Economics of Purchasing a Yield Monitor for Split-Planter Corn Hybrid Testing

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ABSTRACT

Economic studies have not been conducted on yield monitors because it is difficult to separate out costs and benefits of yield mapping. We conducted split-planter studies in 1999 on two farms to test a new ('37M81') and proven ('3752') corn (*Zea mays* L.) hybrid ($10 bag^{-1} seed cost difference) to determine if farmers could offset yield monitor costs by identifying the better hybrid to plant in subsequent years. At one farm, 37M81 yielded 0.48 Mg ha^{-1} greater than 3752 in 1999. In 2000 and 2001, 37M81 yielded 1.03 Mg ha^{-1} greater for an $85 ha^{-1} return above seed costs. If 37M81 were planted on 20 ha in 2000 and 2001, additional revenue from higher yields offset annual fixed costs ($1655) of a yield monitor. If 37M81 were planted to 320 ha, relative profit ($79 ha^{-1}) did not equal the $85 ha^{-1} return for planting 37M81 without on-farm testing. At the other farm, 3752 yielded 0.39 Mg ha^{-1} greater in 1999 but the same (7.7 Mg ha^{-1}) in 2000 and 2001. Savings in seed costs ($9 ha^{-1}) did not offset annual yield monitor costs in 2000 and 2001. If 3752 were planted to more than 200 ha, relative profit from the yield monitor purchase exceeded relative profit for planting 37M81 without on-farm testing. We recommend that farmers who plant 200 or more corn hectares conduct split-planter studies to compare new hybrid releases vs. proven hybrids because seed costs have increased significantly.

The first hardware purchase for farmers using precision agriculture technologies is a yield monitor with a global positioning system (GPS), which allows for mapping of fields and yield map interpretation (Tiffany et al., 2001). The goal of yield map interpretation is better profitability with better understanding and control of natural and management-induced sources of variability (Doerge, 1999). Producers with mid- to large-size farms in the Midwest USA have purchased yield monitors at a moderate rate (Daberkow and McBride, 2001). In other regions of the USA, including the Northeast, producers have purchased yield monitors at a much lower rate (Daberkow and McBride, 2001). A major reason why farmers do not purchase yield monitors is that the benefits are ill defined and not typically realized in the first couple of years after purchase (Swinton and Ahmad, 1997). Farmers in the Northeast USA, where farm size is generally smaller than in the Midwest USA, require some empirical economic data on the profitability of a yield monitor purchase.

Yield mapping may be profitable when it reveals yield patterns that can be managed at acceptable costs (Swinton and Lowenberg-DeBoer, 1998). Yield mapping can also be profitable by significantly lowering the costs of on-farm experimentation at harvest, such as corn hybrid testing, when time is valuable (Swinton and Lowenberg-DeBoer, 1998).

Economic studies have not been conducted on yield monitors because it is difficult to separate costs and benefits of yield mapping from variable-rate input management or off-field information use of yield maps (Swinton and Lowenberg-DeBoer, 1998). In general, yield mapping benefits must be measured empirically on individual farms (Swinton and Ahmad, 1997).

Farmers who test corn hybrids typically use field scales to weigh the grain from different hybrids planted on their farms. A Purdue University survey indicated that results from on-farm testing ranked third in importance for hybrid selection by Indiana corn growers (DeVillez et al., 2003). Bowerman (1998) has pointed out that 1-yr results in university studies from a single location are not as good a predictor of hybrid performance in that location in the subsequent year when compared with 2- or 3-yr results from multilocations. The rapid turnover of hybrids coupled with the genetic gain of hybrids, however, can reduce the relevance of yield data from multiyears (Uricola, 2003). Furthermore, seed companies have greatly reduced the number of corn entries in university trials (DeVillez et al., 2003), which makes it difficult to compare hybrids from different companies across multiyears and multilocations. For example, the number of corn hybrids entered in Cornell University hybrid performance trials decreased from 148 in 1997 to 75 in 2003 (Cornell Coop. Ext., 2003). Pioneer Hi-Bred, which has about 40% of the New York market share of grain corn (Joe Meyer, personal communication, 2003), has not entered hybrids in Cornell grain trials since 2000. Obviously, the importance of university performance trials has decreased significantly for hybrid selection for New York corn growers.

