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Fertilizers

NOT FOR PUBLICATION.

UNIVERSITY OF NOTTINGHAM
SCHOOL OF AGRICULTURE

GIANNINI FOUNDATION OF
AGRICULTURAL ECONOMICS

~~WITHDRAWN~~
JUN 8 1960



Interim Report on An Investigation into the
Economics of Fertiliser Application
to Permanent Pasture for Beef
Production.

DEPARTMENT OF AGRICULTURAL ECONOMICS
SUTTON BONINGTON
LOUGHBOROUGH
SUMMER, 1958.

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University of Nottingham, School of Agriculture,
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OBJECTIVE :

The objective of this study was to measure the response, in terms of liveweight gain, from application of fertiliser to permanent pastures, grazed by beef cattle. Given this information an estimate of the economic gain or loss involved can be obtained.

BACKGROUND TO THE STUDY :

Traditionally the Midlands fattening pastures are considered to be some of the best of their type in the country. The management of this grassland is typified by a low rate of fertiliser usage.

Table 1 shows this feature of management.

AVERAGE RATES OF FERTILISER APPLICATION 1957.¹

(Cwts. per acre N, P₂O₅ and K₂O)

TABLE 1.

	Applied 1957			Changes 1953 to 1957		
	N	P	K	N	P	K
Permanent pasture						
Arable districts	0.14	0.12	0.08	(+) 0.04	(-) 0.04	(+) 0.03
Grassland districts	0.07	0.16	0.06	(+) 0.02	(-) 0.01	(+) 0.03
Temporary grass						
Arable districts	0.24	0.18	0.17	(+) 0.06	(-) 0.02	(+) 0.03
Grassland districts	0.19	0.24	0.15	(+) 0.03	(-) 0.02	(+) 0.03
Permanent pasture grazed	N	P	K	% Acreage receiving fertiliser		
				N	P	K
East Leicestershire	0.06	0.13	0.02	16	18	5
West Leicestershire	0.05	0.05	0.03	16	10	7
Lancashire (Fylde)	0.15	0.32	0.19	55	59	48

¹ Source : Survey of Fertiliser Practice 1957 (Part II).

The study is of significance because of the important influence that cattle have in determining the farm income obtained from these Midland grass farms.

In 1957 on 19 farms in the East Midlands over 150 acres with less than 25 per cent of the land devoted to crops for sale, and less than 14 dairy cows per 100 acres, fat cattle sales were 63 per cent of the Total Revenue, and cattle purchases were 57 per cent of the Total Expenditure.

Much of the grassland in the East Midlands is permanent pasture. In Leicestershire and Northamptonshire 75 per cent of the grassland acreage is permanent pasture. The acreage of permanent pasture represents 50 per cent of the total crop and grass acreage in these counties.

Since fertiliser application is one of the means of effecting greater production from grassland, and since the general level of fertiliser usage appears to be low and is applied to a small acreage only of the permanent pasture in the East Midlands there may well be scope for increasing the output from, and the profitability of, this grassland by using more fertiliser.

This study was designed to show whether an economic return was to be expected from a fairly heavy dressing of fertiliser to a sample of permanent grass pastures grazed by beef cattle.

METHOD OF STUDY :

Twelve farmers who grazed beef cattle on permanent pasture in the East Midlands were selected to co-operate in the investigation. These farmers were, for convenience, allocated code numbers.

Each farmer was asked to provide two fields¹ each of about 10 acres, a fertilised field (A), and an unfertilised field (B). On farms G.B. 7, 8, 10, 15 and 16 one field was divided into two. On the remaining farms fields which, it was hoped, were rather similar were chosen for the study.

Five hundredweights per acre of a 5:12 $\frac{1}{2}$:12 $\frac{1}{2}$ compound fertiliser were applied by each farmer to (A) in the Spring of 1958. The date of fertiliser application on each of the farms is shown in Table 2.

The cattle placed on the experimental fields were weighed on a portable weighbridge. These cattle were subsequently weighed at approximately six weekly intervals.

The farmers were encouraged to manage the cattle on the experimental fields as they would under normal farming practice as far as was

¹ G.B. 16 has three experimental fields - (A) fertilised with a 5:12 $\frac{1}{2}$:12 $\frac{1}{2}$ compound; (C) fertilised with a 12:9:9 compound; (B) not fertilised.

possible. If they wished to place more cattle on an experimental field or remove any to regulate the stocking rate to the available herbage, these cattle were weighed at the time of moving. Cattle from the fields were weighed before going to market.

