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Mitigate the Downside Risks of Second-Year Corn

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The advent of soybean rust (*Phakopsora pachyrhizi*) across the southern U.S. late in 2004 (USDA-APHIS, 2004) has "added fuel to the fire" for some Indiana growers who were already perceiving an economic advantage for switching intended soybean acres to second-year corn acres in 2005 (Univ. of Illinois, 2004). Agronomically, a continuous corn cropping system is fraught with a multitude of negative yield influencing factors (Butzen, 2004; Lauer et al., 1997; Vyn, 2004). Most growers understand this. However, some are equally concerned that soybean rust, soybean aphid (*Aphis glycines* Matsamura), or other major soybean stresses in 2005 may result in unacceptably low soybean yields and/or high production costs.

Consequently, some growers seem willing to accept the known risks associated with second-year corn in order to avoid the uncertain risks associated with soybean production in 2005. While most agronomists certainly do not encourage monoculture of any kind, one can at least offer suggestions for mitigating the downside risks of corn following corn for those growers who feel pressured to do so. More detailed information can be found in the references listed at the end of this article.

Nitrogen Fertility Issues.

The **most important issue relative to N fertility in 2005** is the tight supply and expensive prices of nitrogen fertilizers due to high natural gas prices, reduced domestic N fertilizer production, and a greater volume of imported N fertilizer (personal communication w/ Mike Hancock, Fertilizer Administrator, Office of Indiana State Chemist). Even a minor shift of soybean acres to corn acres nationally in 2005 may greatly increase the difficulty for some growers in arranging for their corn nitrogen fertilizer needs.

> This single factor alone should make growers pause before deciding to switch significant soybean acres to second-year corn acres in 2005. It will be critical to lock in N fertilizer price and availability before making such a decision.

Most agronomists agree that **optimum nitrogen fertilizer rates** for corn following corn are higher than for corn following legumes (including soybean), ranging from 30 to 50 lbs additional N required per acre (Butzen, 2004; Vitosh et al., 1995; Vyn, 2004).

The simplest way to think about this is to use a N-rate calculation equal to 1.25 lbs N per bushel of expected yield for corn following corn versus 1 lb N per bushel for corn following soybean. Remember that yields for corn after corn will likely range from 6 to 15% lower (rotation effect), so calculate N needs accordingly.

P & K Fertility Issues.

Corn removes more soil phosphorus and less soil potassium **per acre** than soybean (Vitosh et al., 1995). Per bushel of grain, corn removes 0.37 and 0.27 lbs of P2O5 and K2O while soybean removes 0.80 and 1.40 lbs of P2O5 and K2O. A 180-bushel corn crop therefore removes a total of 67 and 49 lbs per acre of P2O5 and K2O while a 60-bushel soybean crop removes a total of 48 and 84 lbs of P2O5 and K2O.

A one-time switch to second-year corn will have negligible effects on P & K soil fertility levels. Over a number of years of corn following corn, however, growers should obviously monitor soil phosphorus & potassium levels and adjust P & K fertilizer rates accordingly.

Poor Stand Establishment Risk.

High levels of corn residue in continuous corn cropping systems often translate to difficult stand establishment conditions in Indiana due to slowed soil warming and drying on poorly drained soils. High levels of surface residue (i.e., "trash") in no-till can also interfere with the furrow opening and closing functions of the corn planter (Nielsen, 2003). Not only can germination and emergence be delayed or uneven, but so can initial seedling development. Delayed stand establishment lengthens the potential period of seedling exposure to soil diseases and insects and, thus, increases the risk of lower than desired populations and/or higher numbers of weakened plants that are less able to tolerate later-occurring stresses.

Mitigate the risk of poor stand establishment by selecting hybrids with superior seedling vigor ratings. If you're switching only part of your soybean acres to second-year corn, target better-drained fields in your farming operation. In no-till second-year corn with heavy surface trash conditions, consider the use of row-cleaning attachments for the corn planter to minimize planter difficulties. Where practical, consider burying the stalk residues with tillage to better facilitate seedbed preparation and planting. Avoid planting excessively early in order to minimize the risk of sub-optimal soil temperatures during germination and early seedling establishment. Consider using starter fertilizer, especially nitrogen in a traditional 2 x 2 band at rates no less than 20 to 40 lbs N/ac. Consider the use of either soil-applied insecticide or insecticide-

treated seed if the risk for secondary insect pests (wireworm, seedcorn maggot, etc.) is high.

Disease Risk.

The risk of many corn diseases is greater when corn follows corn, especially where some form of reduced tillage is practiced that leaves greater amounts of non-decomposed inoculum-bearing residue on the soil surface. Two such diseases that can devastate susceptible hybrids are Gray leaf spot (*Cercospora zeae-maydis*) and, as some experienced in 2004, Northern corn leaf blight (*Setosphaeria turcica*). Other diseases that may become more prevalent in corn following corn are those caused by stalk and ear rot fungi, including *Fusarium*, *Gibberella*, and *Diplodia*.

Mitigate the disease risk in second-year corn by careful hybrid selection with emphasis on disease tolerance to specific diseases as well as on overall good plant health characteristics. Where practical, consider burying the stalk residues with tillage to reduce the availability of disease inoculum for next year. The use of fungicides is often not considered economical for disease control in commercial feed grain corn production (Vincelli, 2004c).

Insect Risk.

