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PLANTER COSTS FOR ALTERNATIVE FARM SIZES

This article reports on a study of planter costs for different farm sizes. Our objective was to determine the planter size that had the lowest cost for a given farm size. Farm sizes from 400 to 4,000 acres in 400 acre increments were evaluated. Planter sizes ranged from 6-rows up to 36-rows. Planters were assumed to plant all acres with acres evenly split between corn and soybeans.

Two categories of costs were included in the analysis: timeliness and power costs. Timeliness costs account for yield losses from not planting near optimal times. Power costs include depreciation, interest, repairs, housing, insurance, fuel and lubrication, and labor. Power costs were calculated for the planter and the tractor used to pull the planter. The following sections detail planters evaluated in the study, timeliness costs, power costs, and total timeliness and power costs.

Planters

Costs were calculated for seven different planters ranging in size from a 6-row planter up to a 36-row planter. Purchase prices for a new planter range from $22,100 for a 6-row planter up to $141,950 for a 36-row planter (see Table 1).

Table 1. Planter Purchase Prices and Acres Per Hour

Planter Size	Purchase Price	Acres Per Hour
6-row	$22,100	7.6
8-row	23,800	10.2
12-row	32,300	15.3
16-row	51,000	20.4
24-row	94,350	30.5
32-row	127,500	40.7
36-row	141,950	45.8

Timeliness Costs

Timeliness costs were calculated through a four step procedure:

1. Determine the amount of acres that each planter could plant,
2. Evaluate probabilities of being able to plant,
3. Determine yield losses for planting at different dates, and
4. State costs on a per acre basis.

Determine acres planted: Acres that each planter could plant were determined using an average speed of six miles per hour and a field efficiency of 70%. The 70% field efficiency means that the planter is operated in the field at 6 miles per hour 70% of the time. Field efficiency of less than 100% account for turning the planter at the end of rows, planting end rows, filling the planter, and stopping for some other reasons. Based on these assumptions, acres per hour were calculated using *Machinery Economics*, a Microsoft Excel spreadsheet available for download in the *FAST* section of *farmdoc* (http://www.farmdoc.uiuc.edu/fasttools/index.html). Estimates range from 7.6 acres per hour for a 6-row planter up to 45.8 acres per hour for a 36-row planter (Table 1).

Planters were assumed to be operated twelve hours per day. Acre per hour estimates shown in Table 1 can be multiplied by twelve to arrive at acres per day used to calculate timeliness costs. A 12-row planter, for example, can plant 15.3 acres per hour (see Table 1). This planter will plant 184 acres in twelve hours (15.3 acres per hour x 12 hours).

Evaluate probabilities of being able to plant: We next evaluated the probability of being able to plant on respective days. This was accomplished by using workday probabilities. Workday probabilities are based on historical data and indicate the chance of completing work on a given day. A workday probability of 26% means that 26% of the time work will be completed on a given day while 74% of the time field work can not be completed. Workday probabilities were taken from those included in the *Machinery Economics* spreadsheet for central Illinois. Workday probabilities for central Illinois are 26% between April 20th and April 24th, 36% between April 25th and May 8th, and 28% between May 9th and May 15th.

Workday probabilities were used to calculate the average amount planted for each of the planter and farm size categories. Planting was assumed to begin on April 20th. Average amounts were calculated for each day up to June 30th. If acres could not be planted by June 30th, it was assumed that the acres were prevented from being planted.

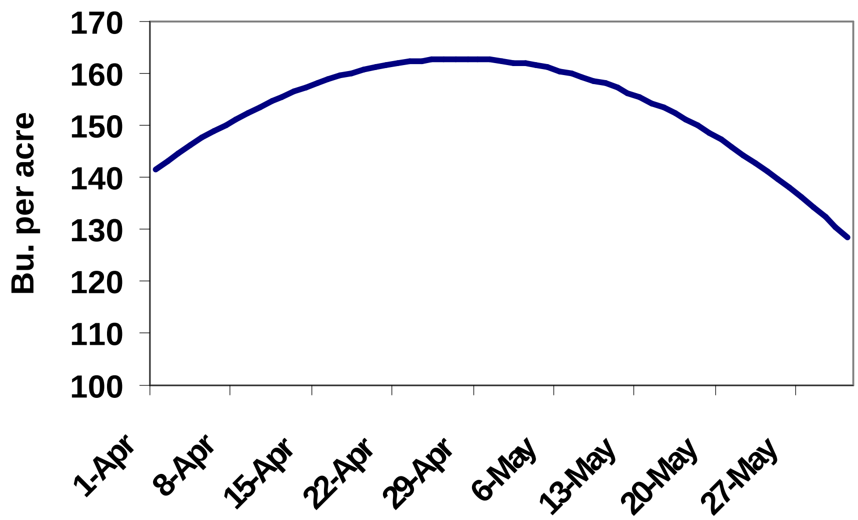
Table 2. Probability of Completing Planting Between April 20th and May 15th in Central Illinois.

