

Leasing Cropland

Kevin Dhuyvetter and Terry Kastens

Kansas State University



Background

Crop producers rely heavily on rented land in their farming operations. For example, in a 1994 survey of producers belonging to the Kansas Farm Management Associations, Langemeier, Albright, and Delano (1995) found that nearly 90 percent of the operations used rented land.¹ Furthermore, from 2000-2002, crop acres rented by Farm Management members represented 68% of the total crop acres they farmed (KFMA, *Annual ProfitLink Summary*). Because rented land is so important in farming operations, the rental arrangements between landowners and producers can have significant impacts on the risk and returns of those operations.² Thus, it is crucial that producers understand how changing production practices impact rental arrangements and how different rental arrangements affect their operations.

Rental arrangements often appear unresponsive to changes in production practices, and generally slow to change over time. One possible explanation for this is that producers generally work with multiple landowners and they may be reluctant to change rental arrangements with any one landowner unless changes can be made with them all. Additionally, rental arrangements may be slow to change because land is often rented from the same landowner for an extended time and the parties involved may believe the costs of renegotiating rental arrangements on a regular basis outweigh the benefits.

Crop land is typically rented in one of three ways: (1) cash rent, (2) crop share, or (3) cash/share combination, with the majority in Kansas being crop share, followed by cash rent. This paper focuses on crop share and cash rental arrangements. The first section of this paper discusses the economic principles of crop share leases, the second section discusses cash rents, and the final section discusses the *KSU-Lease* Excel spreadsheet that can be used to determine rental arrangements for each of these situations. There also has been an increased interest in flexible cash rents over the last several years, but this paper will not discuss flexible cash rents as they still represent only a very small portion of leases in Kansas. However, for those interested in a flexible cash rent lease, the *FlexRent* spreadsheet and corresponding paper available at www.agmanager.info provide additional information on this subject.

¹ More recent surveys (Golden, Tsoodle, and Bigge, 2003; Tsoodle and Wilson, 2000) reported a lower percent of farms that lease cropland, 54% and 67%, respectively. These survey results were based on a broader sample of farms that included more small and part-time farms. The older survey from KFMA is reported here as it likely is a more accurate representation of commercial farms.

² In this paper, the words landowner and landlord are used interchangeably to represent the party owning the land (lessor). Likewise, the words tenant, operator, and producer are used interchangeably to represent the party that is farming the land (leasee).

Crop Share Leases

This section provides a brief discussion of the basic concept and principles of an equitable crop share lease. For a more detailed explanation and discussion of developing equitable leases see Langemeier (1997a). Producers often struggle with establishing terms for crop share rental arrangements. Economic theory says that equilibrium rates occur where supply of land equates with demand for land. Thus, the question arises, How do we arrive at an equilibrium price? Typically, landowners and tenants resort to some sort of negotiation and claim to want a crop share lease arrangement that is “fair” and equitable to both parties. The term “fair” really cannot be defined because what is fair is in the eye of the beholder, but the term equitable can be defined and thus this is the fundamental principle upon which crop share lease arrangements are based.

The concept of an equitable crop share arrangement is to identify all annual contributions made separately by a landowner and a tenant and then share any income in this same proportion. In other words, each party is compensated according to what he/she contributed to the production process. The underlying assumption of an equitable lease is that economic profits are shared in the same proportion as annualized costs of production, where the annualized costs of the various inputs implicitly account for risk via opportunity interest costs assigned to them. That is, with an equitable lease, the rate of return (positive or negative) on annualized costs is exactly the same for all inputs in the production process. Defining a lease in this manner implies that shares going to each party need to change as relative contributions change, if the lease is to remain equitable.

Principles of Crop Share Leases

A good crop share lease should follow five basic principles (Langemeier, 1997a): (1) yield increasing inputs should be shared, (2) share arrangements should be adjusted as technology changes, (3) total returns are divided in the same proportion as resources contributed, (4) compensation for long-term investments at termination, and (5) good landowner/tenant communications.

While all inputs are yield increasing (e.g., without seed there is no yield), principle #1 refers to inputs where yield is a continuous, increasing at a decreasing rate, function of the use of the input. Examples of yield increasing inputs are fertilizer, irrigation water, possibly herbicides in semi-arid regions, and possibly hybrid seed. The economic optimal amount of an input to use is when the value of one additional unit of input equals the cost of supplying that additional unit. In economic language, this is referred to as the point where the value of marginal product (VMP) equals the marginal input cost (MIC).

Figure 1 shows optimal fertilizer application rates across alternative cost- and income-sharing arrangements. In this example, VMP is greater than MIC at 80 pounds of fertilizer but less at 90 pounds, so total returns to fertilizer are maximized at 80 pounds. To determine the optimal amount of fertilizer a tenant would apply, VMP and MIC need to be adjusted to reflect the appropriate percentages. When the cost of the yield increasing input is not shared by the landowner (2/3 inc.- all cost column), the tenant has an economic incentive to under fertilize and hence reduce total returns (returns to both landowner and tenant). Similarly, if the tenant pays none of the cost (2/3 inc.- no cost

column), he has an incentive to over fertilize which also decreases total returns. When the cost of fertilizer is shared in the same proportion as the income (2/3 inc.- 2/3 cost) the tenant maximizes his returns at the same level of fertilizer that maximizes total returns.

Because fertilizer is a relatively low-cost input, sharing fertilizer costs in the same percent as income may not be critical. For example, in Figure 1, when fertilizer costs are not shared (i.e., 2/3 inc. - all cost column), the tenant's returns over fertilizer costs are maximized at 70 pounds (\$96.53/acre), but this is only \$0.26/acre greater than the returns at 80 pounds (\$96.27/acre), which would have been the optimal level for the landowner and tenant sharing the fertilizer input "correctly." Thus, it may be that "violating" principle #1 may not be a major problem in some instances. However, as the relative cost of the yield increasing input increases, it becomes more important to share the input because the economic incentive for the tenant to use either too little or too much of the input becomes greater. The key point behind principle #1 is that it helps to promote optimal production management.

