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Precision Farming and Land Leasing Practices

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Description/Abstract:
Precision farming practices may influence precision farmers' preferences for alternative forms of land lease and may influence the relationships negotiated between landlord and tenant. This paper discusses attributes of cash and share leases, the two primary lease types employed in Ohio, discuss principles of lease design to mitigate perverse economic incentives, suggest implications of precision farming for the choice of lease type. Evidence is presented from the 1999 Precision Farming Survey and the 2001 Precision Farming Case Studies that may shed light on how precision farmers are controlling land through lease.

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Precision farming (PF) is an emerging technology that may allow farmers to better allocate inputs to specific cropland areas based on soil type, fertility levels, and other endowments of that site. Precision farming incorporates four technologies: Remote sensing, geographic information systems (GIS), global positioning systems (GPS), and process control. The consequence of reducing the scale of land area that is managed uniquely is to substantially reduce the number of cropped acres for which inputs are either over- or under-applied. This has significant implications for the magnitude of farm receipts, variable input costs, fixed investment costs, and profitability. It may also hold positive consequences for the environment.

Precision farming practices may influence precision farmers' preferences for alternative forms of land lease and may influence the relationships negotiated between landlord and tenant. In the following presentation I will discuss attributes of cash and share leases, the two primary lease types employed in Ohio, discuss principles of lease design to mitigate perverse economic incentives, suggest implications of precision farming on the choice of lease type, and present evidence from the 1999 Precision Farming Survey and the 2001 Precision Farming Case Studies that may shed light on how precision farmers are controlling land through lease.

Cash Leasing of Cropland

The cash lease is the simplest form of land lease, involving a cash payment for the use of farmland for a specific period of time. Beyond simplicity, the advantages of the cash lease are:

- Greater management freedom for the operator
- Tenant can benefit from windfall profits or earnings from better management
- Lesser record-keeping requirements for operator.

Two of these advantages may be particularly attractive to the precision farmer. Precision farming is management intensive. Crop management decisions are made at the level of small grids or management zones within the field. Potentially, a number of inputs may be applied variably across the field, implying a large number of decisions. A landlord that wishes to be heavily involved in fertility management and other decisions may be a significant hindrance to the precision farmer. In this sense, the precision farmer may value the management freedom of the cash lease. Also, to the extent that precision farming adds to business profitability, the cash lease tenant can fully capture the benefits of the technology.

Simplicity often translates into weaknesses or disadvantages as well. Such is the case with cash leasing. Potential disadvantages of cash leasing of farmland include:

- Higher risk (yield, price and financial)
- Cash rents may rise over time may due to tenant’s excellent management ability.
- Landlord has less incentive for durable investments.

The risk issue may be important to the precision farmer. Additional machinery investments will mean greater amounts of capital at risk, and, with everything else equal, greater financial risk. The impacts of precision farming on production and price risk are unknown at this time. Also, because cash leases typically are a function of the productivity of the land, to the extent that precision farming results in increased yields over time, the landlord and other farmers may attribute this increase to the land, resulting in an upward bidding of the cash lease rate for the parcel. Finally, because the landlord does not share in the returns for production, he/she does not have a direct incentive to make capital improvements, including application of drainage improvements or lime applications, investments that precision farming may identify as important.

There are a number of factors that influence the cash lease rate. The productivity of the soil and size of the parcel are extremely important as argued in the previous paragraph. However, the cash lease is determined in a market environment characterized by many landlords and tenants. Landlords would like to negotiate a rental rate sufficient to cover their costs of ownership, which vary greatly depending on market value of land, real estate tax rates and similar costs. Potential tenants wish to pay an amount small enough so that expected returns for farming the land are positive. Negotiations between these two parties, influenced by the relative numbers of possible landlords and tenants in the market, will determine the final terms of the lease.

How might precision farming modify this negotiated price? To the extent that precision farming results in greater profitability, these farmers may be willing to bid more for the leased land. Currently, we do not know if precision farming typically increases profits. We do know that precision farming profitability will vary depending on the situation in which it is applied and the skill of the manager. Table 1 summarizes the sources of costs and returns that the precision farmer may face, and give some guidance as to whether PF will be profitable in a particular situation, and how this might impact that farmers willingness to bid for cash leased land.

Clearly, yield will be impacted by the application of precision farming. However, it is difficult to argue the direction of change for yield. In Table 1, I suggest that average yields could increase, decrease, or remain approximately constant. It is almost certain that, with application of a PF system that allows regulation of several inputs, yields on some sites (field locations) will increase while others will decrease. That is, PF will identify both areas of uneconomic over- and under-application of inputs. With correction of the over-application of inputs, yields will decrease and with correction of the under-application of inputs, yields will increase.

