

# INTRODUCING EXPECTED YIELD INCREASES INTO SOIL TESTING

J.W. HAMM

Saskatchewan Soil Testing Laboratory

## Introduction

In February of 1970 the Saskatchewan Advisory Fertilizer Council initiated an effort to compile and analyze all available fertility data in Saskatchewan relative to phosphate response on fallow and nitrogen response on stubble. The objectives were: (a) to revise the current soil test benchmarks and (b) to provide a basis for introducing the concept of expected returns into the nutrient recommendation system of The Saskatchewan Soil Testing Laboratory.

One of the immediate reasons for introducing this concept into soil testing is the current instability of grain prices and fertilizer costs. Expected yield increase information will enable farm managers to adjust their nutrient recommendations according to their fertilizer cost and grain price situation. The main reason, however, is to provide farmers with an estimate of the returns they can expect at different levels of nutrient input. The purpose of this paper is to discuss the effect of variable fertilizer costs and grain prices on nutrient recommendations and to present a possible format for the soil test report which would include expected yield increase tables and explain their use.

## The Effect of Variable Fertilizer Costs and Grain Prices

The nutrient recommendation system in The Saskatchewan Soil Testing Laboratory is, in theory, based on the concept that the recommendations given will result in a reasonable level of return on the last dollar invested. The calculations were based on current Wheat Board prices and fertilizer costs. Examination of the recommendation system and supporting data in terms of variable costs and prices indicates that these factors can have considerable influence on the decision making process.

### (A) Grain Prices

The effect of variable grain prices is illustrated in Fig. 1 to 3.

With the exception of extreme situations, phosphate recommendation (Fig. 1) changes are less than or equal to 5 pounds per acre and are not of great consequence. However, nitrogen recommendations can be changed considerably (Fig. 2 and 3). The shape of the yield response curve is also quite important. The decision making process is much more difficult when the slope of the yield response curve is slightly greater than that of the cost line.

#### (B) Fertilizer Costs

The effect of fertilizer costs on the same data is illustrated in Figs. 4 to 6. The conclusions are similar, i.e. recommendation changes due to fertilizer costs are greatest for nitrogen in highly responsive situations. Fig. 5 also illustrates the effect on recommendations of different 'cut-offs' in the marginal return calculations.

In summary, the effect of variable grain prices and fertilizer costs on nutrient recommendations should be stressed with respect to nitrogen recommendations for crops grown on stubble land. The effect of these variables on phosphate recommendations generally is within the range of error encountered in physical application of the nutrient and, therefore, should not be stressed in soil test reports. Costs and prices are two of many variables which affect the nutrient recommendation system. These considerations basically indicate that the Soil Testing Laboratory is not in a position to make the best decision for every farm manager.

#### Expected Yields and Expected Yield Increases

There are many ways of presenting expected yields and their interpretation to the farm manager. The Manitoba Soil Testing Laboratory has gone to a "Target Yield" system (1) in which the farm manager specifies the yield he wants and the Laboratory recommends a nitrogen rate which should give him that yield, provided that phosphate and other nutrients are applied as recommended and that other growth factors are not limiting. They are now going to a format which provides a range of yields and the nitrogen levels required to attain these. Ferguson (2) has proposed a system of "expected marginal yield increases" for use in the Saskatchewan Soil Testing Laboratory. This system involves a table of marginal yield increases (illustrated below) and an explanation of how to interpret the table in terms of "cost:price". The farm manager would be instructed to compare his cost:price ratio to the marginal yield increase



column in the table and apply the phosphate rate which corresponds to a marginal yield increase slightly greater than or equal to his cost:price ratio. The system was to apply to both nitrogen and phosphate recommendations.