The most important factor in hybrid selection by Indiana corn growers is the recommendation by the seed company representative (DeVillez et al., 2003). On-farm hybrid testing can validate seed company recommendations, which are based on multilocation testing within the region or state of mostly company hybrids. Farmers who conduct on-farm hybrid testing, however, frequently test a limited number of hybrids with no replication. Split-planter hybrid testing with the use of a yield monitor would allow for testing a proven high-performing hybrid vs. a new hybrid release with numerous replications throughout the field. The objective of the study was to determine if a farmer could justify the cost of a yield monitor to conduct split-planter hybrid studies to help determine when to substitute a new hybrid release for a high-performing hybrid. A second objective was to compare the economics of a yield monitor purchase with the economics of using previously owned field scales for on-farm hybrid testing.

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MATERIALS AND METHODS

Field Studies

We formed farmer–researcher partnerships (Karlen et al., 1995) to conduct studies on two fields on a dairy farm (42°93′ N, 76°37′ W) in Onondaga County, New York, and two fields on a cash crop farm (42°87′ N, 76°89′ W) in Seneca County, New York, in 1999, 2000, and 2001. At the dairy site, both fields had been in alfalfa (*Medicago sativa* L.) from 1994 to 1997 and in corn in 1998. Consequently, the farmer planted second-, third-, and fourth-year corn in 1999, 2000, and 2001, respectively, which is consistent with the typical rotation of 4 yr of perennial forage followed by 4 yr of corn on dairy farms in New York. At the cash crop site, the two fields had been in a corn–soybean [*Glycine max* (L.) Merr.] rotation in the 1990s, with soybeans planted in each field in 1998. Consequently, the farmer planted first-, second-, and third-year corn in 1999, 2000, and 2001, respectively. Honeoye silt loam (fine-loamy, mixed superactive mesic oxyaquic Hapludalfs) was the predominant soil in both fields at the Onondaga farm. Soil types differed at the Seneca farm. Schoharie clay loam (fine illitic, mesic Oxyaquic Hapludalfs) and Ovid clay loam (fine-loamy, mixed, active, Aeric, Epiaqualfs) were the predominant soils in Field 1, and Collamer silt loam (fine-silty, mixed, active, mesic Glossaquic Hapladalfs) was the predominant soil in Field 2.

The farmers plowed each field in the spring and performed their typical secondary tillage operations for corn planting. Pioneer brand 3752, a hybrid grown extensively on both farms from 1996 to 1998, and Pioneer brand 37M81, a new hybrid released in New York in 1998, were planted at each farm in each year in early to mid-May with starter fertilizer at about 80 000 kernels ha^{-1} with 12-row planters at 0.76-m row spacing. 3752 yielded the greatest in the 95- to 100-d relative maturity tests in the Cornell University hybrid performance trials from 1995 to 1998 (Cornell Coop. Ext., 1999). 37M81, which was never entered in the Cornell trials, was recommended as a replacement for 3752 in 1999 by Pioneer representatives, based on Pioneer trials in New York (Don Specker, personal communication, 1999). Pioneer 3752 was planted on about 17 500, 15 250, and 12 000 ha, and 37M81 was planted on about 105, 6750, and 10 500 ha in New York in 1998, 1999, and 2000, respectively (Joe Meyer, personal communication, 2003). Both hybrids occupied about 10% of the New York grain corn ha in 1999 and 2000 (Joe Meyer, personal communication, 2003).

We used the split-planter technique (one hybrid assigned to the left-side hoppers and the other assigned to the right-side hoppers) for planting, which resulted in 12 rows of one hybrid alternating with 12 rows of another throughout the entire field. The farmers sidedressed each hybrid at two N rates, 25 to 35 kg ha^{-1} above or below the recommended rate (Katsvairo et al., 2003). The N treatments, which were six rows wide, were randomized within each hybrid. After planting, the farmers used recommended pest management practices to control insects and weeds (Cornell Coop. Ext., 1999, 2000, and 2001). Insects and weeds were not a problem at any of the sites in any of the years. More detailed information on the cultural practices was provided by Katsvairo et al. (2003).

