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A Cost Comparison of Alternative Planting Methods: Twin-Row vs. Single 30" Row Corn and 7 1/2 or 15" Row Soybeans

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A COST COMPARISON OF ALTERNATIVE PLANTING METHODS: TWIN-ROW VS. SINGLE 30" ROW CORN AND 7½ OR 15" ROW SOYBEANS

by

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AN ABSTRACT OF THE RESEARCH PAPER OF

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New technology continues to be developed to help farmers use their resources more efficiently. This research focuses on a method of planting crops in a twin-row configuration versus conventional planting. Farmers need to analyze many factors when considering switching from planting corn in thirty-inch rows and soybeans in seven and one-half or fifteen-inch rows, to planting in twin-rows.

The objectives of this research are: (1) Analyze the cost of alternative implements and how the differences in investment affect planting cost per acre. (2) Determine added cost per acre at planting higher corn populations in twin-rows compared to conventional thirty-inch rows. (3) Determine how much of a yield increase is needed to make higher corn populations with twin-row planting profitable. (4) Compare breakeven corn yield increase from objective three with results of recent field trials.

A higher initial investment results in a higher cost per acre for each implement due to the fact that the cost is based on the list price. There is an added seed and fertilizer cost of twenty-two dollars for planting at higher plant populations in twin-rows. An increase of 5.45 bushels per acre is needed for twin-rows to be profitable on a corn-soybean operation and a 6.68 bushel per acre increase for twin-rows to be profitable for a continuous corn operation. It was also concluded that in recent trials the required breakeven bushel per acre increase is obtainable to make twin-rows profitable for farmers.

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INTRODUCTION

Precision technology is rapidly changing the agriculture industry in many aspects. This new technology has its advantages and disadvantages, like any new product, but some precision systems have already proven to be cost effective. Precision planting using twin-rows is becoming more popular in the farming industry. Farmers are facing increasing prices of agriculture inputs and it is becoming harder for all farmers, especially small scale farmers to continue operation. The amount of fertilizer and chemicals being used to prevent weeds and diseases can negatively effect the environment. Using twin-row planting, the same amount of most of these products could be applied and get greater yields than with wider row spacing according to Ryan Hasty, Seed Agronomist for Effingham-Clay FS. Twin-rows also allow farmers to increase their planting populations to utilize more of the land area to produce higher yields.

Some farmers have adopted the new technology of planting their crops in twin staggered row spacing of seven or eight inches on thirty inch centers instead of the standard thirty or thirty-eight-inch single row spacing. However, most farmers still are not sure if it is profitable for them to switch to twin-row planting. This study of twin-row planting would greatly help these farmers in their decision making processes. If this information is available to them, they will have more knowledge of the new system and know how it can benefit their farm.

Ryan Hasty, seed agronomist for Effingham-Clay FS, stated that most farmers in Central Illinois consider buying either a twin-row or a split-row planter when upgrading to new equipment. In the past most farmers used a single thirty-inch row planter to plant corn and a drill for soybeans, but in recent years some have went to using one planter to

plant both crops. Some use their single thirty-inch row planter to also plant soybeans in thirty-inch rows; however, in many cases it has been found that soybeans can be more profitable on narrower rows. So, a benefit of the twin-row and the split-row is that you can plant both crops with these planters to reduce maintenance of two implements and still be producing high yields at harvest. The objectives of this research are: (1) Analyze the cost of alternative implements and how the differences in investment affect planting cost per acre. (2) Determine added cost per acre at planting higher corn populations in twin-rows compared to conventional thirty-inch rows. (3) Determine how much of a yield increase is needed to make higher corn populations with twin-row planting profitable. (4) Compare breakeven corn yield increase from objective three with results of recent field trials.

LITERATURE REVIEW

An article from farmanddairy.com describes what twin-row cropping is and sums up questions that farmers are asking about this new technology:

> "This zigzag seed pattern allows plants and their roots to grow over a larger area, allowing plants to catch and process more sunlight and gain better access to nutrients, with fewer diseases, all resulting in healthier, more uniform crops and improved yields. Many farmers want to know how twin-row cropping will benefit their operation, what equipment is needed, if additional harvesting equipment is necessary, how crops will fare, and if the returns are worth the investment." (Foster)

This explanation helps to define the topic of this research, and it will potentially be able to provide answers to these types of questions for farmers. It is important that farmers know the basics about precision planting so they know what questions to ask.

When thinking about this topic some farmers wonder if twin- row planting is a completely new concept, and if it is not, why have they never heard of it before. An article published on cornandsoybeandigest.com discusses some background of twin-row planting and what is to come from the new technology:

> "The idea of planting crops in double rows certainly isn't new. It's a concept that some folks have been tinkering with for nearly thirty years. The difference today is that technology and plant genetics have caught up with twin-rows' potential to increase yield. Modern equipment can stagger the seed spacing row-to-row to maximize the yield potential. And

some new hybrids yield better in twin-rows than they do in single rows on thirty-inch centers." (Russnogle)

This statement suggests that with this new technology farmers can really use these methods to increase their yields and produce more on their current acres.

