K-STATE Research and Extension
Department of Agricultural Economics MF2137 Crop Economics

Economics of Liming Kansas Cropland

Owner-Operator and Landlord-Tenant Considerations

Liming acid soils is an established recommendation to maintain or improve the productivity of cropland. Soil pH influences both nutrient availability and herbicide activity. Knowledge and management of soil acidity are uses of technology for efficient and economic crop production.

Lime is often considered a soil amendment or cropland maintenance resource. Agricultural limestone is available from many sources, including gravel quarries, water treatment facilities, or as a processed pelletized product from a fertilizer retailer. In situations where soil pH is determined to be so low that yields are affected, liming the soil can be a long term investment that reaps dividends.

Past practices, tradition, and conventional beliefs place the responsibility for land maintenance with the land owner. Intensive fertilization, continuous cropping, monoculture, and economic pressures have induced landlords to shift the responsibility for paying for the liming of acid soils to the tenant.

Economic Analysis of Liming Cropland

Yield response to lime applications on acid soils has been demonstrated and is widely known among crop producers. Lime applications and alternatives to lime for adjusting soil pH have been recently studied for wheat cropland in central Kansas. In these studies, liming at varying rates had a significantly positive effect upon yields. Wheat yields were increased by 18 bushels per acre in Sedgwick County studies for half and full recommended liming rates.

Owner/Operator

The use of a partial budget to evaluate lime applications on cropland can help determine if the lime application will result in a positive income change for the producer. Table 1 shows an example partial budget for lime applications in the production of wheat. In this example, the expected cost of lime application is $36 per acre. Spreading this cost over the expected life of the soil treatment results in an estimate for the annual cost of lime application.

While some producers view the total cost of the treatment as the relevant cost, converting this full cost to an annualized cost over an expected useful life is more consistent with standard crop budgeting procedures.

In this case, the calculation is the same as for a loan for 7 years at 9 percent interest. Seven annual payments of $7.15 are equivalent to a single payment of $36 at the beginning of the decision period. Producers who use savings to pay the entire lime bill can calculate this annualized economic cost for lime. The added cost of $7.15 is entered on the partial budget worksheet.

Soil test reports often indicate soils in Kansas have sufficient phosphate levels to sustain crop production for several years without additional phosphate fertilizers. Correcting an imbalanced pH will allow producers to reduce phosphate applications significantly. In this example, the use of lime to adjust soil pH is assumed to reduce fertilizer expenditure by $3 per acre per year. The reduced cost for fertilizer, in this case $3, is entered on the partial budget worksheet.

To calculate the yield change needed to pay for the lime application, we can see that an additional $4.15 in returns are needed to balance added returns and reduced costs with added costs and reduced returns. In our example, reduced returns were zero. What added yield will return an additional $4.15 in crop sales? If we assume wheat prices will average $3.25 in the coming year, we can calculate that it will take 1.28 added bushels of wheat per acre to balance the benefits of liming with the expected costs.

The partial budget worksheet for lime applications on cropland used for grain sorghum is shown as Table 2. With an estimated season average price for grain sorghum at $2.20 per bushel, it would take a 1.89 bushel per acre yield increase to balance the benefits with the costs for lime applications.

In these examples, the producer who expects a yield response greater than 2 bushels per acre would likely make the investment in lime. Higher rates of lime application would require greater yield response. This analysis applies for owner-operators who receive the full benefits of yield increases for the entire decision period and who pay for all of the lime application.

Landlord-Tenant

Landlord-tenant situations require a slight modification in the analysis. Begin with an evaluation of the rental arrangement to determine if it is equitable. Most crop leasing in Kansas involves a crop-share lease. A fair and equitable crop share lease distributes the crop

production and returns in the same proportion as the production resource contributions.

The landlord provides the land, pays the taxes, and shares in the cost of variable inputs that increase yields. The tenant operator provides the labor, management, machinery, and pays for seed, fuel, and miscellaneous inputs in the production process.

Budgets provide estimates for input costs. Costs can be allocated to either the landlord or the tenant operator to determine the percentage of total resources contributed by the landlord.

Evaluation of wheat and grain sorghum production with and without the application of lime is shown in Table 3. Analysis shows the landlord is contributing less than one-third of production resources in both cases. Yield increases of less than 2 bushels per acre would cover the annualized lime material and application costs. From the landlord's perspective, if the crop share arrangement remains at the customary one-third/two-thirds division, a yield increase of 1.89 bushel per acre for wheat and 2.8 bushel per acre for grain sorghum would cover the full annualized expense of a lime application.

