Corn Production on Sod Ground
Planning Budget and Guide for 2008
(AEC 2008-03)

Introduction:

The market for corn, soybeans, and other grains has increased dramatically over the last two years from historical levels. This rise in the market can be seen graphically in Figure 1 which shows the December 2008 (fall crop) corn futures from the Chicago Board of Trade (CBOT®) for the past two years. Prior to 2007, the price of corn averaged around $2.30-2.50 per bushel. Early in 2006, the market price was just above the $2.50 level and started to increase slowly until surging upward in mid-September, eventually increasing above the $4.00 per bushel mark over that winter. This year, the price of corn increased further and has been well above the $5.00 mark for the last two months. Much of this price increase can be attributed to additional demand for the production of ethanol in the U.S. as well as expanded markets for grains in southeastern Asia.

The market appears to believe this increased demand for corn will not be short-lived. Futures prices out to 2010 are currently trading above $5.00 per bushel. Futures prices are essentially the market expectations for the balance in supply and demand. They may or may not represent the actual price seen for the commodity at the time of harvest. Their accuracy is somewhat like predicting the weather: The prediction for tomorrow's weather (nearby futures prices) is generally accurate, but the weather a week out (next year's futures price) is more likely to change. However, the futures market is still the most accurate farm planning tool that we have related to anticipated market prices.

Futures prices will generally be somewhat higher than what farmers can sell at local grain elevators. The difference is referred to as "basis" and can generally be expected to range between -$.30 and -$.40 per bushel in Kentucky. Currently, the basis for fall 2007 delivery is around -$.50.[1]

Figure 1 – December 2008 CME® Corn Futures (week ending 3/21/08)

[1] As an example, with a December (new crop) futures price of $5.50 and an expected basis of -$.50, the expected elevator price would be $5.00.

Higher grain prices over the next few years will provide unique opportunities for Kentucky farmers. One of these opportunities is the production of grain on ground that has primarily been used for hay or pasture. Corn is a particular good choice to plant into sod ground due to its agronomic characteristics, and may prove to be more profitable than keeping the land in hay or pasture given current prices. Obviously, producers considering this shift will need to compare the additional revenues and costs against those of their current operation. These additional costs include fertilizer, chemicals, seed, labor, and machinery expenses, as well as the additional management required to transition from forage production to grain crop production. In many cases, farmers may be able to rent equipment or hire neighbors to do certain parts of the machinery operations at a lower expense than if they used their own equipment.

The purpose of this publication is to help landowners evaluate if corn production would be profitable relative to hay or pasture on a portion of their land. Multiple budget scenarios are used to help identify those situations under which this transition may prove beneficial. In cases where conversion to corn appears profitable, producers still need to balance the potential increases in profit with market price uncertainty.

Producers who are new to the grain markets should be aware that there are marketing opportunities that can offset part of the price risk. Potentially the most viable option for small operators is to forward contract for fall delivery with a grain elevator. Using this strategy, farmers can "lock in" the price they will receive for their crop. This can be done before the crop is in the ground. However, there is the risk that final yield will be less than expected, so producers generally forward contract only a portion of the anticipated crop.

Reseeding costs also need to be considered if the land will eventually go back into sod. This cost will be lower than reseeding from a sod base as the soil will already be worked up to some degree. Furthermore, lime and nutrient levels should be closer to optimum levels if soil test recommendations are followed for corn. It is worth pointing out that this transition back to sod could provide a potentially valuable opportunity to reseed to something other than traditional KY-31 fescue based forage. On suitable soils, an alfalfa-grass mix could be considered as well as other forages such as orchardgrass, non KY-31 fescues, red clover, and warm-season grasses such as eastern gamagrass.

Users can also use this publication to help determine what conventional grain farmers might be willing to pay for renting out their better sod ground.

