

Economic Benefits of No-Till



■ No-till grain sorghum in wheat.

This chapter discusses other economic issues associated with no-till adoption – issues that might be difficult to observe or hard to measure, such as the idea that no-till leverages management time or machinery, or that traditional landlord/tenant relationships impede adoption of no-till. These issues are often important in an understanding of no-till in Kansas.

Risk, especially financial risk, is always an important concern when considering new agricultural technologies. Alternative cropping systems are no exception. Will the expected costs and returns actually bear out? Yield and cost differences may not be the same as those indicated by research. Will a landlord participate in the necessary cost-sharing? Or, will bringing up the issue of alternative systems cause the landlord to consider a more traditional tenant? Will it cause the landlord to desire a cash-rent relationship, ultimately increasing a tenant's financial risk? These concerns can prevent or limit no-till adoption.

Furthermore, adopting any new technology is often financially stressful during the transition phase. Additional machinery items may need to be purchased while existing items are retained in case the new cropping system fails – meaning increased machinery investment in the short-run for a system expected to require less in the long-run. In other words, long-run economic analyses may indicate a system is profitable, but in the short-run there may be cash flow considerations.

KEY TO CODES IN FIGURES IN THIS CHAPTER:

WF = Wheat-Fallow

WSF = Wheat-Sorghum-Fallow

SS = Sorghum-Sorghum

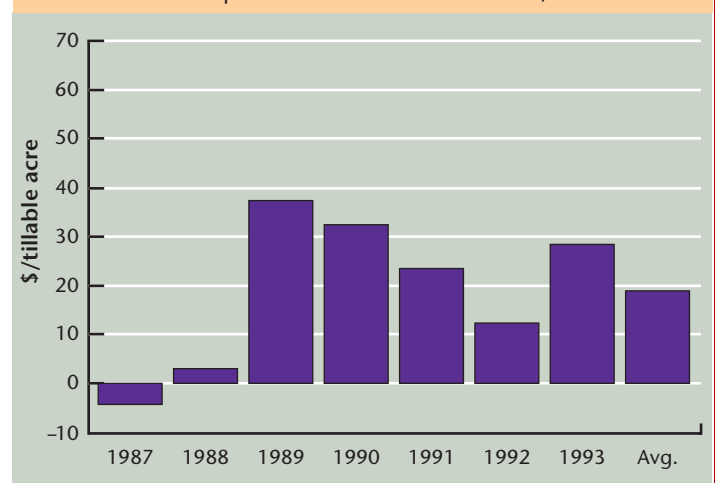
FINANCIAL RISK

Financial risk is especially affected by crop yields and prices, which determine total revenue. Revenue that varies substantially from year to year may be undesirable due to increased borrowing needs in low-revenue years. Because alternative cropping systems often increase costs, and especially annual cash costs if herbicide usage rises, increased loan requirements to cover production expenses may be especially large for some alternative cropping systems. However, increased moisture retention due to reduced tillage could reduce yield variability, at least in drier areas of Kansas. Also, increasing crop diversity could be used to reduce price risk. Consequently, it is possible that total revenue risk may be lessened with adoption of alternative cropping systems.

Research in western Kansas shows that wheat-sorghum-fallow returns do not “bounce about” as much as the returns from either wheat-fallow or continuous sorghum (Figures 1-3), indicating wheat-sorghum-fallow has the least amount of variability.

The reduced variability is the result of diversification (e.g., 1992 was a relatively poor wheat year,

FIGURE 1. Returns per tillable acre—Wheat-Fallow, Reduced-Till



Dhuyvetter & Norwood, Southwest Research-Extension Center, Garden City.

but a good sorghum year, whereas 1993 was a relatively good wheat year, but a poor sorghum year. Additionally, the wheat-sorghum-fallow rotation has the highest average return, indicating that returns and risk are negatively correlated. This is unlike what is typically expected where additional profits are only achieved by taking on more risk.

