PURDUE UNIVERSITY

PURDUE AGRICULTURAL ECONOMICS REPORT

FEBRUARY 2005

The Economic Drama of Soybean Rust in 2005

Corinne Alexander, Craig Dobbins, Chris Hurt, and George Patrick

Asian soybean rust has arrived! The economic consequences of this disease will be a drama, but not a tragedy as rust can be managed. Brazilian farmers have demonstrated that they can manage the disease without severe reductions in national yields. However, it requires new understanding of the life cycle of rust, and especially how to identify and treat the disease. Every indication is that USDA, Land Grant Colleges, fungicide companies, local custom spray companies, and especially U.S. soybean producers are rising to this new challenge, and that we too will a be able to manage soybean rust.

National Impact: USDA's View: The arrival of Asian soybean rust in the United States in 2004 is expected to negatively impact soybean producers, consumers, and animal producers. The magnitude of this impact will depend on the timing, location, spread and severity of rust outbreaks, and on the responses by soybean producers.

U.S. producers can look at the lessons learned from Brazil's experiences. Asian soybean rust arrived in Brazil in 2001. USDA estimates that the least affected of their three rust influenced crops experienced a two percent yield reduction due to rust and the most affected was a six percent yield reduction from rust. However, in two of these three years, Brazilian yields were still above trend. At least two points need to be considered when comparing the U.S. situation to Brazil's experience.

First, unlike the U.S., Brazil has a much larger portion of their bean production in areas where Asian rust over-winters. Secondly, even in the presence of rust, weather still will likely have more impact on yields than a rust infestation. Regardless of the impacts on yields, rust has had a major impact on production costs with Brazilian producers spending over $600 million on fungicides in 2003, increasing production costs by 15 percent.

Asian Soybean Rust

USDA released an economic analysis of the anticipated impacts of soybean rust on U.S. producers in April 2004 (Livingston et al.). The analysis is based on estimates of the probability that the climatic conditions will support the establishment of rust in different regions of the U.S. and assumes that the treatment costs will be $25/acre. The study examines yield impacts ranging from a worst case of a 9.5 percent decrease in yields to a best case of 0.9 percent increase in yields, as well as a moderate case of a 4.3 percent decrease in yields.

In the first year of introduction, USDA estimates that in the worst case of a 9.5 percent yield loss, the total economic cost of rust would be $1.3 billion. The majority of the economic cost would fall on soybean producers to the tune of around $1 billion per year. A portion of the cost will also fall on consumers in the form of increased prices for retail products made from soybeans, and also on livestock producers because of higher prices for soybean meal. These impacts suggest that soybean producers would bear

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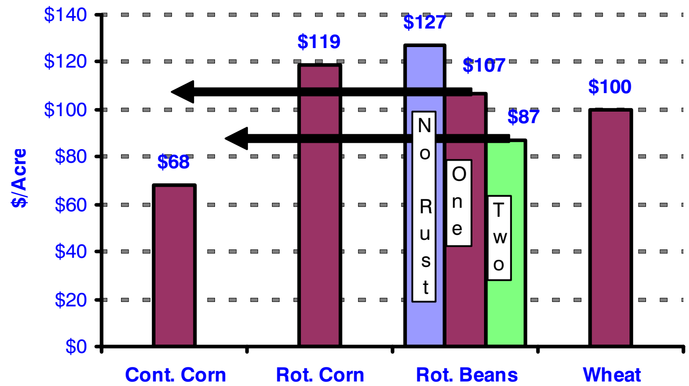
Figure 1. 2005 Estimated return to land, labor, and machinery resourses (excluding government payments)



about 75 percent of the cost of the disease. Even in the best case, with a 0.9 percent yield increase, soybean producers would face loses on the order of $674 million due to the increased costs of treatment. After 3 years with moderate infestation, the USDA study predicts total soybean acreage would decline between two and five percent with about 70 percent of the negative consequences falling on U.S. soybean producers, 25 percent on consumers, and five percent on livestock producers.

Consistent with Brazil's experience, the USDA study shows that soybean rust will primarily have an impact on production costs rather than soybean yields. As a consequence, the majority of the negative impact of rust falls on the soybean producer as higher costs that will not be totally compensated by higher soybean prices.

Purdue Agricultural Economics Report is a quarterly report published by the Department of Agricultural Economics, Purdue University.
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Regional Differences in the U.S.

The likelihood of soybean rust establishment is expected to vary greatly by region. The Southeast, Appalachia, and the Delta are predicted to have climatic conditions favorable to the establishment of rust on the order of 83, 78, and 66 percent of crop years, respectively. Due to the predicted frequent occurrence of soybean rust, USDA expects the regions to reduce soybean acreage 13.3, 11.3, and 10 percent, respectively. The Corn Belt is predicted to have rust-favorable climatic conditions 70 percent of the crop years and result in reduced soybean acreage by 2 percent. In contrast, the Lake States, North Plains, and South Plains are predicted to have favorable climatic conditions for rust only 59, 54 and 38 percent of the crop years, respectively. Consequently, these regions are expected to increase soybean acreage one to two percent.

Indiana may be in the 60 to 80 percent susceptible area, with the higher probabilities further east and south. Since Ohio and Indiana may be more susceptible to rust than the Lake States and the Western Corn Belt our reduction in soybean acreage because of rust will likely be greater than further north and west. This also likely means a shift to more corn acres in our region over time which will tend to moderately reduce corn prices relative to the Western Corn Belt. Overall, this may also help stimulate some increases in animal production in the Eastern Corn Belt as feed ration costs will decline since declining corn prices are more important than rising soybean prices in the final ration costs.

Producer Decisions in Indiana

Estimates are that Indiana producers have 60 percent to 80 percent probability of rust infestation in any given year. No one knows the exact probabilities! What is known is that the costs of treatment can be expensive. In January of 2005 our estimates are $13 to $16 per acre per for materials and application fees of $5 to $6 per acre, total costs in the range of $18 to $22 per acre. Costs will vary by farm based upon fungicides used and specific equipment costs. However, for this analysis an average cost of $20 per acre per treatment was used.

Should Indiana producers stick with their nearly 50/50 corn/soybean rotations or shift more heavily to corn in 2005? For most that are near the 50/50 rotation already, the alternative to fewer bean acres is to plant more corn. This will mean increased acres of 2005 corn that was already in corn in 2004. Thus, the question of the economics of corn-on-corn becomes important to evaluate.

Purdue agronomists suggest that yield reductions could be in the range of six percent to 12 percent with continuous corn. The reasons are potential buildup of disease, insects, and weed pests. In addition, costs of production are higher for continuous corn due to the need to apply more nitrogen (no N contribution from the previous year's soybean crop).

Our analysis assumes a 10 percent yield decrease from corn-on-corn and a $23 higher cost per acre for added nitrogen and pesticide costs. As shown in Figure 1, the economic results of shifting more acres to corn would be discouraging under these assumptions. Using anticipated new crop prices from early February 2005, returns above variable costs per acre for soybeans was $127 without fungicide treatment. This compared with $119 per acre for rotation corn, but only $68 for continuous corn (see Purdue Crop Guide for costs estimates http://www.agecon.purdue.edu/extension/pubs/). Again, returns for continuous corn are low because of the 10 percent yield reduction and higher costs for additional nitrogen and pesticide. Experienced producers will make their own assumptions.