Price received clearly will impact gross receipts. Assuming that the farm was reasonably well managed prior to PF adoption, crop quality for most crops is not likely to change sufficiently to impact price. However, for crops for which price is very sensitive to quality, PF may result in improvements of quality and thus higher prices. Also, if crops are grown that have special characteristics (e.g., high lysine corn, organic crops, etc) that will command premium prices, PF may allow improved ability to preserve the identity of these crops through better record-keeping and mapping of production sites.

The number of acres harvested is also an important determinant of total receipts. In Table 1, I suggest that harvested acreage is likely to remain constant or decrease with precision farming adoption. PF technologies are management intensive. Assuming that the farm manager provides much of the decisionmaking and that the farm manager was fully employed prior to PF adoption, he/she may be challenged to maintain the existing acreage. Over the next decade we are likely to see new technological innovations that will release this restraint on farm size. For example, if on-the-go soil testing and other forms of diagnostic/prescriptive remote sensing are developed many of the analytical and decision processes can be automated, greatly reducing manager time requirements of PF.

Table 1. Crop Enterprise Budget with Addition of Precision Farming Technology

Returns: (price*yield*acreage)		
	Yield	Constant, increase or decrease
	Price	Constant or increasing
	Acres	Constant or decrease
Total Returns		???
Variable Costs:		
	Data costs (Grid sampling, mapping, remote sensing)	Increase
	Fertilizer/lime material costs	Constant, increase or decrease
	Fertilizer/lime application fees	Increase
	Pesticide material costs	Constant, increase or decrease
	Pesticide application fees	Increase
	Labor, management	Increase
Total Variable Costs		???
Fixed costs:		
	Depreciation	Increase
	Interest on Investment	Increase
	Development of management *human capital*	Increase
Total Fixed costs		Increase
Profit		???

The direction of change of farm total gross receipts is indeterminate (Table 1). It will depend on the relative increase or decrease in average yields, change in commodity prices, and change in enterprise size. These, in turn, will be influenced by site-specific factors. As we gain more experience with PF, scientists will be better able to judge the relative contribution of each of these parameters.

The adoption of a precision farming system is expected to result in changes in both variable and fixed costs. Specifically:

Data Acquisition Costs: Precision farming is an information intensive technology. As such, data acquisition costs will be substantial, at least for early forms of the technology. Georeferenced soil sampling and scouting for weed, insect, and disease pests can represent sizeable production expenses.

Fertilizer and Pesticide Materials: Fertilizers, including agricultural lime, and pesticides represent major sources of costs for crop producers. However, the direction of change for these costs is not clear (table 1). For sites that have had a history of uneconomical over-application of nutrients or simply have a soil type that is nutrient rich, grid sampling may reveal that fertilizer applications can be reduced. Other sites, perhaps within the same field or farm, may reveal that nutrient application rates should be increased from the uniform rates previously applied. Thus the sign for fertilizer material costs will vary by site and circumstance. The same argument holds for pesticide usage. If weeds (or pests) are patchy, spot spraying may be an option so that at many sites herbicide (pesticide) applications will be zero. Gains may also be possible for preemergence herbicides. Research has suggested that different rates of herbicide application may be required on different soils. Thus, a variable rate application of these materials based on soil type and other parameters may allow cost savings.

Fertilizer and pesticide application costs will clearly increase with variable rate application of these inputs (table 1). Anecdotal evidence suggests that service firms charge a premium of $2.00 or more for variable rate application of fertilizers relative to a uniform application. Even if the individual owns the variable rate application equipment, application costs are expected to rise to due increased labor costs associated with the application.

Labor and management are inputs that will not be regulated by the PF technology, but rather are required inputs. PF is an information technology. With the current state of the technology, human intervention in the decision process is quite important, and implies a substantial time commitment on the part of the manager. Thus, in table 1 I have suggested that these input costs will increase with PF adoption.

Fixed costs represent those inputs that are invariant with the level of production. Generally, these are annualized costs associated with durable capital investments -- for instance, the depreciation, interest on investment, and insurance costs associated with durable capital such as yield monitors, computers and software, GPS equipment, VRT application equipment, and other necessary equipment. Also, the fixed costs of learning how to use the PF system can be important. Clearly, fixed costs can be expected to rise with adoption of precision farming.

