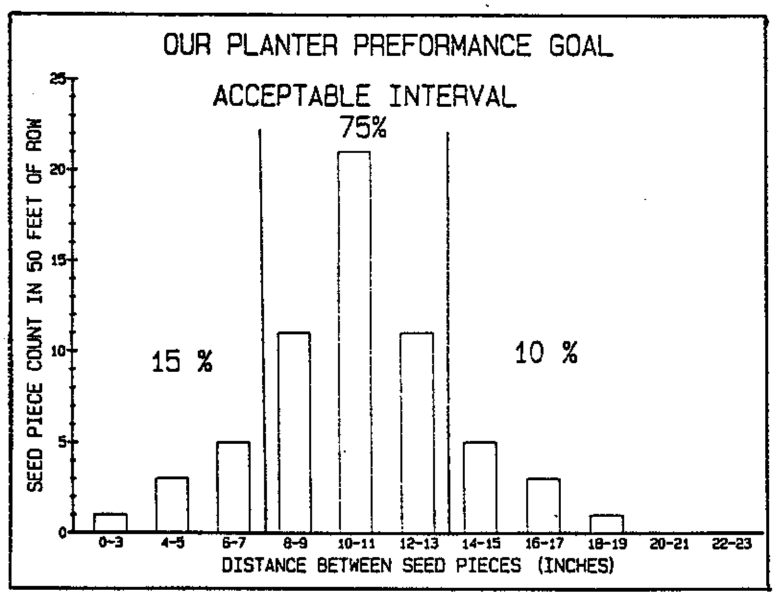

Figure 9. The best planting results were obtained with a planter no longer manufactured.

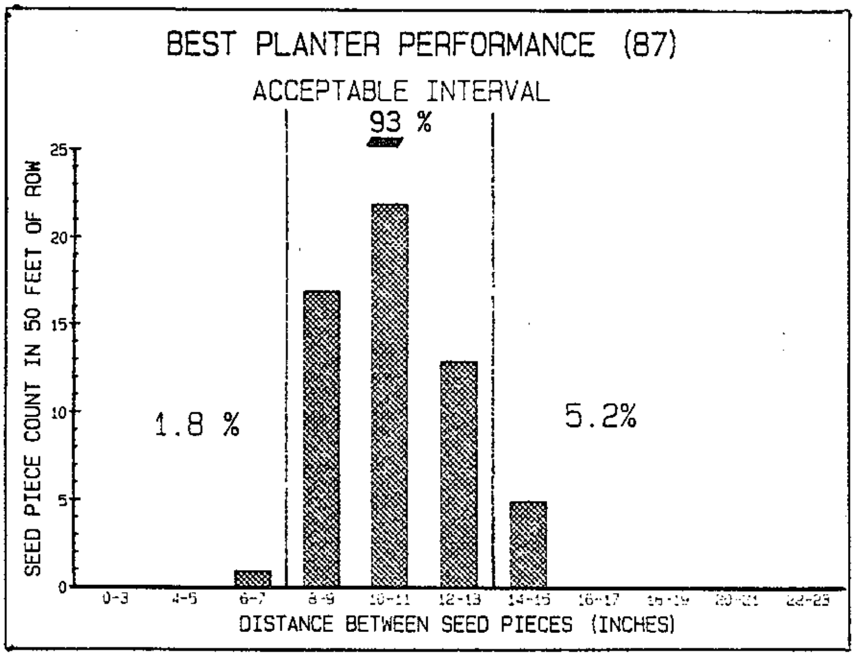

Figure 10. Incorrect pick length may be responsible for reduced seed placement precision.