Overall, 10 strips or replications (300 by 36 m) that contained the two hybrids and N rates were established in 1999, and eight replications were established in 2000 and 2001 across Field 1 at the Onondaga farm. Across Field 2 at the Onondaga farm, 10 replications (250 to 350 by 36 m) were established in 1999 and 2000, and nine replications were established in 2001. At the Seneca farm, six replications (800 by 36 m) in 1999 and 2001 and seven replications in 2000 were established across Field 1, and six replications (600 by 36 m) in 1999, 2000, and 2001 were established across Field 2.

The farmers harvested the corn in late October to mid-November in each year with six-row combines equipped with yield monitors. The Onondaga farmer purchased a new John Deere (Deere Co., Moline, IL) Sidehill 9510 combine that was equipped with a Greenstar yield monitor in the early spring of 1999. The Seneca county farmer had a 8800 John Deere combine in which he installed an AgLeader yield monitor in the winter of 1998–1999. The yield monitors were calibrated at the start of each field operation and intermittently throughout the harvest for both grain mass flow and grain moisture content. Weigh wagons, equipped with calibrated load cells, were used at each site to compare yields of selected passes (one hybrid at one N level) in each strip with the average yield of the yield monitor. Yield differences between the two harvest methods were always less than 3%. Yield measurements were taken every second by grain sensors along each pass. Each data point along each pass was then averaged to calculate the yield for each hybrid at one N level for each replication.

We used an analysis of variance (ANOVA) model, with replications as random and hybrids and N rates as fixed variables, to analyze the yield data with General Linear Model (GLM) procedures of the SAS statistical software package (SAS Inst., 1999). There was only one hybrid × N rate interaction (Field 2 at the Seneca farm in 1999), so hybrid yields, averaged across N rates, will be presented. A systematic layout, such as a split-planter study, does not allow for accurate statistical analysis of hybrid main effects, so the results have been interpreted qualitatively. The replication × hybrid interaction, which was tested against the replication × hybrid × N rate interaction, was significant in Field 1 at the Onondaga farm in 1999 and 2001. We used the replication × N rate LSD value to show spatial variability of the hybrids (Katsvairo et al., 2003). We also used the VARCOMP procedure in SAS (SAS Inst., 1999) to evaluate the relative magnitude of variance components of year, farm, and field within farm effects for hybrid response to determine the need for multiyear or multifield testing of hybrids.

Economic Analysis

We estimated the cost of the yield monitor and GPS system at $5000, which was the average price from local vendors in 1999. Interest on operating capital was 8%, and the yield monitor was depreciated over 5 yr to a salvage value of 40% of new cost (Table 1). Insurance cost was 2.5% of the purchase price, and a service cost of $500 was obtained from local consultants who interpret farmer's yield monitor data. We included a $50 fixed cost for conducting annual split-planter hybrid studies with a yield monitor in two fields based on the time spent in planting and harvesting the two fields. We also included the time spent by a farmer in using the yield monitor as a variable cost ($44.56, $51.87, $66.69, $96.33, and $155.61 for 20, 40, 80, 160, and 320 ha, respectively).

We estimated the cost of field scales at $4250, for the purchase of field scales in 1993, based on quotes from vendors in Ohio and in Nebraska. We included an economic analysis on the use of previously owned field scales for hybrid testing because some farmers currently test hybrids with field scales. Interest on operating capital in 1993 was also 8%, and the field scales were depreciated over 15 yr to a salvage value of 40% of new costs. We included a $150 fixed cost for conducting annual split-planter hybrid studies with field scales in two fields for the additional time and fuel spent for half-empty truck loads, based on previous field-scale studies with field

Table 1. Fixed annual costs for owning a yield monitor or field scales to conduct split-planter hybrid tests.