Profits are the difference in total receipts and total costs. The change in profits with the addition of PF technologies cannot be determined in general -- it depends on the circumstances for the specific farm. Total receipts will either rise or fall with PF adoption for a particular farm. Similarly, variable costs can either rise or fall, depending on the magnitude of input savings (if any) realized with PF. Only fixed costs are predictable, rising with PF adoption. The change in profit will depend on the relative magnitude of changes in the cost and revenue categories.

Share Leasing of Cropland

Share leases specify that the landlord will receive a specified share of the crops produced in exchange for the use of the land by the tenant. The landlord will typically also share the costs of inputs that vary directly with the level of production. These types of leases are very popular in the Midwest. There are a number of advantages and disadvantages of this lease method that the farmers should consider when making a choice of lease type.

Advantages	Disadvantages
Less operating capital required	Less managerial freedom
Risks (price, income, financial) are shared with Landlord	Greater accounting requirements
Landlord may provide valuable management	Accounting rigor, conflict potential, etc. increase with the number of landlords.

Clearly, less operating capital is required with share leases because the landlord provides a share of the operating inputs. Similarly, because the lease is paid with a share of the crop, production and price risks are shared with the landlord. The landlord does have a vested interest in the outcome of production, and thus has an incentive to assist in the best management of the system. Because the precision farming system is information intensive, a knowledgeable landlord may be able to contribute significantly with information about soil types, drainage characteristics, or other information that might be useful in management zone definition or identification of ways to improve input allocation on individual field locations. Clearly, there is a strong tension between this advantage and the first listed disadvantage -- loss of managerial freedom. Whether this is a net advantage or disadvantage depends on the quality of the landlord's knowledge and his/her willingness to share this in an efficient manner.

Other disadvantages include greater accounting requirements and conflict potential with share leases. Because the landlord shares input costs, all input costs must be accounted for at the landlord level. Similarly, crops will need to be carefully segregated through the marketing channel to ensure each landlord receives his or her appropriate returns. Also, because the landlord has a vested interest in the crop outcome, landlords may try to influence when planting, harvest, and other activities occur or to otherwise influence the management process. These disadvantages will increase in magnitude as the number of landlords increases.

The design of the share lease can have an important consequence on the incentives for correct input allocation. The following principles are important to guide the development of the share lease:

Principles to guide share lease terms

1. Variable expenses that increase yields should be shared in the same percentage as the crop is shared.
2. Share arrangements should be adjusted to reflect effect of new technology.
3. Landlord/tenant should share returns in same proportion as they contribute resources.
4. Tenants and Landlords should be compensated at lease end for undepreciated long-term inputs.

The first principle states that variable expenses that increase yields should be shared in the same percentage as the crop is shared. Figures 1 through 3 demonstrate the importance of this principle. Figure 1 describes the allocation of a variable input (nitrogen fertilizer) in the production of a crop. The marginal value product (MVP) curve indicates the value of output produce by each additional unit of input. This curve is consistent with a production function that increases at a decreasing rate with more N. Clearly, the MVP curve will ultimately reach zero and become negative with increased N. The optimal amount of N to apply in this case is that associated with the equality of MVP and the marginal input cost (MIC) for N. This suggests that the rational farmer will continue to apply N as long as the value created from the last unit applied at least equals the cost of the input. The optimal amount of N to apply in this case is N* units. Note that this is the case of the owner operator, who faces 100 percent of the cost of the input costs and realizes 100 percent of the yield. It is worth noting that this also is the case for the cash lease operator because this operator also pays 100 percent of costs and receives all outputs

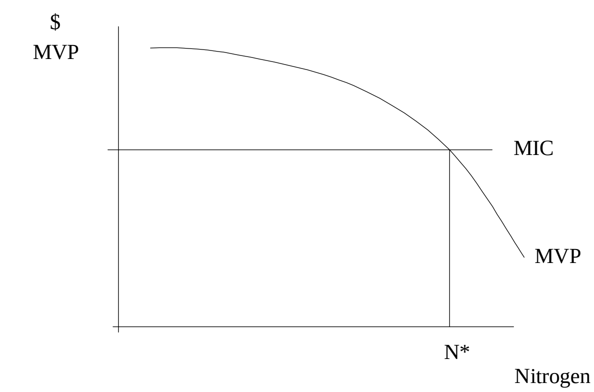


Figure 1. Profit maximizing level of N fertilizer – Owner-operator

Figure 2 illustrates input allocation in the case where the landlord and tenant each share 50 percent of yields and all variable costs. MVP_T represents the total value produced by the nitrogen fertilizer, .5*MVP represents the value of output earned by the tenant. Similarly, the value of the input is shared between operator and landlord on a 50 percent each basis. Thus, the MIC for the tenant is one-half of the total MIC (.5*MIC). The profit-maximizing tenant will apply N to the point where .5*MVP = .5*MIC. Figure two illustrates that this is the same allocation in nitrogen, N^*, that would be made by the owner-operator.

