Risk-Return Frontier:
A RightRisk™ Lesson Guide with King Family Ranch

by Jay Parsons and John Hewlett

Management decisions can change the impact and/or probability of risky events.

There are many different sources of risk that can affect an agricultural operation and, ultimately, its ability to survive and prosper in the long run. Management decisions have the ability to change both the impact and the probability of the outcomes associated with risky events. Yet, many things remain out of the manager's control and bad outcomes can still occur. Identifying and implementing a risk management strategy can help a manager gain piece of mind when it comes to managing risk and systematically incorporate risk management preferences into the decision-making process. RightRisk™ Ag Survivor scenarios provide an outstanding opportunity to experiment with different risk management strategies quickly and easily. In this lesson guide, you are going to practice making risk management decisions on King Family Ranch. Then, you are going to use the simulation software to learn how to build a risk-return frontier and use it to identify good risk management strategies.

Risk-Return Frontier

A risk-return frontier identifies decision sets that represent efficient risk-return tradeoffs.

The concept of an efficient risk-return frontier was first introduced by Harry Markowitz in 1952. The concept can be summarized as a combination (or portfolio) of assets being defined as efficient if they represent the best possible expected return from those assets given a fixed level of risk where risk is usually defined as the standard deviation of returns from the portfolio of assets. In the King Family Ranch Ag Survivor scenario, the expected return (mean) and standard deviation are both reported on the output screen for the Distribution Analysis. Different combinations of decisions produce different distributions of possible outcomes each of which will have a standard deviation and mean that can be used to determine the risk-return efficiency of that particular decision set. A decision set is on the risk-return frontier if there are no other decision sets that produce a higher mean return without a corresponding increase in the standard deviation of those returns.

Building a Risk-Return Frontier with King Family Ranch

Ag Survivor provides you an opportunity to try different management strategies to see if you can improve over what you did last time. It is this ability to practice several strategies that we are going to take advantage of in learning about risk-return tradeoff.

You are going to practice making management decisions that you think will allow King Family Ranch to make more money without taking much more risk.

1. Play the King Family Ranch scenario all the way through and record your final bank balance at the end of Year 2. Final Bank Balance = _____

2. From the End of Game Summary page, click the Distribution Analysis button and run the scenario 100 times. Notice the distribution and statistical calculations that are presented. Record the following statistics from the distribution page into their corresponding slots at the bottom of the Option 1 column of Figure 1: Mean, Standard Deviation, Minimum, Maximum, and 10th Percentile. Record the decisions listed into the Option 1 column of Figure 1.

Figure 1: Matrix of Alternative Decisions

Year 1	Decisions		Option 1	Option 2	Option 3	Option 4	Option 5
Quarter 1	1	Buy (+) or Sell (-) Hay					
Quarter 2	1	Forward Price Calves					
Quarter 3	1	Forward Price Calves					
	2	Buy (+) or Sell (-) Hay					
Quarter 4	1	Forward Price Calves					
	2	Buy (+) or Sell (-) Hay					
	3	Vaccinate Cows					
	4	Retaining Calves					
Year 2							
Quarter 1	1	Buy (+) or Sell (-) Hay					
	2	Forward Price Calves					
	3	Forward Price Background Calves					
Quarter 2	1	Forward Price Calves					
Quarter 3	1	Forward Price Calves					
	2	Buy (+) or Sell (-) Hay					
Quarter 4	1	Forward Price Calves					
	2	Buy (+) or Sell (-) Hay					
	3	Vaccinate Cows					
STATISTICS							
		Mean					
		Standard Deviation					
		Minimum					
		Maximum					
		10th percentile					

3. Now, click the "Compare Second Option" button on the Distribution Results page. On the Second Option page, make changes to your decision set by changing the entries in the Decisions table. Record the new Option 2 set of decisions in the Option 2 column of Figure 1 and click the Re-Calculate button.

4. For Option 2, record the Mean, Standard Deviation, Minimum, Maximum, 10th Percentile and Coefficient of Variation statistics from the distribution page into their corresponding slots at the bottom of the Option 2 column of Figure 1. Is the Mean return for Option 2 greater than or less than the Mean return for Option 1? Is the Standard Deviation for Option 2 greater than or less than the Standard Deviation for Option 1?

5. From the Second Option distribution page, make iterative changes to your decision set to create an Option 3, an Option 4, and an Option 5 set of decisions. Record these new decision sets and statistics in their respective columns of Figure 1.

6. Risk Return Frontier:
    a. Using standard deviation as a measure of risk and the mean as a measure of return, create a scatter plot using the five decision set Options you have created. An Excel template for doing this can be downloaded from Documents page for King Family Ranch on AgSurvivor.com.
    b. From your plot, determine which options are on the risk-return frontier. An option is on the risk-return frontier if there are no other options with a higher expected return that are directly above it or to the left of it. That is, there are no other options with equal to or less risk that have a higher mean.

Additional Resources

Markowitz, H. (1952), PORTFOLIO SELECTION. *The Journal of Finance*, 7: 77–91. doi: 10.1111/j.1540-6261.1952.tb01525.x