Table of Expected Marginal Yield Increases  
(lb. of Grain per 5 lb.  $P_2O_5$ )

<u>lb. <math>P_2O_5</math>/Ac</u>	<u>lb. Grain</u>
10	55
15	55
20	36
25	22
30	18
35	12
40	0

The two systems are considerably different in outward appearance. However, the only basic difference is that one extends expected yields and the other expected yield increases. The concept of expected yield increases has an advantage in that it eliminates climate dependent variables such as nitrogen mineralization from the system. }

#### Alternative Approach

The system proposed for the Saskatchewan Soil Testing Laboratory is derived from Ferguson's original suggestion. Basically, it places less emphasis on cost and price effects. It would, at this stage, involve the introduction of expected yield tables and an explanation of these tables in terms of returns to the farmer. It would also include a formula for adjusting nitrogen recommendations where a farmer's economic factors are different from those used by the Laboratory.

The following is a description in point form of what would be included in the soil test report:

(A) Nutrient Recommendations

1. Same format as previously used, i.e. will allow up to four crops. Recommendations designed to give a marginal return of approximately \$1.50 on the last dollar invested.

(B) Expected Yield Increase Tables

1. Fallow Fields - yield increases which could be expected due to applied phosphate, assuming that nitrogen and potassium are adequate or applied as recommended.
2. Stubble Fields - yield increases due to applied nitrogen, assuming that phosphorus and potassium are adequate or applied as recommended.
3. Interactions, that is the effect of both applied nitrogen and phosphate will not be considered at this stage.

(C) Explanation of Expected Yield Increases

1. Long term averages; annual deviation due to climatic factors.
2. Assumptions made, i.e. growth factors other than climate not limiting; other nutrients applied as recommended; grain prices and fertilizer costs.
3. A marginal return on last dollar invested of approximately \$1.50 used in arriving at soil test recommendations.
4. Instructions on calculation of expected returns and marginal returns per dollar invested from information given - adjustment of rates suggested for nitrogen on stubble mainly.

Summary

A nutrient recommendation system which will provide expected yield increases due to applied phosphate on fallow and nitrogen on stubble is proposed for the Saskatchewan Soil Testing Laboratory. This system will allow the farmer to calculate his returns and make adjustments to the soil test recommendations where his economic factors differ from those used by laboratory. Major emphasis in adjustment will be placed on nitrogen recommendations for crops grown on stubble where variable prices and costs have been found to exert their greatest effects.

References

1. Fehr, P.I., Interpretation of Target Yield Fertilizer Recommendations.  
Paper presented to Manitoba Soil Science Meetings. December, 1970.
2. Ferguson, W.S., Proposals presented to the Saskatchewan Advisory  
Fertilizer Council. February, 1970.