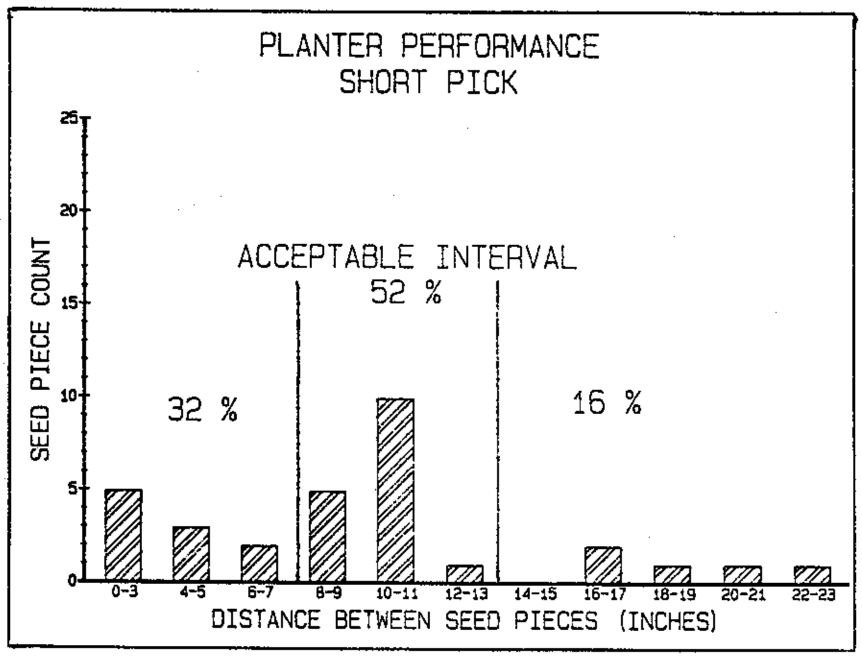

Figure 11. Longer picks improved planter performance with this specific seed lot, as it was cut.

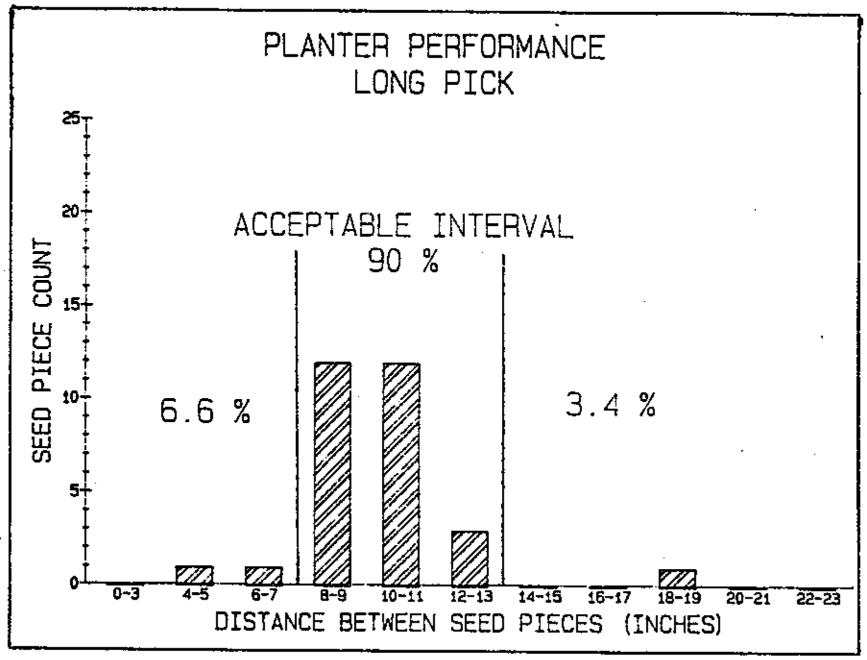

Figure 12. Differences in seed spacing precision resulting from changing only pick length can be very significant.