Income Over Fertilizer Costs With Various Crop Share Arrangements									
						Income and cost position of tenant			
Fert (lb/ac)	Yield (bu)	Income (\$/ac)	Return over fert	VMP* (\$2.05/bu)	MIC** (\$0.30/lb)	All inc. all cost	2/3 inc. all cost	2/3 inc. no cost	2/3 inc. 2/3 cost
0	36	\$73.80	\$73.80	---	---	\$73.80	\$49.20	\$49.20	\$49.20
10	50	\$102.50	\$99.50	\$28.70	\$3.00	\$99.50	\$65.33	\$68.33	\$66.33
20	60	\$123.00	\$117.00	\$20.50	\$3.00	\$117.00	\$76.00	\$82.00	\$78.00
30	68	\$139.40	\$130.40	\$16.40	\$3.00	\$130.40	\$83.93	\$92.93	\$86.93
40	74	\$151.70	\$139.70	\$12.30	\$3.00	\$139.70	\$89.13	\$101.13	\$93.13
50	79	\$161.95	\$146.95	\$10.25	\$3.00	\$146.95	\$92.97	\$107.97	\$97.97
60	83	\$170.15	\$152.15	\$8.20	\$3.00	\$152.15	\$95.43	\$113.43	\$101.43
70	86	\$176.30	\$155.30	\$6.15	\$3.00	\$155.30	\$96.53	\$117.53	\$103.53
80	88	\$180.40	\$156.40	\$4.10	\$3.00	\$156.40	\$96.27	\$120.27	\$104.27
90	89	\$182.45	\$155.45	\$2.05	\$3.00	\$155.45	\$94.63	\$121.63	\$103.63
100	90	\$184.50	\$154.50	\$2.05	\$3.00	\$154.50	\$93.00	\$123.00	\$103.00

* VMP = Value of Marginal Product (value of the change in yield from the preceding row)

** MIC = Marginal Input Cost (cost of the additional fertilizer from the preceding row)

Figure 1

Principle #2 simply recognizes that technologies can affect equitable share arrangements if they change the relative contributions of the parties involved. Examples of technological changes are reduced or no-till, new crops and/or rotations, center pivot irrigation, hybrid seed, bio-technology, and precision ag (GPS).

A specific example of a technological change is the increased adoption of the wheat-corn-fallow rotation in western Kansas. Figure 2 shows how the relative contributions change for the landowner and tenant by moving from a wheat-fallow (WF) to a wheat-corn-fallow (WSF) rotation based on projected crop budgets for these rotations (2001 Farm Management Guides, MF-903 and MF-2150). With the WF rotation, the traditional crop share arrangement has been a 33.3 / 66.7 (landowner 33.3% and tenant 66.7%) with the landowner sharing the fertilizer expense and the tenant paying for all herbicide. However, as can be seen in Figure 2, if the landowner is sharing the fertilizer in the same percent as the income (i.e., according to principle #1), the equitable arrangement would be a 36.9 / 63.1. Based on the budgets in this example, the traditional 1/3 - 2/3 arrangement is equitable when the landowner provides land only and does not share the fertilizer expense. The reason the equitable terms have changed from what they were historically is that the more profitable WCF rotation has led to higher land values which has increased the landowner's relative contribution.³

With the WCF rotation, if the landowner only shares fertilizer costs, the equitable arrangement is a 30/70. On the other hand, if the landowner shares all of the herbicides, the equitable arrangement is a 36.5/63.5. Given the costs in this example, it works out that if the tenant pays 100% of the wheat-related herbicides and 75% of the corn-related herbicides, the equitable arrangement is exactly a 1/3 - 2/3 (data not shown).

Equitable Crop Shares with Wheat-Fallow vs. Wheat-Corn-Fallow Rotations (based on 2001 Farm Management Guides)							
Contributor --- (L=Landlord, T=Tenant, and S=Shared (equitably))							
Alternative Arrangements for Sharing Various Inputs							
<u>Crop rotation</u>	<u>Wheat-Fallow</u>			<u>Wheat-Corn-Fallow</u>			
Land	L	L	L	L	L	L	L
Machinery	T	T	T	T	T	T	T
Fertilizer ¹	S	S	T	S	S	S	T
Herbicide (wheat) ¹	T	S	T	T	T	S	T
Herbicide (corn) ¹	---	---	---	T	S	S	T
Other	T	T	T	T	T	T	T
Contributions (L/T)	36.9/63.1	44.8/55.2	33.5/66.5	30.0/70.0	34.8/65.2	36.5/63.5	26.0/74.0
Net return, \$/ac	-\$15.20	-\$15.20	-\$15.20	-\$0.60	-\$0.60	-\$0.60	-\$0.60

¹ Product only; application cost is included in machinery category and is covered by tenant.

Figure 2

³ This is reinforced by the fact that the WF rotation is not profitable while the WCF rotation has an economic profit close to \$0. That is, dryland land values in western Kansas have increased to reflect the economic returns associated with the more intensive crop rotation.

How a lease is structured before the adoption of a new technology should also be considered. Figure 3 compares the equitable crop share percentages of going from conventional till (CT) to no-tillage (NT) in north central Kansas under two different scenarios. In the first scenario (Farm #1), the landowner only shares fertilizer and the equitable arrangement is approximately a 1/3 - 2/3. In this case, switching to no-till has little impact on the equitable crop share percentages because herbicide is essentially a substitution for tillage. That is, the move to no-till simply means the tenant is substituting one input he was responsible for (machinery) for another input he is responsible for (herbicides), and thus this has no affect on the landowner.

In the second scenario (Farm #2), it is assumed the landowner is initially sharing all herbicides and application costs (third and fourth columns). In this case, switching to no-till increases the equitable share for the landowner (40.6% compared to 36.3%), as the landowner is now contributing a larger share of total inputs. The last column shows the equitable arrangements if the tenant pays 100% of the burndown herbicide expense (and application) and the landowner continues to share the “non-burndown” herbicides. It can be seen that in this case, the equitable terms remain close to what they were prior to switching to no-till (i.e., 36.3% with CT and 36.7% with NT).

Equitable Crop Shares with Conventional (CT) vs. No-Tillage (NT) in NC Kansas (Costs are based on Ty Stucky's Master's Thesis (2000))					
Alternative Arrangements for Sharing Various Inputs					
Contribution	Farm #1		Farm #2		
	CT	NT	CT	NT	NT
Land	Landlord	Landlord	Landlord	Landlord	Landlord
Machinery	Tenant	Tenant	Tenant	Tenant	Tenant
Fertilizer/insecticide¹	Shared	Shared	Shared	Shared	Shared
Herbicide	Tenant	Tenant	Tenant	Shared	Shared
Herbicide appl.	Tenant	Tenant	Tenant	Shared	Shared
Burndown herbicide	Tenant	Tenant	Tenant	Shared	Tenant
Burndown herb. appl.	Tenant	Tenant	Tenant	Shared	Tenant
Other	Tenant	Tenant	Tenant	Tenant	Tenant
Contributions (L/T)	32.5/67.5	33.1/66.9	36.3/63.7	40.6/59.4	36.7/63.3

¹ Product and application cost

Figure 3

Figures 2 and 3 demonstrate that the impacts new technologies have on equitable crop share arrangements will vary due to a number of factors (e.g., geographic region, specific technology being adopted, inputs shared initially). These examples also indicate that the adoption of a new technology may increase, decrease, or have no effect on the equitable crop share percentage for either the landowner or the producer. Therefore,

generalizations about the impact of new technologies on crop share arrangements are not always possible. Because of this, the impacts that new technologies have on equitable shares need to be analyzed on a case-by-case basis. Clearly, in the face of on-going technological change in agriculture, it is important that lease arrangements are flexible enough to accommodate such changing technologies. Another key point from Figures 2 and 3 is that if the landowner and tenant are willing to consider terms that are “different from the past,” there are numerous arrangements that can be equitable in any particular situation.