If the landlord does not cover the expense of lime applications, the share of resources contributed by the landlord remains below one-third. An equitable lease would provide a different share arrangement than the customary one-third/two-thirds division. If the tenant operator decides to utilize lime to increase production, then the share of resources provided by the tenant increases and the landlord's share decreases. For this example, the tenant paying the full lime bill would be providing approximately 72 percent of the total crop production resources. An equitable lease would divide the crop production in the same proportion.

Common Lime Expense Share Practices in Kansas

In a survey of 60 lime dealers, haulers, and retailers, six different lime expense sharing practices were identified. Table 4 shows the survey results. Liming cropland is most common in the eastern two-thirds of Kansas. Figure 1 shows agricultural lime quarries and volume of lime produced in the year ending June 30, 1993.

In the past it was common for landlords to pay for cropland liming in full. Fourteen of the lime dealers reported that this practice is still followed.

Some landlords have negotiated with their tenants to have them share in these land maintenance expenses. This results in a shift in some expense to the tenant operator. Dealers reported knowledge of several expense sharing arrangements with the tenant paying a part of the liming bill with the landlord.

The most common lime expense sharing arrangement was one in which the landlord paid one-third of the lime bill and the tenant paid two-thirds. This arrangement matches the most common crop share arrangement for wheat cropland in Kansas.

Table 1. Partial Budget Worksheet		
Alternative under consideration:	Liming Acid Soils for Wheat Production	
Added Returns:	Break-even Added returns from 1.28 bushels of wheat	$4.15
Reduced Costs:	Reduction in Phosphate ($P_2 0_5$) expense per acre per year	3.00
(1) Total added Returns and Reduced Costs:		$7.15
Added Costs:	Apply 2 ton lime/acre @ $18/ton, capitalized over 7 years, 9% interest	$7.15
Reduced Returns:	None	—
(2) Total Added Costs and Reduced Returns:		$7.15
Net Income Change (1) – (2)		**0**
Notes: Break-even yield increase to offset $4.15 in added expense from liming: $4.15/$3.25 per bushel = 1.28 bushels per acre.		

Table 2. Partial Budget Worksheet		
Alternative under consideration:	Liming Acid Soils for Grain Sorghum Production	
Added Returns:	Break-even added returns from 1.89 bushels of grain sorghum	$4.15
Reduced Costs:	Reduction in Phosphate ($P_2 P_5$) expense per acre per year	3.00
(1) Total Added Returns and Reduced Costs:		$7.15
Added Costs:	Apply 2 ton lime/acre @ $18/ton, capitalized over 7 years, 9% interest	$7.15
Reduced Returns:	None	—
(2) Total Added Costs and Reduced Returns:		$7.15
Net Income Change (1) – (2)		**0**
Notes: Break-even yield increase to offset $4.15 in added expense from liming: $4.15/$3.25 per bushel = 1.28 bushels per acre.		

There are instances when the landlord does not agree to pay any of the expenses for maintaining the cropland with liming.

Cropland Leases

Lime dealers indicated they are familiar with traditional share arrangements for crop production and production expenses. They also recognize the long term nature of lime treatments of cropland. Dealers routinely advise tenant operators to secure long-term lease arrangements whenever they are responsible for any portion of the lime expense on wheat cropland. Since a lime treatment will provide a positive impact on crop yields for several years, it is in the tenant's financial interest to secure these benefits with a long term lease.

Lime dealers indicated that a 5-year lease was common among landlords and tenants when lime expenses are shared. Ten-year leases also were observed, especially when the lime treatments were designed to remain effective in the soil for that period.

These survey results indicate there is wide variation in the arrangements between landlords and tenant operators in both crop share arrangements and lime expense sharing. Some operators hold to the traditional view that liming of cropland is periodically necessary to maintaining the productive capacity and efficiency of the land. Other landlords faced with cash flow pressures or unexpected expenditures for lime materials for their cropland are negotiating share arrangements with their tenants.

Summary

Tenant farm operators who recognize the value of liming acid soils and expect significant yield response to corrected soil pH levels are willing to pay a portion of the soil maintenance expenses. In return for this payment, they are negotiating long term lease arrangements that secure the landlord's land to their operation for five or more years. This permits tenant operators to make other investment decisions that require some long term stability in operation size and scale.

Some landowners prefer to retain more control over their cropland investments and therefore are willing to pay for all lime materials and the associated expenses for delivery and spreading. The lime investment for these landlords results in greater productive cropland, increased share crop returns and income without entering into a long term cropland lease with the current tenant operator.

Liming acid soils is a traditional cropland management practice that continues to have practical and economic benefits for owner-operators and for both landlords and tenant farm operators. Using scientific and business principles, owners and operators can make appropriate decisions that lead to short and long term economic benefits.