Rows on	Acres Planted									
Planter	400	800	1200	1600	2000	2400	2800	3200	3600	4000
	Percent of Time									
6	95	30	2	0	0	0	0	0	0	0
8	98	62	18	2	0	0	0	0	0	0
12	99	95	62	30	9	2	0	0	0	0
16	99	98	88	62	46	18	9	2	0	0
24	99	99	98	95	88	62	46	30	18	9
32	99	99	99	98	95	88	77	62	62	46
36	99	99	99	98	95	95	88	77	62	62

A feel for how these probabilities impact planting can be gained from Table 2. Table 2 shows probabilities of completing planting between April 20th and May 15th. For example, the 12-row planter has a 62% chance of completing planting between the above two dates for 1,200 acres. This means that in 62% of the years planting will be done by May 15th. In 38% (100% - 62%) of the cases, planting will not be done by May 15th. As expected, chances of completion decrease as acres planted increase. A 12-row planter, for example, has a 99% chance of completing 400 acres between April 20th and May 15th, 95% of 800 acres, 62% of 1,200 acres, 9% of 2,000 acres, 2% of 2,400, and 0% chance for larger acreages.

Determine yield losses from untimely planting: Yield losses were estimated through yield functions obtained through conversations with Emerson Nafziger, a crop scientist at the University of Illinois. Corn yields per acres were estimated according to the following function (140 + 1.66 x D - .0303 x D x D, where D is the number of days from April 1). Yields from this function are shown in Figure 1. The function reaches its maximum of 162 bushels on April 27th. Yield losses equal the maximum yield minus the yield for each a given day. This procedure results in an estimated yield loss of 1 bushel per acre for corn planted on May 5th, 9 bushels on May 15th, and 34 bushels on May 31st. The acre of corn planted on May 5th would be assigned a yield loss of one bushel, on May 15th of nine bushels, and so on.

Figure 1. Estimated Yields by Planting Date



For soybeans, yield losses were estimated to begin on May 15th. Between May 15th and May 31st, yields were projected to decline by .33 bushels per day for each day after May 15th. After May 31st, the yield decline was projected at one bushel per day.

State costs on a per acre basis: Losses from the above functions were multiplied by the acres planted on each date. This result was then multiplied by respective corn and soybean prices ($2.40 per bushel for corn and $5.60 per bushel for soybeans). Total losses were then divided by the acres planted.

Losses associated with untimely planting are shown in Table 3. As expected, timeliness costs increase for a given size planter increases with acres planted. For example, a 12-row planter has an $.86 timeliness cost for 400 acres, $1.41 for 1,200 acres, $12.02 for 2,400 acres, and $32.81 for 3,600 acres.

Table 3. Yield Losses from Untimely Planting.

Rows on Planter	Acres Planted									
	400	800	1200	1600	2000	2400	2800	3200	3600	4000
	$ per Acre									
6	0.85	2.89	11.99	24.74	41.53	65.60	84.64	102.00	115.59	126.69
8	0.80	1.41	4.02	12.02	21.17	32.81	46.32	65.44	79.51	92.90
12	0.86	0.85	1.41	2.89	5.52	12.02	17.83	24.82	32.81	41.63
16	0.87	0.80	0.86	1.41	2.86	4.02	7.33	12.02	14.56	21.17
24	0.87	0.86	0.80	0.85	1.04	1.41	2.00	2.89	4.02	5.52
32	0.00	0.87	0.83	0.80	0.85	0.87	1.03	1.41	2.00	2.86
36	0.00	0.87	0.86	0.79	0.78	0.85	1.04	1.03	1.41	2.00

Power Costs

Power costs include charges for depreciation, interest, repairs, housing, insurance, fuel and lubrication, and labor. Planters were assumed to be purchased new and used for 10 years. Factors used to calculate cost include a 10-year useful life on planters, diesel fuel prices of $1.00 per gallon, the interest rate of 8%, housing and insurance cost of 1%, and labor costs of $12.50 per hour. Power costs were calculated using the *Machinery Economics* spreadsheet.