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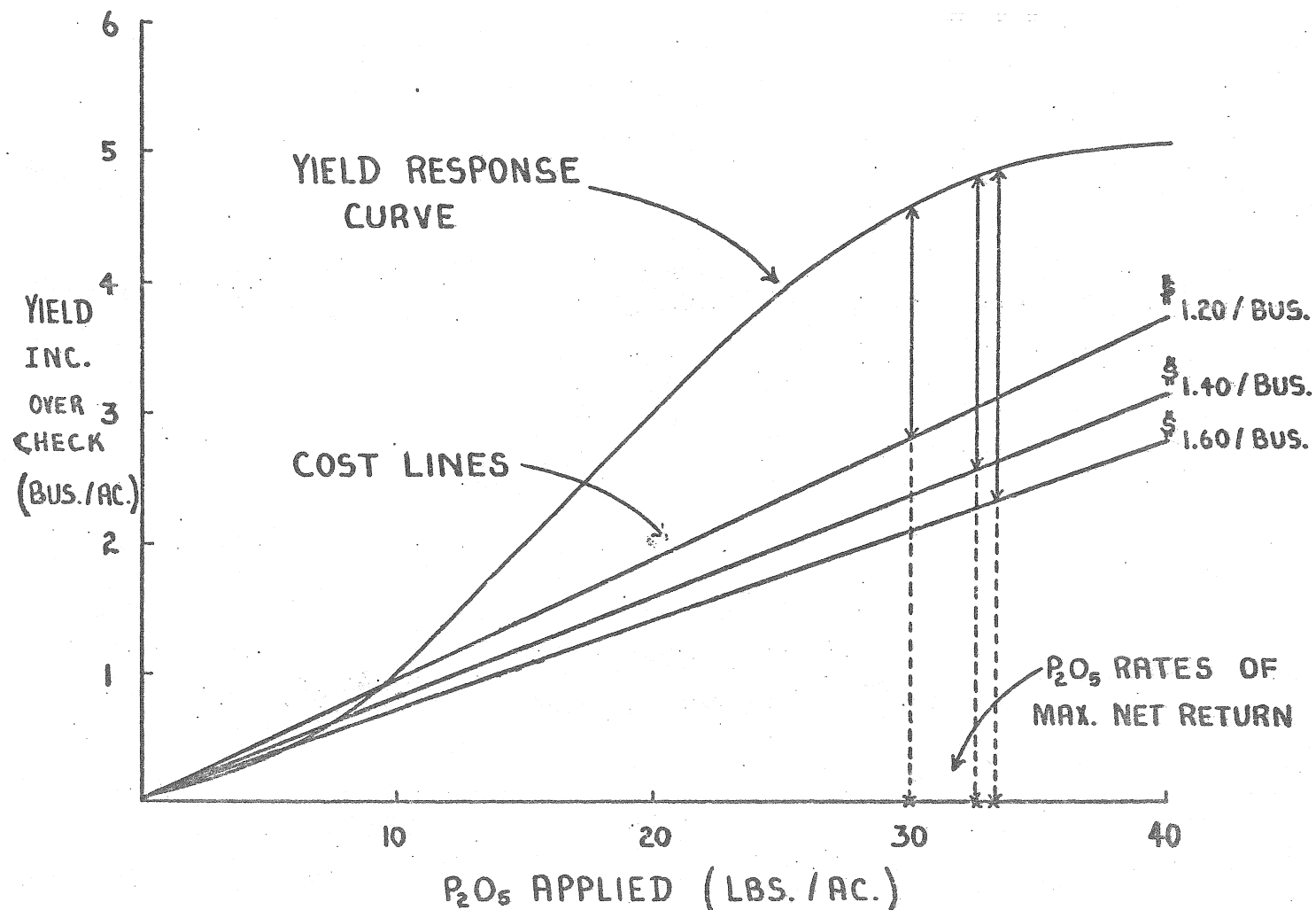


FIG. 1 EFFECT OF VARIABLE WHEAT PRICES ON  
PHOSPHATE RECOMMENDATIONS FOR FALLOW —  
S. CURRENT DATA ;  $P_2O_5$  AT 10¢/LB.