Agronomic Considerations:

Weed, Insect, and Rodent Control:
Weed control is essential to corn following sod, and may require two burndown (herbicide) applications prior to planting. Sod is known for having high insect populations, especially wireworm and white grubs. If present and not controlled, these pests will cause stand loss or decreased seedling vigor. Insecticide options include liquid or granular soil insecticides at planting or the use of an insecticide seed treatment. Typically, the higher end of the dose range on the insecticide label is required for control

of wireworms. Older planters may need to be retrofitted to handle the liquid and granular insecticide applications.

Voles and other small animals can cause problems in corn following sod. Early burndown of the sod will help by removing some of the plant material in which voles can hide. In addition, about two bushels of cracked corn can be spread per acre immediately after planting to help control voles. The voles will eat the cracked corn on the soil surface before digging out planted seeds. This practice is recommended for no-till planting systems but is not needed for conventional tillage.

Nutrient Requirements:
Corn following sod usually requires 25 to 50 fewer pounds of nitrogen per acre than corn following soybeans or corn. This reduced requirement is largely due to the breakdown of the organic material from the previous sod crop and the subsequent release of nitrogen. Soil testing should be done to determine the recommended supply of phosphorus, potassium, zinc, and lime. However, a general idea of the likely recommendation can be taken from recent soil tests that have come off sod ground in Kentucky. The average recommendations from this sod ground on a per year, per acre basis were: 0.5 tons for lime (1.5 tons for the first year good for three years), 48 pounds of phosphate (P_2O_5) and 45 lbs potash (K_2O). This translates into roughly $60-65 per year for material and application costs at current prices (March 2008).

Till vs. No-Till Planting Systems – Advantages and Disadvantages:
No-till planting conserves soil, organic matter, and soil structure. Timely control of pests with chemicals is an absolute must for successful no-till corn following sod. No-till soils will warm more slowly and may delay planting slightly versus a tilled system. Tillage warms the soil, buries some of the plant residue and exposes some insects to birds. However, tillage destroys soil structure and promotes erosion. Tillage is not generally recommended on sloping soils, which comprise much of the Kentucky landscape.

Till vs. No-Till Planting Systems – Practices Needed for Corn after Sod:
No-tillage planting will require an early burndown of the sod and may require two applications for maximum effectiveness. If this sod is primarily fescue, then a high application rate of glyphosate (e.g. 2 qt/A of Roundup Original) is recommended. If sod has both grasses and legumes, then glyphosate plus 2,4-D (1 qt/a) or dicamba (1 pt/a of Banvel) will be needed to control most of the vegetation. In some cases paraquat (e.g. Gramaxone) instead of glyphosate may be used in combination with atrazine as part of a burndown program. A soil-residual herbicide should be applied at time of planting and a post-emergence herbicide will likely be needed later in the season (refer to AGR-6 for specific recommendations and rates).

If tillage is to occur then the fields should be plowed early in the spring before fescue breaks dormancy. If the sod is thick, then a burndown may be needed several weeks before the tillage to prevent plants from wrapping on equipment.

Yield Potentials:
Most of Kentucky's sod ground is not currently in corn or other grains because the historical yields were low on those fields. You can use NRCS publications to get

estimates for expected yields from your soils (refer to county soil map, online web-soil survey, or county extension agent). The NRCS numbers are somewhat dated and should be adjusted to reflect yield trend increases, so add 25% to those numbers to give you an idea of where average corn yields should be in your fields. For example, if the NRCS estimates an average yield potential of 80 bushels per acre, then assume that your fields should be able to produce about 100 bushels per acre on average (80 bushels multiplied by 1.25). Obviously late planting, poor weed or insect control, inadequate nutrients, or other sub-optimal farming practices will result in reduced yields.

Financial Returns:

Table 1 shows the final planning budgets and the estimated returns. These budgets are for first year corn coming out of sod. The price used in the analysis centers around the new crop (fall 2008) corn price that can be forward contracted at Kentucky elevators, which has averaged around $5.00 per bushel in recent weeks. This has been the approximate price that farmers could cash forward contract or "lock in" with a grain elevator. A deviation of $.75 per bushel above and below this expected price is also used to show a range of potential returns that could occur depending on market fluctuations. The final price for corn could of course fall outside of this range.