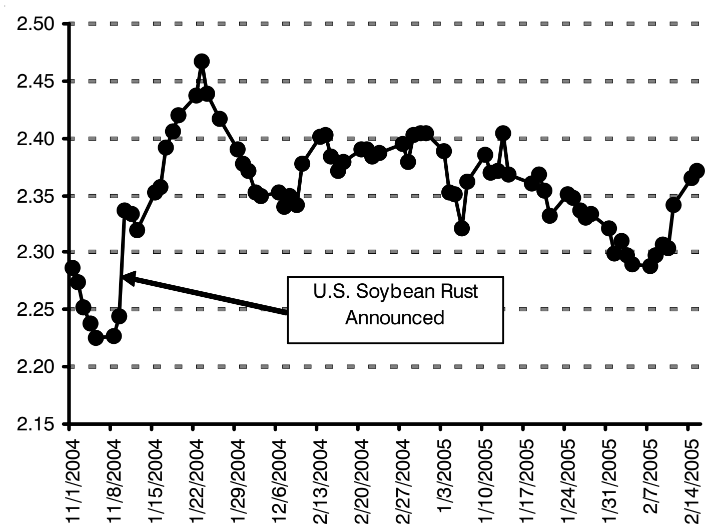
If one application of fungicide is required, this would reduce the soybean returns from $127 above variable costs to $107. If two applications were required, this would reduce soybean returns to $87 per acre above variable costs. Thus, soybean returns, even with up to two fungicide treatments, would far exceed returns for continuous corn with these assumptions.

Two additional concerns arise for producers when corn acreage is increased relative to soybeans. The first is that more corn acres mean it will be more difficult to achieve optimal planting/harvesting dates for all corn acres. Secondly, movement to a higher percent of corn acres in 2005 may distort rotations for 2006 and later years. As one producer stated, "I can avoid soybean rust in 2005 by planting all corn. But in 2006, if I want to go to all soybeans, I will have 100 percent of my acres exposed to the rust uncertainty. Maybe it's better to just take the rust exposure on 50 percent of my total acres in both 2005 and 2006!"

How Will Markets React to Rust?
The threat of rust also raises questions of how marketing and pricing decisions should be adjusted. First, some thoughts on how market prices may behave this winter and spring. Since rust increases the potential costs of raising soybeans, producers will build those expected higher costs into their 2005 planting decisions. If there is a large intention to cut-back bean acres, then new crop bean prices would rally sharply. How much? Enough to give a sufficient number of producers a high enough price premium to overcome their higher expected costs such that the needed acres of soybeans are planted. This might be observed as a rise in the price prospects for new crop soybeans relative to corn. In fact, in Figure 2 you can see that the November soybean futures did rise relative to December corn futures on November 10, 2004 with the announcement that rust had been found. Soybean futures prices continued to rise relative to corn for nearly two weeks and have moderated since, but are still well ahead of the pre-November 10th rust announcement. It is likely that the market will provide producers with a $10 to $20 per acre expected higher return to take the chance on raising soybeans in 2005 and thus being subject to the potential high costs for fungicide application.

The uncertainty of rust is causing many producers to be less willing to sell old crop beans, or to forward price 2005 new crop soybeans. Soybean buyers, on the other hand, are more aggressive buyers of both old and new crop soybeans and soybean futures. Buyer response may have increased prices by 30 to 50 cents per bushel above what they would be in the absence of potential rust in 2005. This "rust premium" was probably quickly built into the market soon after the November 10th announcement. This can be very roughly

Figure 2. Ratio November 2005 Soybean Futures to December 2005 Corn Futures



approximated as the increase of 40 cents per bushel in old crop March 2005 futures from November 9th to November 23rd and in the 52 cent increase in the new crop November 2005 futures during the same time period.

For 2005 soybean prices, the presence of rust in the U.S. increases the uncertainty of both acreage and yield. Greater uncertainty generally means greater potential for volatility in prices. Greater volatility simply means there may be very poor times to price soybeans and much better periods to price. Since the presence of rust increases uncertainty, producers are encouraged to diversify their pricing strategies, especially spreading their sales over multiple time periods. For example, imagine how cheap soybeans could get this summer if a favorable growing season develops and rust does not become a major threat to the soybean crop by mid-July. Alternatively, if a wet spring would delay soybean seeding and rust is moving northward by mid-June, soybean prices could move rapidly upward.

How does rust affect the potential prices for the 2005 crop? If soybean acreage is down four percent and yields are trimmed two percent below trend, then production would be around 2.8 billion bushels. We expect this to be about 65 million bushels under usage, thus ending stocks for the 2005 crop would drop to 375 million bushels and prices would average about 20 cents per bushel higher than the 2004 crop. While it is still very early to know much about the 2005 crop, the point is that even facing rust, major increases in price are not expected given these assumptions.

In the longer-run, assuming resistant varieties are not available, soybean prices will adjust upward to reflect the higher potential costs for rust treatment and the returns from alternative crops in each region. Overall, it means that soybean prices will be higher than they would have been in the total absence of rust.

Crop Insurance Considerations

The arrival of soybean rust has implications for producers' 2005 crop insurance decisions. In 2004, Indiana producers insured 64.2 percent of Indiana crop acres. Insured corn acres were 67 percent and soybean acres were 62 percent. The most popular products, accounting for 81 percent of the insured acres, were the individual producer-based products including Actual Production History (APH), Crop Revenue Coverage (CRC), Revenue Assurance (RA), and Income Protection (IP). The remaining insured acres were county-based products including Group Risk Plan (GRP) and Group Revenue Insurance Plan (GRIP). GRP and GRIP are based on county average yields/revenue, not individual producer's yields. Indemnities are paid if county average yields/revenues are below the "trigger" yield/revenue due to insured causes, including soybean rust. This means that individual producers could receive an indemnity without having a loss, but a producer may also have a loss with no indemnity because county yields/revenues are above the "trigger" level.

For the individual crop insurance plans, soybean rust will be a covered peril and the producer is expected to use good farming practices. This means if soybean rust is in the area, producers must make an attempt to spray a recommended fungicide at the correct application rate regardless of cost, and document all details of the application if a potential claim is filed. Insurance coverage for rust losses would also apply if there are no available fungicide supplies. It remains unclear if rust insurance coverage would apply if custom applicator spray equipment was not available. Producers should consult with their crop insurance agent about the insurance company's expectations in terms of documentation from fungicide suppliers or custom spray firms if they are unable to treat their soybeans in a timely manner.

The critical questions that claim adjustors will consider are:

- Could the producer have applied the recommended fungicides in a timely manner?
- Were the fungicides applied in a *timely* manner at the rate for optimal control *regardless of cost*?