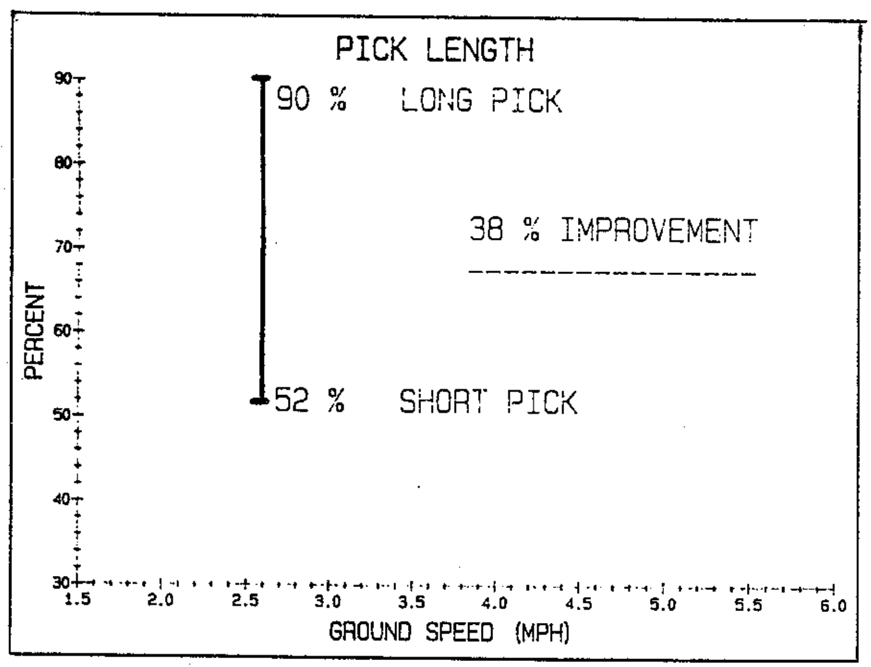

Figure 13. Pick arrangement can be equally important to seed interval precision.

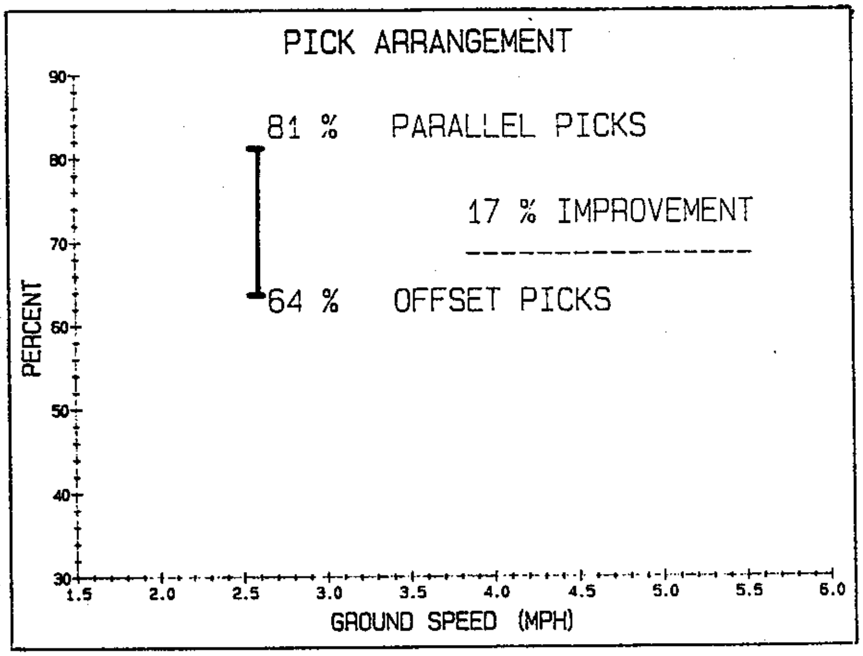

Figure 14. Cup interior slope and depth must be correct for the characteristics of the seed lot to achieve maximum performance.