It is realised that time of weighing will affect the weight of the cattle due to varying gut fill. Since the cattle from both fields were weighed at approximately the same time and directly off the fields and since the interest is in the difference in liveweight gains between the two fields and not in the absolute liveweight gain, it is not considered that any correction need be applied to the weights recorded.

As far as possible the cattle going on to the experimental fields were as evenly matched as possible regarding weight, condition, sex, method of wintering or if purchased, place of origin. Unfortunately, on one farm, the cattle were not well matched.

The average weights of the cattle placed onto the experimental fields are shown in Table 2.

THE RESULTS :

The date of the first weighing i.e. equivalent to the beginning of the grazing season, the length of the grazing season in days, and the

AVERAGE LIVWEIGHT OF THE CATTLE PLACED ONTO THE EXPERIMENTAL
FIELDS AND THE DATES OF FERTILISER APPLICATION.

TABLE 2.

Code number	Average liveweight of cattle placed on fields (lbs.)		Weights of cattle on (B) as a % of (A)	Dates of fertiliser application
	Fertilised (A)	Unfertilised (B)		
G.B. 1	1,042	1,000	96	3.3.58
G.B. 2	1,080	1,069	99	19.3.58
G.B. 3	1,010	999	99	11.3.58
G.B. 6	972	943	97	18.3.58
G.B. 7	693	728	105	15.3.58
G.B. 8	899	900	100	14.3.58
G.B.10	456	431	94	21.3.58
G.B.11	1,000	961	96	24.3.58
G.B.12	963	978	101	19.3.58
G.B.13	1,020	1,002	98	12.3.58
G.B.15	1,056	1,040	98	19.3.58
G.B.16 ¹	825	757	92	5.4.58
Average	918	900	98	(18.3.58)

¹ On G.B. 16 the average liveweight of the cattle placed on field (C) was 820 lbs., or 92 per cent of the weight of cattle on (A).

turnover¹ of stock on each field are shown in Table 3.

On most farms the length of the grazing season was the same on both the fertilised and unfertilised fields.

¹ Turnover of stock is calculated by dividing the length of the grazing season in days by the average number of days each head of stock is on the field.

DATES OF COMMENCEMENT OF GRAZING SEASON, LENGTH OF GRAZING SEASON¹ AND
TURNOVER RATE OF STOCK.

TABLE 3.

Code number	Fields (A)			Fields (B)			Turnover (A) as a percentage of (B)
	Start of grazing season	Length of grazing season (days)	Turnover of stock	Start of grazing season	Length of grazing season (days)	Turnover of stock	
G.B. 2	8.5.58	160	4.2	8.5.58	160	3.7	111
G.B. 3	8.5.58	162	1.0	8.5.58	155	1.0	100
G.B. 6	28.4.58	172	2.2	28.4.58	172	2.2	100
G.B. 8	15.4.58	187	5.2	15.4.58	187	5.5	94
G.B.13	15.4.58	186	2.2	15.4.58	188	2.0	110
G.B.15	7.5.58	142	1.5	7.5.58	142	2.2	68
G.B. 1	23.4.58	173	1.7	23.4.58	173	1.2	142
G.B.11	28.4.58	168	1.7	28.4.58	168	1.9	89
G.B.12	8.5.58	158	2.4	8.5.58	158	2.0	120
G.B. 7	13.5.58	99	2.1	13.5.58	99	2.1	100
G.B.10	28.4.58	181	1.3	28.4.58	181	1.3	100
G.B.16 ²	7.5.58	179	2.3	7.5.58	179	2.0	115
Average	(1.5.58)	163	2.3	(1.5.58)	163	2.2	104

¹ The end of the grazing season was during the first two weeks of October. This was about the time that the majority of farmers began to offer supplementary feed.

² On farm G.B. 16, field (C), the length of the grazing season was 179 days and the stock turnover was 2.6.

The average liveweight gains per acre¹ are recorded in Table 4 together with the difference in liveweight gain between the fertilised and unfertilised areas.

After discussion with the graziers concerned it was evident that, in their opinion, there was an inherent quality in a field which made it a fattening pasture. It was thought that it would be of interest to compare the response to fertiliser application obtained on "fattening" and "store fields". Hence the layout of the results in the tables.

LIVWEIGHT GAINS AND STOCKING RATES :

From an inspection of Table 4 and possibly more clearly from Graph I it is obvious that the liveweight gains per acre are rather closely associated with the stocking rates per acre.