Longer term studies at Hays and Tribune (Williams, 1988 and Williams et al., 1990) allowed for a more sophisticated analysis of the relative risks of the different crop rotations. Williams concluded that for the Hays location wheat-sorghum-fallow with conventional tillage was the preferred system regardless of a producer's aversion to risk. For the Tribune location, the authors concluded that producers with low levels of risk aversion would prefer wheat-sorghum-fallow to wheat-fallow, but extremely risk-averse producers would prefer wheat-fallow. Risk-averse producers would always prefer reduced-tillage over conventional-tillage.

While these are only three studies, the general conclusion is that increasing cropping intensity can actually decrease financial risk in western Kansas. At the very least, a more conservative conclusion might be that reducing tillage and increasing cropping intensity will not increase financial risk.

GOVERNMENT PROGRAM COMPLIANCE

Historical government farm programs, especially those tied to crop acreage bases and requiring cross compliance across wheat and feedgrain programs, may have inhibited farmers from changing to alternative crops or farming systems. However, for the most part, compliance issues with the current farm bill all have to do with environmental issues and not historical crop acreage

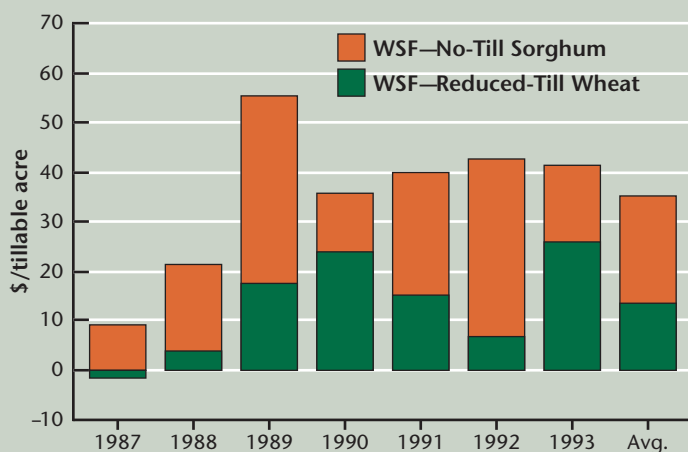
bases. Therefore, producers are basically free to plant whatever crop they want. However, more important is the fact that government support is decreasing and payments are fixed, which potentially results in both lower income and more income variability. Therefore, if there are cropping systems that can both increase returns and decrease financial risk, producers now have even greater incentives to consider these systems.

LANDLORD/TENANT ARRANGEMENTS

Perhaps the greatest impediment to the adoption of less-tillage farming systems has been landlord/tenant relationships. Because landlords are often further removed than tenants from the latest sources of information, they may be less willing to diverge from traditional farming practices. That is especially true if the change involves greater cash outlays for *potentially* increased revenues, usually implying increased risk. In western Kansas, for example, no-till typically involves increased cropping intensity (less summerfallow acres, more crops) because of increased moisture conservation, or inclusion of crops that are more cash intense than wheat, such as corn or grain sorghum. Both changes involve greater cash outlays for potentially increased revenues. Similarly, in central and eastern Kansas, because of reduced time spent in seedbed preparation and moisture conservation, no-till may allow producers to increase cropping intensity by planting a crop following wheat harvest (e.g., sorghum, soybeans, or sunflowers).

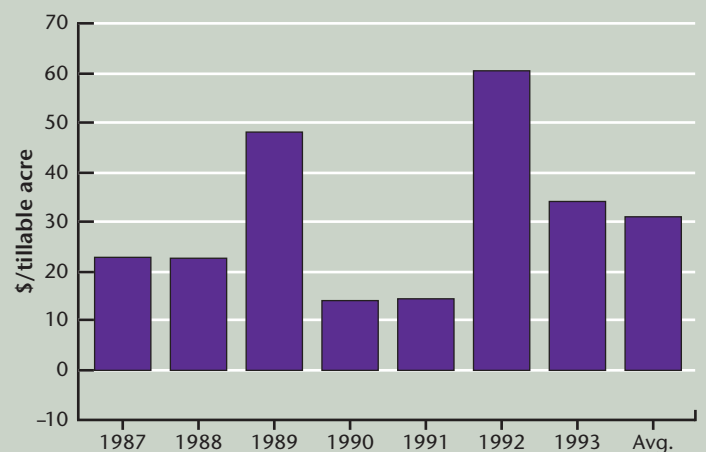
Even if no-till would increase total profitability, the economic incentives to adopt this technology may not exist on rented land. On crop-share rented land, the portions of the income received