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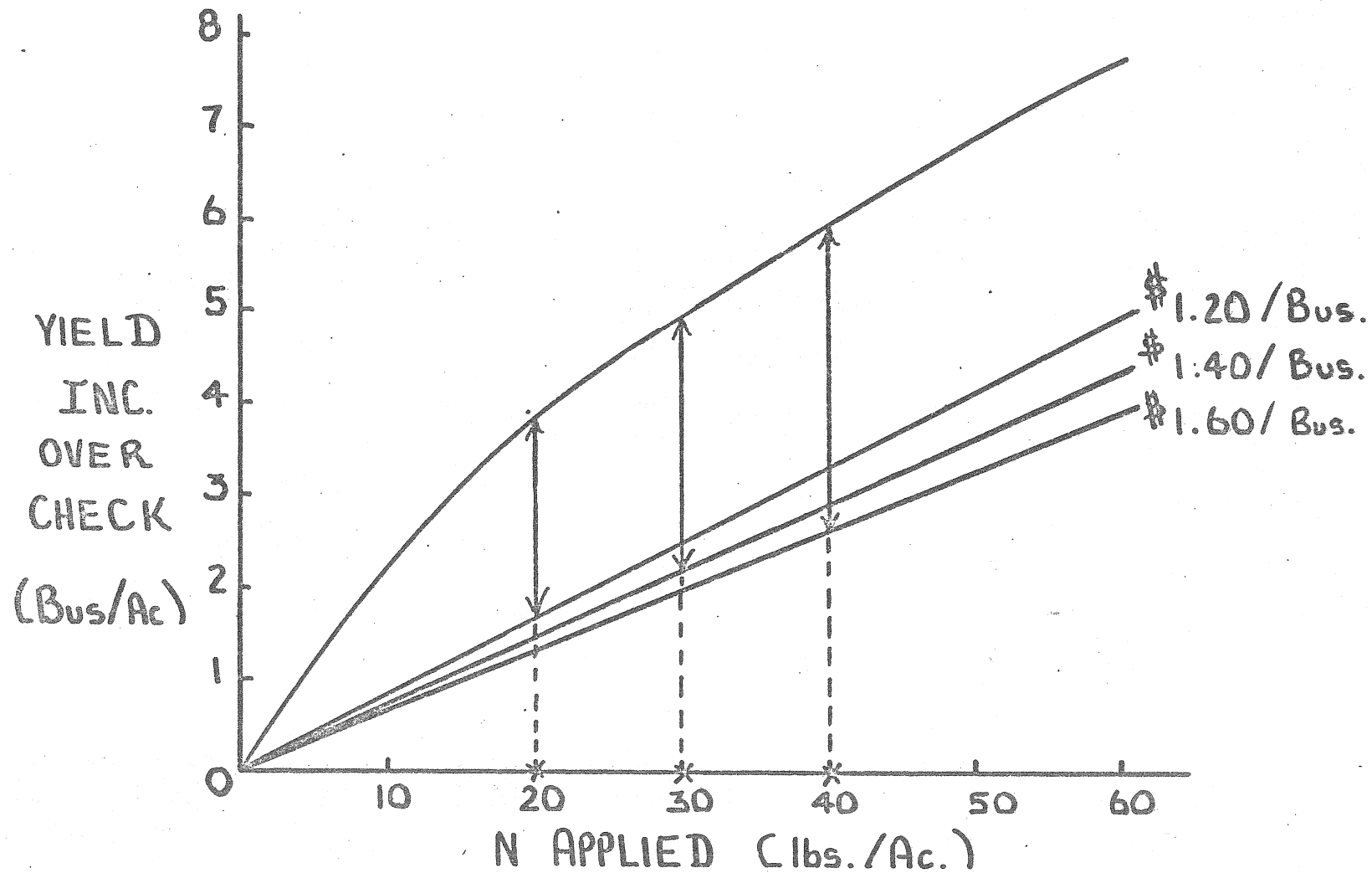


FIG. 2 EFFECT OF VARIABLE WHEAT PRICES ON NITROGEN RECOMMENDATIONS FOR STUBBLE  
S. CURRENT DATA; N. at 10¢/lb.