Farmers can be told about new technology over and over again, but until they actually see the benefits they are not convinced that it does indeed work. After the information is collected for this current research, farmers in Illinois will have a cost analysis as well as a summary of field trial results to see how twin-rows compare to conventional methods. The President and Vice President of First Ag Inc., Minden, NE wrote an article published in the Fluid Journal, which states what is expected of twin-rows in the future. "We believe corn yields in excess of 300 bu/A and soybean yields in excess of eighty-five bu/A are well within our reach and will happen shortly. Not only will we reach these levels, but they will also be achieved profitably and with no adverse environmental impact." (Carstens)

The spacing of each seed is a key factor in this planting method. Plants benefit in many ways with the staggered placement of twin-row planting. Editors of the Delta Farm Press stated in an article published in 2002, "Plants and their roots can spread over a larger area, allowing plants to catch more sunlight and gain better access to nutrients, with fewer diseases, all resulting in healthier, more uniform crops and improved yields." (Hembree) These improved yields will potentially benefit the profitability of the farm operation. Crop Science Society of America also mentioned in an article about the importance of available sunlight in twin-row planting. The authors said, "Increased light interception is considered the main factor responsible for greater seed yield in narrow-

compared with wide-row soybean culture (Board). A study done by Great Plains Manufacturing compared sunlight, nutrient availability, and the use of land using different row widths:

> "When corn is knee high, thirty-inch corn has access to 30 percent of available sunlight; the twenty-inch corn has access to 68 percent, while the twin-row corn has access to 90 percent of available sunlight. Tom Evans, Great Plains Manufacturing vice president of sales and marketing stated, "When planting corn at 38,000 seeds per acre, thirty-inch rows use 14 percent of the land, 20-inch rows use 32 percent, and twin-rows use 45 percent of the land. Twin-row planting allows us to mine more of the nutrients and moisture than if we were planting single-row corn at 38,000 seeds per acre," Tom says." (Johnson)

The corn that has more available sunlight and nutrients will not need to compete with other plants and all seeds have the chance to grow at a uniform rate. Below are illustrations of what twin row corn and soybeans look like in the field.

Figure 1: Twin-row corn on a farm in Central Illinois

Figure 2: Twin row soybeans on a farm in Central Illinois

Switching to twin-row planting will require farmers to make some adjustments to what equipment they use. However, it will not require them to get all new machinery which is a positive benefit of changing their planting methods. The author of Worth the Trouble included a farmer's statement in an article out of Hay and Forage magazine; "One advantage to twin-row is being able to plant soybeans and corn with the same equipment, Kusilek says. "The other thing I wanted to do was increase my population and this allowed me to do that." He upped it from 28,000 to 32,000." (Holin) This means that farmers can modify their current planters by adding additional units if this is possible. Otherwise, they can trade their old equipment in for a tool that is capable to plant both crops. This also would mean that they only have the one planter to maintain which could cut back on maintenance costs. Along with this benefit of planting equipment, there is a benefit when considering what is needed for harvest. Andrea Johnson, editor of Farm and Ranch Guide said exactly this, "A corn head set for thirty inch rows can harvest twin rows at the same time." (Johnson) This is important for farmers to understand, because it would not be necessary for them go out and purchase

new harvesting equipment. They will be able to continue to use their current combine with the same corn and soybean heads.

A study done by Nebraska-Lincoln Extension analyzes the economic comparison between single narrow-row and single thirty inch rows. It analyzes only the cost changes, not the profitability of switching from thirty-inch rows to ten-inch rows. The researchers at Nebraska-Lincoln Extension only found that there is a four dollar increase in cost when switching from thirty to ten inch rows. (Elmore) In the right conditions, there is potential here to increase production and still be efficient.

Other universities conducted research on narrow and twin-row planting. For example, Iowa State University worked with the Iowa Soybean Association and discussed the benefits and concerns of switching to narrow row planting of soybeans throughout Iowa. An associate professor at Iowa State wrote in an article:

> "Narrow row spacing is a risk management tool that helps stabilize yields in stressful environments. Since 2004, multiple experiments have been conducted in Iowa, and on average there is a 4.5 bu./acre yield advantage of fifteen-inch rows compared to thirty-inch rows. These data suggest that soybeans grown in narrow rows will frequently yield more than soybeans grown in wide rows. The most common reasons farmers do not use narrow rows include: 1) Disbelief that it will actually increase yield since they have already tried it once and did not see a yield increase. 2) Lack of equipment to plant in narrow rows. 3) High seed cost and failure to achieve a uniform stand." (Pedersen)

This is why farmers need to know the advantages and the disadvantages of switching to narrow or twin-row planting to make the most accurate decision for their farming operation.