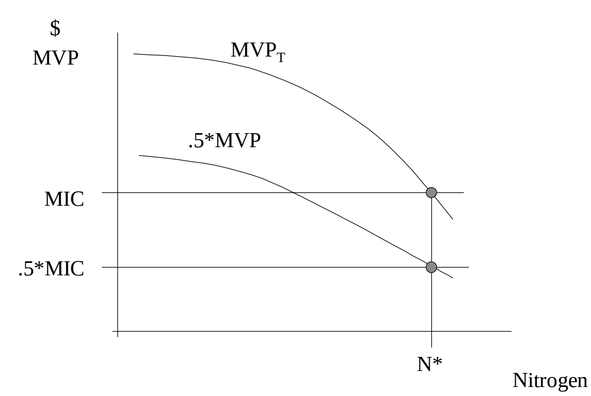


Figure 2. Profit maximizing N Fertilizer –50/50 Share lease

Figure 3. Profit maximizing level of N Fertilizer – 50/100 Share lease

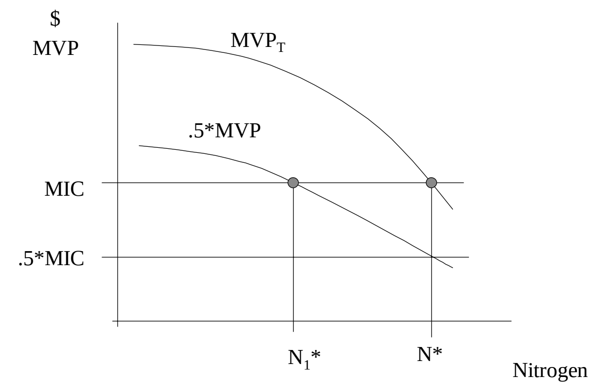


Figure 3 illustrates the consequences when operator and landlord share costs and returns in different proportions. In the example, the tenant receives 50 percent of yield (thus the .5*MVP curve is appropriate), but must pay all costs of the variable input (MIC). Hence, the profit maximizing level N input is determined by the point of equality of the .5*MVP and MIC curves. This implies N_1^* units of nitrogen fertilizer is profit maximizing from the tenant's perspective. Although this is the best input allocation under these lease terms, both landlord and tenant could earn higher profits under a lease designed as in figure 2.

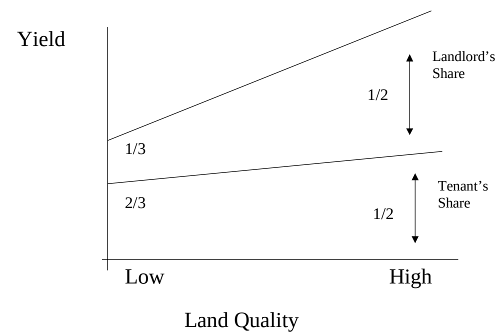
There are several implications for precision farmers. Clearly, output increasing variable inputs such as fertilizers should be shared between landlord and tenant. When inputs are applied variably across the field, the input allocation at each site must be shared in this same manner. Also, the costs of variable application of the inputs, and any associated costs such as costs of grid soil sampling to support the variable application of inputs, should also be shared in the same manner as is yield.

The second principle is that share arrangement should periodically be adjusted to reflect the effects of new technology. If the technology is yield increasing, then the lease terms should be altered so that operator and landlord share the costs associated with the technology. If the new technology is essentially one of input substitution -- e.g., herbicides substituted for mechanical tillage -- then the costs of the new technology should be borne by the party originally responsible for that input. Finally, if the new technology both increases yields and substitutes for other inputs, terms of the lease should be negotiated to have some but not full sharing of the costs of the new technology. Some examples for precision farming include:

Technolgy	Effect	Sharing
Variable rate planting	Changes yield and variable costs	Shared fully
Variable rate fertilizers	Changes yield and variable costs	Shared fully
GPS navigation systems	Substitutes for manual guidance but may increase efficiency of input application.	Operator provided or may negotiate a partial sharing

The third principle suggests that landlord and tenant should share costs and yields in the same proportion that they contribute resources. A good example of how these shares may differ can be explained based on the quality of the land contributed by the landlord (figure 4). The costs faced by the operator are relatively constant whether farming on poor or good soils, however, the costs faced by the landlord increase with the value of the land, which generally is a strong function of land quality. Thus as land quality increases, the share earned by the landlord typically increases.