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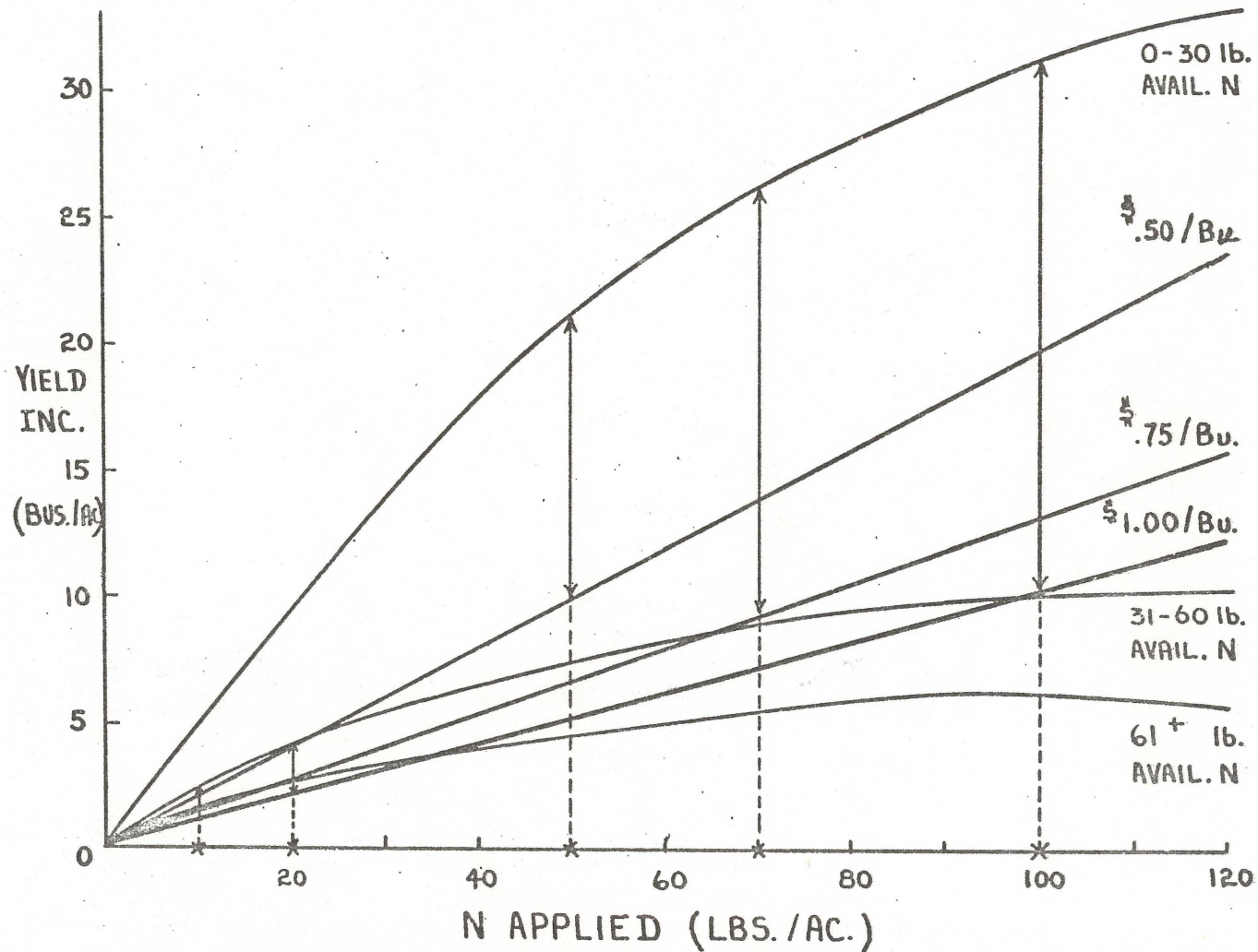


FIG.3 EFFECT OF VARIABLE BARLEY PRICES ON  
NITROGEN RECOMMENDATIONS FOR STUBBLE —  
MELFORT DATA; N AT 10¢ / LB.