Crop insurance adjusters will most likely make claim decisions on a case-by-case basis for the 2005 crop until better guidelines can be developed. Again, it will be critical for producers to document their rust monitoring and spray activity. Claims of losses from rust may be denied without such documentation.

How does the introduction of rust affect soybean insurance decisions for 2005? Crop insurance premiums are based on historical losses. Since rust is a new risk, 2005 premiums will not reflect this increased risk. Consequently, crop insurance in 2005 may be considered a better deal than it was in 2004. Overall, the new rust threat would tend to cause producers to stay with the insurance they have had, or to increase coverage levels in 2005.

Longer Term Policy Considerations

It is clear that soybean rust is a new threat, but the exact impacts remain uncertain. However, it appears that the negative impacts of this disease are most heavily borne by soybean producers themselves. Since the negative impacts are heavily focused on producers, this raises policy questions regarding the level of public funding for soybean rust damage. USDA and Land Grant Colleges such as Purdue will be working closely to accurately monitor the diseases' spread each year and formulate models to predict where and when fungicide treatment should be made. Additional public research funding to discover more effective or lower cost fungicides and especially increased funding for the search for resistant varieties may be possibilities.

The current farm bill will expire with the 2007 crop year. As the next farm bill is debated in 2006, the involvement of public funding for soybean rust will likely be considered. A more enlightened discussion of public policy needs and alternatives can occur after the U.S. has a year of experience with rust in 2005.

Summary

Soybean rust is a new enemy that the soybean industry will have to live with. It adds uncertainty for 2005 and increases producers' anxiety levels. The experiences of Brazilian producers indicate that through early identification and proper treatment rust can be managed such that it does not have a major impact on yields. However, it is costly to treat, and USDA estimates that roughly 70 percent of the costs of this disease will be borne by soybean producers due to extra costs in excess of higher soybean prices. Consumers will also bear about 25 percent of the negative impacts as higher prices for soybean products, and animal producers will share about five percent of the negative consequences as higher soybean meal costs.

Eastern Corn Belt producers have been exploring how the potential for rust infestation impacts their production, marketing, and management practices. Generally, the answer is that the "best management practices" before rust tend to remain the "best management practices" for 2005. As an example, planting soybeans earlier, or moving to an earlier group bean could both result in somewhat earlier bean maturity and thus potentially reduce rust treatment costs, but both of these practices have a tendency to reduce yields.

"Soybean rust is a new enemy that the soybean industry will have to live with."

In 2005, producers should consider staying with their most profitable crop rotation in the past. For 2005, at least, the alternative for most Eastern Corn Belt producers who have been close to a 50/50 corn/soybean rotation is to increase acres of corn. This would mean planting more corn on acres that were in corn last year. The consequences are higher costs for additional nitrogen and pesticides, and potentially lower yields. Under the assumptions in this analysis, continuing with rotation soybeans provided superior returns to corn-on-corn even if soybean acres required two fungicide applications.

Soybean market prices for the 2005 crop have already adjusted upward relative to corn given the expectation of higher costs for soybean production. The amount of this "rust premium" is likely in the range of 30 cents to 50 cents per bushel and is roughly equal to the anticipated higher costs of treatment for rust.

The expected treatment costs will be higher in areas such as the Deep South and the southeast U.S. where rust may have an 80 to 100 percent probability of spread and where their long growing season may require more fungicide treatments. These areas are likely to reduce acreage proportionally more than the country as a whole. Indiana may be in the 60 to 80 percent susceptible range while Minnesota, western Iowa, and South Dakota may be only 40 to 60 percent susceptible. Overall, the rust premium may equate to a $10 to $20 per acre premium for soybeans. The higher the treatment costs for an area, the more the percentage reduction of soybean acres, unless their alternative crops have even lower expected returns.

Most producers should not make major changes in their marketing programs due to rust. The potential for rust does however increase the uncertainty regarding acreage and yields in 2005, and thus may increase the potential variability of prices through the year. This means that a more diversified pricing strategy could be considered.

Producers are considering implications for their crop insurance selection in 2005 as well. They should first review why they have made their insurance selections in the past and how the threat of rust might change those selections. Rust will be a covered disease for insurance claims in 2005; however, producers will have to demonstrate that they used good management practices to treat for the disease. For 2005, soybean rust is a new threat that is added to all previously existing threats, yet insurance premium costs will not yet reflect this added threat. Therefore, most will want to either stay with their 2004 insurance coverage, or somewhat increase soybean coverage levels.

Finally, USDA, Purdue and other Land Grant Colleges will be working closely to monitor rust and to make spraying recommendations in 2005. Soybean rust is likely to cause policymakers to consider additional ways the public can assist soybean producers including funding for soybean rust research and education.

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Purdue Soybean Rust Web Site. http://www.agriculture.purdue.edu/soybeanrust/




Corinne Alexander (Row 1 l) is an Assistant Professor; Craig Dobbins (Row 1 r) is a Professor; Chris Hurt (Row 2 l) is a Professor; and George Patrick (Row 2 r) is a Professor in the Department of Agricultural Economics at Purdue University.

New Faculty

Joe Balagtas, an assistant professor, joined the faculty in August 2004. He conducts research in the areas of farm policy and regulation, including domestic and international commodity policy, marketing orders, and commodity promotion. Current topics of interest include R&D and promotion funded by commodity check-offs, the economics of animal identification, and the implications of the WTO for U.S. commodity programs.

Dr. Joe Balagtas

Joe's recent work addressed issues affecting the U.S. dairy sector. Publications include an analysis of regional dairy compacts, returns to R&D for new uses for dairy products. He has also analyzed the impact of the Australia-U.S. free trade agreement, and the welfare effects of milk marketing orders.

He enjoys sharing research insights with undergraduates in his class on agricultural markets. Joe lives in West Lafayette with his wife and two sons.

You may reach Dr. Balagtas by E-mail: <balagtas@purdue.edu>.

Value of More Uniform Nitrogen Application Across the Toolbar

Bruce Erickson, Fulgence Mishili, and Jess Lowenberg-DeBoer

While the application of some crop inputs is becoming more precise, many corn growers continue to apply one of their most important crop inputs in a very inexact way. With conventional technology, anhydrous ammonia application is difficult to control and application may vary widely from knife-to-knife and one part of a field to another. The goals of this research were to test the economic consequences of nitrogen application variability across the toolbar, and the profitability of investing in equipment to reduce application variability.

Anhydrous ammonia is often the nitrogen (N) choice for corn producers since it is relatively less expensive per unit of actual nutrient compared to other nitrogen fertilizers. And although it has some unique human safety issues, ammonia is held tightly to soil particles upon application to the soil, putting it in a favorable view from an environmental loss standpoint. With a boiling temperature of -28°F, anhydrous ammonia is necessarily stored and transported as a pressurized liquid. As it is applied, ammonia moves by its own pressure from the tank out through metering devices and a distribution manifold that allocates the ammonia among hoses leading to row outlets. Ammonia begins to change to a gas as its pressure decreases, occupying a far greater volume. Since the metering and distribution is by volume but nutrient amounts are by weight, the actual amount of nitrogen applied can vary dramatically.