Table 4. Lime Share Arrangements Between Landlords and Tenants Reported by Lime Dealers

	Number of Dealers Reporting
Lime Expense Paid in Full by Landlord	14
Landlord Pays ⅔ - Tenant Pays ⅓	3
Landlord Pays ½ - Tenant Pays ½	7
Landlord Pays ⅖ - Tenant Pays ⅗	4
Landlord Pays ⅓ - Tenant Pays ⅔	21
Lime Expense Paid in Full by Tenant	4

Table 3. Production Costs, Landlord Shares and Break-even Yields for Liming Acid Soils in Kansas

	Crop			
	Wheat		Grain Sorghum	
	No Lime	Lime	No Lime	Lime
Total Economic Cost of Production per Acre	$160.43	$164.58	$183.87	$188.02
Landlord Cost per Acre Includes: Land cost, taxes, lime expense and share of fertilizer	45.85	52	51.78	57.93
Landlord Share as a Percent of Total Cost	28.6%	32%	28.2%	30.8%
Break-even Wheat Yield (bu/a) at $3.25/bushel and $22.75/acre Deficiency Payment	42.36	43.64	—	—
Break-even Grain Sorghum Yield (bu/a) at $2.20/bushel and $18.70/acre Deficiency Payment	—	—	75.08	76.96
Break-even Yield/a Increase Needed to Cover Added Total Costs Due to Liming	—	1.28	—	1.89
Break-even Yield/a Increase Needed to Cover Added Landlord Costs Due to Liming	—	1.89	—	2.8

Two tons of lime per acre are applied. Lime costs of $7.15 per acre per year are derived from a lime cost of $18 per ton, capitalized over 7 years at 9 percent interest. Fertilizer cost per acre per year are reduced by $3.00, which reduces the landlord share of fertilizer expense by $1.00

References and Resources

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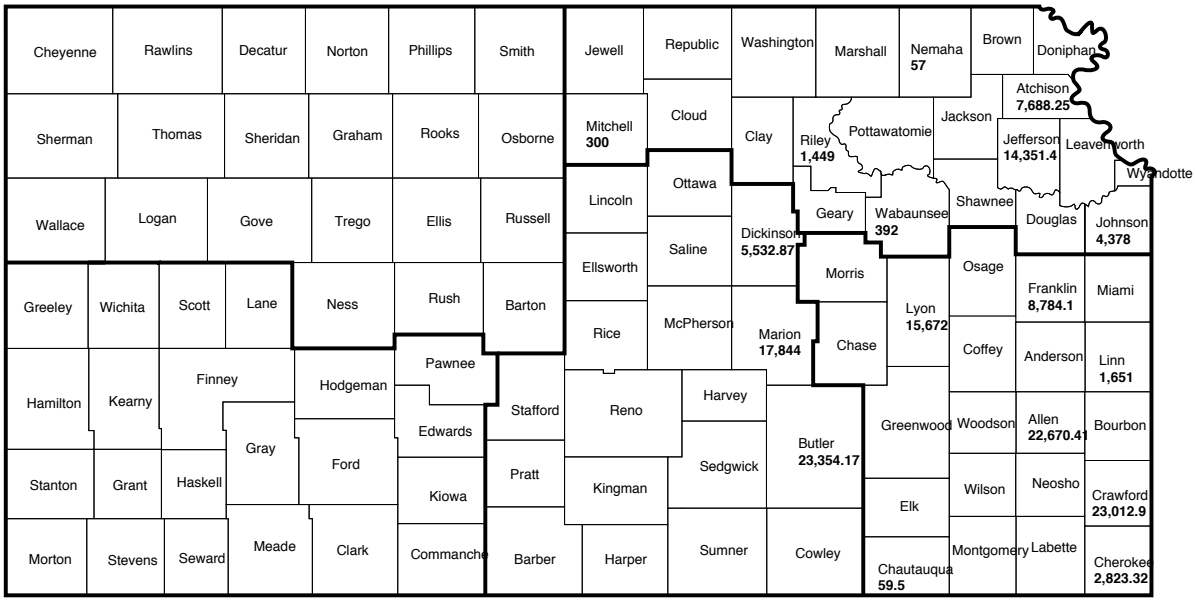
Figure 1. Kansas Agricultural Lime Report — *July 1, 1992* through *June 30, 1993*



Kansas Totals by Area

Kansas Total	149,939.92 Tons	SC—46,731.04 Tons	NW—0 Tons
Out of State Total	31,446.81 Tons	NE—28,535.65 Tons	SW—0 Tons
Total Ag Lime	181,386.73 Tons	SE—74,673.23 Tons	

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