Figure 4. Output shares for land of differing productivity.



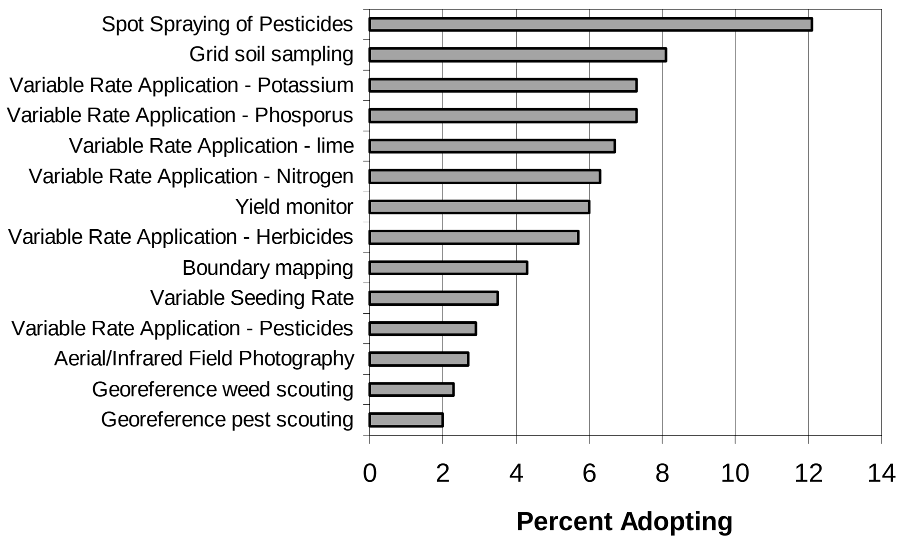
There may be implications for precision farming because the precision farmer may be contributing more to the production process in the form of increased capital equipment (precision farming tools) and managerial inputs. Thus, over time precision farmers may expect to negotiate leases with greater shares to the tenant than are common in the area.

Evidence from the 1999 Precision Farming Survey

The 1999 Ohio Precision Farming Survey was administered by mail to a representative sample of all Ohio farmers. In March 1999, 2,500 farmers were contacted. Responses were received from 1,351 producers, 782 of whom were farming and completed the survey. The characteristics of the sample respondents matched closely the age and size distributions of the 1997 Census of Agriculture.

Adoption rates for various precision farming components differ greatly (Figure 5). The four most frequently adopted precision farming practices are spot spraying of pesticides, georeferenced grid soil sampling, and the variable rate application of phosphorus and potassium fertilizers. The least frequently adopted practices include GPS-based spot spraying of herbicides, georeferenced field scouting for weeds, pests and disease, aerial field photography, and variable rate application of pesticides. Overall, about 24% of the surveyed farmers have adopted at least one precision farming practice.

Figure 5. Adoption of Precision Farming Technologies by Ohio Farmers



Adoption of precision farming technologies is strongly associated with increased farm size and other characteristics of the farmer. For instance, adoption rates for yield monitors vary significantly as shown in Figure 6. Fifty percent of the largest group of farmers have adopted yield monitors. Even within this group, the largest farmers are more likely to adopt as indicated by the fact that 70 percent of the acreage farmed by the largest group was harvested with yield-monitored combines.

There are important differences between the precision farming and non-precision farming groups. Precision farmers are defined here as those who have adopted at least one of the practices identified in figure 5. Precision farmers are younger, they have a greater reliance on leased land, and they are less likely to have a livestock enterprise in the business. Farm size is substantially larger for the precision farming adopers, with an average farm size about 350 acres larger than the non-adopters. There were no significant difference in the level of formal education between the two groups.

Figure 6. Adoption of Yield Monitors on Ohio Farms by Sales Class

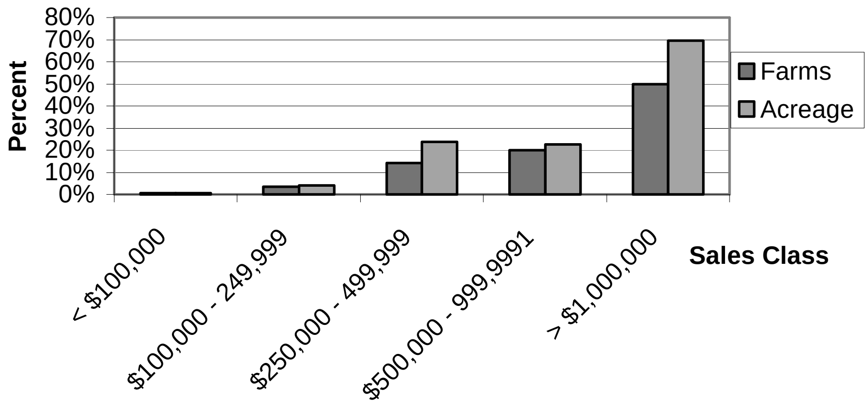


Table 2. Differences in farmer and farm business characteristics for precision farming adopters and Non-adopters.