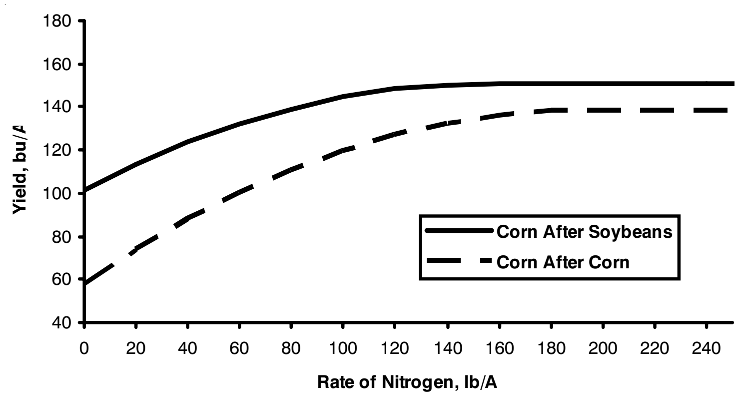
The difficulties of ammonia regulation can result in significant application variability. Nebraska on-farm measurements show an average of a 16 percent variation among different parts of fields Other research has shown a high degree of knife-to-knife distribution variability. Testing at Iowa State University has shown row outlet differences from 4 to 16 percent on average from the mean, depending on the rate of nitrogen and the type of manifold used. At a 150 lb/A rate using the conventional manifold, the highest output outlet was putting out about twice the amount of N of the lowest output outlet. Other studies have shown up to four-fold differences among outlets. To compensate for variability some growers use higher N rates, so that even the lower rate areas receive enough N for optimal yields.

Equipment manufacturers are claiming that new types of equipment can reduce variability. With nitrogen prices increasing and intense scrutiny of the link between N fertilizer and nitrates in ground and surface water, there is strong interest in ensuring that nitrogen is being applied more precisely. When N was less expensive, higher N rates to compensate for variability made some economic sense, even if it was environmentally risky. With higher N prices more accurate application can help achieve both economic and environmental objectives.

Effects of Non-Uniform Ammonia Applications on Yield

Anhydrous ammonia applicators that do not apply nitrogen uniformly leave an uneven pattern in a field, which should cause a corresponding variation in corn response. Nitrogen responses can be unpredictable and influenced by many factors, but rate response curves remain a foundation of nitrogen recommendations. University of Illinois response functions served as the basis of this analysis (Figure 1).

Figure 1. University of Illinois nitrogen response curves for two crop rotations based 34 site/years, 1999-2003.



To test the ramifications of nitrogen variability, a series of analyses were conducted that simulated corn yields in response to the levels of variability across the toolbar. Three levels of variability of nitrogen rate were simulated in a spreadsheet—a high variability set designed to mimic the application pattern when using a conventional ammonia manifold, a medium variability set that reduces the variability by about half, and a low variability set that mimics a nearly uniform application. Numbers representing the rate of nitrogen applied for knives across a 7-knife toolbar were randomly generated based on the variation and nitrogen rate.

Corn roots extend outward about three feet in all directions, so it was assumed that corn in 30-inch rows would draw as an average from two fertilizer bands. No factor was added for variability among various areas of fields, only for variability across the toolbar.

Average yields resulting from various combinations of nitrogen rates and crop histories (Tables 1

Table 1. Estimated long term yields *for corn following soybeans* by N rate and application variability.

	Rate of Nitrogen, lb/A			
	120	130	140	150
Management Situation	Yield, bu/A			
Low Variability	148.2	149.5	150.4	150.9
Medium Variability	148.1	149.5	150.3	150.8
High Variability	146.6	148.5	150.0	150.5

Table 2. Estimated long term yields for *corn following corn* by N rate and application variability.

	Rate of Nitrogen, lb/A			
	150	160	170	180
Management Situation	Yield, bu/A			
Low Variability	134.2	135.9	137.2	138.0
Medium Variability	134.0	135.6	136.9	137.9
High Variability	133.2	135.0	136.6	137.1

and 2) are based on the Illinois response curves. The long term average yield gain from greater N uniformity across the toolbar is modest. For a corn-soybean rotation the average yield gain from moving from a conventional high variability system to medium variability equipment is only around 0.3 bu/A at the economic optimum N rate for the Illinois response curves of 140 lb/A, and going to the low variability application equipment adds 0.1 bu/A, for a total gain of 0.4 bu/A with the low variability technology. These responses are low since the yield response curves are relatively flat near the economic optimums—changing the N rate has a small affect on yield. The gains are slightly more at lower N rates and for the continuous corn because the N response is greater.

Economic Consequences of Non-Uniform Ammonia Applications

Nitrogen recommendations based on response curves place the economic optimum rate of N at that point where the last pound of N is just paid for by the yield increase from that N. Utilizing the yield information generated in Tables 2 and 3, economic analyses were conducted to determine the relative returns of equipment/variability options, rates of nitrogen, and ammonia knife spacings. The base analysis was calculated using prices from the Purdue Crop Cost and Return Guide (http://www.agecon.purdue.edu/extension/pubs/crop_guide_04.pdf):

Cost of anhydrous ammonia	$0.24/lb
Price of corn	$2.00/bu
Corn acres	1000 acres
Cost of manifold to achieve medium variability	$1000.00
Cost of manifold to achieve low variability	$12,000.00
Equipment life expectancy	10 years
Depreciation and Interest	10%
Variable cost per bushel for corn	$0.63/bu

Variable costs assume nutrients removed by the crop are replaced at a cost of $0.28/lb P_2O_5, $0.14/lb K_2O, $16/T lime. In addition, hauling is charged at $0.20/bu and drying at $0.25/bu.

The results of this analysis are presented in Tables 3 and 4.

Table 3. Estimated long term differences in income for *corn following soybeans* by N rate and application variability.

	Rate of Nitrogen, lb/A			
	120	130	140	150
Management Situation	**Difference in Whole Farm Income**			
Using Low Variability Equipment	-2,153	-1,620	-1,835	-3,282
Using Med. Variability Equipment	-153	482	178	-1,259
Using High Variability Equipment	-1,992	-677	0	-1,492

Table 4. Estimated long term differences in income for *corn following corn* by N rate and application variability.

	Rate of Nitrogen, lb/A			
	150	160	170	180
Management Situation	**Difference in Whole Farm Income**			
Using Low Variability Equipment	-2,956	-1,918	-1,592	-2,524
Using Med. Variability Equipment	-988	-141	243	-448
Using High Variability Equipment	-1,974	-783	0	-1,358

In each table, all combinations are compared to a conventional, high variability manifold. For corn following soybeans (Table 3), the 140 lb/A rate of N was closest to the economic optimum with conventional equipment, so this was chosen as the basis for comparison. For corn following corn (Table 4), 170 lb/A was the nitrogen rate closest to the economic optimum, and was chosen as the basis for those comparisons.