Yields of 100, 125, and 150 bushels per acre were thought to be most representative for sod ground going into corn. Average sod ground is going to have lower potential yield than the average grain crop ground. The average statewide corn yield between 2000 and 2006 was 135 bushels per acre. Hence, the mean yield used in this analysis (125 bushels) is slightly below this average. Average yields can fall below or above the range of yields used in this analysis. As previously mentioned, consult with NRCS county soil maps to estimate the yield potential of your farm. Your county extension agent will have access to these soils maps and may also have detailed knowledge of recent yields on your soil type.

Most of the inputs and other costs used for sod ground are fairly similar to conventional corn ground, with a few notable differences. The cost of nitrogen fertilizer is set at $.60 per pound of actual nitrogen, with the assumption that urea will be used. A majority of conventional grain farmers in Kentucky use anhydrous ammonia or liquid nitrogen for their nitrogen source, which is generally $.10-.20 cheaper per unit. However, specialized equipment is needed and there are also safety concerns and issues associated with its use, particularly with anhydrous ammonia. So urea is probably the most likely nitrogen source for farmers outside the traditional grain growing belt. On the flip side, less actual nitrogen will be needed for corn coming out of sod for the first year due to the nitrogen credit of the sod. Plant and Soil Sciences generally recommends about 120 pounds of actual nitrogen for tilled planting systems and 145 pounds of actual nitrogen for no-till planting systems on well-drained soils. However, a nitrogen credit of 40 pounds per acre is subtracted off these rates for first year corn.

The average recommendations for P and K on recent sod ground tested in Kentucky are used in this analysis (48 lbs P_2O_5 and 45 lbs K_2O). The average lime recommendation on this same ground of 1.5 tons per acre was averaged over the three year useful lifespan of the application (.5 tons lime per year). However, a soil test should be taken to determine

your specific requirements for P, K, and lime. They may of course be above or below those used in this analysis.

Machinery and labor costs are assumed to be 20% higher than the average custom rate for Kentucky conditions (see appendix for a link to these rates). The higher rate was used based on the assumption that most producers would have less-efficient machinery practices than producers whose main operation was grain production. These custom rates account for all costs related to machinery usage (fuel, lube, repairs, depreciation, overhead, labor) but do not include input costs which are listed separately in the budgets.[2]

The budget compares conventional tillage (plow-disk-plant) to the no-till system. In general, conventional tillage had slightly higher returns. Decreases in machinery charges for the no-till system were offset by an increased herbicide requirement, a slight increase in nitrogen requirements, and the need for the cracked corn used for vole control.

The budgets shown here are for first year corn coming out of sod. Costs and returns will change slightly after this first year. More nitrogen will be needed as the N-credit will be depleted after the first year. However, less herbicide and insecticide will generally be needed in future years. Voles should no longer be a problem and thus there should be no need for cracked corn bait. Overall, net returns should be similar in subsequent years assuming similar corn and input prices.

Budget Results:

Results are presented in Table 1 on a per acre basis. Net returns ranged from a low of $4 for a 100 bushel yield at $4.25 per bushel, to a high of $440 for a 150 bushel yield at $5.75 per bushel. Net returns at the current average elevator price of $5.00 ranged between $79 and $327 depending on yield and tillage type. Net returns with an elevator price of $5.00 and with a 125 bushel yield were approximately $200.

Net returns equals total corn revenue less all costs except land-related charges (land rent, opportunity cost of land, mortgage, property taxes, etc.). These net returns should be compared to the net returns for current operations. However, make sure that you are comparing apples to apples. If you do not include your labor and/or machinery depreciation costs in your current operation, you should try to subtract these out of the corn budgets. Machinery depreciation and overhead costs account for approximately 50% of the total cost in the "Machinery and Labor" cost section, while labor accounts for approximately 10%, fuel and lube accounts for approximately 20%, and repairs account for the remaining 20%.[3]

Conclusions:

In general, the returns estimated in this analysis are greater than typical land rents for hay and pasture at all but the lowest yield and price combinations evaluated. On the better ground capable of producing 125-150 bushels, net returns were above $100 in all situations evaluated, even with $4.50 per bushel corn. Using the mid-points for price and yield, net returns were around $200 per acre. Land capable of producing 150 bushel yields had net revenues of over $300 per acre at current expected prices.