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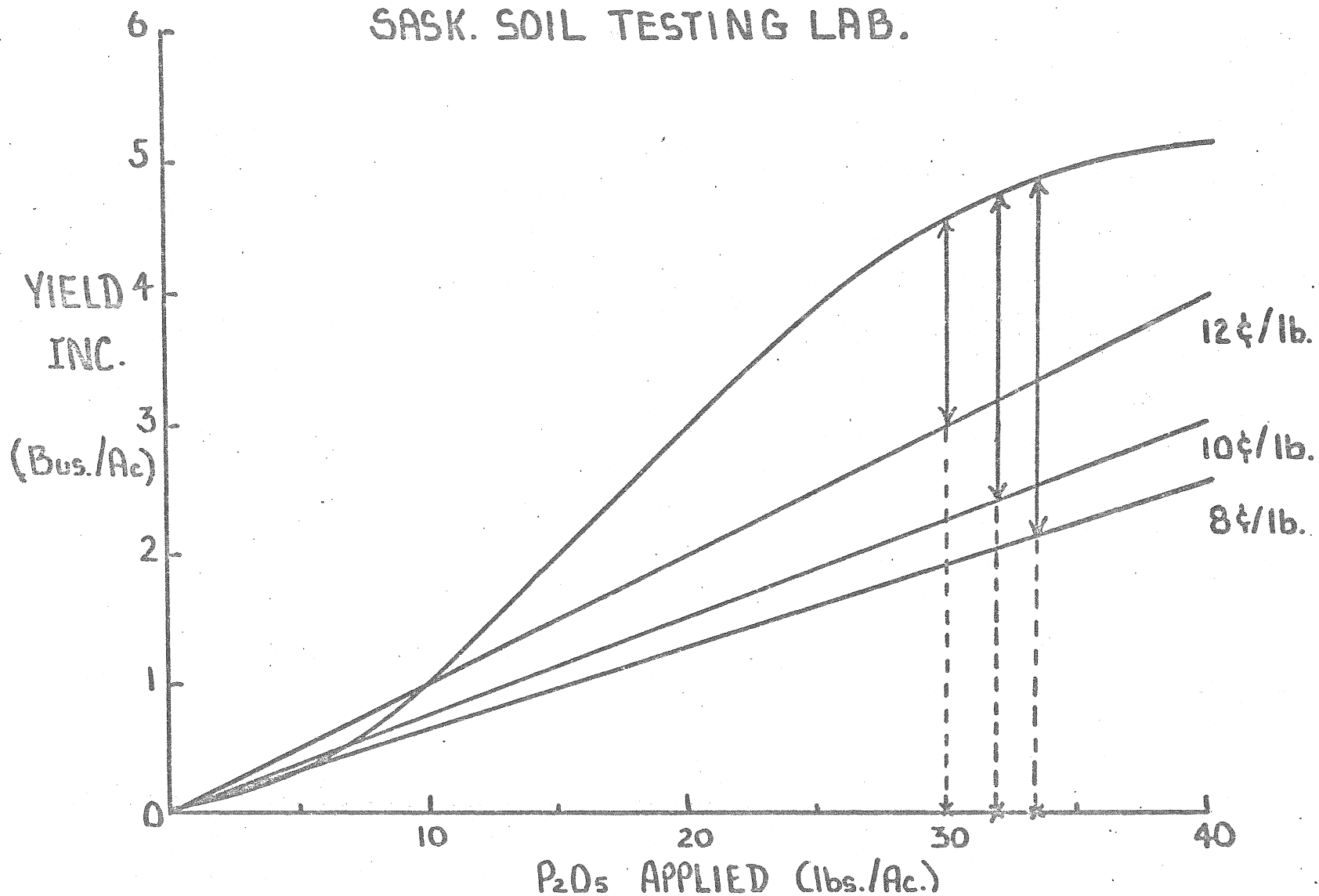


FIG.4 EFFECT OF VARIABLE FERTILIZER COSTS ON PHOSPHATE RECOMMENDATIONS FOR WHEAT ON FALLOW - S. CURRENT DATA ; WHEAT AT \$1.30 / BUS.