Note in Table 3 for corn following soybeans that it is economically advantageous to utilize equipment that applies ammonia somewhat more uniformly, but the cost of going to a low variability situation is prohibitive if the equipment costs $12,000. Even more advantageous is the combination of investing in medium-variability equipment to minimize low application areas and reducing nitrogen rates, with the economic benefits coming both from uniformity and lower N cost. With more uniform application higher N rates to compensate for variability is no longer the most profitable option. In corn after corn there is an advantage for moving to a medium level of application uniformity, but it is not profitable to use medium uniformity equipment and cut N rates, due to the steeper slope of the corn after corn response curve. No accounting was made for some of the other advantages claimed by manufacturers of precision application equipment, such as an ability to apply ammonia at low temperatures, or more even application from one portion of a field to another from better regulation ahead of the distribution manifold.

A set of sensitivity analyses were conducted to test the consequences of changing nitrogen costs and grain prices, and the effects of equipment cost and farm size. As expected, higher grain prices, larger farming operations, and less expensive equipment favor the investment in equipment to lower the variability of N rates across the toolbar.

Conclusions

This analysis used long-term nitrogen response curves from Illinois to test the economic benefit of greater uniformity in nitrogen application. The analysis shows that in the long run over many crop seasons, the yield gains to greater N uniformity may be quite modest. For example, the analyses suggest a long-run gain of less than a half bushel per acre for a corn-soybean rotation. At current prices this modest yield gain may justify an investment in an improved manifold which would reduce the application rate variability by about half, but more expensive equipment which provides an almost uniform application may be difficult to justify on benefits of N uniformity alone. The right decision for a specific farming operation depends on grain prices, fertilizer cost, site-specific N responses and other factors.

For More Information

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New Faculty

Professor Brigitte S. Waldorf joined the Department of Agricultural Economics in January 2005, recently a professor at the University of Arizona, Tucson. She received her MA degrees in mathematics and in geography from the Heinrich Heine Universität Düsseldorf, Germany, and her Ph.D. in geography and regional science from the University of Illinois. She has held faculty positions at Princeton University, and Indiana University. Dr. Waldorf is a regional scientist interested in the overlapping realms of demography, housing and transportation, with an emphasis on spatial processes and regional development. Her expertise includes integrated models of demographic dynamics and their linkages to housing markets, land use, and transportation. These models allow her to analyze economic as well as social implications of, for instance, aging populations, fluctuations in fertility, residential relocation, and immigration. She has published in renowned national and international journals.

Dr. Brigitte S. Waldorf

Professor Waldorf's teaching includes courses on quantitative methods and models, as well as demographic analysis. She received an award for outstanding teaching at the graduate level, and her courses have attracted students from a wide variety of fields, including economics, epidemiology, renewable natural resources, engineering, business and planning. Her academic career has a strong international focus. She is involved in joint projects with researchers from England, The Netherlands, Spain, Australia and Mexico. She has taught not only at U.S. universities but also at the Heinrich Heine Universität Düsseldorf, Germany, and at the Universidad de Ciudad Juárez, Mexico. As a council member of the Regional Science Association International, she represents the North American Regional Science Council and she is an active member of the international regional science community.

2005 Agricultural Economy Can't Match Last Year

Farm income was at record high levels in both Indiana and the nation last year. It was an extraordinary year with high grain prices in the first-half of the year and record yields in the last-half. Low prices for corn and soybeans late in the year brought huge financial support from government payments as well. The animal sector also had an outstanding year with record high prices for milk and cattle at the farm level, and very good hog and poultry prices. Lower feed costs in the last-half of 2004 also stimulated incomes from animal enterprises.

The tune is different for 2005 however. The cropping sector is now facing much lower commodity prices and will likely need to rely on government programs again this fall. Costs of production look to be up sharply again this year, and a return to normal yields will mean many fewer bushels to sell. Asian soybean rust is a new threat that may add substantially to producers' costs for treatment but not provide a substantial increase in soybean prices. The animals sector appears to be the most positive with strong anticipated returns for producers of beef, milk, pork, and turkey. A sharp drop in expected egg prices may push that enterprise into losses. Our early estimates are for Indiana net farm income to be fairly close to the longer-run average for the year. Here's a look at individual components of the 2005 outlook.

General Economic Outlook

Larry DeBoer

The United States economy is in the fourth year of expansion, and is nearing capacity. Real Gross Domestic Product (GDP) grew 3.7 percent over the past year, as the unemployment rate edged downward to 5.4 percent. Oil price increases caused a spike in the inflation rate, but underlying inflation remained low. The Federal Reserve increased interest rates. The value of the dollar fell.

Expect real GDP growth to continue at 3.8 percent over the next year. Higher interest rates and high oil prices could restrain consumer and investment spending. War spending and big budget deficits mean the Federal government will stimulate growth, but state and local governments will be cutting back. The low value of the dollar should increase exports and cut import growth, adding to GDP growth.

Oil prices rose in 2004. Expect no similar rise in 2005. But Chinese demand will likely grow rapidly for the foreseeable future, so we should not expect a significant fall in the price of oil.

Oil price increases caused a spike in the inflation rate, to 3.4 percent in 2004. Not counting energy and food prices, the "core" rate of inflation was 2.3 percent. The core rate should rise as the economy approaches capacity, but with oil price rises moderating, the inflation rate over the next 12 months should come down to 2.6 percent. Real GDP growth of 3.8 percent is enough to bring the unemployment rate down, a little. Expect an unemployment rate of 5.0 percent by this time next year.

The Federal Reserve likely will increase interest rates by nearly another point in 2005. Expect the 3-month Treasury bill interest rate to rise to 3.2 percent by December. Tighter monetary policy, an economy approaching capacity, and the falling value of the dollar all point to higher long term rates, too. The 10-year Treasury bond rate should rise to 4.8 percent by the end of the year.

There appears to be no recession on the horizon. But there is uncertainty. A rapid fall in the exchange value of the dollar would raise interest rates. The coming retirement of Alan Greenspan in January 2006 could unsettle financial and currency markets as well.

Larry DeBoer is a Professor in the Department of Agricultural Economics at Purdue University.

Food Imports as Large as Exports

Philip L. Paarlberg

Agricultural exports and imports for the United States are expected to be equal in fiscal year 2004/05 at $56 billion. Compared to the 2003/04 year, U.S. agricultural exports are lower because the decline in global commodity prices outstrips volume increases. In fiscal year 2003/04, U.S. agricultural exports were valued at $62.3 billion – a nominal record. For 2004/05, improved U.S. and global crops have lowered grain and oilseed prices. Export volumes for corn, rice, soybeans, soybean oil and soybean meal are forecast to be higher but not enough to offset lower prices. Wheat, sorghum, barley, and cotton export volumes and prices are forecast lower. U.S. meat export volumes are expected to rise slightly. The weaker U.S. dollar is a positive factor, but the boost to exports lags a few quarters. The expectation is that U.S. beef exports to Japan, Korea, and Taiwan will resume during 2005.