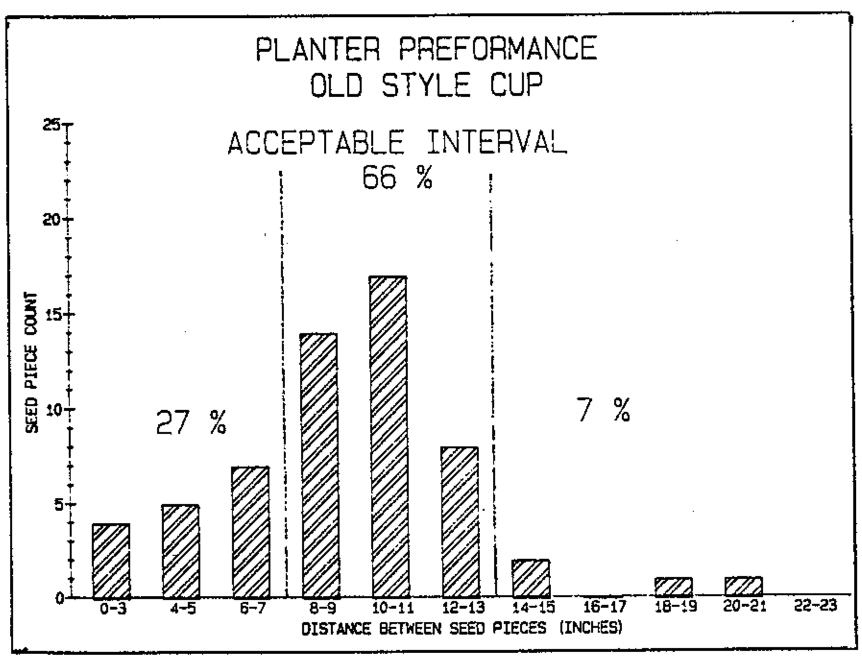

Figure 15. Incorrect cup design for the cut seed size and shape characteristics, will perform poorly.

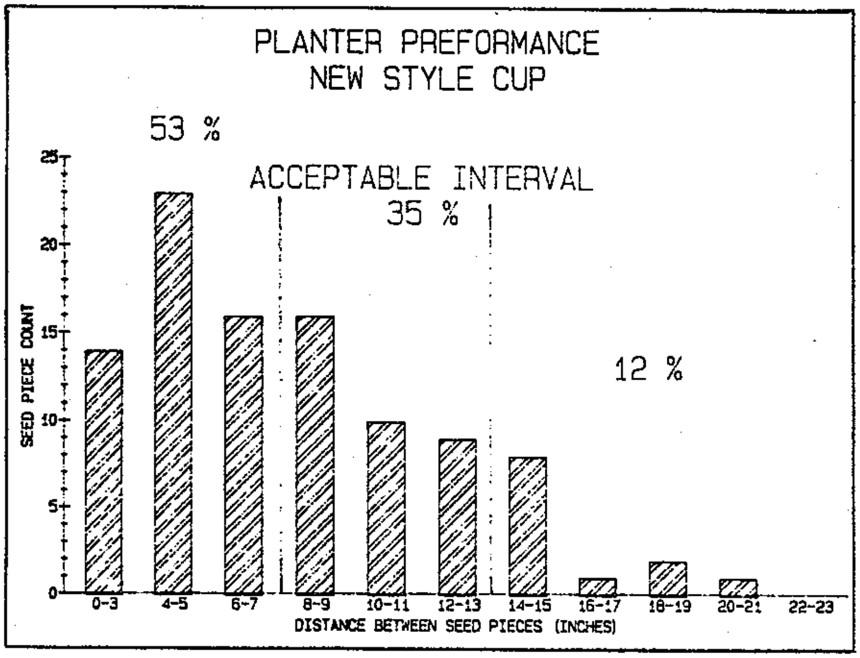

Figure 16. The difference in seed placement precision resulting from changing cup design can be very significant.