Cost	Yield monitor	Field scales
	$	
Depreciation	600	170
Interest	280	476
Insurance	125	106
Service/yr	500	–
Testing	50	150
Repairs	100	100
Total	1655	1002

scales (Cox and Cherney, 2002) and weigh wagons (Singer and Cox, 1998). Additional fixed annual costs for owning field scales are shown in Table 1.

The difference in seed cost, a variable cost between 37M81 and 3752, was \$10 bag^{-1} or \$10 ha^{-1} at a seeding rate of 80 000 kernels ha^{-1}. The marketing year weighted average price for corn in New York in 2000 and 2001 was \$0.092 kg^{-1} (New York Agric. Stat. Serv., 2002). Grain moisture comparisons between hybrids averaged less than 10 g kg^{-1}, so it was not included in the economic analyses. Also, we did not measure test weight in this study. We calculated relative profit above seed costs for selecting the new or standard hybrid without the purchase of a yield monitor, based on yield and seed cost differences and a \$0.092 kg^{-1} corn price. We then used the break-even point analysis to determine the relative profit of the yield monitor purchase. The break-even point is where profits are not enhanced or diminished in comparison to profits with or without a yield monitor or field scales. Relative profit is defined as the return above the sum of the annual ownership costs and increased labor and seed costs. We calculated relative profit for owning a yield monitor or field scales at 20, 40, 80, 160, and 320 ha planted to the selected hybrid at a corn price of \$0.092 kg^{-1}. The break-even yield increase or the additional megagrams per hectare required to cover the fixed and additional operating costs of a yield monitor was also calculated at 20, 40, 80, 160, and 320 ha within a range of corn prices in New York over the last 10 yr.

RESULTS AND DISCUSSION

Weather conditions differed markedly among growing seasons (Table 2). Corn showed significant leaf wilting in most areas of all fields during late June and early July in 1999 because of hot and dry conditions. Also, in late June of 2000, corn showed significant leaf yellowing in some areas of all fields because of cool and wet conditions. In August of 2001, corn showed some leaf wilting in some areas of all fields because of hot and dry conditions. Consequently, the hybrids were evaluated over a range of environmental conditions.

Pioneer 37M81 averaged 0.48 Mg ha^{-1} greater yield than 3752 across fields at the Onondaga farm in 1999 (Table 3). When comparing the relative profit above seed costs between hybrids, 37M81 averaged about \$34 ha^{-1} more profit in 1999 (Table 3). On the basis of these results, we assumed that the Onondaga farmer would replace 3752 with 37M81, the more expensive new hybrid, in 2000 and 2001. In contrast, 3752 averaged 0.39 Mg ha^{-1} greater yield than 37M81 across fields at the Seneca farm in 1999. When comparing the relative profit above seed costs, 3752 averaged about \$35 ha^{-1} more profit. On the basis of these results, we assumed that the Seneca farmer would not replace 3752, the high-yielding hybrid in previous years, with 37M81.

Table 2. Precipitation (precip.) and growing degree days (GDD, 30–10°C) at two farms in New York during the 1999, 2000, and 2001 growing seasons.

	Onondaga farm				Seneca farm			
	Field 1		Field 2		Field 1		Field 2	
Month	Precip.	GDD	Precip.	GDD	Precip.	GDD	Precip.	GDD
	mm	°C	mm	°C	mm	°C	mm	°C
				1999				
May	33	197	33	197	36	193	35	193
June	55	311	55	311	71	313	67	313
July	97	401	96	401	83	392	83	392
Aug.	57	312	55	312	76	304	70	304
Sept.†	–	255	–	255	–	246	–	246
Total	242	1476	239	1476	266	1448	255	1448
				2000				
May	168	190	170	190	168	180	166	180
June	108	268	109	268	118	262	119	262
July	144	297	144	297	182	303	193	303
Aug.	78	318	80	318	89	308	91	308
Sept.	119	216	114	216	128	284	118	204
Total	617	1289	617	1289	685	1257	687	1257
				2001				
May	37	186	38	186	38	187	41	187
June	90	277	89	277	77	275	79	275
July	53	321	53	321	48	317	57	317
Aug.	90	385	90	385	70	378	41	378
Sept.	–	225	–	225	–	211	–	211
Total	270	1394	270	1394	233	1368	218	1368

† Corn attained black layer formation in mid-September in 1999 and 2001, so we did not include September precipitation in those years.