Research conducted by Purdue University included a graph by Pioneer of the corn row spacing effects on amount of bushels per acre throughout states in the Midwest.

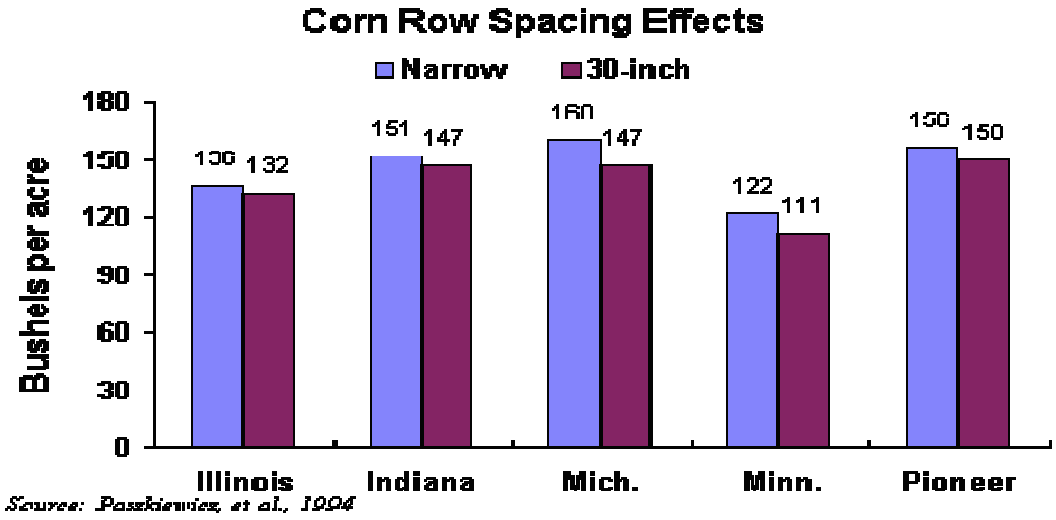

Figure 3: Pioneer Hi-Bred yields in five states – Narrow-rows vs. Thirty-inch rows

Pioneer Hi-Bred data reveals the variability in yield response from site to site. (Nielsen) It can be seen that narrow row spacing did produce slightly more bushels per acre than thirty-inch spacing.

Another study comparing twin-row vs. thirty-inch corn was a combined effort of specialist from the University of Maryland and Delaware. These comparisons were done in 2003 and 2004 on four different locations, three in Maryland and one in Delaware. The results of this study unlike most others did not show positive effects of planting twin-rows over thirty inch row corn. The yields of each row configuration, population, and

seed variety varied over all locations, but overall the thirty inch row spacing was the better choice. They also concluded that there was an increase in lodging and stalk rot with the twin-rows, which would contribute to the loss of greater yields. (Kratochvll) This just proves that twin-row spacing will not be beneficial to everyone in every location and further need for additional research.

Through this literature review it can be seen that experiments are being done in many different locations throughout different regions of the United States, but there are also studies being done on corn yields when rotated with non traditional crops. In this next study an agronomist, economist and agricultural engineer from the National Peanut Research Laboratory conducted an experiment on rotating corn and peanuts in the southeastern U.S. They started by comparing corn yields of single row and twin row corn at the recommended rate and also twin rows at twice the recommended rate of planting. The results showed that single and twin-rows at the recommended rate yielded about the same and the twin-rows with double the population had much lower yields. (Sorensen) This means that at double the rate of seeds per acre it is not beneficial, but this does not mean that smaller increases in population would also yield lower. These researchers found that peanuts yielded better when being rotated with corn instead of cotton. They also established that planting peanuts in twin-rows was beneficial because they yielded more and the amount of disease was reduced. (Sorensen) In this research, they found that planting peanuts in twin-rows as well as in a crop rotation with corn will benefit farmers in the southeastern part of the United States.

Effingham-Clay Service Company has been working with Monsanto and some customers in the past few years experimenting with twin-row corn on their farms.

Monsanto has focused on many DeKalb varieties to see which ones are adaptable to higher populations in the twin-row configuration. Studies like these are critical for giving farmers information on how planting higher corn populations in twin-rows compares to single thirty-inch rows. These studies give real data, where farmers can consider the plant hybrids, populations, location and perhaps the same growing conditions as they might have on their own farm. This is significant because, as mentioned before this new method does not work in all areas and conditions. Data for trials conducted by Monsanto and DeKalb are included in the appendix of this paper.