Principle #3 states that total returns should be divided in the same proportion as resources contributed, which is basically how an equitable lease is defined. In order to identify what is contributed by each party, some type of budgeting process is required to account for all costs. Often the most difficult part of this process is determining the annual contributions for capital assets such as land, machinery, or irrigation equipment. The different costs to consider and how they are valued is discussed in the using the *KSU-Lease* spreadsheet section that follows.

If the objective of a crop share arrangement is to have a “fair” and equitable lease where both parties are compensated according to their relative contributions, then whether certain inputs are shared or not shared is not an issue (except as it may apply to principle #1). Rather, what is important is that whoever contributes or pays for the input is compensated accordingly by adjusting the crop shares when necessary.

If landowners and tenants have preconceptions about which inputs should be shared, the actual percentages are then determined by the equitable process, which simultaneously selects crop shares. On the other hand, if there are preconceptions about what crop shares should be (i.e., crop production “should be shared 1/3 - 2/3”), different input items might be cost shared at different levels to make the equitable process happen. In other words, crop share leases based on this equitable concept can be developed based on either a predetermined share rate (e.g., 33/67, 40/60, 50/50) or a predetermined mixture of which inputs are shared (e.g., fertilizer and insecticide) but not both as a general rule. In short, with a continuous changing agriculture, landlords and tenants need to be willing to consider changing crop shares, input shares, and which inputs are shared, relative to what has been traditionally accepted.

Principle #4 simply states that if a tenant pays for any long term inputs (e.g., lime, alfalfa seed) he/she should be compensated for any unused portion of that investment when the lease is terminated. This would hold true whether the lease is a crop share or cash lease, and whether the input was paid entirely by the tenant or whether it was shared with the landowner.

Principle #5 says that a successful lease is based on good communications between the landowner and the tenant. Regardless of whether the lease is cash rent or crop share, good communications and trust between the landowner and producer are more important than any other factor if the goal is to have a long term arrangement that is in the best interest of both parties. It is especially important that landowners and tenants maintain good communication as production practices change so that rental arrangements can be evaluated and revised as economic and technological conditions dictate.

Cropland Cash Rental Arrangements

Historically, cash renting crop land has been much less common than renting on a crop share basis in Kansas; however, recently the interest in cash rent has been increasing. A number of possible explanations arise: (1) increased planting flexibility, (2) landowner reluctance to share increased expenses associated with new tillage/cropping systems/production technologies, (3) ever older landowners wanting fixed income, (4) increasing farm size and number of landowners per tenant, which lead to higher costs of servicing crop share leases, and (5) difficulty in prorating long run capital investments in certain technologies (e.g., precision agriculture).

While there are numerous benefits associated with cash leases, it is important for both landowners and tenants to recognize there are consequences of switching from a crop share lease to a cash lease. Cash rents are more “transparent” and thus it may be easier for competing tenants to bid land away. For example, Langemeier, Albright, and Delano (1995) found that in areas where cash renting was more common, land tended to change hands more often than in areas where crop share renting was more common. While the consequences of this are quite obvious for tenants, i.e., less land to farm, there can be downside for landowners as well with land changing hands frequently. That is, landowners need to recognize that the highest “gross” rent offered does not always equate to the highest “net” rent. Instances exist where producers have bid up rents to get access to the land, only to default on their payments to the landowner at a later date. Another consideration when going to cash rent is that the risks of low yields and prices shifts entirely to the tenant; whereas, these risks are shared with a crop share lease. This may mean that tenants need to offer a slightly lower rent to compensate for increased risks (this is discussed in more detail in the next section). The bottom line is that both producers and landowners need to recognize that switching to cash rent can have both positive and negative consequences.

Risk-return tradeoff

With regards to any type of investment, the tradeoff between risk and return is generally characterized as increased returns being associated with increased risk (Figure 4). Given this type of tradeoff, it can be seen that in order to realize higher average returns (O), a person needs to be willing to take on more risk (s_x). Similarly, a person desiring less risk will need to accept lower returns. Putting this in the crop share and cash rent framework, it seems reasonable that a landowner would be willing to accept lower returns with cash rent relative to crop share because of the lower risk (e.g., move from point A to point B). Likewise, because of the increased risk associated with cash rent, a producer would want a higher return relative to crop share (e.g., move from point B to point A). Thus, a producer would want to pay less with cash rent compared to share rent. How much lower the cash rent might be, relative to crop share, will depend primarily upon the relative risk of the two parties involved.

It is important that producers consider the impact of moving from share to cash rent can have on the profitability and risk of their operations. Specifically, it is important to realize how much the variability in income might increase with cash renting compared to crop share renting.