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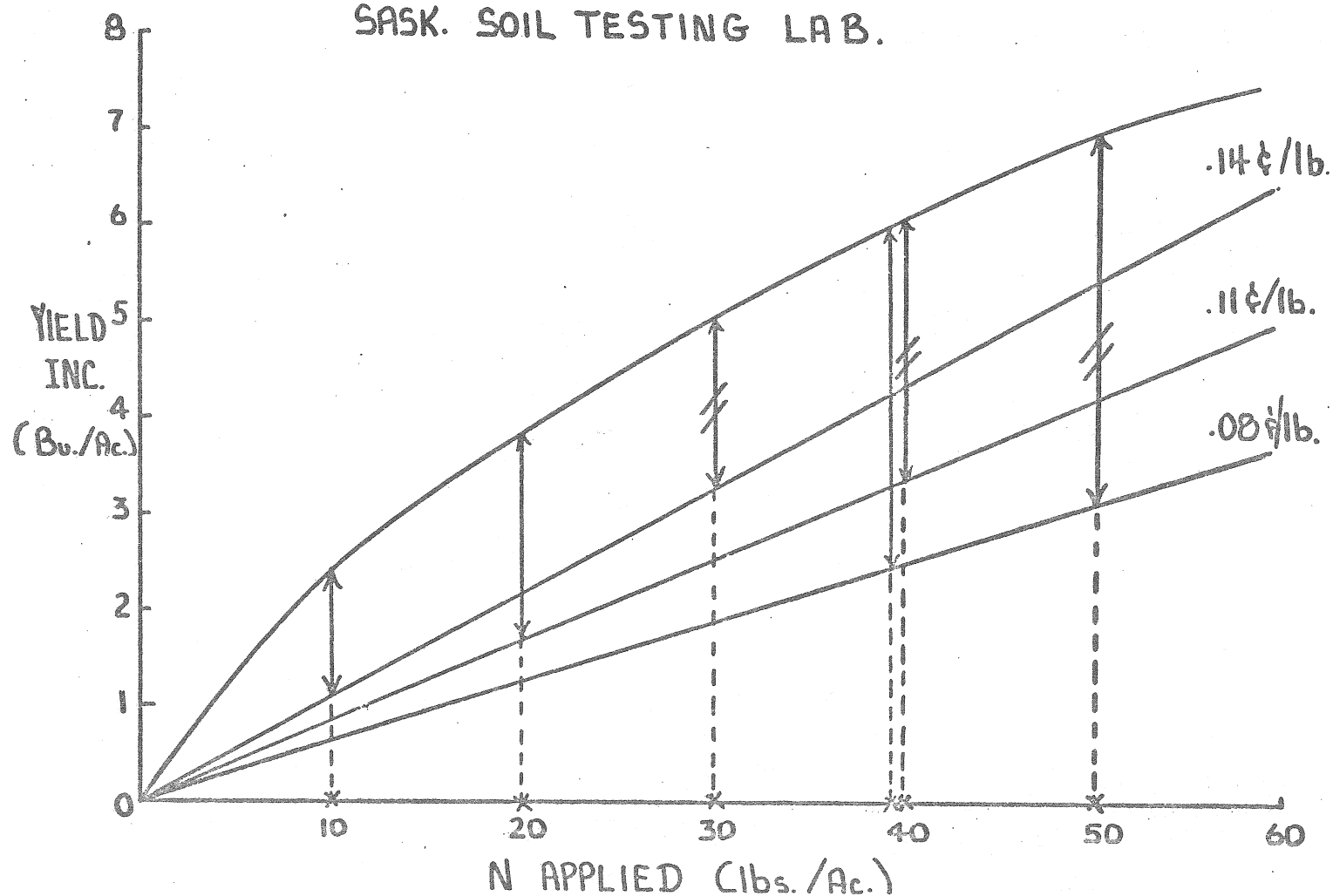


FIG. 5 EFFECT OF VARIABLE FERTILIZER COSTS AND MARGINAL RETURN CUT-OFF'S ON NITROGEN RECOMMENDATIONS FOR WHEAT ON STUBBLE - S. CURRENT DATA ; WHEAT AT \$ 1.30 / BUS.