U.S. import value continues to rise as Americans consume more imported food. The weaker U.S. dollar should make imports more costly in the future but the effects are delayed by several quarters. Resumption of imports of cattle from Canada that had been banned due to Bovine Spongiform Encephalopathy (BSE) is scheduled for March 7. Opening the border has become controversial with the discovery of two additional Canadian animals with BSE in 2005. The National Cattleman's Beef Association has withdrawn its support for opening the border and legislation has been introduced to keep the U.S. border with Canada closed to Canadian cattle.

Duties on Canadian hogs announced in the fall are temporary. Converting the preliminary 14 percent anti-dumping duty into a formal duty is being considered. A ruling is expected in March 2005.

Trade negotiations continue. The trade agreement with Central American nations is under consideration in Congress, but faces considerable opposition. Negotiations under the World Trade Organization continue but major progress is unlikely this year due to changes in personnel. The ministerial in Hong Kong set for December is still planned but is not expected to mark completion of the round.

Philip Paarlberg is a Professor in the Department of Agricultural Economics at Purdue University.

Food Price Inflation to Slow

Corinne Alexander

Food shoppers are paying somewhat higher prices than they were last year, but the good news is that food prices are increasing at a slower pace than general inflation for the first time in a year and a half. The smaller price increases are due to increased meat production, moderating energy costs which affect the costs of food processing and transport, and possible stabilization in the costs increases for imported foods as the dollar also stabilizes.

Grocery store prices rose 2.4 percent from December 2003 to December 2004, compared to last year's rise of 2.2 percent. The USDA estimates that grocery store price increases will be in the 3 to 4 percent range for 2005, which is above the rate of core inflation. Restaurant prices are currently increasing at a rate of three percent and are expected to increase in the 2.5 to 3.5 percent range for 2005. While many factors determine retail food prices, the dominant factor will be energy costs.

Food price increases in 2004 were lead by dairy with a 24 percent increase in the price of butter and a 10 percent increase in the price of milk. Fruit and vegetable prices also increased at the end of 2004 due to crop damage from hurricanes in Florida and severe weather in October in California. For example, tomato prices increased 60 percent and grape prices increased 54 percent. Fruit and vegetable prices may be higher in the winter of 2005 due to the severe storms in California this January.

For 2005, the USDA forecasts much smaller food price increases relative to 2004. For example, compared to near record meat price increases in 2004, in 2005 retail prices for beef and veal, pork and poultry are expected to only increase 2 to 3 percent. Egg prices are forecasted to decrease 1 to 2 percent. One explanation for the smaller expected price increases or even price decreases is that the "low carb" diet trend is moderating.

Corinne Alexander is an Assistant Professor in the Department of Agricultural Economics at Purdue University.

Animals Will Be Big Income Contributors

Chris Hurt

Animal enterprises are expected to be important contributors to farm incomes in 2005 led by strong returns for hogs with prices in the higher $40s per live hundredweight for an annual average. The best of the prices are expected this spring and summer, before ending the year in the mid $40s. Build-up of the breeding herd late in 2005, is expected to result in much reduced returns for 2006 and 2007.

Beef cattle will have another very good year. Finished cattle prices are expected to average about $83 for an annual average which is $2 lower than the last two years. Prices should reach the low $90 in late February, but opening of the Canadian border to imports of live animals may trim prices back to the low-to-mid $80s into the spring. End of summer lows could get in to the higher $70 or lower $80. Opening of the beef export market to Japan sometime in the late spring or summer would be a price booster. Cow-calf enterprises had record high calf prices in 2004. Those will be lower by as much as $8 to $10 per hundredweight this year, but will still provide very good profits.

Milk producers had record high farm prices in 2004, near $16 per hundredweight. Those prices are expected to drop to more like $14.50 this year, but lowered costs for feed will help dairies maintain strong margins.

Broiler prices are expected to be only slightly below last year's level and thus lower feed costs will help maintain margins. Prospects for turkey producers improve with prices near 70 cents per pound at Eastern markets. Finally, egg prices are expected to drop sharply from about 82 cents per dozen last years at Eastern markets to only 65 cents this year. Thus, returns to egg producers may be the most vulnerable of all the major animal enterprises.

Chris Hurt is a Professor in the Department of Agricultural Economics at Purdue University.

Crops Prices Will Remain Depressed

Chris Hurt

Substantial reductions in the returns to crops are in store as prices are expected to remain depressed in 2005 given the prospect of a return to normal yields and with much higher production and land costs. Prices of old crop corn are expected to average about $2.00 for Indiana producers. This is down from about $2.50 for the 2003 crop. There remains a lot of corn still to be priced as USDA estimates that ending stocks in the country will be 2.0 billion bushels at the end of August 2005. This is nearly 1.0 billion more than is regarded as sufficient stocks at the end the marketing year.

This winter and spring, the market is burdened by a triple-threat to corn prices: large old-crop inventories, weak exports, and more planted corn acres this spring due to soybean rust. Old crop prices are expected to rise 10 to 15 cents per bushel in the late winter. If a normal crop develops, late summer prices could move even lower as producers try to sell large stocks of corn. Harmful summer weather would, of course, cause some rally this summer, but major price increases should not be expected unless weather is very severe.

With that magnitude of acreage increase and yields at 145.5 bushels per acre, the 2005 crop would reach 10.9 billion bushels. This is expected to be near the level of utilization and thus ending stocks for the 2005 crop would only be reduced a small amount. Prices for the 2005 crop in Indiana then would be about $2.05 per bushel. This would mean that prices would be only slightly better than 2004 and that government payments would again be a major source of corn acreage revenue. Harvest time prices could be expected to be in the $1.70 to $1.90 range across the state, with LDP's in the 20 cent to 30 cent range at harvest. Some new-crop corn pricing should be considered in the spring, especially if prices are 20 cents or more above loan levels. One pricing strategy might be to price new-crop corn at $2.15 per bushel and then expect an additional $.30 of LDP in the fall, as an example. Producers should remember that new-crop prices are generally already down to the loan level, thus the government program protects them if prices should drop even more.

Soybean supplies are also large and oncoming crops in South America threaten to flood the world with beans this spring and summer. The price rally due to dry weather in Brazil should likey be cause for some pricing.

Announcements of soybean rust this summer could be a stimulant to higher soybean prices. These increases however may be limited to 50 to 75 cents per bushel unless weather also becomes a concern.

With a four percent reduction in acreage across the country and a two percent reduction in yields due to rust, soybean production would reach 2.8 billion bushels. This is expected to be less than usage with ending stocks dropping about 50 to 60 million bushels and prices improving about 25 cent to about $5.35 per bushel for Indiana producers for the 2005 crop. At harvest time, prices could still be somewhat below loan. Producers should therefore consider priceing some new crop beans when fall cash bids are above the loan.

Wheat prices are expected to weaken somewhat in the late winter, but lower winter wheat acres likely mean that production will be down enough in 2005 to begin some price increases in the spring and summer.