Western corn rootworm (*Diabrotica virgifera virgifera*) is a threat to corn following corn throughout the state. Beetle numbers in both corn and soybean fields were elevated in 2004, indicating that the risk of corn root damage is greater than normal for 2005 (Obermeyer & Bledsoe, 2004a). Greater levels of surface corn residues in a corn-corn system can delay corn emergence and growth, resulting in a lengthier exposure of corn seedlings to secondary soil pests that in turn may result in weakened plants and/or stand reductions. A combination of surface corn residues and winter annual weeds in the spring may attract cutworm and armyworm moths for egg laying, leading to corn seedling damage/death from subsequent larval feeding on plant tissue.

Second-year corn should not experience greater European corn borer (*Ostrinia nubilalis*) populations or damage from this pest. However, continued use of a corn-corn system over several years would increase the risk of elevated corn borer pressure and potential yield/harvest losses.

Mitigate the insect risk in second-year corn by the judicious use of soil-applied insecticides, insecticide seed treatments (high rate formulations), or transgenic resistance for rootworm (Obermeyer & Bledsoe, 2004b & 2004c). Scout fields during emergence for cutworm and/or armyworm damage to leaves and stems to determine the possible need for rescue foliar insecticides.

Hybrid Availability Issues.

Growers who are considering the switch from soybean acres to second-year corn acres need to communicate early on with their seed suppliers to determine the availability of

hybrids, especially relative to specific desired traits (biotech or otherwise). As mentioned elsewhere in this article, growers considering second-year corn should place extra importance on traits such as disease tolerance, stalk strength, stalk health, seedling vigor, and stress tolerance in general.

Harvest Season Issues.

Growers should recognize that planting more corn acres will effectively lengthen the corn harvest season because of time and capacity demands on harvest machinery, drying facilities, transport, and storage. Some portion of the corn crop will consequently remain standing for longer periods of time well into the fall. Deterioration of mature stalk tissue, especially if already stressed with stalk rots, greatly increases the risk of stalk breakage and mechanical harvest loss if fields suffer severe wind damage prior to harvest. The greater risk of leaf diseases in second-year corn also indirectly increases the risk of stalk rot development if photosynthetic output is compromised during grain fill.

> **Mitigate the risk of stalk breakage** by selecting hybrids with superior overall plant health and stalk strength characteristics. Scout fields for the occurrence of stalk rots prior to harvest and prioritize their harvest schedule if necessary to harvest "weak-kneed" fields early. Consider beginning harvest earlier than usual to avoid finishing in late fall when rain and snow prospects typically increase.

Late Season Weed Escapes.

Weed management concerns in second-year corn will be influenced by the performance of the previous year's weed management program. In 2004, early planting and subsequent wet conditions diluted soil-applied herbicides, resulting in widespread instances of giant ragweed (*Ambrosia trifida*), burcucumber (*Sicyos angulatus*), and giant foxtail (*Setaria faberii*) breaking through the soil-applied treatments. Fields with such weed escapes will contain a good supply of new weed seed in the soil seed bank. Furthermore, giant ragweed and burcucumber have relatively long emergence periods in Indiana.

> **Mitigate the risk of poor giant ragweed and burcucumber control** by adjusting weed management plans to include the use of postemergence herbicides that provide residual activity on these weeds. Shifting atrazine use from preplanting to postemergence will extend the residual window of activity and reduce late season weed emergence. Callisto™ and Hornet™ containing products also provide some residual activity on these weeds and would be well suited to use as postemergence treatments as well.
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> **For better control of late-emerging grass weeds**, consider adding a reduced rate of a chloroacetamide (Dual™, Harness™, Outlook™, Define™, etc.) to the

postemergence herbicide treatment. All of these products are labeled for application to emerged corn.

Glyphosate-Resistant Weeds. Glyphosate-resistant marestail (aka horseweed, *Conyza canadensis*) is widespread in southeast Indiana and effective postemergence control of marestail with glyphosate alone in this region is unlikely. Wisconsin and Ohio are experiencing frequent lambsquarter control problems with glyphosate with applications made in cool or dry conditions.

Mitigate the risk of glyphosate resistant weeds by rotating herbicide modes of action. If glyphosate-resistant corn was grown in a particular field in 2004, one should also consider utilization of herbicides that rely on other herbicide modes of action to prevent additional selection pressure for glyphosate-resistant weeds. Marestail is effectively controlled by many postemergence herbicides. The most effective control is usually provided by dicamba, 2,4-D, Hornet, or products containing atrazine, provided the applications are made before marestail is 6 inches tall. Lambsquarter (*Chenopodium album*) is easily controlled with tillage and many soil-applied herbicides, so effective management is not difficult if one doesn't rely solely on postemergence herbicides.

Consider investing in a software program called **WeedSoft®** (Univ. of Nebraska, 2004), that provides you with the weed control information you need based on your specific field conditions while factoring in economic and environmental principles. Indiana is one of seven states in the NorthCentral region that collaborated on the development of this decision support system.

Bottom Line

The decision to switch significant soybean acres to second-year corn acres should be made cautiously with careful attention to both the economics and agronomics of such a choice. While short-term economics generally favor second-year corn over soybean production (Univ. of Illinois, 2004), long-term economics generally still favor the traditional corn-soybean crop rotation. Growers should recognize that second-year corn yields will easily range from 6 to 15% less than corn following soybean. Consideration of the risks outlined in this article will help minimize the downside dollar potential of second-year corn relative to corn following soybean.

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