Pioneer 37M81 averaged 1.03 Mg ha^{-1} greater yield than 3752 across fields at the Onondaga farm in 2000 and 2001 (Table 3). When comparing relative profit above seed costs between hybrids in 2000 and 2001, 37M81 averaged \$85 ha^{-1} more profit (Table 3). At the Seneca farm, 3752 yielded 0.52 Mg ha^{-1} less than 37M81 on one field and about the same on another field in 2000. In 2001, however, 3752 averaged 0.26 Mg ha^{-1} greater yield than 37M81 across fields. When comparing relative profit above seed costs between hybrids in 2000 and 2001, 3752 averaged about \$9 ha^{-1} more profit. Although the hybrid response was less consistent at the Seneca farm, presumably because of different soil types between fields, the split-planter hybrid studies in 1999

Table 3. Corn grain yield of two hybrids and relative profit above seed costs for 37M81 at the Onondaga farm and 3752 at the Seneca farm in New York in 1999, 2000, and 2001.

	Yield				Relative profit			
	Onondaga farm		Seneca farm		Onondaga farm		Seneca farm	
Hybrid	Field 1	Field 2	Field 1	Field 2	Field 1	Field 2	Field 1	Field 2
	Mg ha^{-1}				\$ ha^{-1}			
				1999				
37M81	9.08	9.67	5.92	6.42	21.28	46.12	–	–
3752	8.74	9.06	6.38	6.72	–	–	43.24	27.60
				2000				
37M81	7.42	7.72	7.92	7.19	86.60	110.52	–	–
3752	6.37	6.41	7.40	7.13	–	–	−37.84	4.48
				2001				
37M81	8.40	10.18	8.49	7.11	113.28	27.72	–	–
3752	7.06	9.77	8.76	7.36	–	–	34.84	33.00

Table 4. Variance (var) component analysis for hybrid response by year, farm, and field.

Variance component	Estimate
Var (year)	0.1152100
Var (farm)	0.3057700
Var (farm × year)	0.0235600
Var field (farm)	0.0024774
Var (error)	0.2417700

provided sufficient information for both growers to select the more profitable hybrid for the two subsequent years.

Most agronomists accept the hypothesis that hybrid testing at a single location is not as accurate as multilocation testing for selecting the best hybrid to plant at that single location in subsequent years. The basis for this hypothesis, however, is from university studies, which are typically small-plot studies with only two to four replications per location. The results from this study indicate that large-scale plots with 10 to 20 replications throughout the entire field provide sufficient information to select between a new hybrid release and a proven hybrid in that field(s) in subsequent years. Studies with 10 to 20 hybrids are needed to determine if large-scale hybrid plots, replicated throughout an entire field, provide sufficient information to select the best hybrid(s) among many hybrids in that field for subsequent years.

Variance component analysis confirmed that farm effects on hybrid response were much more pronounced than year effects (Table 4). The variance component for the year × farm interaction was relatively small, which is especially notable because weather conditions during the three growing seasons were highly variable. The variance component for fields-within-farm was very small, indicating that tests from a single field in 1999 generally provided sufficient information for the two fields on the farm in 2000 and 2001. Nevertheless, the large variance component for the error term, mostly attributed to the greater yield of 37M81 on Field 1 at the Seneca farm in 2000, indicates that testing hybrids on fields with different soil types within a farm will improve the precision of on-farm testing. The large variance component for farms indicates the importance of on-farm testing of these two hybrids. Interestingly, Pioneer Hi-Bred characterized 37M81 vs. 3752 as performing better in high-yielding fields as well as in droughty situations (Joe Meyer, personal communication, 2003). 37M81 yielded greater than 3752 at the high-yielding Onondaga site but yielded less at the Seneca site in the droughty 1999 and 2001 growing seasons. The results from this study indicate that broad characterizations of hybrids can but do not always hold true on individual farms.