FIGURE 2. Returns per tillable acre—Wheat-Sorghum-Fallow



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FIGURE 3. Returns per tillable acre—Continuous Sorghum, No-Till



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by both parties is often based on an equitable crop share lease. An equitable crop share lease is based on the principle that income is shared in the same proportion as cost contributions by all parties involved (Langemeier). If total returns can be increased by adopting some new technology, the returns to both the landowner and the producer will also increase if returns are shared in the same proportion as expenses (assuming the initial arrangement is based on an equitable crop share). Because adopting a new technology may change the relative contributions of the landowner and the producer, the equitable crop share arrangement may need to change in order for there to be an economic incentive to adopt the new technology.

Using western Kansas as an example, landowners and producers typically split the income from wheat produced in a wheat-fallow rotation 33/67 percent and share fertilizer expense in the same proportions. If producers elect to use reduced-tillage in a wheat-fallow rotation, herbicide expense is typically not shared by the landowner as it is primarily viewed as a substitute for tillage. Figure 4 shows how the relative contributions in the Garden City study referenced in figures 1-3 change as the crop rotation changes from wheat-fallow (reduced tillage) to wheat-sorghum-fallow (no-till prior to the sorghum crop). If the tenant continues to pay all herbicide expenses the relative contribution changes from 33/67 to 30/70. However, if the landlord shares the sorghum herbicides the equitable crop share remains at 33/67. Based on this, if a landlord is not willing to share in the sorghum herbicide expense, yet wants to maintain the crop share split at 33/67, the producer has less economic incentive to increase cropping intensity because income and expenses would be split

disproportionately. In this particular case, the landowner would be getting a disproportionate share of the gains from switching to wheat-sorghum-fallow at the expense of the tenant.

Figure 5 shows similar information using the costs from the Tribune study (Chapter 5, Figure 2), which had higher herbicide costs than the Garden City study. If the tenant continues to pay all herbicide expenses the relative contribution changes from 33/67 to 30/70; and, if the landlord shares the sorghum herbicides the equitable crop share changes to 35/65. Based on this, if a producer wants the landlord to share in the sorghum herbicide expense, yet wants to maintain the crop share split at 33/67, the landlord has less economic incentive to increase cropping intensity because income and expenses would be split disproportionately. In this case it may be that sharing the sorghum herbicide expenses in some proportion other than 35/65 would result in the original 33/67 split for income. Figure 6 shows that if the landlord and tenant share the herbicide expenses 25/75 the equitable shares for income and fertilizer would be 33/67.

Figures 4, 5, and 6 indicate that in western Kansas landowners may need to share additional expenses if they want to maintain a 33/67 split when cropping intensity increases and no-till is adopted. However, it needs to be noted that if herbicide is initially a shared expense, as might be the case in eastern Kansas, the adoption of no-tillage might have the opposite effect; i.e., the landowner should receive a larger share if herbicides essentially replace tillage normally done by the tenant.

While rules-of-thumb are appealing, the figures associated with rental arrangements show that there is not one “correct” arrangement that is

FIGURE 4. Landowner/tenant equitable crop shares

	WF	WSF	WSF
Land	Landlord	Landlord	Landlord
Machinery	Tenant	Tenant	Tenant
Fertilizer	Shared	Shared	Shared
Herbicide*			
Wheat	Tenant	Tenant	Tenant
Sorghum		Tenant	Shared
Other operating	Tenant	Tenant	Tenant
Contributions (L/T)	33.3/66.7	30.5/69.5	33.1/66.9
*Herbicide expense only, spraying expense is included in other operating.			

Based on costs from Garden City study (Dhuyvetter and Norwood).

FIGURE 5. Landowner/tenant equitable crop shares

	WF	WSF	WSF
Land	Landlord	Landlord	Landlord
Machinery	Tenant	Tenant	Tenant
Fertilizer	Shared	Shared	Shared
Herbicide*			
Wheat	Tenant	Tenant	Tenant
Sorghum		Tenant	Shared
Other operating	Tenant	Tenant	Tenant
Contributions (L/T)	33.3/66.7	29.5/70.5	35.1/64.9
*Herbicide expense only, spraying expense is included in other operating.			