	PF[a]	Non-PF[a]
Operator Age	50.6	53.0**
Percent with post-High School Education	38.4	38.1
Tenancy (%)	55.1	39.7***
Farm size (acres)	810.4	462.4***
Livestock (percent of gross)	26.0	32.7*
Organization		
Sole proprietorship (%)	70.8	80.1
Partnership (%)	23.4	14.2
Corporation (%)	5.1	4.3
Other (%)	0.7	1.3
Percent full time farmers	72.2	66.0
Debt to Asset ratio (%)	18.5	16.3
Farm Business Gross Income	381,151	187,025
Net Farm Income	70,603	21,280

* one, two, and three asterisks indicate significance at the 0.1, 0.05, and 0.01 probability levels, respectively.
a PF -- Precision farming adopters. Non-PF -- Precision farming non adopters.

Table 3 provides information about the relative usage of ownership, cash leasing and share leasing by precision farming adopters and non-adopters. Precision farmers do use significantly larger percentages of leased land than non-adopters. Precision farmers make greater relative use of share leasing than do non-adopters -- 32 percent of the leased land farmed by precision farming adoters was share leased, versus 28 percent for the non-adopters.

Table 3. Land control methods for PF and non-PF farmers

	PF[a]	Non-PF[a]
Land control		
Percent owned	45.19	65.09***
Percent cash leased	37.46	28.66***
Percent share leased	17.68	11.08***

* One, two, and three asterisks indicate significance at the 0.1, 0.05, and 0.01 probability levels, respectively.
a PF -- Precision farming adopters. Non-PF -- Precision farming non adopters

Precision farmers paid higher cash rental rates than did non-adopters, and leased land from a greater number of landlords (table 4). Precision farmers also indicated higher average yields for corn, soybeans and wheat than did non-adopting farmers. These relationships also hold true when the analysis is restricted to cornbelt counties only, thus these differences do not appear to be the result of location differences within the state. The higher yield results could be an indication that precision farming does raise average yields, or it may suggest that precision farming adopters are typically better managers, that they tend to select more productive land for rental, or that they simply have better yield data due to yield monitors and are reporting more accurate (and higher) yield estimates.

Table 4. Cash rental arrangements

	PF[a]	Non-PF[a]
Cash rent ($/acre)	76.9	65.6***
Number of Landlords	4.7	3.8*
Crop Yields (bu/ac)		
Corn	136.2	127.1***
Soybeans	45.4	43.3***
Wheat	60.6	55.9***

* One, two, and three asterisks indicate significance at the 0.1, 0.05, and 0.01 probability levels, respectively.
a PF -- Precision farming adopters. Non-PF -- Precision farming non adopters

Tables 5 and 6 provide information regarding differences in share leasing between precision farming adopters and non-adopters. The most substantial finding is that there are no statistically significant differences in share leasing terms between these two groups. Crop yield shares are essentially equal between the groups, ranging from 52 to 56 percent of the yield to the operator. There also were not significant differences in the crop yields reported for the two groups.

Table 5. Share lease - Yield Sharing

	PF[a]	Non-PF[a]
Number of Landlords	2.6	2.3
Crop Yields	Bu/acre	
Corn	134.9	131.6
Soybeans	44.4	44.3
Wheat	59.3	57.4
Crop yield share to operator	Percent	
Corn	54.9	55.7
Soybeans	52.9	53.3
Wheat	52.6	52.2

* One, two, and three asterisks indicate significance at the 0.1, 0.05, and 0.01 probability levels, respectively.
a PF -- Precision farming adopters. Non-PF -- Precision farming non adopters

There also is no statistically significant evidence of any difference in the operators share of variable input or application cost between adopter and non-adopter groups (table 6). For both groups, the variable inputs were generally shared at approximately the same percentage as yield was shared. However, the operator tended to pay a somewhat higher percentage of application costs -- typically about three-quarters of the cost of application.