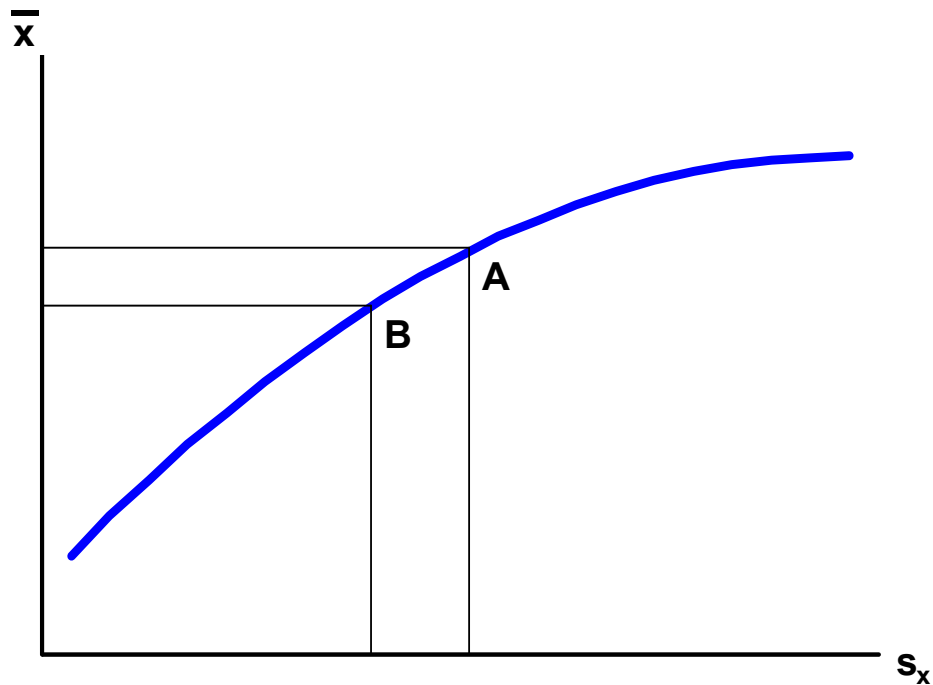


Figure 4

Comparison of tenant's income from crop share vs. cash rent

To examine income variability from renting on a cash versus crop share basis, 1987-1996 yield information was collected for farms in the north central (NC), southeast (SE), and southwest (SW) Kansas Farm Management Associations. Only farms having yields for wheat, milo, and soybeans for each year were considered for NC and SE, and only farms having wheat and irrigated corn yields each year were considered for SW. Using these criteria, the numbers of farms considered were 24, 65, and 14 for NC, SE, and SW, respectively. A representative farm was developed based on the average number of acres for all the farms considered. The representative farms had the following crops and acres: NC - wheat (460), milo (211), and soybeans (141); SE - wheat (328), milo (243), and soybeans (374); SW - wheat (548), fallow (548), and irrigated corn (388).

Given the acreage mix of the representative farms and the actual yields of all farms considered, net income was generated for each farm for each year using average county prices, an average government payment, and 1997 costs for the region (KSU Farm Management Guides). Because yields trend up over time and this analysis is based on 1987-1996 actual yields, average returns over the ten year period were normalized to zero by adjusting yields up proportionally (increase of approximately 10 percent in all regions). This normalization of returns is also consistent with the general assumption that average profits equal zero in the long run.

Equitable crop share arrangements were calculated and compared to those typical in the region (Lanagemeier, Albright, and DeLano, 1995). The equitable crop share arrangements determined were 1/3 - 2/3 with the landowner sharing fertilizer, insecticide, irrigation energy, and herbicides on spring crops and the tenant paying all other operating expenses.

The tenant's returns were calculated for each year with the following rental arrangements: (1) typical crop share, (2) cash rent equivalent, and (3) crop share with no shared inputs. The first method was the 1/3 - 2/3 arrangement discussed above. The second method was a fixed cash rent that was equal to the average cash equivalent of the crop share returns of the landowner (landowner's 1/3 share of income less landowner's shared expenses). No risk adjustment was considered, as that would affect average returns but not income variability, and so is not relevant for this analysis. The third method was an equitable arrangement where no inputs are shared by the landowner. With this method, the tenant's share of the income was 73.5, 74.8, and 77.9 percent for NC, SE, and SW, respectively. This third method was considered because it represents an arrangement that shares risk but is consistent with landowners who may not want to pay bills associated with sharing inputs. This type of crop share arrangement where income is shared equitably and the landlord pays no expenses, which violates principle #1, is referred to as a "net share rent."

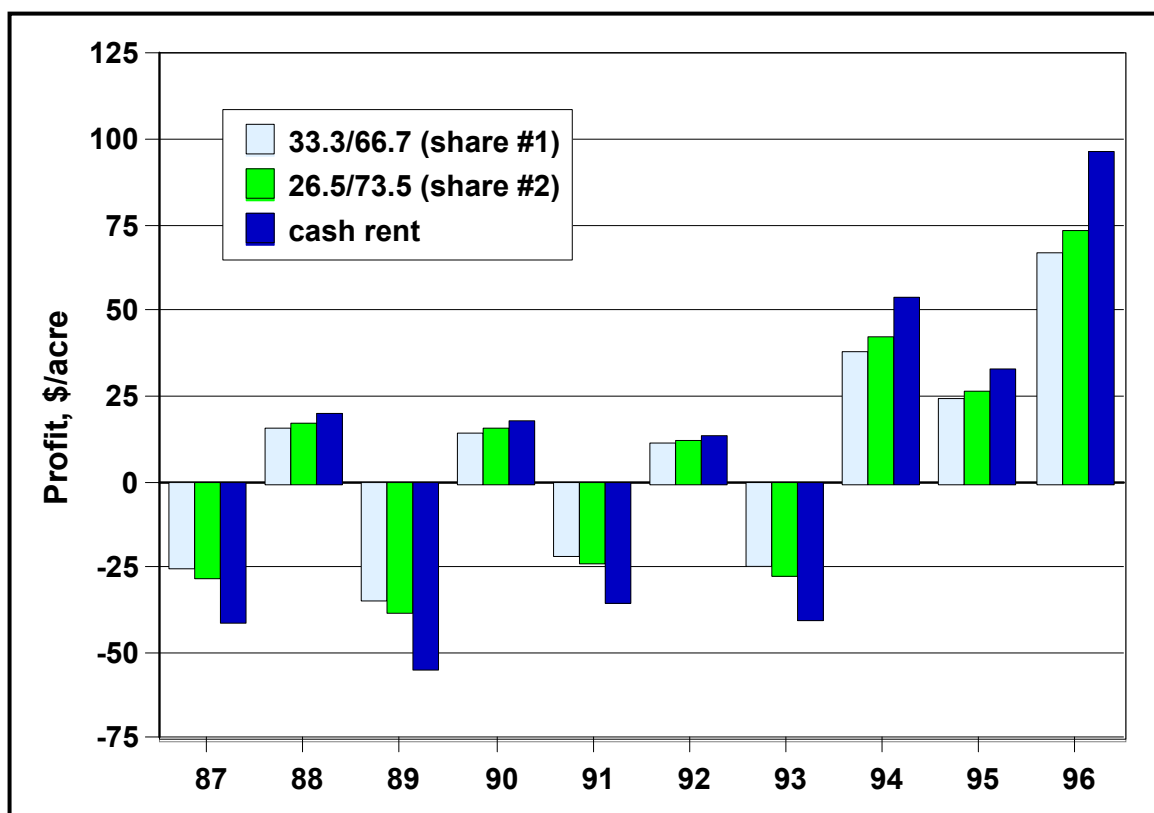


Figure 5

The analysis assumes that all acres are rented and that the producer does not make any changes in production (acres or costs) as the rental arrangement changes. Figure 5 shows the annual profit per acre to the tenant of one of the individual farms in NC Kansas for each of the three rental arrangements considered. The annual variability of profit is considerably greater with the cash rent than with either of the crop share rental arrangements — average profits are equal for all methods. As expected, the producer is better off with a cash rent in the good years but would prefer a crop share arrangement in the bad years. Although not shown, similar patterns exist for the farms in SE and SW Kansas.

