THE ADVANTAGES AND DISADVANTAGES OF USING SURVEY DATA TO DERIVE PRODUCTION RESPONSES TO NUTRIENT INPUTS BY THE STABILIZED GROUP METHOD

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Summary

Use of survey methods as an experimental tool to replace traditional input/output experiments is advocated, and the stabilized group method is proposed as a means of overcoming some of the limitations of survey methods. The main advantages of this approach are as follows: 1) Minimum time delay between identification of the problem and publication of the solution. 2) Minimum cost since no research facilities are required. 3) The results are directly applicable to the industry since they are based on their own data.

I. INTRODUCTION

The object of many research programmes is to measure the effect of an input on animal production. It is usually known that a certain input will increase production but the producer requires quantitative information on the effect of different levels of the input on animal production. This information together with a knowledge of the latest cost of each unit of input and market price of the product enables the producer to determine the most economic level to use.

There appears to be little difficulty in identifying and defining the limits of the problem. The major difficulty is that few experimental farms are large enough for cattle experiments with six or more input levels. Even where they are sufficiently large there is often a reluctance to use valuable research facilities and staff for long periods on such simple problems. An alternative approach to conventional experiments is the use of data collected from producers. This paper reviews some of the methods used to analyse survey data.

II. METHODS OF ANALYSIS

(a) Simple treatment groups

with this method the only data required for each farm is the level of input per hectare or per animal and the corresponding level of production. The farms are divided into six or more treatment groups according to their level of the input being studied. For each treatment group the mean level of the input is calculated together with the mean level of production achieved. This method has been used by the New Zealand Dairy- Board (1953) to study the effect of superphosphate on butterfat production, and by the Milk Marketing Board (1974) in their study of the relation between concentrate feeding and milk production. However in both studies there was a reluctance to calculate a response curve.

Other workers have not been so reticent in placing a numerical value on responses obtained from survey data. Using data from 236 producers in the Dublin liquid milk area, Griffith and Conniffe (1971) reported that SNF% of milk was significantly related to the intake of starch equivalent. No other data were presented so there is no evidence that the response was not due to some other factor.

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In the New Zealand study there was doubt that the result "indicated a straight forward relationship between phosphate topdressing and butterfat production per acre". It was found that when farms were ranked in order of use of superphosphate they were also ranked in order of stocking rate. Although the study was limited to 360 farms with no purchased feed there was concern that the higher stocked farms were also "more fully improved farms" and thus the increased fat production was due to factors other than superphosphate. An increase in stocking rate was also present in the Milk Marketing Board (1974) study, and again it was impossible to state categorically that increased milk production was directly caused by the input studied.

(b) Unbiased treatment groups

The main weakness of the simple method is the possibility that the observed response may have been due to some input other than the one being studied. when designing experiments this problem is overcome by randomisation of the treatment between the farms but this is impossible when using survey data. One solution is to collect data on other inputs that might affect production and find whether there is any bias between the mean level of each of these inputs for each of the six treatment groups. This method was used by Rees, Minson and Kerr 1972 in a study of the effect of supplementary feed on milk fat production. Data on many other inputs were collected including fertilizer nitrogen and phosphorus, irrigation and temperate pasture. There were no major differences between the treatment groups in the levels of other inputs, indicating the absence of bias (Table 1).

TABLE 1
Effect of six levels of supplementary feed on mean fat production for six years on 82 dairy farms

Farm groups	1	2	3	4	5	6
Supplementary feed - kg per cow	1	24	63	146	270	490
Fat production - kg per cow	74	75	75	74	85	91
Other inputs						
Superphosphate - kg per cow	61	91	77	79	94	71
Irrigation - ha per cow	0.08	0.08	0.08	0.05	0.06	0.08
Temperate pasture - ha per cow	0.16	0.18	0.17	0.16	0.15	0.18
Fertilizer nitrogen - kg per cow	4	6	6	6	6	5

(c) Stabilized treatment groups

Satisfactory results of this type shown in Table 1 are rare. A more common situation is to find a horrible bias between the treatment groups. In the example shown in Table 2 the effect of superphosphate on fat production was confounded by increases in three other inputs - irrigation, nitrogen fertilizer and the area of temperate pastures. To overcome this bias, Rees, Minson and Kerr (1972) used a stabilizing technique. The 82 farms were reranked in ascending order for level of temperate pastures. The first six farms in the array were then ranked in order of level of superphosphate and allocated to each of the six treatment groups. This process was repeated until all farms had been allocated to the six groups. The mean level of all inputs and output was then calculated for each group.