[2] These rates were adjusted to reflect a $3.50 per gallon fuel price.

[3] These are broad calculations based on engineering estimates and vary considerably by field operation.

Table 1 - Planning Budget for Corn after Sod (2008)

Conventional Till Operation	100 Bushel Yield	125 Bushel Yield	150 Bushel Yield		No-Till Operation	100 Bushel Yield	125 Bushel Yield	150 Bushel Yield
Inputs:					**Inputs:**			
Seed	$60	$60	$60		Seed	$60	$60	c
Nitrogen	$48	$48	$48		Nitrogen	$63	$63	$63
P, K, and Lime	$63	$63	$63		P, K, and Lime	$63	$63	$63
Herbicides	$30	$30	$30		Herbicides	$45	$45	$45
Insecticides	$20	$20	$20		Insecticides	$20	$20	$20
Cracked Corn (bait)	$0	$0	$0		Cracked Corn (bait)	$10	$10	$10
Total Inputs	$221	$221	$221		Total Inputs	$261	$261	$261
Machinery and Labor:					**Machinery and Labor:**			
Plow, Disk, and Plant	$51	$51	$51		No-Till Plant	$15	$15	$15
Fert and Chem Application	$32	$32	$32		Fert and Chem Application	$39	$39	$39
Harvest	$34	$34	$34		Harvest	$34	$34	$34
Total Machinery and Labor	$116	$116	$116		Total Machinery and Labor	$90	$90	$90
Other:					**Other:**			
Drying Grain	$20	$25	$30		Drying Grain	$20	$25	$30
Trucking Grain	$11	$14	$17		Trucking Grain	$11	$14	$17
Crop Insurance and Interest	$38	$38	$38		Crop Insurance and Interest	$38	$38	$38
Total Other	$69	$77	$85		Total Other	$70	$78	$86
Total Costs	$407	$415	$423		Total Costs	$421	$429	$437
Net Revenue:					***Net Revenue:***			
$5.75/bushel	***$168***	***$304***	***$440***		***$5.75/bushel***	***$154***	***$290***	***$426***
$5.00/bushel	***$93***	***$210***	***$327***		***$5.00/bushel***	***$79***	***$196***	***$313***
$4.25/bushel	***$18***	***$117***	***$215***		***$4.25/bushel***	***$4***	***$102***	***$201***

Notes: Net revenue is derived by taking total revenue from corn and subtracting out all costs except land-related charges such as land rent, opportunity cost, and property taxes. Thus user should use these budgets to compare against current farming operations. Machinery and labor costs are based on custom machinery rates that include all costs including fuel, lube, depreciation, overhead, labor. A 20% increase was used over the standard custom rates to account for less-efficient machinery practices from producers whose main operation is not grain production.

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Publications and References (most are available at County Extension Offices):

A Comprehensive Guide to Corn Management in Kentucky (ID-139):
http://www.ca.uky.edu/agc/pubs/id/id139/id139.htm

Lime and Fertilizer Recommendations (AGR-1):
http://www.ca.uky.edu/agc/pubs/agr/agr1/agr1.pdf

Weed Control Guide Recommendations for Field Crops (AGR-6):
http://www.uky.edu/Ag/Agronomy/Weeds/agr-6.htm

Insecticide Recommendations for Corn (ENT-16):
http://www.uky.edu/Ag/PAT/recs/crop/pdf/Entfact-16.pdf

Bringing CRP/Pasture Back into Production (ID-124):
http://www.ca.uky.edu/agc/pubs/id/id124/id124.htm

NRCS Online Soil Survey (can also access soil survey data at County Extension Office):
http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx

Custom Machinery Rates Applicable to Kentucky (2008):
http://www.uky.edu/Ag/AgEcon/pubs/ext_aec/2008-01.pdf