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WEED PROBLEMS IN REDUCED AND NO-TILL PRODUCTION

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The rising cost of producing corn and soybeans has greatly influenced the rapid increase in minimum and no-tillage farming in Indiana and other states in the north central section of the Nation. While some success has been seen with reduced tillage practices, failures with these systems has been high. There is no question that reduced or no-tillage crop production has been beneficial in the preservation and development of the soil and conservation of water, energy, and equipment. However, the lack of weed control limits the use of reduced tillage practices or in many cases totally prevents the use of these systems. Losses in soybean production caused by weeds are greater than those for all other pests combined. The excessive cost is due largely to the complexity of the weed control problem and the lack of techniques that permit farmers to control weeds effectively.

The need to control weeds is a major factor in determining the amount of tillage needed for crop production. Without tillage, successful weed control depends entirely upon a satisfactory herbicide program. If the herbicide program fails, then a no-till program becomes a disaster. Proper herbicide management is much more critical with reduced tillage than with conventional tillage. Likewise, agronomic managerial decisions are more critical as tillage is reduced. In most cases, no tillage or reduced tillage combined with narrow row spacing is successful for a few years; then a buildup of weeds forces the return to wide rows and intensive tillage to clean up the fields. Available herbicides provide more opportunity for no tillage in corn production than in soybean production. Season-long weed control in no-till soybeans is extremely difficult to achieve. Before considering a reduced or no-tillage program in a particular field, determine the weeds in that field by scouting and mapping the weeds in the crop preceeding the year that no-till is to be used. This will establish the types and severity of the weed problem and will indicate the feasibility of no-till in that location. It will also help in selecting the right herbicide program for that particular situation. If the weed population is such that cultivation is the best control measure, then no-till would not be the best program.

Weeds which compete with a crop for the first 4 to 8 weeks have the most influence on yields. This is particularly true for soybeans. Weeds which emerge 8 to 10 weeks after crop emergence have little effect on yields per se but can reduce grade and harvest efficiency to the point that the benefits gained from

lack of tillage are annihilated. The best way to prepare land for no-till is to control the problem weeds with intensive tillage where feasible and use herbicides, including spot treatment with non-selective herbicides, before going into the no-till program. Common sense practices are also needed for no-tillage.

Always choose well-drained land for no-till programs. Use varieties with the proper maturity for the chosen row spacing. Plant high-quality seed in moist, firm seed beds to obtain a uniform stand within 5 to 7 days that will grow fast. These factors will greatly benefit weed control.

Influence of Tillage on Weed Shifts

Lack of tillage gives early germinating species a chance to become a dominant species. In most cases in Indiana, this tends to be broadleaf weeds such as smartweed, common ragweed, lambsquarter, cocklebur, velvetleaf, and giant ragweed. Generally, broadleaf weeds are easier to control with herbicides than are grasses. Thus, the overall shift in reduced tillage is to grass species. If broadleaf weeds have germinated and begun to canopy over smaller grasses at the time of planting, then the postemergence sprays used for knockdown will not reach the grass species. Thus, the herbicide will not be totally effective. Annual grass populations tend to shift after about 2 years from foxtails to fall panicum. This creates a more serious problem since fall panicum is harder to control with available herbicides. Fall panicum is considered a late season grass in conventional tillage systems, yet is a serious problem early in the season on reduced tillage. In southern Indiana, fall panicum can be present in fields as early as the 15th of April.

A major concern with reduced tillage is the creation of a perennial weed problem. Perennial species both herbaceous and woody will tend to increase as tillage is decreased (Table 1). Perennial weeds such as field bineweed, milkweed, horsenettle, nutsedge, and even trumpetcreeper can increase and will be a more acute problem in corn in old sods where the weeds are already established. In southern Indiana, johnsongrass is the limiting factor in no-till production. Johnsongrass infestations not only reduce yield and interfere with harvest but also increase the frequency of corn disease such as maize chlorotic virus and maize dwarf mosaic virus. These diseases overwinter in the living tissue of johnsongrass rhizomes and not in the dead corn stalks left with no-till. When tillage is eliminated, johnsongrass is present when corn is planted and even low populations of this weed can cause trouble if the proper resistant varieties are not used.

When a weed problem builds up in a reduced tillage system, it can be reversed with good management and intensive tillage with a mold board plow.

Table 1. Average number of perennials per acre after 3 years in a particular tillage system

Weed species	Tillage system		
	Conventional	Chisel	No-till
Canada thistle	876	6424	11388
Milkweed	146	1460	1606
Horsenettle	1022	6716	4672
Ground Cherry	0	3504	2336

Table 2. Average number of weeds per 6 square feet under 3 different tillage systems for 4 years

Weed species	Tillage system: 4 years no-till		Tillage system: 3 years no-till + 1 year conventional		Tillage system: 4 years conventional	
Smartweed	113		25		10	
Common Ragweed	79		21		5	
Lambsquarter	46	238	2	51	25	47
Pigweed	0		3		7	
Fall Panicum	0		3		20	

Buildup of annual weeds over a few years with reduced tillage systems, especially the no-till system, can be readily reversed by one year of conventional mold board tillage (Table 2). Many perennial weeds including hemp dogbane and horsenettle can also be reduced by intensive tillage, but in many cases more than one year of tillage is needed, and spot treatment with herbicides is usually beneficial.

Influence of Reduced Tillage on Weeds and Herbicides

Several factors contribute to the difficulty of controlling weeds in reduced tillage systems. Weed seeds are equally distributed throughout the plow layer with conventional tillage, while with no-till weed seeds accumulate near the soil surface. The residues of weeds and the crop that is associated with reduced tillage provide an ideal moist medium for weed seed germination. Deep plowing the soil every 4 to 6 years will redistribute the weed seeds throughout the soil depth similar to conventional tillage practices. The mulch can intercept and adsorb some of the applied herbicides and reduce the amount that reaches the soil surface. In addition, trash may completely block herbicides from reaching the soil surface, and weeds are not controlled in those specific areas. Research in Indiana indicates that fields covered with 85% trash reduces the amount of atrazine that reaches the soil surface by 30%. Fields under no-till for several years can have surface organic matter readings that are double that of comparable fields which have been mold board plowed. These factors indicate that recommended herbicides for conventional tillage systems may be too low for tillage systems that leave trash on the surface.

Summary

The success of reduced tillage production will depend upon the level of weed control that is maintained throughout the season. A combination of two or more herbicides will be needed to control vegetation that is present at planting and to provide adequate residual control throughout the season. Early season broadleaf weeds usually predominate in no-till; however, these weeds are usually easy to control with herbicides, thus causing annual grasses to be the dominant species. Annual grass species usually shift after a few years from foxtails to fall panicum. Biennial and perennial weeds also increase as tillage decreases. Many of these weed shifts can be reversed by thorough tillage once every 3 or 4 years. Common sense agronomic practices need to be maximized for a successful reduced tillage system. It is essential to obtain

a quick, uniform crop to out-compete weeds which emerge after the herbicide activity has diminished. Combinations of contact and residual herbicides are needed to obtain total weed control. With trash on the soil surface, herbicide rates may have to be adjusted from those used on conventional tillage systems. Reduced tillage can be a successful and economical alternative in present-day crop production only if a concentrated effort is made to apply the proper agronomic and chemical knowledge to the desired production program.

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