METHODS AND PROCEDURES

This research includes a comparison to help farmers make informed decisions for their farming operations. The objective was to compare the difference in planter cost of a twin-row, split-row, single thirty-inch row, and a drill. Great Plains Manufacturing is the brand of planters and drill used, because they are a company that makes all the planters. Using a single manufacturer, we can factor out price differences due to brand. Ownership costs including depreciation, interest, insurance, and housing are estimated for each planter. Operating costs which includes repairs, power, and labor are estimated only if there is a cost difference between implements.

Assumptions and sources of information necessary to calculate ownership and operating cost difference between implements are: widths and lengths of each for calculation of housing space, the current list prices of each implement (Brenneman), and the current price or investment is 90 percent of the list price (Lazarus).

Great Plains Manufacturing provided estimations of acres per hour for each implement (Brenneman). A farm size of 1000 acres was used for acres covered annually on a continuous corn operation and 500 acres of corn and 500 acres of soybeans for a corn-soybean operation. The expected years owned is five years, an average of how long a farmer will keep an implement before trading it in for something new (Brenneman). This information was used to calculate annual hours of use and estimated accumulated hours at trade-in. An estimated trade-in value of 85 percent of the list price was used (Kastens). Rates and formulas to estimate the depreciation, implement overhead, and repair cost were those described by Lazarus of the University of Minnesota (See Table 1).

With all the previous data and assumptions, the implement cost per acre could be figured for each implement.

A motive to switch to twin rows is higher yields from larger plant populations, but does the yield increase justify the higher cost at a larger plant population. To address this question, cost of higher corn populations were estimated. There is little information and data that supports higher soybean plant populations are only profitable in twin-rows, therefore soybean seed cost per acre at 165,000 seeds per acre is consistent for both planters and the drill. The population for twin-rows in corn is higher at 36,000 seeds per acre, because recent studies show planting rates can be increased here without decreasing yields (Monsanto). The population for corn in single thirty-inch rows is lower at 32,000 seeds per acre, because at higher seeding rates the yield plateaus or does not increase enough to justify the higher seed cost (Monsanto). Also, a concern with switching to twin-rows would be the change in fertilizer application rates. Hasty says that the only main difference in fertilizer application is an increase of twenty pounds of nitrogen at $0.45/lb for twin-rows, because you are increasing the plants per acre (Hasty). All other fertilizer practices stay the same for both methods of planting and therefore were not included in the analysis. The last part of the budget shows the total cost per acre difference between the twin-row, the single thirty-inch row, and the split-row planters.

Table 1: Percentages and Formulas used to calculate Implement Cost

Housing Space per square feet = Transport Width x Transport Length

[1]**Current Purchase Price:** 90% of List Price

Planting Acres per Hour: Given by Great Plains Manufacturing

Annual Hours of Use = Acres Covered Annually / Planting Acres per Hour

Estimated Accumulated Hours at Trade-in = Annual Hours of Use
x Expected Years Owned

Estimated Total Hours at Trade-in = Est. Accum. Hrs at Trade-in for Soybeans
+ Est. Accum. Hrs at Trade-in for Corn

[2]**Estimated Trade-in Value:** 85% of List Price

[1]**Implement Depreciation($/Year)**=$\frac{\text{Current Purchase Price – Est. Trade-in Value}}{\text{Expected Years Owned}}$

[1]**Interest Rate:** 6.0%

$/acre = $\frac{\text{purchase cost + trade-in value + depreciation ($/year) x 6.0\% / 2}}{\text{Total Acres Covered Annually}}$

[1]**Insurance Rate:** 0.85%

$/acre = $\frac{\text{purchase cost + trade-in value + depreciation ($/year) x 0.85\% / 2}}{\text{Total Acres Covered Annually}}$

[1]**Housing Rate:** $0.67/sq. ft.

$/acre = price per sq. foot x sq. feet shelter space required

Taxes: no taxes on personal property in Illinois

[1]**Repair Costs %** = 100 x RF1 x (total hours/1000) ^{RF2}

RF1 = .32 RF2 = 2.1

[1]**Repair Costs:** ($/acre) = Repair Cost % x List Price

[1] Purchase Price %, Implement Overhead rates, Repair Costs formula source is William F. Lazarus, University of Minnesota Extension

[2] Estimated Trade-in Value % source is Terry Kastens, Extension Agricultural Economist, Kansas State University

RESULTS

Table 2: Implement and Seed Cost per Acre Comparison – 1000 acre farm Corn-Soybean Operation