Table 6. Share lease - Costs Sharing

	PF[a]		Non-PF[a]	
Crop Expense share (%)	material	application cost	material	application cost
	Percent			
Seed	58.8	82.4	58.6	77.6
Nitrogen fertilizer	59.1	74.1	57.7	72.8
Phospahe and Potassium fertilizer	60.5	71.7	56.9	71.3
Lime	47.2	51.0	50.6	59.8
Burndown herbicides	60.4	74.0	59.2	73.4
pre-emergence herbicides	58.3	74.0	59.1	73.5
post-emergence hervicides	58.9	76.9	59.4	74.0
Insecticies	58.2	72.3	57.2	71.4
Combining costs charged landlord	Dollars per acre			
Corn	18.00		16.60	
Soybeans	17.70		17.10	
Wheat	16.60		16.00	

* One, two, and three asterisks indicate significance at the 0.1, 0.05, and 0.01 probability levels, respectively.
a PF -- Precision farming adopters. Non-PF -- Precision farming non adopters

Surveyed precision farmers were specifically asked how the operator and landlord shared costs of grid soil sampling and variable rate application of fertilizers and lime. Results are presented graphically in figure 7. The most common arrangement (50% of responses) was that the operator and landlord shared these costs on a 50 percent each basis. However, the other large group (45%) indicated that the operator paid 100 percent of grid soil sampling and VRT application costs. The other five percent had the landlord paying either 70 or 100 percent of these costs. It is possible that these latter cases are associated with land lease among family members or other unusual circumstance.

Figure 7. Operator/Landlord Sharing of VRT Application Fees and Grid Soil Sampling Costs

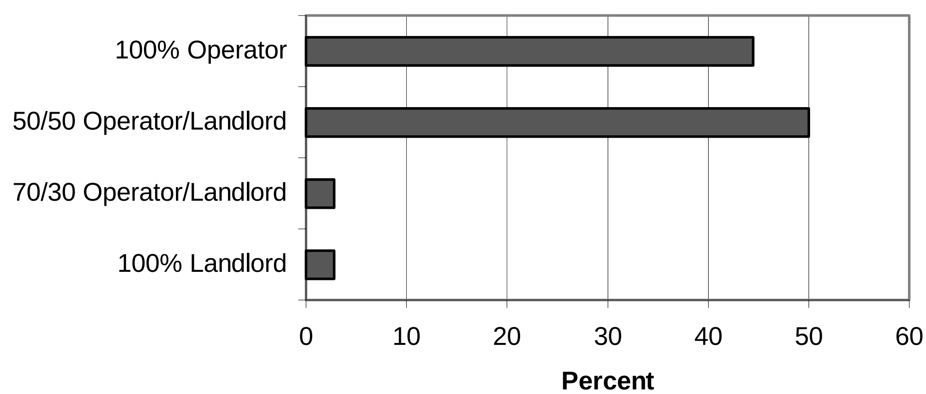
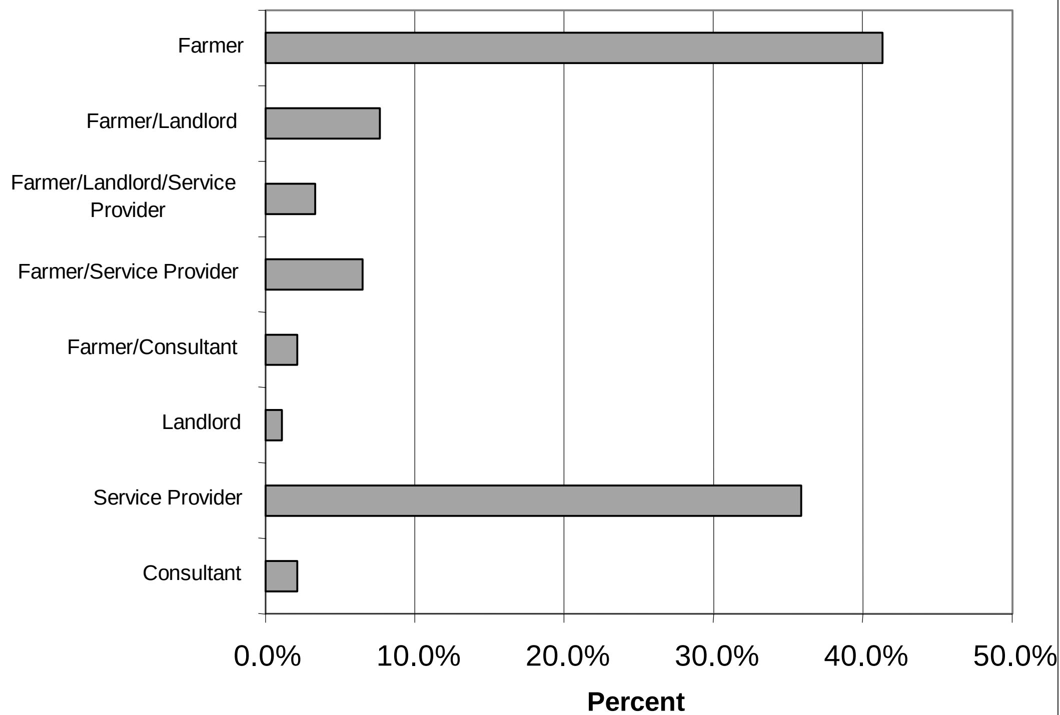