On average 0.1 higher stocking rate per acre is associated with 35 lbs. extra liveweight gain per acre.

This ties up very well with the average differences between the fertilised and unfertilised fields, liveweight gain 37 lbs., and stocking rate 0.1.

¹ The experimental field acreages have not yet been carefully measured and the per acre figures in this report may be slightly altered when accurate measurements of the fields have been carried out.

AVERAGE LIVELWEIGHT GAINS LBS. PER ACRE AND AVERAGE STOCKING RATE BEASTS PER ACRE.

TABLE 4.

Code number	Liveweight gains (lbs. per acre)		Difference (A minus B) (lbs. live-weight gain per acre)	Average stocking rate	
	Fertilised (A)	Unfertilised (B)		Fertilised (A)	Unfertilised (B)
"Fattening Fields"					
G.B. 2	365	386	(-) 21	0.98	1.00
G.B. 3	420	332	88	1.09	1.03
G.B. 6	510	479	31	1.58	1.29
G.B. 8	466	527	(-) 61	1.34	1.32
G.B.13	287	253	34	0.94	0.85
G.B.15	310	285	25	0.95	0.98
G.B. 1	541	381	160	1.36	1.13
G.B.11	353	351	2	1.13	0.99
G.B.12	252	245	7	0.78	0.66
Average (9)	389	358	31	1.13	1.03
"Store Fields"					
G.B. 7	258	122	136	1.14	1.06
G.B.10	337	332	5	1.27	1.12
G.B.16 ¹	312	271	41	0.92	0.76
Average (3)	302	241	61	1.11	0.96
Total Average (12)	367	330	37	1.12	1.02

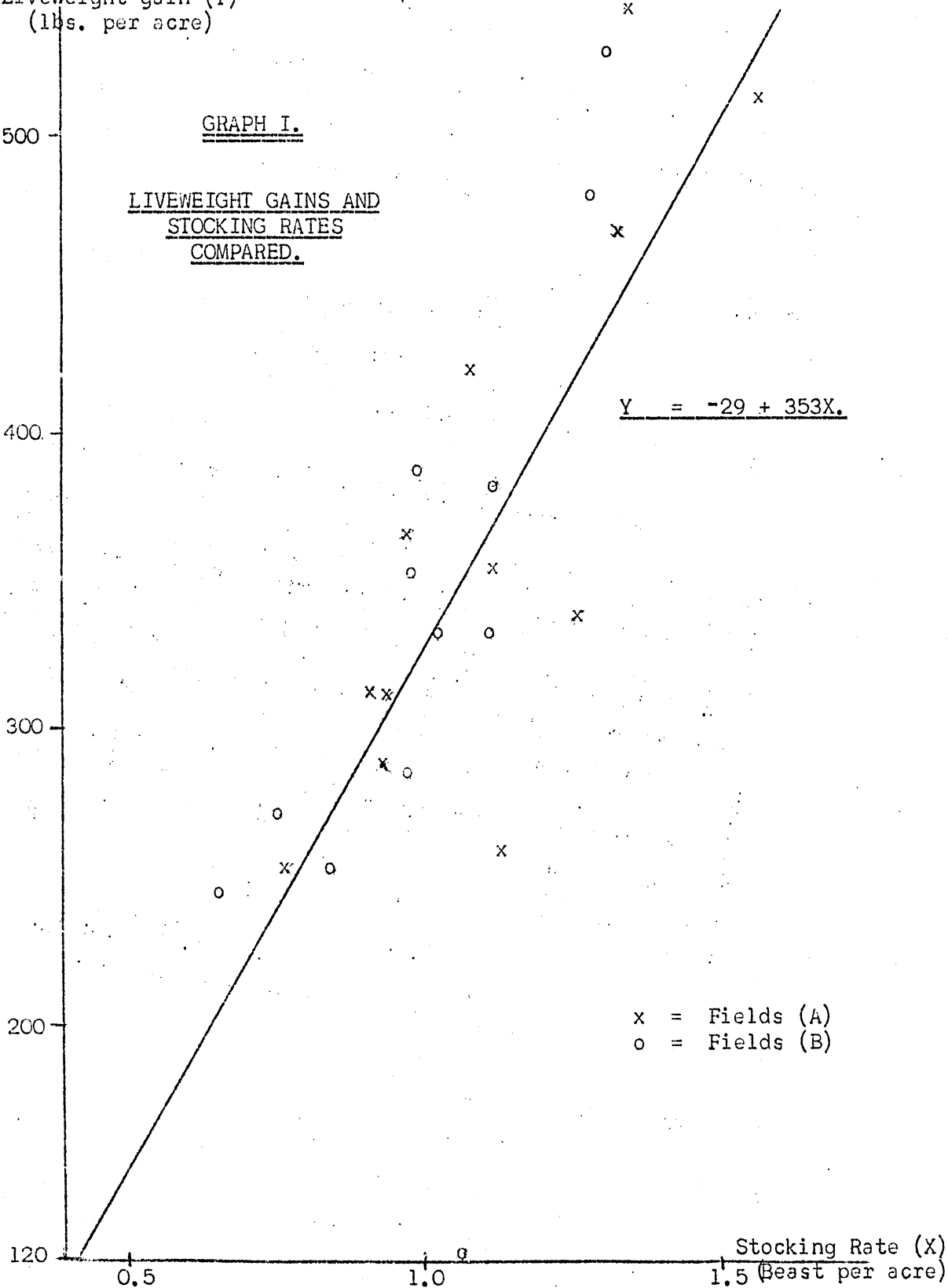
¹ On farm G.B. 16 the liveweight gain per acre on field (C) was 256 lbs. and the average stocking rate was 0.92 beast per acre.