Based on costs from Tribune study (Dhuyvetter and Schlegel).

fitting for all situations. Rather, the equitable crop share arrangement will depend on relative costs and how they change as a new technology is adopted. This leads to two major points. First is that equitable crop share arrangements probably need to be modified in order for both parties to have an economic incentive to adopt the new technology, and second is that good communication between the producer and the landowner is critical in identifying the crop share arrangement that best fits the particular situation.

Although figures 1-3 suggest that financial risk might decrease with the adoption of no-till and increased cropping intensity, other factors might negate those benefits. For example, some landlords may not wish to share in the additional cash outlays often required of new technologies – especially elderly landlords on fixed incomes, or those who may have lost touch with modern agriculture and view tenant requests for additional cash as inappropriate. Those landlords may prefer to switch to cash-rent arrangements, ultimately increasing the financial risk for tenants. Likewise, no-till adopters who are unprepared for the additional cash outlays that may be needed might experience reduced or more variable crop yields as cash flow constraints affect cropping decisions.

CROPPING INTENSITY

Chapter 5 did not show increased yields or reduced costs with less tillage for some parts of Kansas. Yet Chapter 7 clearly shows that earlier adopters of less-tillage were more profitable throughout Kansas, and that all regions of Kansas have increased adoption. This suggests that traditional research may not be appropriate for uncovering the actual gains associated with less

tillage. For example, no-till may make it possible to increase cropping intensity, thus reducing land costs per crop acre harvested. In that case, the full extent of no-till's economic benefits will not be uncovered unless the research explicitly allows for cropping intensity changes across tillage regimes (which was allowed for in the study discussed in Chapter 7).

LEVERAGING MACHINERY AND MANAGEMENT

Closely related to increased cropping intensity from an economic perspective, farmers often indicate they choose no-till because it allows them to farm more acres. Put another way, it allows them to leverage their machinery, labor, and or management time. Smaller farms increase labor efficiency by getting larger (Figure 7). Beyond about 2,000 acres, gains in labor efficiency are small, but other gains, such as reduced machinery ownership costs or reduced management costs, continue with increased farm size.

Figure 7 shows substantial benefits to increased farm size. For example, even at 2,000 acres, increasing farm size by 100 acres (to 2,100 acres) is associated with a drop in average machinery (including labor) costs from \$54.30 per acre to \$53.49 per acre. Against 2,000 acres, that \$0.81 per acre lowering of costs is \$1,620. If that reduced cost or additional profit is assigned only to the 100 acres in the farm expansion that comes to \$16.20 per acre. Thus, if it is true, as farmers often indicate, that no-till permits farming more acres than otherwise would be possible, it is easy to see how no-till could be profitable even if a more traditional economic analysis, which looks only at yield and assigned cost differences, cannot verify those profits.

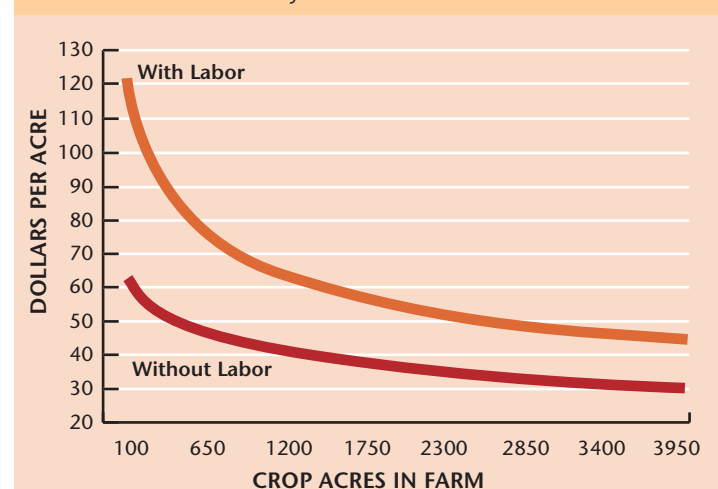
FIGURE 6. Landowner/tenant equitable crop shares

	WF	WSF	WSF
Land	Landlord	Landlord	Landlord
Machinery	Tenant	Tenant	Tenant
Fertilizer	Shared	Shared	Shared
Herbicide*			
Wheat	Tenant	Tenant	Tenant
Sorghum		Tenant	25/75
Other operating	Tenant	Tenant	Tenant
Contributions (L/T)	33.3/66.7	29.5/70.5	33.5/66.5

*Herbicide expense only, spraying expense is included in other operating.

