

321

AE321

1976-

(no designated month)

Can Profits From Potato Production Be Increased?

by

G. Ray Prigge\*

Introduction

Many Idaho potato producers are finding it increasingly difficult to obtain a satisfactory return from the production and sale of their potatoes. Rapidly increasing costs of production continue to narrow profit margins even when potato prices are stable. When, however, potato prices are depressed as they are today, profit margins tend to disappear and large losses often result.

The individual potato producer, because he is a member of a very competitive industry, cannot significantly affect the price he receives (except by timing and selection of alternative marketing strategies). Therefore the primary practical way that he can improve the profitability of his crop is to increase the efficiency with which he uses land, machinery, labor, capital and other production inputs.

Efficient use of production inputs is a problem --primarily because of the difficulty of measuring and evaluating the impact of risk and uncertainty on the outcome or productivity of input usage. For instance, if, in an average year, potato yields increase by a measured hundredweight in response to each additional 10 pound increment of fertilizer, it is relatively easy to determine the most profitable level of fertilizer usage. What makes the process so much more complicated, however, is the variability

---

Agricultural Economics Extension Series No. 321.

\*Extension Economist, Farm Management Specialist, University of Idaho, Moscow, Idaho 83843

in yield response to added fertilizer from one year to the next. A method for accurately assessing this risk would allow the farmer to make a more knowledgeable decision.

### Increasing Profits by Managing Risk and Uncertainty

Although prices received by farmers have increased dramatically in recent years, the price increases have been neither smooth nor predictable. Commodity prices have tended to rise rapidly with fluctuations over short periods of time. Farmers have also been faced with rapidly increasing costs of production. Since 1970, the prices paid for production inputs by U.S. farmers have increased by over 70 percent! The average price of farm land rose over 100 percent between 1970 and 1976.

Recent shortages of key production inputs, unstable supply and demand conditions, changing market price relationships, rapid technological change, shifting governmental policies and the variability of wealth cause farm management decision-making to be an increasingly difficult and risky undertaking.

One technique that can be used to aid decision-making is called the "payoff matrix". A payoff matrix is useful when dealing with a number of decision choices and provides an indication of all of the possible consequences for each separate choice. An example of a matrix is shown in Table 1.

Table 1 shows the hypothetical average expected yield of potatoes from three levels of fertilizer and three levels of rainfall. If potatoes are expected to sell for \$4 per hundredweight, each of the yields are multiplied to convert the yield matrix to a gross return matrix i.e., \$4 x 136 cwt. = \$544 gross return per acre (Table 2).



Table 1: Potato Response to Fertilization

		<u>Potato Yields (in hundredweight)</u>		
		<u>Fertilizer Application (per acre)</u>		
<u>Rainfall</u>		1 Unit	2 Units	3 Units
Low		136	132	120
Normal		154	180	190
High		166	220	230

Table 2: Gross Return Per Acre, Potatoes (in \$)

		<u>Fertilizer Application (per acre)</u>		
<u>Rainfall</u>		1 Unit	2 Units	3 Units
Low		\$544	\$528	\$480
Normal		616	720	760
High		664	880	920

If each unit of fertilizer costs \$30, subtraction of \$30 per unit from the gross returns matrix will give a return above fertilizer cost matrix, i.e.,  $\$544 - 30 = \$514$  returns above fertilizer (Table 3).

Table 3: Return Above Fertilizer Cost

		<u>Fertilizer Application (per acre)</u>		
<u>Rainfall</u>		1 Unit	2 Units	3 Units
Low		514	468	390
Normal		586	660	670
High		634	820	830

After calculating the above returns matrix, one thing is still needed to determine what is called the "expected payoff". That is the probabilities associated with the three levels of rainfall. Suppose the farmer does his homework and determines that the probability of low, normal and high rainfall is 30 percent or .3 for low, 50 percent or .5 for normal and 20 percent or .2 for high. The sum of the probabilities must add to 100 percent or 1. To calculate the expected payoff each of the above nine items in the return above fertilizer cost are multiplied by the probability of their occurrence, i.e. (Table 4)

Table 4: Return Above Fertilizer Cost

Probability	Fertilizer Application (per acre)		
	Rainfall	1 Unit	
.3	low	\$514	x .3 = \$154.20
.5	normal	586	x .5 = 293.00
.2	high	634	x .2 = 126.80
			\$574.00 Expected Payoff

Multiplying the values for normal and high rainfall in the same manner gives a net return above fertilizer cost matrix (Table 5). The expected payoffs calculated in Table 5 are the average return the farmer would expect from each decision choice over a number of years. For any particular year the actual return could be quite different. These expected payoffs are additional information to be used in making the decision.

The final decision of how much fertilizer to use depends upon the farmer's attitude. There are three general types of attitudes which people exhibit when faced with a risky decision.



They are:

1. Risk Aversion - A farmer with a large family, high debts, little savings, may be unable to take the risk of a low payoff. Note that in a year of low rainfall the least risk of low returns is associated with the use of one unit of fertilizer. Even though the odds for the largest return favor the use of two units of fertilizer, the risk averter will choose the use of one unit.

2. Risk Neutral - A farmer who is in sounder financial condition may be risk neutral. He determines that the highest consistent profits are to be obtained by using two units of fertilizer and consistently uses two units.

3. Risk Taking - A farmer in excellent financial shape or who enjoys taking a risk or wants to get the highest yield (here 230 hundredweight) will choose to use three units of fertilizer -- in effect gambling that the rainfall will be normal or high. Note that this strategy, in the long run, will lead to lower average returns per acre.

A variety of strategies may be used to counteract or reduce uncertainty. They include diversification of crop and livestock enterprises, flexibility in input usage, i.e., custom hire vs. owning, forward marketing contracts, hedging and insurance.

In the increasingly uncertain world of the potato grower it is more and more certain that the traditional ways of viewing management decisions are no longer adequate. The successful farmer of the future will have to evaluate and adopt numerous new decision-making techniques just as the successful farmer of today has adopted new machines, varieties and chemicals.

NOTE: Table 5 on page six.

Table 5: Net Return Above Fertilizer Cost

Fertilizer Application (per acre)

Rainfall	1 Unit	2 Units	3 Units	
Low	514	468	390	
Normal	586	660	670	
High	638	820	830	
Expected Payoff	574	634.40	618	