Economic Analysis

The relative profit on the purchase of a yield monitor, solely used to test corn hybrids, depends upon the costs associated with the purchase of a yield monitor, differences in seed costs between hybrids, number of hectares that a farmer would plant to the selected hybrid, and the corn price. If the Onondaga farmer substituted as little as 20 ha of 37M81 for 3752 in 2000 and 2001, the additional revenue from the higher corn yields approximates the sum of the annual costs of the yield monitor, labor cost in using the yield monitor, and additional seed costs for the new hybrid (Table 5). The Onondaga farmer would thus realize a relative profit in the first two years after purchase by planting a minimum of about 25 ha to 37M81. Nevertheless, the relative profit on the purchase of a yield monitor, even with planting 320 ha to 37M81 ($79 ha^{-1}), did not equal the relative profit above seed costs for planting 37M81 at the Onondaga farm without on-farm testing. The Onondaga farmer would have realized the greatest profit by following the seed company recommendation to substitute 37M81 for 3752 without on-farm testing. The new hybrid, however, does not always yield better, as observed at the Seneca farm.

Table 5. Relative profit per hectare for investing in a yield monitor or using previously owned field scales to select and plant 37M81 at varying corn hectares in 2000 and 2001 at the Onondaga farm in New York.

	2000		2001		Mean		
Hectares	Field 1	Field 2	Field 1	Field 2	Field 1	Field 2	Mean
	$ ha^{-1}						
	Relative profit with yield monitor						
20	1.66	25.58	28.33	−57.22	15.00	−15.82	−0.41
40	43.88	67.80	70.56	−15.00	57.22	26.40	41.81
80	65.04	88.96	91.72	6.16	78.38	47.56	62.97
160	75.62	99.54	102.30	16.74	88.96	58.14	73.55
320	80.96	104.88	107.64	22.08	94.30	63.48	78.89
	Relative profit with field scales						
20	36.52	60.44	63.20	−22.36	49.86	19.04	34.45
40	61.55	85.47	88.23	2.67	74.89	44.07	59.48
80	74.06	97.98	100.74	15.18	87.40	56.58	71.99
160	80.32	104.23	107.00	21.44	93.66	62.84	78.25
320	83.44	107.36	110.12	24.56	96.78	65.96	81.37

The use of field scales would have resulted in greater relative profit at the Onondaga site although differences in relative profit between the yield monitor purchase and use of previously owned field scales was small at 320 ha because of lower fixed annual costs (Table 5). The two hybrids, however, had significant spatial yield differences in Field 1 in 1999 and 2001 at the Onondaga farm (Fig. 1). 3752 yielded as well or greater than 37M81 in the eastern region of the field where the farmer enters from the road with his equipment. Farmers, who are very busy at harvest, prefer not to drive half-empty truck loads across field scales, so they plant a limited number of strips or plant hybrids in blocks within fields (Uricola, 2003). If the Onondaga farmer had planted a limited number of strips in the eastern region or had planted 3752 in the eastern and 37M81 in the western half of Field 1 in 1999, the results would have been misleading. Although the fixed annual costs for a yield monitor are more than for field scales, the use of a yield monitor probably results in more precise information on hybrid testing. Farmers who already use field scales for hybrid testing should consider the advantages of wide-scale field testing with the use of a yield monitor because it lowers the risk for erroneous test results.