Input Prices Keep Soaring

Alan Miller and Craig Dobbins

The past few years have seen major changes in the cost of crop production. According to the USDA, for example, the total operating costs of producing an acre of corn in the US increased $27.87 from 2002 through 2004. Which inputs are likely to increase again in 2005 and how much? Also, 2005 brings with it the possibility of a new cost for the production of soybeans, fungicide treatments for Asian Rust. How will the forecast changes in input prices affect crop production costs? And, what do these changes in costs imply for crop margins and crop rotations in 2005?

Chemicals: One bright spot in the input costs picture for 2005 appears to be farm chemicals. The index of prices paid for farm chemicals has been essentially flat in recent years. The price of the different chemicals used to develop the Purdue Crop Guide budgets is expected to decline in 2005. Competition from generic products appears to be a key factor explaining the downward trend. New or reformulated products or products in high demand, such as fungicides used in treating Asian rust are likely to go up instead.

Fertilizers: Prices paid for N, P, and K rose by $129, $45, a $17 per ton, respectively from April 2002 through April 2004. Natural gas futures prices, around $8.50 per MMBtu (million British thermal units) in early November of 2004, tight supplies of urea, and America's increasing dependence on imported nitrogen had analysts concerned about how much higher nitrogen prices might go in the spring of 2005. Fortunately, unseasonably warm weather during December led to lower consumption for heating and more natural gas in inventory. Natural gas prices were more than $2.00 per MMBtu lower by January 2005. Prospects for increasing domestic production have also contributed to the moderation in natural gas futures prices.

Expect that anhydrous ammonia prices will be up 6 to 12 percent again this spring relative to April 2004. Phosphate prices are likely to increase 6 to 8 percent. Potash price increases had lagged behind nitrogen and phosphate since 2002, and are now playing catch-up with price increases from 12–30 plus percent.

Fuels: The price of crude oil in late January 2005 has been moving up. The US imports the majority of its crude oil supplies and usage of global oil production capacity is currently estimated at 99 percent. World demand for oil is expected to grow at a rate of 2.1 million barrels per day in 2005, which is down from the 2.6 million barrels per day growth rate seen in 2004. Growing demand and the tiny amount of excess production capacity worldwide will continue to make price volatility the norm. Lower than expected heating demand in December 2004, an expected decline in the rate of industrial growth in 2005, and more crude oil in inventory contributed to relatively flat diesel prices in the Midwest in early January. At that time, diesel prices in the US were up about 37 cents per gallon from year earlier price levels. The price of propane fuel also climbed markedly from January 2004 to January 2005. Propane inventory in the US was up about 22 percent in late January 2005 over the year earlier inventory due again primarily to lower than expected consumption of propane for heating. The US Energy Information Administration has forecast crude oil prices averaging about $42-$43 per barrel for 2005, which might suggest slightly lower diesel and propane prices at the farm level in the coming months, but expect continued volatility in fuel prices.

"The past few years have seen major changes in the cost of crop production."

Interest Rates: In 2004, concerns about the return of inflationary pressures increased. The Federal Reserve countered by raising the discount rate in small increments last year, which increased short-term interest rates. Short term interest rates appear to have increased by about one-half a percentage point. However, short term interest rates are expected to rise by about one percentage point in 2005.

Seed: Seed prices are expected to be up in 2005 as much as 5-10 percent on average for genetically modified varieties. By comparison, from 2002 to 2004 seed prices in Indiana increased at an annual average rate of approximately 7 percent for corn and 8 percent for soybeans. Farmers have had an opportunity to see the benefits of biotech traits and the seed industry will continue to try to recover the cost of developing new varieties through higher prices. New stacked trait varieties will be among the price leaders. In addition, expect the industry to continue promoting the use of seed to deliver chemical treatments, particularly for early season control and to protect producers' seed investments. Such treatments contribute to the general trend toward higher overall seed prices that has prevailed for the last several years. It is important to remember that these higher seed costs per acre can be offset by lower per acre chemical costs. The stacking of traits may also lead to a yield increase because of reduced plant stress.

Crop Margins Mean Belt Tightening

Craig Dobbins and Alan Miller

Figure 1 illustrates the change in per acre cost for corn, soybeans, and wheat using the estimated costs published in the 2004 and 2005 Purdue Crop Guides (http://www.agecon.purdue.edu/extension/pubs/). Compared to 2004, wheat had the largest percentage increase - 11.4. The increase in per acre cost for continuous corn, rotation corn and rotation soybeans were very similar ranging from 7.3 to 7.6 percent. The highest per acre costs are for continuous corn. This is because of higher nitrogen requirements and the need for root worm insecticide when compared to rotation corn. While per acre seed costs for soybeans can be equal to or greater than corn, lower fertilizer requirements, the smaller volume of grain that must be handled, and the lack of drying expenses results in soybean production costs being $70 less than rotation corn. Wheat continues to have the lowest per acre variable costs.

Crop Margins: To obtain an estimate of the return to land, labor, and machinery resources, crop revenue estimates are needed. The assumed per acre yields for rotation corn, rotation soybeans, and wheat on average Indiana farmland were 143 bushel per acre, 46 bushels per acre, and 68.6 bushels per acre, respectively. Yields for corn-after-corn or continuous corn were assumed to be 10 percent less than those of rotation corn.

A harvest price was estimated using the futures prices in early January and subtracting a typical harvest-time basis. The assumed harvest time price for corn, soybeans and wheat was $2.12 per bushel, $5.23 per bushel, and $2.88 per bushel, respectively.

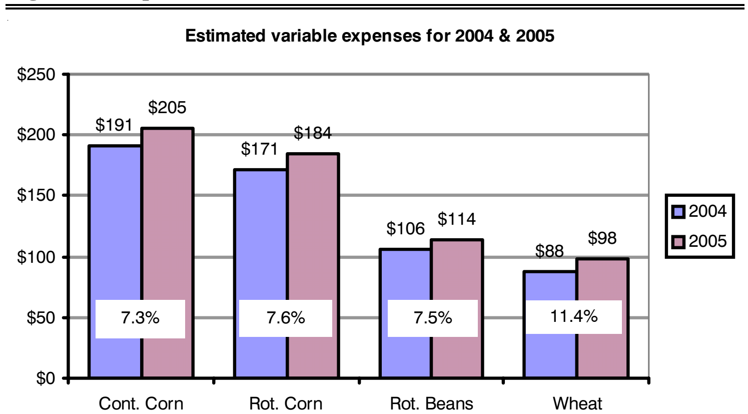
Subtracting the estimated variable costs from estimated harvest time revenues provides a contribution margin of $68, $119, $127, and $100 for continuous corn, rotation corn, rotation soybeans, and wheat, respectively, on average soils. These contribution margins indicate that under our assumptions, rotation soybeans provide the largest contribution margin. However, this estimate does not include any additional charge for the treatment of Asian Rust. Since the discovery of Asian rust in the U.S., soybean production in Indiana has become more risky. Soybean expected returns have been about $8 to $12 more than corn providing a little extra encouragement for producers to take the risk of higher costs for rust treatment.