	Great Plains Manufacturing[1]									
	Twin Row		**Single 30" Row**		**Grain Drill**		**Avg. of Single 30" Row & Grain Drill**	**Split Row**	
Description of Implement	YP-1625 16 row, 32 units, 8" Spacing Central Fill Working Width: 40', Transport Width: 13'6" Length:41'2", Weight: Aprox. 14,900 lbs		YP-1625 16 row 30", Central Fill, Working Width: 40', Transport Width: 12'4" Length:41'2", Weight: Aprox. 14,900 lbs		3S-3000 HD - 4875, 48 openers on 7.5" spacing, Working Width: 30', Transport Width: 15' Length: 30', Weight: Approx. 11,890 lbs			YP1625, 16 row-30" corn, 31 row-15" beans, Central Fill, Working Width: 40', Transport Width: 12'4" Length: 41'2", Weight: 14900	
Housing Space (square feet)	556	sq. ft	508	sq. ft	450	sq. ft		508	sq. ft
Current List Price	$ 144,175		$ 105,563		$ 66,836			$ 141,762	
Current Purchase Price (90% of List suggested)[3]	$ 129,758		$ 95,007		$ 60,152			$ 127,586	
	Soybeans	Corn	Corn		Soybeans			Soybeans	Corn
Estimated Planting Acres per Hour	34.9	29.41	29.41	ac./hr	34.9	ac./hr		34.9	29.41
Acres Covered Annually	500	500	500		500			500	500
Annual hours of use	14	17	17		14			14	17
Expected Years Owned	5	5	5		5			5	5
Estimated Accum. Hrs at Trade-in	72	85	85		72			72	85
Estimated Total Hours at Trade-in	157		85		72			157	
Estimated Trade-in Value % of List Price[2]	85%		85%		85%			85%	
Estimated Trade-in Value	$ 122,549		$ 89,729		$ 56,811			$ 120,498	
	$/Year	**Costs/Acre**	**$/Year**	**Costs/Acre**	**$/Year**	**Costs/Acre**	**Costs/Acre**	**$/Year**	**Costs/Acre**
Implement Depreciation	$ 1,442	$ 1.44	$ 1,056	$ 2.11	$ 668	$ 1.34	$ 1.72	$ 1,418	$ 1.42
Implement overhead cost:[3]									
Interest	$ 7,612.44	$ 7.61	$5,573.73	$ 11.15	$ 3,528.94	$ 7.06	$ 9.10	$ 7,485.03	$ 7.49
Insurance	$ 1,078.43	$ 1.08	$ 789.61	$ 1.58	$ 499.93	$ 1.00	$ 1.29	$ 1,060.38	$ 1.06
Housing	$ 372.35	$ 0.37	$ 340.16	$ 0.68	$ 301.50	$ 0.60	$ 0.64	$ 340.16	$ 0.34
Taxes	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Implement Overhead	$ 9,063.22	$ 9.06	$6,703.50	$ 13.41	$ 4,330.37	$ 8.66	$ 11.03	$ 8,885.57	$ 8.89
Annual Repairs[3]	$ 940.43	$ 0.94	$ 190.76	$ 0.38	$ 84.31	$ 0.17	$ 0.28	$ 924.69	$ 0.92
Implement Cost ($/Acre)		$11.45		$15.90		$10.17	$ 13.03		$11.23
	Soybeans	Corn	Corn		Soybeans			Soybeans	Corn
Seed Population	**165,000**	**36,000**	**32,000**		**163,000**			**165,000**	**32,000**
Seed Cost $/Acre: (Soybeans @ 47/unit, Corn @ $250/unit)[4]	$ 55	$ 113	$ 100		$ 55			$ 55	$ 100
Fertilizer $/Acre: (20 lbs/ac. Increase of Nitrogen for Twin-Row @ $.45/lbs)[4]	$ -	$ 9	$ -		$ -			$ -	$ -
Total Seed & Fertilizer Cost $/Acre	$ 55	$ 122	$ 100		$ 55			$ 55	$ 100
Total Cost $/Acre	$ 66	$ 133	$ 116		$ 65			$ 66	$ 111

[1] Great Plains Planter List Prices and information source is Greg Brenneman, Marketing Manager of Sales Great Plains Manufacturing.

[2] Estimated Trade-in Value % source is Terry Kastens, Extension Agricultural Economist, Kansas State University

[3] Purchase Price %, Implement Overhead rates, Repair Costs formula source is William F. Lazarus, University of Minnesota Extension

[4] Seed Cost per acre & Fertilizer cost source is Ryan Hasty, Seed Agronomist for Effingham-Clay Service Company.