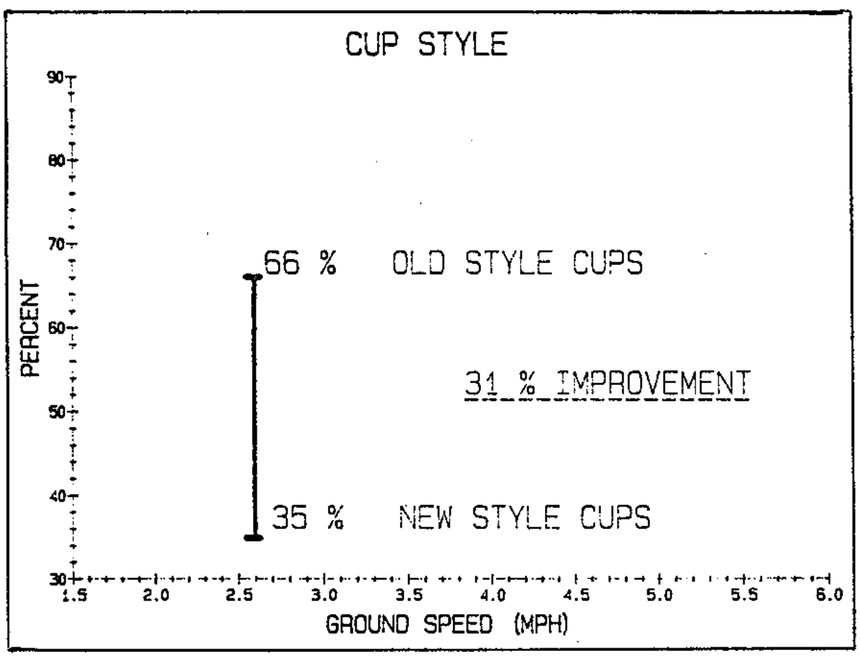

Figure 17. Typical response to changes in speed for cup planters.

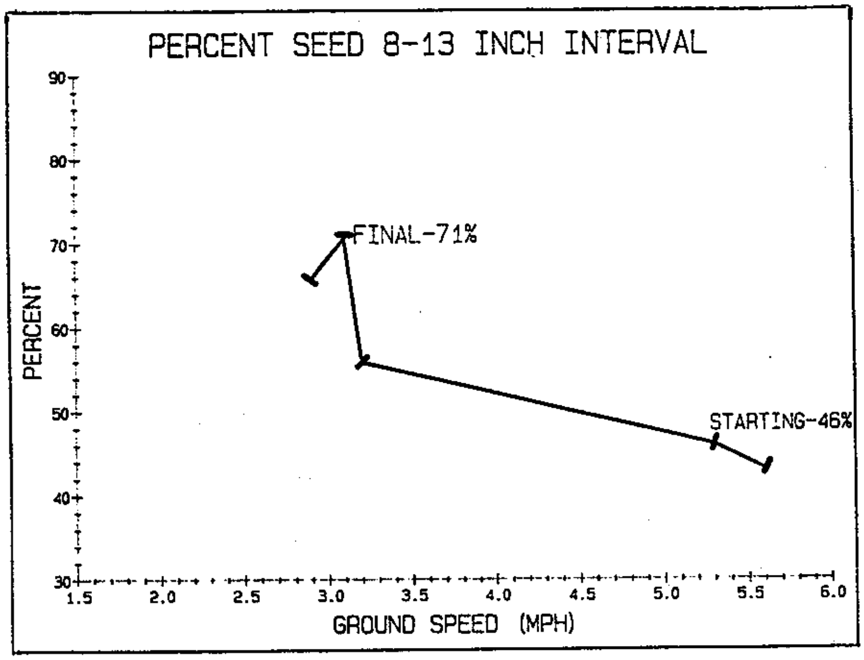

Figure 18. A typical pick planters response to changes in speed. Note: Both pick and cup type planters respond similarly to ground speed changes.