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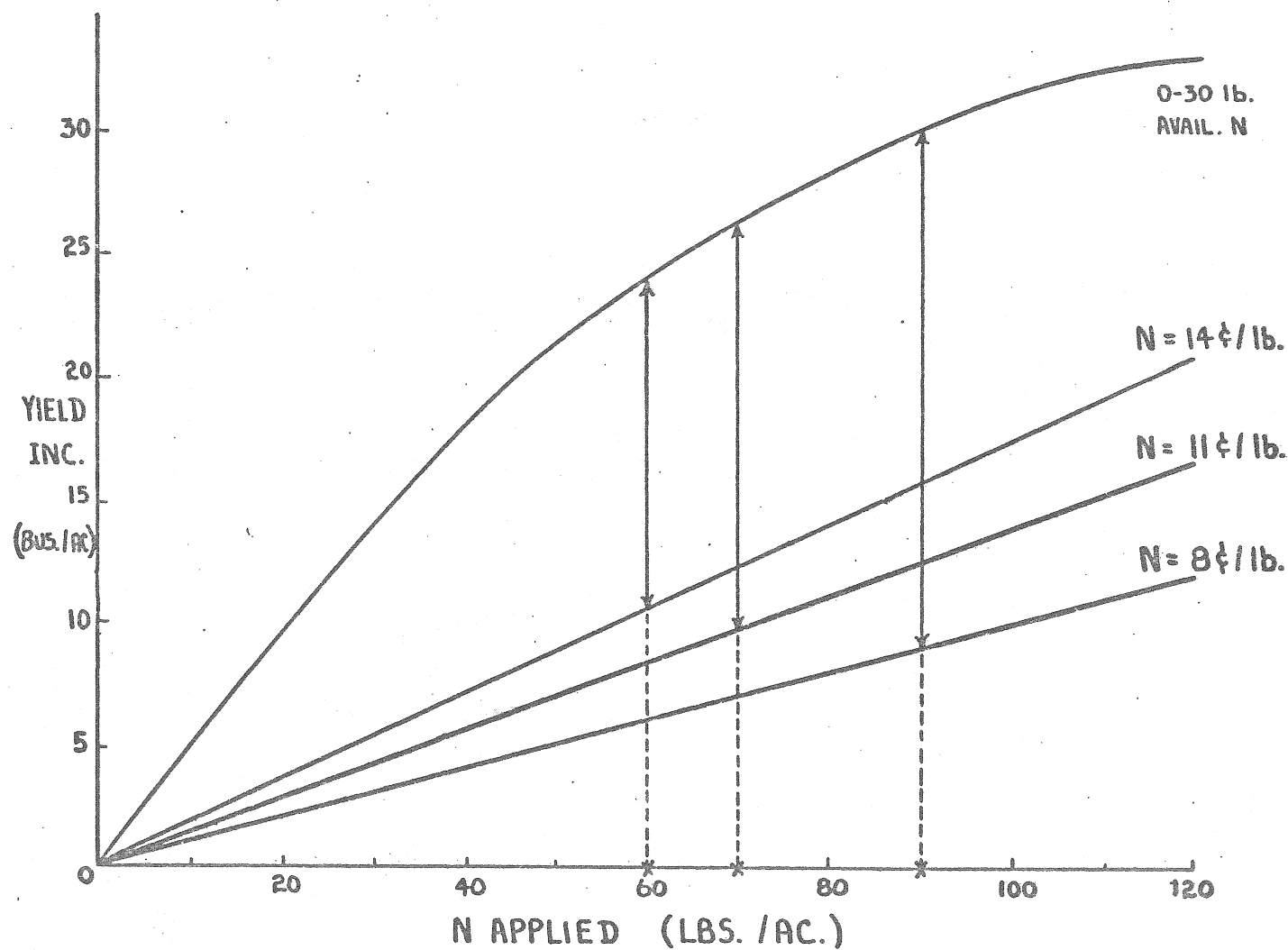


FIG. 6 EFFECT OF VARIABLE NITROGEN FERTILIZER COSTS  
ON NITROGEN RECOMMENDATIONS FOR STUBBLE-  
MELFORT DATA ; BARLEY AT \$.80/BUS.