Table 3: Implement and Seed Cost per Acre Comparison – 1000 acre farm
Continuous Corn Operation

	Great Plains Manufacturing[1]			
	Twin Row		**Single 30" Row**	
Description of Implement	YP-1625 16 row, 32 units, 8" Spacing Central Fill Working Width: 40', Transport Width: 13'6" Length:41'2", Weight: Aprox. 14,900 lbs		YP-1625 16 row 30", Central Fill, Working Width: 40', Transport Width: 12'4" Length:41'2", Weight: Aprox. 14,900 lbs	
Housing Space (square feet)	556	sq. ft	508	sq. ft
Current List Price	$ 144,175		$ 105,563	
Current Purchase Price (90% of List suggested)[3]	$ 129,758		$ 95,007	
	Corn		Corn	
Estimated Planting Acres per Hour	29.41	ac./hr	29.41	ac./hr
Acres Covered Annually	1000		1000	
Annual hours of use	34		34	
Expected Years Owned	5		5	
Estimated Accum. Hrs at Trade-in	170		170	
Estimated Total Hours at Trade-in	170		170	
Estimated Trade-in Value % of List Price[2]	85%		85%	
Estimated Trade-in Value	$ 122,549		$ 89,729	
	$/Year	**Costs/Acre**	**$/Year**	**Costs/Acre**
Implement Depreciation	$ 1,442	$ 1.44	$ 1,056	$ 1.06
Implement overhead cost:[3]				
Interest	$ 7,612.44	$ 7.61	$ 5,573.73	$ 5.57
Insurance	$ 1,078.43	$ 1.08	$ 789.61	$ 0.79
Housing	$ 372.35	$ 0.37	$ 340.16	$ 0.34
Taxes	$ -	$ -	$ -	$ -
Total Implement Overhead	$ 9,063.22	$ 9.06	$ 6,703.50	$ 6.70
Annual Repairs[3]	$ 1,116.96	$ 1.12	$ 817.82	$ 0.82
Implement Cost ($/Acre)		$11.62		$8.58
	Corn		Corn	
Seed Population	**36,000**		**32,000**	
Seed Cost $/Acre: (Soybeans @ 47/unit, Corn @ $250/unit)[4]	$ 113		$ 100	
Fertilizer $/Acre: (20 lbs/ac. Increase of Nitrogen for Twin-Row @ $.45/lbs)[4]	$ 9.00		$ -	
Total Seed & Fertilizer Cost $/Acre	$ 122		$ 100	
Total Cost $/Acre	$ 134		$ 109	

[1] Great Plains Planter List Prices and information source is Greg Brenneman, Marketing Manager of Sales Great Plains Manufacturing.

[2] Estimated Trade-in Value % source is Terry Kastens, Extension Agricultural Economist, Kansas State University

[3] Purchase Price %, Implement Overhead rates, Repair Costs formula source is William F. Lazarus, University of Minnesota Extension

[4] Seed Cost per acre & Fertilizer cost source is Ryan Hasty, Seed Agronomist for Effingham-Clay Service Company.

Great Plains Manufacturing makes the Yield Pro 1625 model planter in each configuration that was compared in this analysis. The twin-row list price is $38,612 more expensive compared to the single thirty-inch row planter, which would be an advantage for thirty-inch row planter on an operation that is continuous corn. However, if soybeans are in a rotation with corn, the farmer would also need a drill which is at a list price of $66,836. So, when a farmer is comparing investments of one twin-row implement with two conventional implements, it would be less to purchase the twin-row planter. The twin-row has a competitor in the split-row planter, because of its ability also of eliminating the use of two implements and it has a lower list price than the twin-row. Therefore, when just looking at the initial investment, the best choice would be a split-row planter for a corn soybean rotation. With further analysis of the implement depreciation and overhead, it was also found that the implement cost per acre is lowest for the split-row planter. The highest implement cost would be the average of the single thirty-inch row planter and the drill combination. (See Table 2) Considering that cost is based on list price, it is not surprising that these were the results.

Seed and fertilizer cost for planting corn in twin-rows is higher at 122 dollars per acre than planting in single thirty-inch rows at 100 dollars, because of the higher planting population. Along, with the extra seed needed, an extra twenty pounds of nitrogen per acre is applied when the population is increased with twin-rows. This increase results in an extra nine dollar per acre cost that would not be incurred if planting in single thirty-inch rows at a lower population. Since there is limited data on soybeans planted in twin-rows the planting population was kept the same among each planting method. Therefore,

much of the difference in total cost per acre occurs because of the change in corn population.

Finally now looking at the total cost per acre, again the split-row planter is the lowest cost method if a farm is on a corn-soybean rotation. Continuous corn operations would be better off going with the single thirty-inch row planter when looking at the total cost per acre of each implement.

Then, a breakeven analysis of bushels per acre was calculated, to show how many bushel increase is needed for twin-rows to cover the initial higher investment and the extra seed and fertilizer cost. A corn price of 3.75 dollars was used as an average of the past five years (USDA). Table 4 shows the breakeven yield for a corn-soybean operation is 5.45 bushels per acre. Table 5 shows the breakeven yield for a continuous corn operation is 6.68 bushels per acre. These are the yields that need to be reached to make twin rows profitable over conventional methods.