Crop Rotations: The estimated returns indicate that for average Indiana soils, a rotation of corn and soybeans still provides the best returns. Is the additional $8 in estimated return per acre on the rotation soybeans enough incentive in the face of higher potential costs if rust hits or would it be better plant some other crop this spring? If we select another crop, what crop should it be? For most Indiana farmers, that other crop is corn.

If more corn will be planted this year, that means there will be more corn planted on land that was in corn the preceding year. Agronomic research indicates a significant yield reduction associated with this practice. There are also higher nitrogen and insecticide costs. However, planting soybeans and treating to control rust also increases costs. In addition, there may be reduced soybean yields. If it becomes necessary to apply a fungicide to control rust in soybeans, it is estimated that the cost will be $18 to $22 per acre per application. If we plant soybeans and need to make one treatment to control rust, the estimated return for soybeans would be $107 per acre. This is still well above the estimated return for continuous or second-year corn. A requirement for a second fungicide treatment would reduce the estimated return to $87 per acre. This is still greater than the $68 estimated contribution margin per acre for second-year corn by $19 per acre.

These estimates indicate that by managing problems caused by Asian rust there appears to be little economic incentive to change from a corn and soybean rotation to corn-after-corn. However, the critical issue is your situation. Our estimates assume a reduction of 10 percent for corn following corn. This may not accurately reflect your situation. A smaller yield reduction for second year corn would make corn after corn a more competitive alternative. Our budget for continuous corn also has additional costs for root worm insecticide and nitrogen. In some areas of Indiana, root worm insecticide is required in a corn and soybean rotation. The need to include root worm insecticide in a corn and soybean rotation will reduce the advantage of this rotation relative to continuous corn. These items point out the importance of making projections for your situation. Producers who expect a smaller yield loss when growing corn-after-corn and don't expect variable costs for growing corn-after-corn to increase as much as our budgets indicate should refigure the margins based on their own expectations. These estimates may lead to a different conclusion.

Figure 1. Comparison of estimated variable costs for 2004 & 2005



Alan Miller is a Farm Business Management Specialist in the Department of Agricultural Economics at Purdue University.

Farmland Price Increases Will Slow

Craig Dobbins

The June 2004 Purdue Land Value Survey indicated that the value of average Indiana farmland increased by 7.3 percent over the value reported in June 2003. Since June, surveys of Indiana and other Midwestern states indicate continued strength. The quarterly survey of farmland values conducted by the Federal Reserve Bank of Chicago found farmland values in northern Indiana increased 3 percent between July 1 and October 1, 2004. Farmland values in central Indiana increased 1 percent during this period.

Surveys from other Midwestern states also indicate a strong farmland market. An Illinois survey conducted in August 2004 indicated that farmland values had increased 10 percent since January 2004. An Iowa survey conducted in November, 2004 found land values were up 15.6 percent from the previous year's values, setting a new all time high.

The reasons for the continued strength of the farmland market are much the same as in the past. There is a strong demand for rural residences and development. The 1031 tax-free exchanges that often accompany the sale of farmland to a developer continue to be an important influence in setting the tone of the farmland market. Non-farm investors seeking better returns on their investments and farmers seeking to expand the size of their business also contribute to the demand. While long-term interest rates have increased from their historic lows, this increase has not done much to dampen the enthusiasm of buyers, at least to this point.

What does the future hold? Given the current strength of the market, farmland values are expected to increase over the next year. However smaller expected margins in the year ahead from crop production and rising long-term interest rates are expected to slow the rate of increase. For the year ahead, it is expected that farmland values will increase 4.5 to 5.5 percent.

What could side track increasing land values? Here is a potential watch list: 1) sharply higher long-term interest rates. 2) A serious effort to reduce the federal budget deficit that results in reduced government support payments. 3) A different method of distributing government support payments like tying payments to conservation programs rather than commodity programs. 4) Sharply reduced expectations about the return from crop production resulting from a widespread outbreak of Asian Rust or other major event.

Craig Dobbins is a Professor in the Department of Agricultural Economics at Purdue University.

Cash Rents: Sharpen That Pencil

Craig Dobbins

Because of the desire by many farmers to expand the size of the business, the farmland rental market remains strong. The June 2004 Purdue Land Value Survey estimated cash rent for average Indiana land to be $122 per acre when compared to cash rent values reported in 2003, this was an increase of 1.6 percent. This increase was less than the average annual increase of 2.2 percent for the 2000 to 2003 period.

Corn and soybean yields in 2004 set records in many parts of Indiana. Plus, there were attractive pricing opportunities early in the year. Many of the 2005 cash rents are negociated shortly after harvest, a time that provided more optimistic expectations than the dead of winter. As the market began to abosrb the size of the 2004 corn and soybean crops, prices moved downward. Future market prices for fall 2005 remain low. At the same time, higher fertilizer, seed, machinery, and energy prices have contributed to an estimated 7 to 8 percent upward jump in per acre prodution costs. Budgets using estimated fall prices and higher production costs, indicate that a corn-soybean rotation provides a return to land and other fixed resoruces of only $150 per acre. In spite of this tight margin, the strong demand for land is expected to push cash rents up 1.5 to 2.5 percent, a bit more than was experienced last year.

For 2005, cash rents and crop production margins seem to be heading in opposite directions. It appears that 2005 has the potential for being a year of very tight margins. Given weak revenue and high cost prospects for 2005, producers need to push the pencil, and not let their expectations be inflated by the unusually favorable 2004 returns. With tight margins, it is important to carefully monitor the financial position of the business and where the business is headed. Developing revenue and expense projections for your business this winter may help to avoid an unpleasant surprise this fall.

New Faculty

Raymond J.G.M. Florax joined the Department of Agricultural Economics as a full professor in January 2005. He is originally from The Netherlands. His research centers on spatial and environmental economics, spatial econometric methods, and meta-analysis. He has substantial experience in the assessment of impacts of knowledge and technology on processes of economic growth, and the relevance of location and space in land use, precision agriculture, population-employment dynamics, and socio-economic externalities (for instance, language acquisition by immigrants). Dr. Florax has also worked on environmental issues related to water management and water valuation, and the effect of domestic environmental regulation on international trade.

Dr. Raymond J.G.M. Florax

His contributions to meta-analysis focus on developing quantitative techniques to combine and synthesize knowledge derived from previous quantitative studies. Meta-analysis contributes to gaining a better understanding of the 'state of the art' of our knowledge about a specific topic. Professor Florax has held academic and administrative positions at the Free University in Amsterdam, Wageningen Agricultural University, and the University of Twente, in The Netherlands, and visiting positions at the University of Arizona in Tucson, and San Diego State University as well as the University of Barcelona, in Spain. He is a fellow of the Netherlands Network of Economics, and co-authored numerous publications, in addition to two books and eight edited volumes and special journal issues.

He is a member of two editorial boards, and Editor-in-Chief of the journal "Papers in Regional Science," the official journal of the Regional Science Association International. His teaching career spans a period of more than twenty years, and he has taught courses in macro- and microeconomics, spatial econometrics, spatial economics, meta-analysis, and economic growth, and he has advised numerous graduate students.

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