Table 4 shows power costs. For a given size planter, power costs tend to initially decrease as planted acres increase. After a certain farm size they then increase. For example, a 12-row planter has $13.10 of power costs for a 400 acre farm. These costs then decrease to $5.59 for a 2,800 acre farm. This decrease occurs because depreciation and interest cost are spread over more acres. Power costs then increase up to $5.75 for a 4,000 acre farms. The increase occurs because repair costs increase with usage.

Table 4. Power Costs for Different Planters Sizes and Acres Planted.

Rows on Planter	Acres Planted									
	400	800	1200	1600	2000	2400	2800	3200	3600	4000
	$ per Acre									
6	13.83	10.84	10.17	10.13	10.36	10.74	11.21	11.76	12.35	12.97
8	**11.46**	**8.02**	7.03	6.68	6.62	6.69	6.87	7.08	7.35	7.67
12	13.10	8.37	**6.84**	**6.16**	**5.81**	**5.65**	**5.59**	5.60	5.66	5.75
16	17.89	10.44	8.02	6.88	6.26	5.89	5.69	**5.57**	**5.54**	**5.55**
24	30.15	16.31	11.76	9.54	8.25	7.43	6.90	6.53	6.27	6.10
32	39.42	20.71	14.52	11.47	9.67	8.51	7.71	7.13	6.71	6.39
36	43.48	22.63	15.73	12.31	10.29	8.97	8.05	7.40	6.91	6.53

Bolded numbers indicate the planter that has the lowest power costs for alternative acres planted. The 8-row planter has the lowest power costs for 400 acres ($11.46 per acre) and 800 acre

($8.02) farm sizes. The 12-row planter has the lowest costs for the 1,200 acre through 2,800 acre categories. The 16-row planter is the lowest cost planter for the 3,200 through 4,000 acre categories.

Power and Timeliness Costs

Estimates in Table 4 only include power costs and do not account for any losses due to untimely planting. The timeliness costs shown in Table 3 were added to the power costs shown in Table 4 to arrive at total power and timeliness costs. Total costs are shown in Table 5.

Table 5. Power and Timeliness Costs.

Rows on	Acres Planted									
Planter	400	800	1200	1600	2000	2400	2800	3200	3600	4000
	$ per Acre									
6	14.68	13.73	22.16	34.87	51.89	76.34	95.85	113.76	127.94	139.66
8	**12.26**	9.43	11.05	18.70	27.79	39.50	53.19	72.52	86.86	100.57
12	13.96	**9.22**	**8.25**	9.05	11.33	17.67	23.42	30.42	38.47	47.38
16	18.76	11.24	8.88	**8.29**	**9.12**	9.91	13.02	17.59	20.10	26.72
24	31.02	17.17	12.56	10.39	9.29	**8.84**	8.90	9.42	10.29	11.62
32	39.42	21.58	15.35	12.27	10.52	9.38	**8.74**	8.54	8.71	9.25
36	43.48	23.50	16.59	13.10	11.07	9.82	9.09	**8.43**	**8.32**	**8.53**

As shown in Table 5, the 8-row planter has the lowest costs for a 400 acre farm. The 12-row planter has lowest cost for 800 and 1,200 acres. The 16-row planter has the lowest costs for 1,600 and 2,000 acres. A 24-row planter has the lowest cost for a 2,400 acre farm. The 32-row planter has lowest cost for a 2,800 acre farm and 36-row planters have lowest costs for 3,200 through 4,000 acre farms.

Including timeliness costs changes planters with the least costs. For example, the 36-row planter has the lowest cost for 3,200 acre and above acre sizes when timeliness costs are included (Table 5). When only power costs are included, a 16-row planter has lower costs for 3,200 and above farm sizes (Table 4). Hence, including timeliness costs is important because least cost planter differ when timeliness costs are included from least cost planters when timeliness costs are not included.

Summary

This article reports on results of a study that examined planter costs for alternative planter sizes. Costs included both timeliness and power costs. For planted acres ranging from 400 to 4,000 acres, the planter with the least costs range from an 8-row planter up to a 36-row planter.

The above results depend on the assumptions used in calculating costs. Of particular importance is the acres planted per day. Planting more hours per day could result in a smaller planter size having lower costs. A feel for the impacts of assumptions can be obtained using the *Machinery Economics* spreadsheet (http://www.farmdoc.uiuc.edu/fasttools/index.html). This is a Microsoft Excel spreadsheet that can be downloaded from the *FAST* section of *farmdoc*.

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