Table 4: Breakeven Analysis of a Corn and Soybean Operation

Benefits and Costs of switching to twin-rows from thirty-inch row corn planter and a grain drill

	Cost	Benefit
Machinery Cost		1.58
Seed Cost	$13.00	
Extra Nitrogen	$9.00	
	$22.00	$1.58
Net Benefit		-$20.42
Added Yield		5.45 bu/acre
breakeven corn @ $3.75 per bushel		

Table 5: Breakeven Analysis of Continuous Corn Operation

Benefits and Costs of switching to twin-rows from conventional thirty-inch row method

	Cost	Benefit
Machinery Cost	3.04	
Seed Cost	$13.00	
Extra Nitrogen	$9.00	
	$25.04	0
Net Benefit		-$25.04
Added Yield		6.68 bu/acre
breakeven corn @ $3.75 per bushel		

SUMMARY AND CONCLUSIONS

The first objective of this research was to analyze the cost of alternative implements and how the differences in investment affect planting cost per acre. We found that the higher the initial investment the higher the cost per acre, since calculations are based on that cost. Next, we wanted to determine added cost per acre at planting higher corn populations compared to conventional thirty-inch rows. Planting twin-rows at a higher population means an increase of seed cost of twenty-two dollars per acre. With the higher investment and seed cost per acre we now needed to determine how much of a yield increase is needed to make higher corn populations with twin-row planting profitable. The breakeven analysis was used to answer this question and turned out that a 5.45 bushel per acre increase would be necessary for an operation with a corn soybean rotation. And, for a continuous corn operation a 6.68 bushel per acre is necessary for twin-rows to be profitable. Finally we wanted to compare breakeven corn yield increase from objective three with results of recent field trials. Trials included were obtained from Effingham – Clay Service Company who worked with Monsanto and DeKalb to collect 2010 results of plots comparing twin-rows verses thirty-inch rows, in Central Illinois. These studies are both on a corn soybean rotation and the planting populations varied. However, in most cases, when the population was increased twin-rows proved to produce at least the breakeven bushels per acre of 5.45 if not more.

During this research, a few obstacles were encountered. There was concern about the weight of the twin-row and the split-row planters and the compaction they will cause. According to Greg Brenneman of Great Plains, there would not be much difference in these two planters; however, the single thirty-inch planter would be lighter and cause less compaction. He also stated, "The tires that Great Plains uses on these units are either the large tractor type or the skid steer, which both are designed to provide flotation. This tire configuration allows us to avoid tracking over rows on single thirty-inch and twin-row and only two rows on fifteen-inch split-row. This is much different than the competition, and this allows us to reduce the yield drag from running on rows." (Brenneman)

In the methods and procedures when calculating the cost differences of each implement the power and labor cost was not included. A better analysis would have included the difference in power cost between the twin-row and the thirty-inch row planter. There is a difference in the number of units that are being pulled through the ground and the twin-row would take more powerful tractor. There would not be much difference in the twin-row and split row when planting soybeans, but there would be when planting corn. So, if this was included the breakeven bushels per acre would need to be a little higher for twin-rows to cover the extra power cost.

Precision agriculture has advanced the methods of farming in the past decade and will continue this same path in the future. It will be essential for farmers to keep up with new technology so they will not fall through the cracks and loose potential profits with their farming operations.

The studies that have been done in the past show that there is much potential with this method of twin-row planting. Advantages and disadvantages need to be discussed

and analyzed before a farmer makes any major decisions on whether or not to switch from conventional thirty-inch row spacing to twin-rows. This method will not be perfect for all farmers in every region, however; if the combinations are right it could be more profitable for farmers to plant in twin rows.