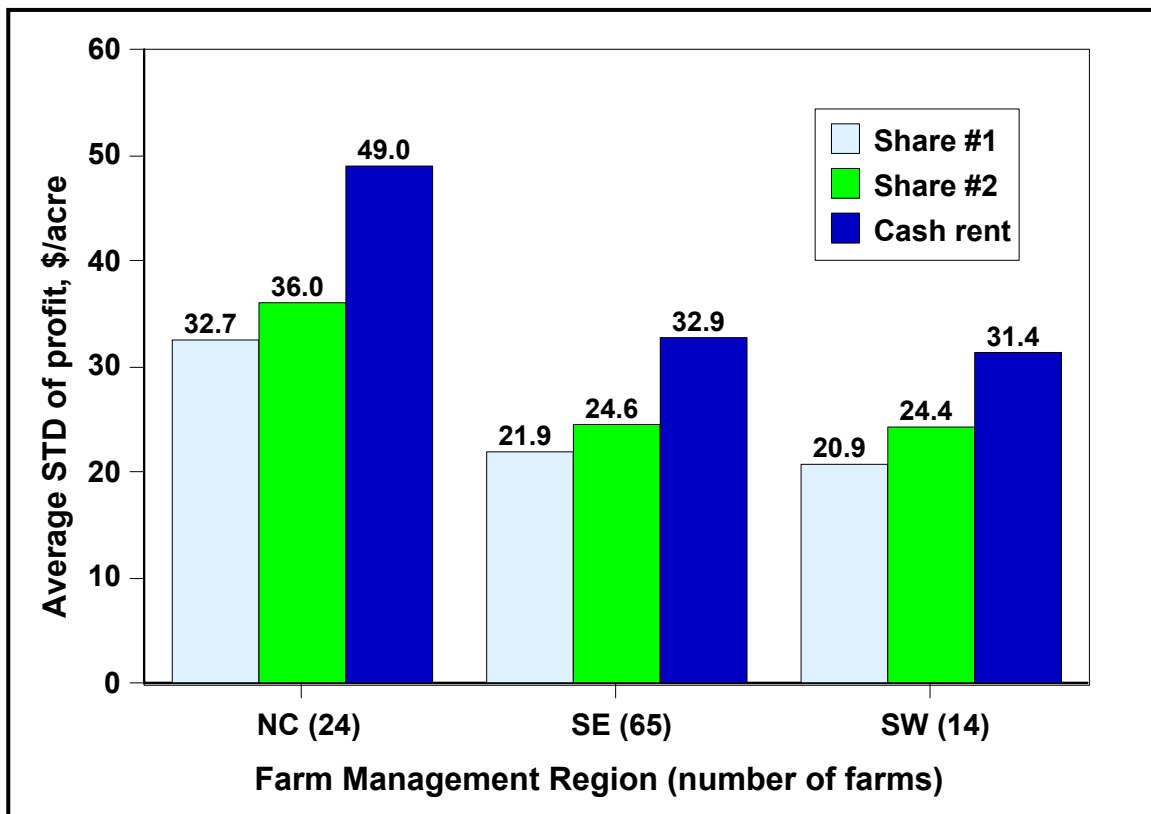


Figure 6

The average variability of producer profit for the different rental arrangements for the different regions is shown in Figure 6. In all regions, variability, as measured by the standard deviation of income across years, increased about 50 percent by going from an equitable crop share arrangement sharing some inputs to a cash rent. This indicates that the risk to producers increases substantially with a cash rent compared to the “typical” crop share arrangement. The way to interpret a standard deviation is the following: returns would be expected to fall in the range of the average (mean) plus or minus one standard deviation 68 percent of the time and between the mean +/- two standard deviations 95 percent of the time. For example, in the NC region, we would expect returns from a typical crop share arrangement to fall between $-\$32.7$ and $+\$32.7$ 68 percent of the time, compared to $-\$49$ and $+\$49$ with a cash rent (the mean is zero for both methods because returns were normalized).

If producers switched to an equitable crop share arrangement with the landowners sharing no expenses (share #2), income variability increased only 10-17 percent. Thus, for landowners not wanting to pay bills associated with the typical crop share arrangements, producers may want to consider alternative crop share arrangements as opposed to switching to cash rents, unless there is an adequate “risk premium” factored into the cash rent.

Risk Premium

A risk premium, or risk adjustment, represents a reduction in the cash rent relative to what is expected from a crop share arrangement, to account for the shift in risk from the landowner to the tenant. The amount of the risk adjustment is a function of an

individual's aversion to risk as well as the income variability. Since an individual's aversion to risk is difficult to quantify, a recommended risk premium cannot be calculated. In working with landowners and producers in Kansas, a risk adjustment of 3-7 percent is typically suggested, which is generally understood and considered reasonable.

It should be pointed out that risk premiums may not always be observed (i.e., cash rents might be equal to or greater than crop share cash equivalents). Possible reasons for this are: (1) costs associated with servicing crop share leases are high, (2) environmental stewardship concerns, (3) short-term lease, and (4) producers are not average. For tenants that have many landowners the cost of tracking shared expenses, marketing a landlord's crop, and complying with government programs in the name of the landowner (all are costs associated with crop share leases), may be sufficiently high that tenants effectively will pay a premium for a cash rent. Moreover, if a landowner is concerned that a tenant will not maintain the quality of land with regards to fertility or weed control, the landowner may require a cash rent above what would be expected from a crop share arrangement. Producers wishing to spread fixed machinery and labor costs over more acres may bid cash rents up above an equilibrium long run rate. However, because fixed costs will need to be paid in the long run, these higher cash rents will not be able to be sustained over long periods of time. Producers that are above average in terms of production abilities (i.e., higher yields) or cost efficiencies (i.e., lower costs) may bid cash rents up relative to what the average producer can pay over the long run. Also, the tenant's risks might not increase with cash rent due to things such as subsidized crop insurance, geographical spread of acres, disaster payments, etc. Thus, there are legitimate reasons why cash rent risk premiums may not be observed in all cases.