The relative profit on the purchase of a yield monitor at the Seneca farm was negative from 20 to 320 ha because

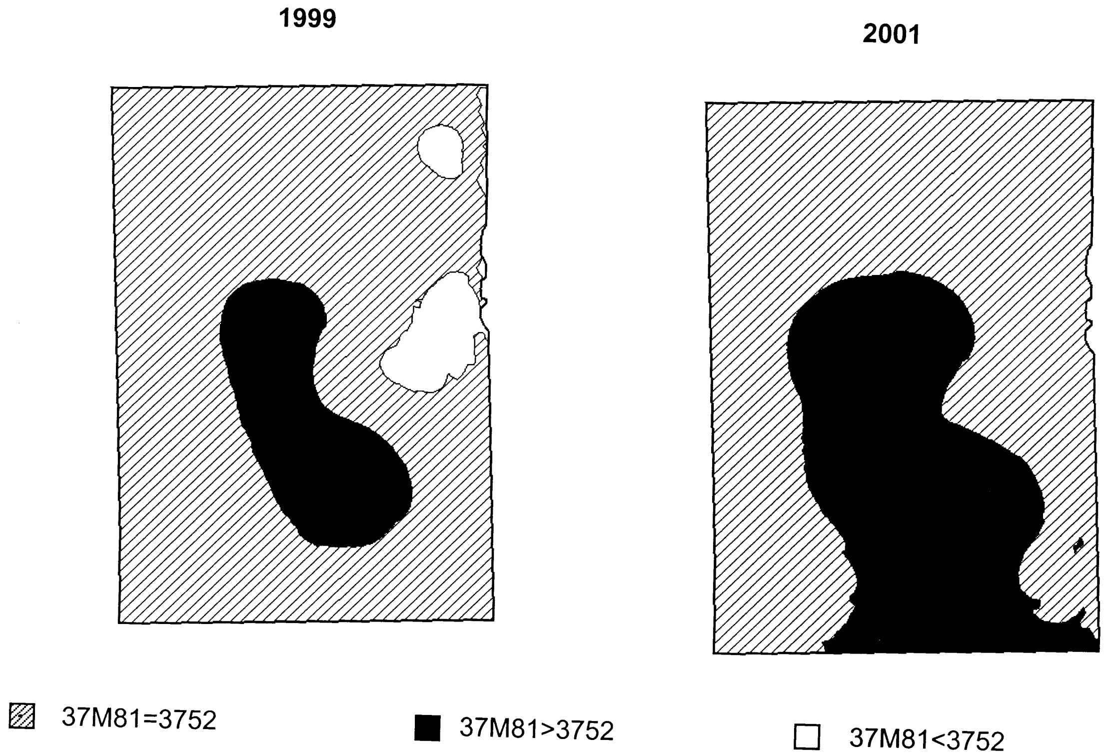

Fig. 1. Corn yield differences between hybrids at Field 1 on the Onondaga farm based on LSD interaction values (1.0 Mg ha^{-1} in 1999 and 1.4 Mg ha^{-1} in 2001).

the savings in seed costs with 3752 did not offset the annual fixed costs and labor costs of a yield monitor (Table 6). Swinton and Lowenberg-DeBoer (1998) stated that yield improvements are likely to have a much greater impact than marginal savings on input costs with the purchase of a yield monitor. Nevertheless, the negative return on the purchase of a yield monitor with the planting of 3752 on about 250 ha approximated the negative return above seed costs ($-\$9$ ha^{-1}) for planting 37M81 without on-farm testing at the Seneca farm. The negative return with the use of field scales for hybrid testing approximated the negative return above seed costs by planting 3752 instead of 37M81 on about 140 ha (Table 6). The Seneca farmer would have realized the greatest relative profit by using field scales or a yield monitor for hybrid testing if the costs were spread across enough hectares.

The results at the Seneca farm, however, were inconsistent across years in both fields with 37M81 yielding more in 2000 and 3752 yielding more in 2001. If the farmer had initiated testing these two hybrids in 2000, he would have selected the wrong hybrid in 2001. Bowerman (1998) has reported that multiyear testing is superior to single-year testing when selecting the best hybrids. Farmers who conduct on-farm testing should consider the improved precision for multiyear testing.