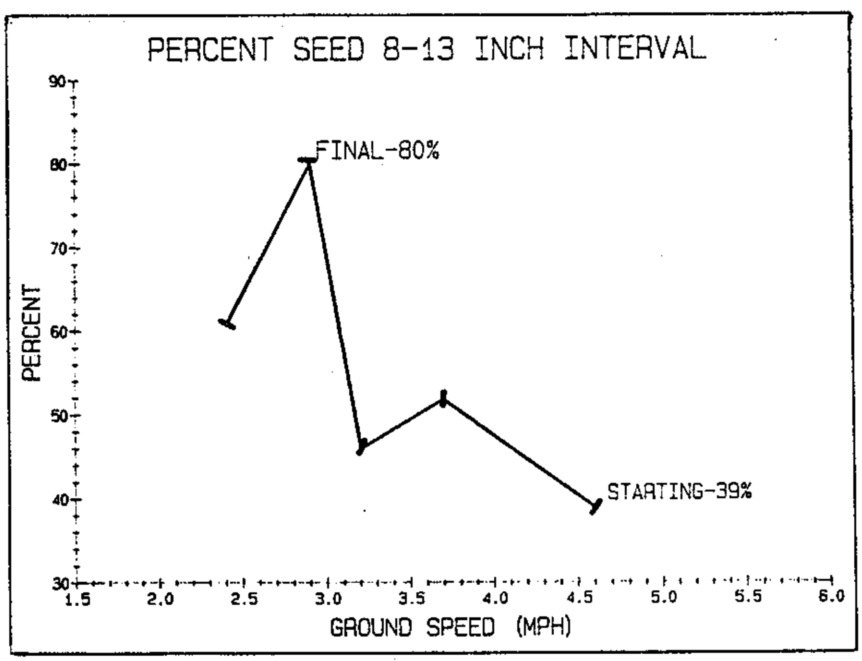

Figure 19. A newly designed pick mechanism operates best at faster ground speed than all other makes and models tested.

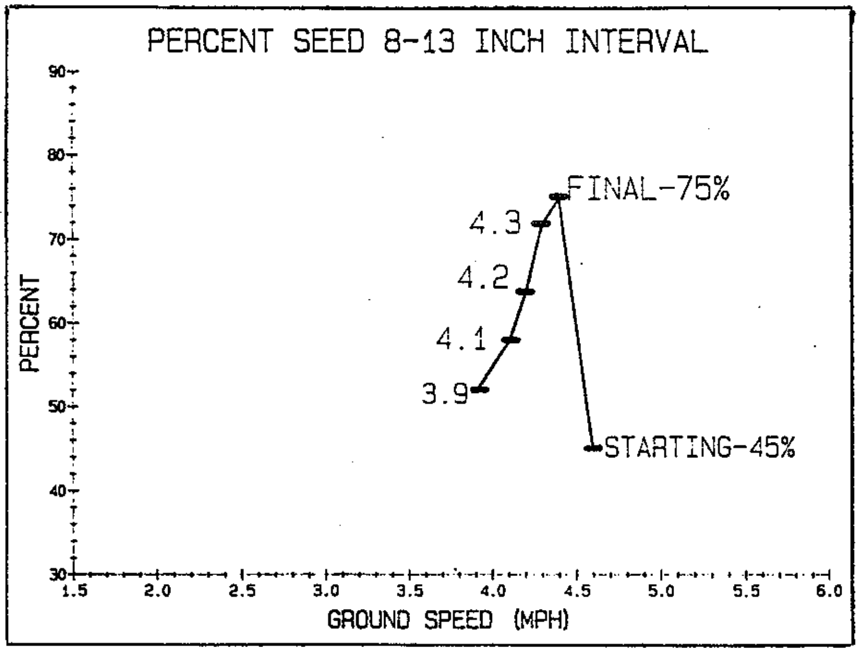

Figure 20. Changes in seed lot and/or variety may require additional fine tuning in one or more of the adjustable variables to achieve optimal planter performance.