Determining cash rent rates

As with crop share rental arrangements, both landowners and tenants often request help in determining cash rental rates that are "fair" to both parties. Given that market rental prices (i.e., cash rents) are determined by supply and demand, the cash rent negotiated between landowners and tenants *is* the fair rent. That is, in areas where there is sufficient cash renting, the prevailing cash rent should provide an approximation of the appropriate measure of "fair" rent. However, in some situations there is no established rental rate or, if there is one, the rate has extenuating circumstances that preclude it from being appropriate (e.g., rate includes buildings or machinery, rent is between family members). Furthermore, publicly reported cash rental rates often represent a relatively wide geographical region and thus may not reflect local conditions. For reported cash rents see *Kansas Land Prices and Cash Rental Prices* (Dhuyvetter and Kastens, MF-1100) and *Kansas County Level Land Values and Cash Rents* (Dhuyvetter, Kastens, and Taylor, 2003). In cases where publicly reported values or local rates are not appropriate, the following methods are typically used for determining a starting point for negotiation between the landowner and producer (Langemeier, 1997b): (1) landowner's cost, (2) crop share adjusted for risk, and (3) amount tenant can afford to pay. By definition, these three methods, and especially method (2), are consistent with the equitable approach used to develop crop share rental arrangements.

Landowner's cost refers to the opportunity cost of land investment, less expected capital gains, plus real estate tax. The idea is that a landowner expects some net rate of return

(capital gains plus cash rent less real estate taxes) on his investment otherwise the land would be sold. This net rate of return can be approximated by the historical average rent-to-value ratio. The cash rent would be calculated by multiplying the rent-to-value ratio by the market value of the land. For a much more detailed discussion of land values and historical returns to land, see *Valuing and Buying Farmland, with a Consideration of Non-Ag Features* (Kastens and Dhuyvetter, 2003).

Because many landowners and tenants are familiar with crop share arrangements, using a crop share-equivalent approach to determine a cash rental rate is practical. This approach determines the cash equivalent amount of an equitable crop share arrangement and then often makes a risk adjustment to that value (risk adjustment or risk premium was discussed earlier). The risk adjustment suggested is to reduce the crop share equivalent amount by 3-7 percent. However, as previously mentioned, there are situations where the tenant's risk may not increase and thus a risk adjustment of zero may be appropriate.

The “amount a tenant can afford to pay” method of establishing cash rents is based on the tenant receiving all of the income and paying all expenses and whatever is left is available for cash rent to the landowner. In practice, landowner's cost and amount a tenant can afford to pay often represent lower and upper bounds, respectively, to the rent negotiation process. But, if individual land ownership and tenant profitability values are used, rather than averages, the “amount a tenant can afford” can be less than the land ownership costs method.⁴ Nonetheless, these values can help establish a framework within which to begin rent negotiation.

Using the *KSU-Lease* Spreadsheet

Determining equitable crop share percentages

KSU-Lease is based on the principle that the crop share lease is equitable to both parties, where “equitable” means the income generated from the crop land (e.g., crop production, government payments, crop insurance indemnities) is shared in the same proportion as the inputs are contributed by the parties involved in the lease.

The first step in determining the terms of an equitable crop share lease is to identify all contributions to the production process made by the landowner and the tenant. In *KSU-Lease*, the “tab” labeled **Crop budgets** represents the section in the spreadsheet where all cost and return information for up to six crops is entered. The information represented in this section should represent total costs for both the landowner and operator. This section follows the format of the K-State Farm Management Guides (projected crop budgets) so users may want to refer to these budgets for cost and return information. These budgets can be accessed at the K-State Agricultural Economics website (www.agmanager.info).

⁴ This will especially be true when costs are higher than average or yields are lower than average. In other words, as would be expected, the “amount a tenant can pay” will result in the lowest cash rent of the three methods for below average producers. Another situation that will lead to this is if land values used in the analysis reflect non-ag uses and an inappropriate cap rate (i.e., rent-to-value ratio) is used.

Inputs Required for KSU-Lease

The following is a brief explanation of the different inputs required in the spreadsheet. Cells for inputs are shaded (light blue) and identified with blue text. Outputs, or calculated values, are represented with black text. Some input costs are entered directly in the Budget; others are entered in either Table 1 or Table 2 located directly below the crop budget section in the spreadsheet. Unless otherwise noted, all income and cost variables should be entered on a per planted acre basis.

Crop/System – up to six different crops can be considered at one time in the *KSU-Lease* spreadsheet (columns D through I).

Planted acres of each crop (Budget) – acres typically planted to each crop in the rotation.

Tillable acres per planted acre (Budget) – tillable acres per planted acres represents the land use intensity. With continuous cropping this value = 1.0, but for fallow situations it will be greater than 1.0 (e.g., wheat_fallow = 2.0 and wheat_corn_fallow = 1.5). With double cropping this value will be less than 1.0 (e.g., wheat_double crop soybeans = 0.5 for both crops or 1.0 for the wheat and 0.0 for the soybeans). Total tillable acres represents the basis for the lease analysis and should match up with the total tillable acres in the lease. Note that with fallow acres, total tillable acres will be greater than total planted acres; whereas, with double-cropping total planted acres will be greater than total tillable acres.

Income per acre – because equitable crop share leases are based on relative contributions (i.e., costs), income per acre does not directly impact crop share percentages, however, this information is required for determining cash rents.

Yield per acre (Budget) – expected yield over the lease period.

Price per unit (Budget) – expected price per unit (\$ per bu or ton etc.) over the lease period.

Net government payments (Budget) – expected government payment (\$/acre).

Indemnity payments (Budget) – expected crop insurance payments (\$/acre – enter if premiums are entered as a cost – see more below).

Miscellaneous income (Budget) – other income that is part of the lease (\$/acre, e.g., wheat grazing, crop aftermath).

Costs per acre – costs per planted acre should represent expected average costs over the lease period.

Seed (Table 1) – enter seeding rate/acre and cost per unit (make sure rate in “rate/acre” and cost in “cost/unit” are the same units (e.g., 1,000 seeds/acre and \$/1,000 seeds or lbs/acre and \$/lb). For perennials (e.g., alfalfa), enter the annualized cost over the lease period. If the seed cost includes a technology fee or additive/treatment (e.g., Roundup Ready soybeans, Bt corn, Gaucho) that is treated differently in the crop share arrangement than the seed cost, this cost should be entered separately. For example, if the landlord shares insecticide costs but not seed cost, then the portion of the seed cost that replaces any insecticide should be entered as an insecticide (i.e., Gaucho, or the technology fee associated with Bt, should be entered as an insecticide not as seed).