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APPENDICES

APPENDIX

Source: Great Plains Manufacturing at www.greatplainsmfg.com

Figure 4: Great Plains Yield Pro-1625, Sixteen-row, Twin-Row Planter

Source: Great Plains Manufacturing at www.greatplainsmfg.com

Figure 5: Great Plains 3S-3000, Thirty-foot, Three-Section Folding Drill

Table 6: Twin-Row Plot results Altamont, IL by Monsanto and DeKalb

Monsanto/ Dekalb on Farm Trials													
Monsanto Representative Shannon Schultz													
Dealer Effingham-Clay Service Company				**Location:**	Altamont, IL								
				County:	Effingham County								
Planting Date:	4/15/2010												
Harvest Date:	9/8/2010			**Selling Price:**	$4.00/Bu.								
				Drying Charge:	$0.07/point								
Previous Crop:	Soybeans												
Tillage Type:	Conventions												
Entry No.	**Brand**	**Hybrid**	**Traits**	**Agronomic Trial Info.**	**Harvest Moist %**	**Row Width**	**Row Length**	**# Rows**	**Harvest Population**	**Bu/Acre @ 15% moisture**	**Gross Income**	**Yield Rank**	**Income Rank**
		1st Trial											
1	DEKALB	DKC61-69	VT3	30"	15.1	30	308	6	30000	190.0	758.79	3	3
4	DEKALB	DKC61-69	VT3	Twin-Row	15.6	15	308	12	30000	182.2	721.24	4	4
5	DEKALB	DKC61-69	VT3	Twin-Row	15.5	15	308	12	34000	192.5	763.19	2	2
6	DEKALB	DKC61-69	VT3	Twin-Row	15.7	15	308	12	38000	215.4	851.06	1	1
		2nd Trial											
10	DEKALB	DKC61-69	VT3	30"	14.5	30	313	6	30000	186.6	746.59	4	4
13	DEKALB	DKC61-69	VT3	Twin-Row	15.6	15	313	12	30000	202.3	800.87	2	2
14	DEKALB	DKC61-69	VT3	Twin-Row	14.5	15	313	12	34000	195.0	779.92	3	3
15	DEKALB	DKC61-69	VT3	Twin-Row	14.8	15	313	12	38000	204.3	817.04	1	1
		3rd Trial											
19	DEKALB	DKC63-42	VT3	30"	14.8	30	376	6	30000	201.8	807.33	1	1
22	DEKALB	DKC63-42	VT3	Twin-Row	15.5	15	376	12	30000	197.4	782.82	3	3
23	DEKALB	DKC63-42	VT3	Twin-Row	16.0	15	376	12	34000	201.7	792.74	2	2
24	DEKALB	DKC63-42	VT3	Twin-Row	15.8	15	376	12	38000	191.3	754.35	4	4
		4th Trial											
28	DEKALB	DKC63-42	VT3	30"	15.3	30	376	6	30000	199.3	792.91	3	3
31	DEKALB	DKC63-42	VT3	Twin-Row	16.3	15	376	12	30000	175.2	684.82	4	4
32	DEKALB	DKC63-42	VT3	Twin-Row	17.0	15	376	12	34000	216.8	836.93	1	1
33	DEKALB	DKC63-42	VT3	Twin-Row	17.0	15	376	12	38000	208.7	805.74	2	2

Source: Monsanto Company

Table 7: Twin-Row Plot results in Carmi, IL by Monsanto and DeKalb

Monsanto Representative: Haworth													
Dealer: Burnt Prairie Fertilizer				**Location:**	Carmi, IL								
				County:	White County								
Planting Date:	4/16/2010												
Harvest Date:	9/2/2010												
Previous Crop:	Soybeans			**Selling Price:**	$4.00/Bu.								
Tillage Type:	Conventions			**Drying Charge:**	$0.08/point								
Entry No.	**Hybrid**	**Traits**	**Seed Treatment**	**Agronomic Trial Info.**	**Harvest Moist %**	**Row Width**	**Row Length**	**# Rows**	**Harvest Population**	**Bu/Acre @ 15% moisture**	**Gross Income**	**Yield Rank**	**Income Rank**
1	DKC62-54	VT3	Poncho 250	Border				18					
2	DKC62-54	VT3	Poncho 251	30"	16.6	30	1010	12	32,000	216.1	836.61	9	9
3	DKC62-54	VT3	Poncho 252	Twin-Row	17.1	30	1009	12	32,000	221.4	848.4	8	8
4	Transition (Fill)	VT3	Poncho 253										
5	DKC62-54	VT3	Poncho 254	Twin-Row	17.0	30	918	12	35,500	229.4	880.93	4	4
6	DKC62-54	VT3	Poncho 255	30"	17.3	30	1008	12	35,500	212.1	809.47	12	12
7	Transition (Fill)	VT3	Poncho 256										
8	DKC62-54	VT3	Poncho 257	30"	17.4	30	1006	12	37,000	225.2	857.42	6	5
9	DKC62-54	VT3	Poncho 258	Twin-Row	17.2	30	1006	12	37,000	236.7	905.16	1	2
10	Transition (Fill)	VT3	Poncho 259										
11	DKC62-54	VT3	Poncho 260	Twin-Row	18.0	30	891	12	32,000	226.5	851.62	5	6
12	DKC62-54	VT3	Poncho 261	30"	17.8	30	1004	12	32,000	215.9	815.34	10	11
13	Transition (Fill)	VT3	Poncho 262										
14	DKC62-54	VT3	Poncho 263	30"	17.0	30	1003	12	37,000	221.5	850.67	7	7
15	DKC62-54	VT3	Poncho 264	Twin-Row	16.7	30	1002	12	37,000	234.8	907.36	2	1
16	Transition (Fill)	VT3	Poncho 265										
17	DKC62-54	VT3	Poncho 266	Twin-Row	16.8	30	1001	12	35,500	230.2	887.51	3	3
18	DKC62-54	VT3	Poncho 267	30"	16.6	30	1000	12	35,500	215.8	835.52	11	10
19	DKC62-54	VT3	Poncho 268	Border				18					

Source: Monsanto Company

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