University of Idaho College of Agriculture

Cooperative Extension Service Agricultural Experiment Station Current Information Series No. 383 March 1977

R. B. Long Research Agricultural Economist R. W. Schermerhorn Extension Economist R. L. Sargent Extension Economist

Fertilizer Use in Idaho Too Much or Too Little?

Problem

:22

Within the past two or three years, fertilizer and crop prices have fluctuated more widely than normal and some inputs, including fertilizer, have been scarce. These conditions have created interest in supply and demand relationships for inputs like fertilizer. The demand for fertilizer at the farm is said by economists to be a derived demand, deriving from demand for the crops it is used to produce. Consequently, as the prices for crops increase the demand for fertilizer used on these crops would also be expected to increase (or shift in response to greater product demand).

With these factors in mind, the Department of Agricultural Economics studied the use of fertilizer by crops in the Western United States to evaluate whether or not increased fertilizer prices would affect agricultural productivity.¹ The results of this study were used to estimate the marginal productivity² of fertilizer in Idaho for its major crops and to evaluate whether too much or too little fertilizer was being used on these Idaho crops.

Briefly, if the marginal returns from fertilizer use (additional income per additional application of fertilizer) were lower than the cost of fertilizer, too much fertilizer was applied. If the marginal returns

²Marginal concepts are of key importance to economics and to farming. They refer to the added products and revenues produced or to the added costs incurred as a result of adding more of an input (in this case fertilizer). Marginal productivity is the amount of additional sugarbeets, wheat, etc., that is produced per acre as a result of additional fertilizer. Marginal returns refer to the increase in returns from the crop that results from added fertilizer, i.e. the added income from additional sugarbeets, wheat, etc., that results from additional fertilizer. were greater than the cost of fertilizer, then more could be applied profitably. Since returns per acre vary by farm, these results can only be used as a general guide as to whether or not excess fertilizer applications exist. Either poor response from fertilizer or low product prices may make fertilizer use economically excessive. On the other hand, very high product prices may cover high fertilizer costs even when response is poor, leading to unnecessary expenses.

Methodology

To analyze fertilizer use in the Western States, data were accumulated from the 1959, 1964 and 1969 Census of Agriculture on acres planted, total fertilizer use and production for the major crops. Secondly, a statistical analysis was made estimating total crop production as related to acres planted and fertilizer applied. Results for most crops showed a strong statistical relationship between crop production, acres planted and fertilizer applied.

A wide variety of growing conditions exist in the Western States. Consequently, yields and fertilizer applications also varied widely. Indications of excessive or inadequate fertilizer applications may be caused by other factors not included in this study, such as short growing season, limited water supplies or inadequate moisture and widely fluctuating crop prices.

To determine the relative use of fertilizer, the marginal returns per acre were calculated, multiplied by the average price and compared with the average cost of fertilizer. If the dollars received from increased production resulting from the application of an additional pound of fertilizer (marginal value product) were less than average cost (dollars per pound of fertilizer applied), too much fertilizer was being applied. Variables in this analysis included the additional yield per additional pound of fertilizer applied (estimated marginal physical product from fertilizers), the average unit price of the crop and the average unit price of the fertilizer.

¹This study is reported in full in Idaho Agricultural Experiment Station Research Bulletin 98. The Structure of Demand for Fertilizer in Idaho, by R.B. Long, Debra Peterson and Gary Hines, November 1976. Copies of this study may be obtained from the College of Agriculture, University of Idaho, Moscow, ID 83843.

Table 1. Re	sults of fertilizer	use analyses in the	Western United	States and im	plications to	Idaho 1969 ¹
-------------	---------------------	---------------------	----------------	---------------	---------------	-------------------------

Сгор	Average fertilizer use (Ib./acre)	Estimated marginal physical product (additional yield per additional pound of fertilizer applied)	Estimated marginal value product (additional dollars income per additional pound of fertilizer applied)	
Barley	113	.090 bu/lb.	\$.083/lb.	
Corn	392	.025 bu/lb.	.033/lb.	
Dry edible beans	52	.110 cwt/lb.	.869/lb-	
Hay	40	.021 ton/lb.	.452/lb.	
Irish potatoes	693	.115 cwt/lb.	.232/lb	
Oats	86	_	_	
Sorghum	185	_	_	
Sugarbeets	688	.0005 ton/lb.	.007	
Vegetables	391	.008 ton/lb.	.417	
Wheat	103	.075 bu/lb.	.094	

¹Data in this table were derived from estimated production functions – these functions are shown in Idaho Agricultural Experiment Station Research Bulletin 98.

Economically speaking, fertilizer use should increase if the price of fertilizer decreases or the price of the product increases. Fertilizer use should decrease if the price of fertilizer increases or the price of the product decreases. However, for very high value crops — i.e., sugarbeets in Idaho — the price of fertilizer may have little effect on use. For such crops, fertilizer costs are a small proportion of total costs.

Implications for Idaho

The statistically estimated marginal physical products and derived marginal value products for various crops in 1969 are shown in Table 1. For example, this table shows that for barley the average application of fertilizer per acre in 1969 was 113 pounds. An additional pound of fertilizer applied per acre increased the yield by .09 bushels, and the value of that yield increase was \$.083. Marginal value product of fertilizer was determined by multiplying the marginal physical product for the amount of fertilizer used times the price of the product.

The marginal value products of fertilizer in dollars per pound for 1969 and 1973 are summarized in Table 2. The two columns in Table 2 are different only because crop prices were higher in 1973 than in 1969. For this reason only, marginal value products are greater in 1973.

In 1969, the average price of fertilizer was about 5 cents per pound. Thus, oats, sugarbeets and corn were over-fertilized (for these three crops the marginal value product was below 5 cents per pound of fertilizer applied). At that time, dry edible beans, hay, vegetables, Irish potatoes, wheat and barley could have had more fertilizer applied profitably if circumstances permitted. Roughly the same situation existed in 1973, even though crop prices increased the marginal value products. Fertilizer also had increased to about 10 cents per pound in 1973. The analysis indicates that too much fertilizer was being applied to oats, sugarbeets and corn and not enough to other crops.

By comparing your fertilizer application rates with those in Table 1, you can get an indication of whether you are using too much or too little fertilizer. For example, if you applied over 688 pounds per acre on sugarbeets, you are probably using too much. However, if you only applied 391 pounds on vegetables, you probably applied too little.

In summary, this research on past fertilizer use in Idaho provides a guide for farmers to evaluate their fertilizer application rates. In general, corn and sugarbeets received too much fertilizer while beans, hay, vegetables, potatoes, wheat and barley received too little. Results will vary year by year depending on the product price and the fertilizer price.

Table 2. Summary of the marginal value product of fertilizer in Idaho 1969 and 1973 compared.

Сгор	1969 Marginal value product	1973 Marginal value product	
	\$/lb.	\$/lb.	
Dry edible beans	\$.87	\$2.64	
Hay	.45	1.01	
Vegetables	.42	.79	
Irish potatoes	.23	.44	
Wheat	.09	.32	
Barley	.08	.21	
Corn	.03	.07	
Sugarbeets	.01	.02	
Oats	_	-	

Issued in furtherance of cooperative extension work in agriculture and home economics, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, James L. Graves, Director of Cooperative Extension Service, University of Idaho, Moscow, Idaho 83843. We offer our programs and facilities to all people without regard to race, creed, color, sex, or national origin.