Herbicide (Table 1) – rates and prices for up to ten herbicides can be entered (make sure rate and cost units match). For tank mixes where the cost/acre is known, enter the rate as 1 and the \$/unit as the per acre cost.

Insecticide / Fungicide (Table 1) – rates and prices for up to four insecticides/fungicides can be entered (make sure rate and cost units match).

Fertilizer (Table 1) – annual rates and prices of up to five different fertilizer products can be entered (make sure rate and cost units match). For fertilizer that is not applied annually (e.g., lime), enter the annualized cost over the lease period.

Irrigation water, inches/acre (Table 1) – expected inches of irrigation water applied and the cost per acre-inch. If non-irrigated land, enter zero.

Irrigation repairs, \$/acre-inch (Table 1) – expected repairs for irrigation equipment on a per acre-inch basis. If non-irrigated land, enter zero.

Drying cost, \$/unit (Table 1) – expected cost of drying grain on a per unit of yield basis (make sure drying cost and yield per acre units match, e.g., bu, cwt). If selling price entered on line B in income section is net of drying costs, then enter zero for drying cost.

Crop consulting (Budget) – cost for crop consultant(s) if that service is considered.

Crop insurance (Budget) – enter cost for crop insurance if an expected indemnity payment was entered on line D in income section. On average, if expected indemnity payments equal expected crop insurance premiums, then both of these categories can be left blank as they offset each other. Historically, crop insurance premiums have been about the same as indemnity payments due to the government subsidy for a number of crops.

Miscellaneous (Budget) – enter miscellaneous cost (this typically includes farm dues, fees, subscriptions, etc. that have not been included in any other category).

Machinery expense (Table 2) – machinery expenses are entered using the total number of field operations (e.g., planting, tillage, spraying, harvest) and the cost per acre for each operation. An estimate of machinery cost per acre often used is market custom rates. Custom rates for most field operations in Kansas are reported by Kansas Ag Statistics (see <http://www.nass.usda.gov/ks/>). Research has estimated that custom rates underestimate the total costs to own and operate machinery by 25-30 percent (Beaton, Dhuyvetter, and Kastens), thus an estimate for the cost per acre for each operation would be the reported custom rate times 1.25. Harvesting cost can be entered as an amount per acre, an amount per bushel, or a combination of the two.

Non-machinery labor (Table 2) – non-machinery labor (hours and \$/hour) are included to capture labor costs that may not be accounted for using machinery custom rates (e.g., time spent checking fields, marketing). Research indicates that non-machinery labor costs have averaged 11-13 percent of machinery costs. On a dollar-per-acre basis, non-machinery labor costs are estimated to range from \$5.50 to \$11.50 and average approximately \$8.25 for nonirrigated crops in Kansas.

Irrigation – irrigation cost includes depreciation, interest, repairs, labor, and pumping cost. Repairs and pumping cost information is entered in Table 1 (see discussion above) and investment and labor information is entered in Table 2. Enter hours per acre and \$/hour for irrigation labor. Enter total investment for the well, pump and gearhead, power unit and meter, and delivery system on a new equipment basis. Enter the years to depreciate the irrigation equipment over and salvage value (percent of new investment) at the end of that time. Values entered for investment, years, salvage value, and interest on capital are used to calculate depreciation and interest

costs. Depreciation and interest costs are allocated to the different crops based on both acres irrigated and inches of water applied.

Land charge (Table 2) – enter an average value of land (\$/tillable acre) and an annual rate of return in Table 2. Based on cash rents and land values reported by Kansas Agricultural Statistics, the rent-to-value ratio has historically been 5.5 to 6.5 percent for crop land in Kansas. Thus, enter 5.5 to 6.5% in the \$/unit cell for the land cost.⁵

Interest on nonland costs – interest on nonland costs is calculated based on the interest on capital rate entered in Table 2 times one-half of all costs (line G) less the land charge and drying cost. It is recommended to enter the typical rate on operating loans at banks in the interest on capital cell.

Income, expenses, and returns over costs in the crop budgets tab are reported for the farm (total) and on a per planted and per tillable acre basis. Total costs per unit and the rate of return to total costs are calculated for each crop. Although these measures are included for comparison purposes and management decisions, they have no direct impact on crop share leases. The crop budgets, as well as Tables 1 and 2, can be printed by clicking on the “Print budgets” and “Print tables” buttons. Alternatively, the Excel print features can be used to manually print selected ranges.

The second step, after all contributions (costs) have been determined, is to identify who is responsible for each of the expenses. This is done in the “tab” labeled **Shares** of the *KSU-Lease* spreadsheet. Relevant information for the landowner and the operator (name, address, phone number, etc.) and the basis for the equitable shares calculations also are entered in this section. The basis for the equitable shares calculations can either be the entire rotation or crop-by-crop by entering either 0 or 1 in cell L4, respectively. By choosing the entire rotation (L4=0), the spreadsheet will determine the equitable shares for both the landowner and tenant based on contributions and then assign that same percent to all crops (income and equitably shared inputs). That is, despite how costs might be assigned for each crop, setting L4=0 means that the landlord’s percent share of income (and equitably shared inputs) will be the same for all crops in the rotation. On the other hand, if crop-by-crop (L4=1) is chosen, the spreadsheet will assign a unique equitable share percent to each crop individually, meaning that the landlord would receive a different percent share of income for each crop.

Although the ability of *KSU-Lease* to consider equitable shares on a crop-by-crop basis (L4 = 1) is a powerful feature, that feature should be used cautiously. In particular, given that crop production has substantial agronomic and economic interactions among crops in a rotation, reported income, cost, and profit could be reasonably accurate when calculated across the whole rotation, but highly inaccurate when calculated on a crop-specific basis. For example, one crop in a western Kansas rotation of wheat-corn-fallow might be reported to be more profitable than the other, implying only that crop should be grown, yet that crop’s success might depend in large part on the rotation of which it is a part.

⁵ The historical rent-to-value ratio times market land value is only appropriate when the market value represents agriculture uses. That is, as land values increase due to non-ag uses, the historical rent-to-value ratio will not be appropriate. For a more detailed discussion of land values, returns to land, and non-ag considerations, see *Valuing and Buying Farmland, with a Consideration of Non-Ag Features* (Kastens and Dhuyvetter, 2003).