Based on costs from Tribune study (Dhuyvetter and Schlegel).

FIGURE 7. Real machinery costs with and without labor



Kansas wheat farms, 1986-1995, 1996 dollars (Kastens).

OTHER ISSUES

Still other potential economic opportunities might be driving no-till expansion. For example, additional moisture retention provided by no-till in western Kansas might provide farmers with the confidence to plant corn rather than sorghum. Corn often has higher yield potential than sorghum in especially favorable years. In that case, profits attributed to corn over sorghum might more appropriately be attributed to no-till. Similarly, increased cropping intensity due to no-till may not only impact land costs per crop acre but also crop selection. If double-cropping behind wheat can be more timely due to no-till, later-maturing crops or varieties of the same crop with higher yield potential might be used. Finally, farmers might adopt no-till now, in spite of flat yields and costs, because they perceive that economic benefits will come due to improved yields or reduced costs in the future — after soil structures have improved with years of organic matter retention and reduced compaction.

Besides being impacted by farm-level economics, no-till adoption will also be impacted by economics at the society level. Farm chemicals might have external costs and benefits related to water quality (e.g., streams may have to be cleaned up if polluted with herbicides). On the other hand, no-till might reduce erosion, which could lessen the impact of sediment pollution and maintain the value of land in future years by maintaining productivity. Overall, no-till's net benefit to society is not yet clear.

CONCLUSION

In order to increase returns by increasing cropping intensity, producers need to be both willing and able to spend more money on inputs. On land that is rented on a crop-share basis, traditional crop-share arrangements will often need to be adjusted in order for both the landowner and the tenant to have an economic incentive to select the most profitable cropping system.

Other motives that might be underlying the adoption of no-till in Kansas were briefly discussed. Among these were government program compliance, reduced land costs per crop acre due to increases in crop intensity, leveraging limited management resources to capture economies of size in labor and machinery, crop types and maturities with higher yield potential, and potential long-run benefits of improved soil structure. There is little reason to doubt that no-till adoption will continue into the foreseeable future for Kansas.

REFERENCES

- Dhuyvetter, K.C., and C.A. Norwood. 1994. Economic incentives for adopting alternative dryland cropping systems. p. 18-23. *In* J.L. Havlin (ed.) Proc. Great Plains Soil Fertility Conference, Vol. 5. Denver, CO, 7-9 Mar.
- Dhuyvetter, K.C. and A.J. Schlegel. 1995. Unpublished data.
- Kastens, T.L. Machinery Costs: Economies of Size and Selected Topics. Unpublished paper in the Department of Agricultural Economics, Kansas State University, Manhattan, Kansas. December 1997.
- Langemeier, L.N. Fixed and Flexible Cash Rental Arrangements for Your Farm. North Central Regional Publication No. 75. Cooperative Extension Service Kansas State University. 1997.
- Williams, J.R. 1988. A stochastic dominance analysis of tillage and crop insurance practices in a semiarid region. *Amer. J. Agric. Econ* 70 (February 1988): 112-120.
- Williams, J.R., R.V. Llewelyn, and G.A. Barnaby. 1990. Risk analysis of tillage alternatives with government programs. *Amer. J. Agric. Econ.* 72 (February 1990): 172-181.

SUMMARY

- Increased cropping intensity, coupled with less-tillage, can increase profitability and decrease financial risk in western Kansas.
- Because no-till may change the relative cost expenditures of the landowner and producer, the equitable crop share arrangement may need to change in order for there to be an economic incentive to adopt no-till.
- No-till might allow producers to farm more acres, which allows them to leverage their machinery, labor, and management.
- No-till might improve profit potential by making it possible to use varieties or crops with higher yield potential.
- To increase returns by increasing cropping intensity, producers need to be willing and able to spend more money on inputs.