Figure 8 asked the precision farming respondents to further characterize who owns the data associated with site-specific soil sampling and yield maps. A number of options were presented. However, in a relatively few cases were any ownership rights indicated of the landlord. Most felt the farmer (operator) owned this data. Surprisingly, many also indicated the service provider or consultant also had some ownership rights to the data. It is unknown whether this is an indication of true ownership rights or if some farmers are simply indicating that the service provider has retained possession of these data.

Figure 8. Who Owns Soil Test and Yield Map Data?



Evidence from the 2001 Precision Farming Case Studies

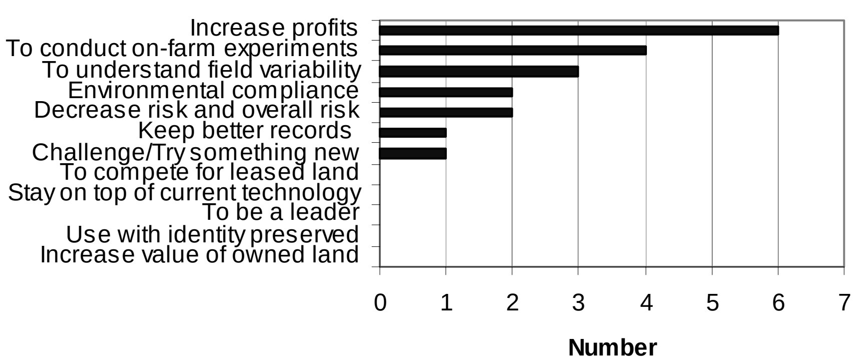
During the winter of 2001, case study research was completed for six leading Ohio precision farmers. Its purpose was to illustrate the types of systems used, the value these farmers perceived they derive from the system, and the changes that resulted in how they managed their farms.

All six cases are fulltime farmers. All have earned a high school diploma, and three have some college education. The participants have been actively farming for a range of 4 to 38 years. Total gross sales in 2000 ranged from $250,000 to over $1,000,000. All six are grain farmers, although one grower also has a large livestock enterprise. Acres farmed in the year 2000 ranged from 1,350 to 3,400. Five of the six growers own and actively use at least one personal computer for business activities. In nearly all cases there were other family members involved in the operation of these farms. The six cases are located in various regions of the state and thus operate under different soil and topography conditions.

A look across the six cases studied reveals a number of similarities and a number of unique things. The case farmers are early adopters of this technology. Five growers have been using at least one precision farming technology since 1995. The four most commonly used precision farming technologies in this case study were yield monitors, GPS receivers, GIS maps and software, and georeferenced grid or zone management soil sampling. All six growers are currently using all four of these precision farming technologies on nearly all the acres they farm. Although variable rate application of inputs is thought of as an important element of precision farming, only half of the case farms are using VRT application of N, P or K nutrients, only one is doing VRT application of herbicides, and only two are planting with variable seed populations or site-specific variety selection.

The case farmers generally made important use of leased land, ranging from about 10 percent leased land to nearly 90 percent leased land. However, the case studies do not allow many conclusions specific to land leasing. Farmers were asked to identify the most important motives for adopting precision farming technologies. These are summarized in Figure 1. One motive presented to these farmers was *To improve the farmers ability to compete for leased land*. Although land leasing was important to these farmers, none of the six identified this as one of the top three motives for adopting the technology.

Figure 9. Number of Farmers Citing as First, Second or Third Most Important Motivation Factor



Summary

Choice of land lease method can be an important decision for farmers. Those farmers who have adopted precision farming technologies may differ from non-adopters in how these lease types may suite their operations. Managerial freedom may be particularly important due to the complexity of the decision environment for these farmers.

Results from the 1999 Precision Farming Study suggested that precision farmers do make heavy usage of leased land. Furthermore, they tend to make somewhat heavier use of the cash lease method than do non-adopters. For those precision farmers who chose share leases, there was no evidence that there were any important differences in the terms of the lease shares.