Double-crop soybeans is another example. Although economic profits for all crops are expected to be 0 in the long run, observed values in a particular application of *KSU-Lease* might depart from 0. Thus, one crop might show a positive profit and another negative. In that case, the incentive for either the landlord or the tenant is to want to be responsible for all costs on the profitable crop and no costs on the unprofitable one. Such skewed incentives likely will be counterproductive in the long run. To avoid that problem, lease parties might a) consider a lease that is less crop-specific (i.e., keep $L4 = 0$), or b) adjust costs among crops so that expected profits are similar across crops.

For each expense listed in the crop budget, the OPERATOR's share is entered as a percentage. For expenses that are totally the responsibility of the operator, enter 100%. If the expense is totally the landowner's responsibility, enter 0%. Other shares can be entered as needed. However, for shared expenses (e.g., fertilizer), it is recommended to enter the percentage as -100%. Entering -100% simply means that particular input is to be shared in the same percentage as the income, which is what *KSU-Lease* computes – the equitable crop share percentages. As noted earlier, the reason it is recommended to share many inputs (especially yield increasing inputs such as fertilizer) in the same percentage as the crop income is that this provides both parties to the lease the economic signals for optimal input use. For example, a tenant who pays for 100% of the fertilizer but receives only 67% of the crop may have an incentive to under fertilize, causing both the landlord and the tenant to be less profitable than they otherwise would be. However, *KSU-Lease* is adaptable and does allow users to enter some predetermined percentage to share inputs. This adaptability allows crop inputs to be shared many different ways. For example, inputs can be entered such that the operator's share of burn-down herbicides is 100%, but only 67% of other herbicides. Yet, for the same crop, fertilizer might be shared "equitably" (i.e., -100% entered).⁶

By entering the operator's share for each input, the landowner's share is calculated as 100% minus the operator's share. Thus, *KSU-Lease* assumes there are only two parties to the lease because each cost is allocated to the operator, the landowner, or some combination of the two. In addition to entering the operator's share for each input of each crop, there is a line to enter a direct cash payment (\$/acre) from the operator to the landowner. This line will almost always be left zero because cash payments are seldom a part of crop share leases. Example scenarios where this line might be used are as follows. If a predetermined share is desired on both income and certain inputs, a cash transfer (positive or negative) may be required to make the lease equitable. Or, if a lease is a combination of crop share and cash (i.e., the tenant pays a low cash rent but the landowner also receives a share of the crop), the cash amount might be included here. After all values have been entered, the tables showing the operator's shares (OS%) can be printed by clicking on the "Print operator's shares" button.

After these first two steps are completed, that is, all costs (step 1) and the parties responsible (step 2) for them are identified, the equitable crop share percentages of the operator (OS%) and the landowner (100-OS%) are known. In *KSU-Lease*, the "tab" labeled **Lease budgets** reports the crop share budgets for both the operator and the

⁶ This is an example for illustrative purposes only to show the adaptability of *KSU-Lease* and should not be considered a recommendation as to how certain inputs should be shared.

landowner where income and any equitably shared inputs (i.e., those entered with a - 100%) are split according to the equitable shares reported at the top of the budget (identified as OS% for the operator and 100-OS% for the landowner). The returns over total costs (i.e., profit) will be shared in the same proportion as the income. Thus, if the **Crop budgets** section showed a profit of \$5 per planted acre, that \$5 will be split as OS% going to the operator and (100-OS%) going to the landowner. In short, the operator covers OS% of the total costs, gets OS% of the total income, and OS% of the profit. And, the landowner covers (100-OS%) of the costs, gets (100-OS%) of the income, and (100-OS%) of the profit. The operator and landowner equitable crop share budgets can be printed by clicking on the “Print budgets” button.

Determining Cash Rental Rates in KSU-Lease

Landowner’s Cost Method: Like many investments, the total annual return to crop land can be divided between a cash return (dollar amount of cash or cash-equivalents received each year, less real estate taxes) and a capital gain return (dollar amount of appreciation in value each year). For convenience, these returns can be expressed as a percent of land value (e.g., 5.5% cash, 4.0% gain, and 9.5% total). As used here, the relevant landowner cost is only the cash return because the landowner acquires the capital gain return outside of the lease. The landowner’s cost can be approximated by the historical average rent-to-value ratio. Using this method, the cash rent would be calculated by multiplying the rent-to-value ratio by the market value of the land. As previously discussed, the historical rent-to-value ratio for Kansas crop land has been between 5.5 and 6.5 percent.

Crop Share Adjusted for Risk Method: Because most landowners and tenants are familiar with crop share arrangements, using a crop share approach to determine a cash rental rate is appropriate and understandable. This approach determines the cash equivalent amount of an equitable crop share arrangement and then makes a risk adjustment to that value. The reason for making the risk adjustment is that, with cash rent, all of the production and price risk falls on the producer; whereas, with crop share this risk is shared between the producer and the landowner. A “risk adjustment factor” of 3 to 7 percent is typically recommended (see previous discussion about risk adjustment). For example, after calculating the cash equivalent of an equitable crop share, this dollar amount should be reduced by some percent (e.g., 3%) to account for the fact that the landowner has no yield or price risk.

Amount Tenant Can Afford to Pay Method: The “amount a tenant can afford to pay” method of establishing cash rents says that the tenant receives all income and pays all expenses and whatever is left is available for cash rent to the landowner. This “residual” approach considers how much (or little) can be paid for land given the income and production expenses.

KSU-Lease calculates cash rents for each of these three methods based on the inputs in the **Crop budgets** section (the only additional input required is the risk adjustment factor). As previously stated, the “going market rate” for cash rents is the most relevant number when available. However, the values calculated in *KSU-Lease* can be useful as landowners and producers negotiate cash rents for their particular situations. Calculated

cash rents are reported for the farm (total) and on a per planted and per tillable acre basis. The cash rent information can be printed by clicking on the “Print cash rent info” button.

Summary

The terms of cropland leases, whether they are crop share or cash leases, are ultimately determined in the market through the negotiations of landowners (supply of land) and producers (demand for land). However, in many cases landowners and tenants seek out guidance as to what is a “fair” and equitable lease. The *KSU-Lease* embodies the principle of crop share leases being equitable and carries this principle forward for establishing cash rents. That is, *KSU-Lease* calculates crop share percentages based on income being shared in the same proportion as contributions of expenses. This program is intended to serve as a tool for landowners and tenants as they negotiate lease terms. While this spreadsheet allows for considerable flexibility in how landowners and producers share (or don’t share) individual expenses, and can accommodate most scenarios, it is important to recognize that it is not a substitute for good communications between landowners and their tenants.

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