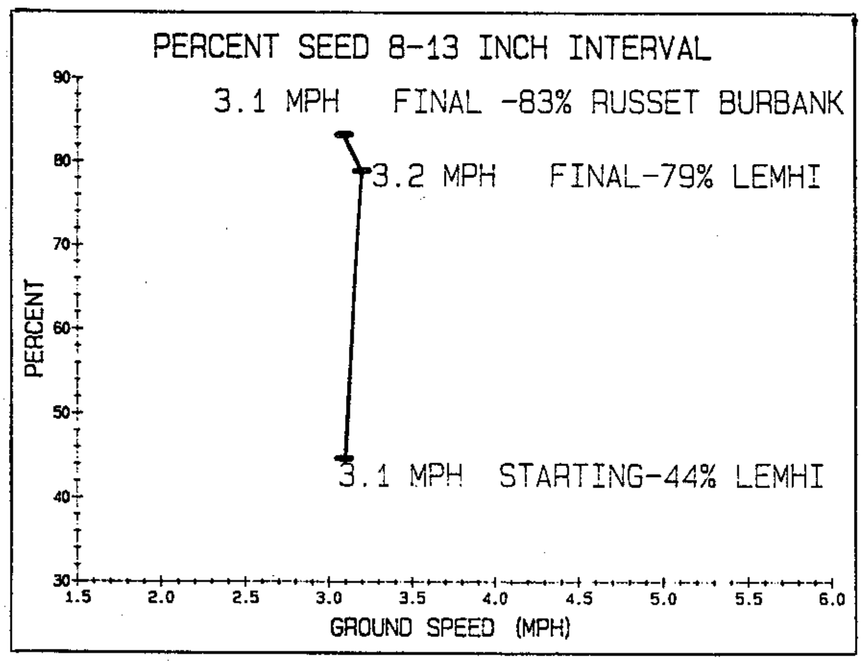

Figure 21. Performance of fifteen different planters (6 different makes) before any adjustments were made illustrates the need for fine tuning adjustments.

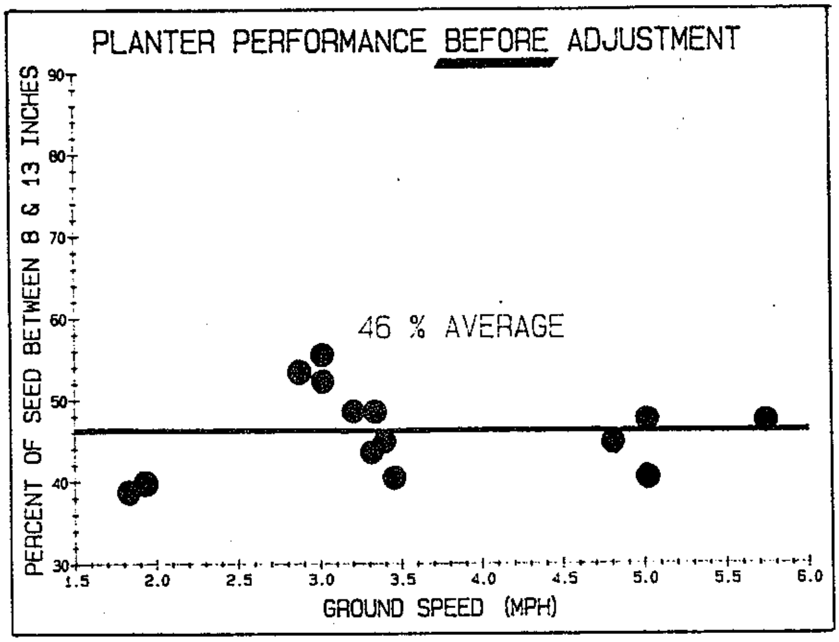

Figure 22. Performance of the same fifteen planters included in Figure 21, after fine tuning was completed, shows the benefits of more seed being spaced correctly in the row.