Stabilizing eliminated the bias caused by differences in level of temperate pasture. Most important was finding that by eliminating the

bias in temperate pastures the bias in all the other inputs were virtually eliminated.

TABLE 2
Effect of six levels of superphosphate on areas other than sown tropical pastures on mean fat production for six years and the values of other inputs for each level of superphosphate group .

A. Unstabilized farm groups	1	2	3	4	5	6	Mean
Superphosphate - kg per cow	5	24	44	69	106	237	78
Fat production - kg per cow	66	70	78	75	86	95	78
Other inputs							
Irrigation - ha per cow	0.04	0.05	0.07	0.09	0.09	0.10	0.07
Temperate pastures - ha per cow	0.06	0.13	0.19	0.17	0.21	0.26	0.16
Fertilizer nitrogen - kg per cow	3	3	5	7	8	8	6
B. Stabilized farm groups	**1**	**2**	**3**	**4**	**5**	**6**	**Mean**
Superphosphate - kg per cow	16	30	45	67	104	203	78
Fat production - kg per cow	72	72	77	77	77	92	78
Other inputs							
Irrigation - ha per cow	0.05	0.08	0.06	0.08	0.08	0.07	0.07
Temperate pastures - ha per cow	0.14	0.16	0.18	0.16	0.17	0.18	0.16
Fertilizer nitrogen - kg per cow	4	5	4	7	7	7	6

Once the bias is removed from the treatment groups the results are similar to those achieved in a conventional six treatment experiment and valid output/input functions may be calculated.

IV. DISCUSSION

Output functions based on survey data are often suspect since no attempt is made to ensure that the treatment groups are free of bias. This problem may be overcome by collecting data on other inputs and removing any bias between treatment groups with the stabilizing technique. With this method the results may be presented graphically, drawing attention to any suggestion of curvilinearity. Another feature of the stabilized group method is that it lists the mean levels of all inputs so the producer can readily determine the possible relevance of the output functions to his property. These two features create a level of understanding and confidence that can never be approached by the use of multiple regressions (Rayner and Young 1963, Cook and Dolby 1970).

The main advantage of the survey method is the use of information accumulated in years prior to the study. Thus the time taken to solve the problem is independant of the number of years covered by the study. Since experiments are not conducted, no field facilities are required and problems of continually justifying the work never arise.

The reliability of survey data is often questioned especially where the questionaire is completed by the producer without help. In conventional experiments the research officer supervises the collection of data to ensure its reliability and the same effort must be applied to survey data if comparable accuracy is to be expected. This obviously takes considerable time since it is rarely possible to collect data from more than four properties each day. Information on numbers of cows

milked, areas of land irrigated and fertilizer applied is readily obtained from the producer while the best milk production data is held by the dairy factories, although in some case this information is only retained for a few years. Fertilizer purchases may also be checked against the records of the local distributor.

The obvious objection to the survey approach is that it can only be employed where the input studied is already being used in the industry. However this is not relevant since the inputs for which response curves are required are often those that have already been adopted by some producers and could never be satisfactorily tested in any other way. It is recognised that new pasture varieties are released to the industry without a complete evaluation and the final assessment is left to the individual property owner (Hutton and Minson 1974). The survey approach can convert these subjective assessments into experiments with a level of objectively close to that achieved with conventional experiments. The results of survey studies should accelerate the adoption of worthwhile improvements while unsound practices will be rapidly identified and their use discouraged.

It is concluded that the stabilized group method of analysing survey data may be used to calculate production response functions with a confidence similar to that achieved with conventional experiments.

V. ACKNOWLEDGEMENTS

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