Table 7 shows the yield increase required at varying hectares planted to the new hybrid release at varying corn prices to attain the break-even point for the purchase of a yield monitor. Break-even yield increases range from 0.88 Mg ha^{-1} at 20 ha to 0.15 Mg ha^{-1} at 320 ha planted to the new hybrid release at a corn price of \$0.108 kg^{-1}. The purchase of a yield monitor is obviously scale-biased toward large farms because the cost is spread over more hectares. Break-even yield increases ranged from 0.45 Mg ha^{-1} at a corn price of \$0.069 kg^{-1}

Table 6. Relative profit per hectare for investing in a yield monitor or using previously owned field scales to select and plant 3752 at varying corn hectares in 2000 and 2001 at the Seneca farm in New York.

	2000		2001		Mean		
Hectares	Field 1	Field 2	Field 1	Field 2	Field 1	Field 2	Mean
	\$ ha^{-1}						
	Relative profit with yield monitor						
20	−132.76	−90.43	−60.08	−61.92	−96.42	−76.18	−86.30
40	−90.53	−48.21	−17.85	−19.69	−54.19	−33.95	−44.07
80	−69.37	−27.05	3.31	1.47	−33.03	−12.79	−22.91
160	−58.79	−16.47	13.89	12.05	−22.45	−2.21	−12.33
320	−53.45	−11.13	19.23	17.39	−17.11	3.13	−6.99
	Relative profit with field scales						
20	−97.98	−55.66	−25.30	−27.14	−61.64	−41.40	−51.52
40	−72.86	−30.54	−0.18	−2.03	−36.52	−16.28	−26.40
80	−60.35	−18.03	12.33	10.49	−24.01	−3.77	−13.89
160	−54.10	−11.78	18.58	16.74	−17.76	2.48	−7.64
320	−50.97	−8.65	21.71	19.87	−14.63	5.61	−4.51

Table 7. Required yield differences between hybrids with a \$10 bag^{-1} difference in seed costs at varying hectares and corn prices to cover the costs of a yield monitor.

	Corn price (\$ kg^{-1})					
Hectares	0.069	0.088	0.108	0.128	0.147	0.167
	Mg ha^{-1}					
20	1.38	1.08	0.88	0.74	0.64	0.57
40	0.76	0.60	0.49	0.41	0.36	0.32
80	0.46	0.36	0.29	0.25	0.21	0.19
160	0.30	0.24	0.19	0.16	0.14	0.13
320	0.23	0.18	0.15	0.12	0.12	0.09

to 0.19 Mg ha^{-1} at a corn price of \$0.167 kg^{-1} at 80 ha planted to the new hybrid release. Obviously, corn growers should consider the expected area planted to corn and the expected corn price when deciding to purchase a yield monitor for hybrid testing.

CONCLUSION

Seed costs of some corn hybrids have increased significantly in recent years because traits such as pest resistance and herbicide resistance have been added to the seed. Seed costs will increase even more in the near future with the addition of new traits and/or stacked traits, which will increase the importance of hybrid selection. Many growers rely on seed company recommendations for hybrid selection, which are based on hybrid testing of mostly company hybrids within the region or state. Although we tested only two hybrids in this study, the hybrids occupied 10% of the grain corn acres in New York and performed differently across farms. Furthermore, a split-planter hybrid study in 1999 identified the more profitable hybrid to plant at each farm when averaged across the 2000 and 2001 growing seasons. We recommend to corn growers who plant more than 200 ha of corn, especially in states where a few seed companies dominate market share and universities test a limited number of hybrids, to conduct split-planter hybrid tests to determine if new hybrid releases outyield proven high-performing hybrids. If the farmers currently do not conduct on-farm hybrid testing, we recommend that they purchase a yield monitor instead of field scales, despite higher fixed annual costs, because of the potential for more precise testing. If the farmers currently conduct on-farm hybrid testing with field scales, we recommend the continued use of field scales because of cost savings, provided that the farmers conduct split-planter studies with a number of strips or replications throughout the field. Once the field scales incur significant maintenance costs, we recommend the purchase of a yield monitor because of the potential for more precise testing, savings in time at harvest, the additional yield information that can be obtained on all the fields, and the potential for improved record-keeping.

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