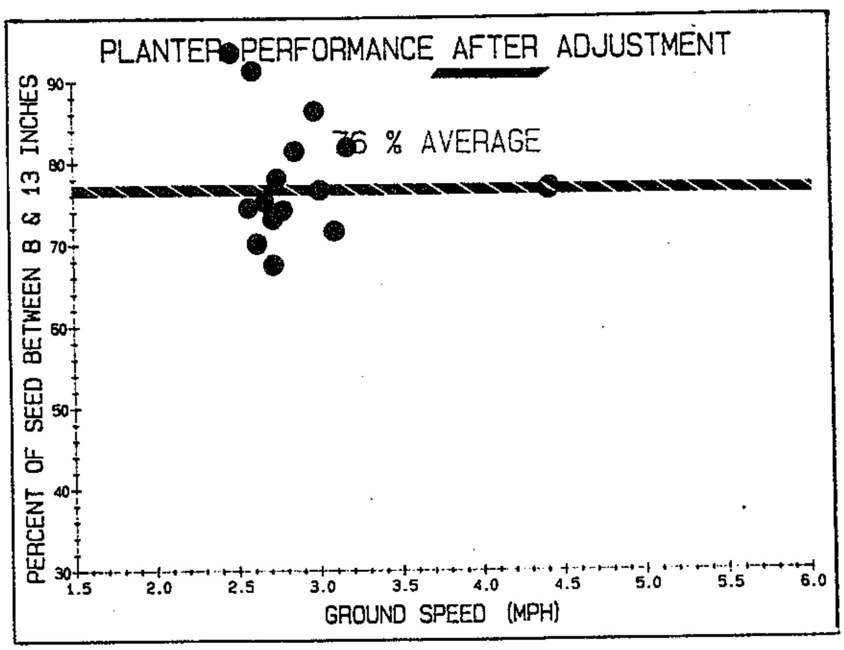

Figure 23. Planter performance sensitivity to speed is very critical approaching the optimal rate of travel. Speed appears to be rather unimportant to performance outside the narrow range where optimums occur.

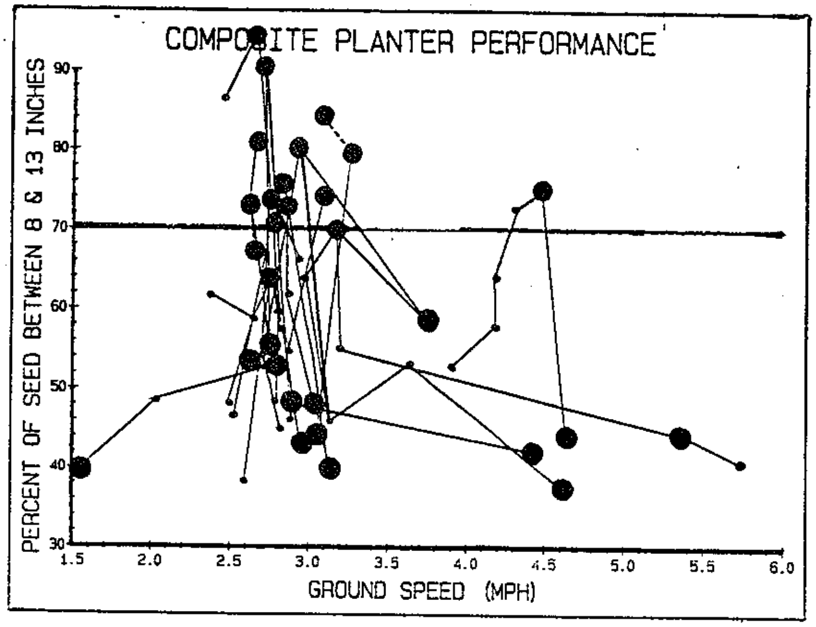

Figure 24. Stand counts show marked improvements as a result of the fine tuning adjustments to the planter.