Liveweight gain (Y)
(lbs. per acre)

GRAPH I.

LIVEWEIGHT GAINS AND
STOCKING RATES
COMPARED.

Y = -29 + 353X.



This relationship between stocking rates and liveweight gains is what would be expected in as far as extra grass available would normally be utilised by stocking the field more heavily.

SEASONAL LIVEWEIGHT GAINS :

From the periodic weighing of the cattle, the approximate liveweight gains per acre for each month have been calculated. These results are presented in Table 5.

AVERAGE MONTHLY LIVEWEIGHT GAINS (lbs. per acre).

TABLE 5.

Fields	Apr.	May	June	July	Aug.	Sept.	Oct.	Total
Fertilised (A)	8.4	82.8	103.2	63.6	46.9	43.1	19.4	367.4
Unfertilised (B)	7.1	70.4	96.9	55.7	42.9	40.3	16.8	330.1
(A) as a percentage of (B)	118.2	117.6	106.5	114.1	109.4	107.1	116.0	111.3
Liveweight gain per month as a percentage of Total								
(A)	2.3	22.5	28.1	17.3	12.8	11.7	5.3	100.0
(B)	2.1	21.3	29.4	16.9	13.0	12.2	5.1	100.0

ADDITIONAL ANALYSES :

It is planned to carry out soil tests on the experimental fields during the 1958-59 Winter, and to carry out a botanical analysis of the fields during Spring, 1959.

SOME DETAILS OF STOCK AND FIELDS.

TABLE 6.

Code number	Fields	Cattle
G.B. 2	Field (A) was ploughed during war. Slag applied to field (A) six years ago, and to field (B) five years ago. Sheep on during Winter. "Fattening fields".	Cattle were well matched. Varying types. Some home wintered, some purchased in Spring. May have moved them more and grazed sheep too.
G.B. 3	No stock on fields from 1.1.58 until commencement of study. "Fattening fields".	Cattle well matched. Mainly Hereford crosses. Same cattle on fields all Summer.
G.B. 6	Sheep on all Winter. Three cwt. per acre Fisons 32 in 1957. Fields well matched. "Fattening fields".	Mostly Irish cattle, Hereford and Poll crosses. First batch even. Second batch, bias in favour of field (B). One beast was a very bad "doer" on field (A).
G.B. 8	No difference between halves of divided field. A very good "fattening field".	Cattle, mostly Herefords and their crosses well matched throughout.
G.B.13	Two fields used, well matched. "Fattening fields".	Cattle well matched. Irish Herefords. One teg and one lamb per acre grazed on both fields for part of Summer.
G.B.15	Field divided. Both halves matched. Field (A) grazed better. Both halves might have carried more stock. "Fattening field".	Cattle home reared. Well matched.
G.B. 1	Fields matched. No fertilizer previously applied. No stock on in Winter. "Fattening fields".	Cattle on field (A) - "gentleman's cattle" good beef type. On field (B) cattle were bonier, leaner with Friesian in the cross.
G.B.11	Both "fattening fields" but field (A) definitely not so good as field (B). Sheep on during Winter.	Cattle, Irish, Hereford, polled, well matched. Cattle not changed. Normally graze sheep with cattle.

TABLE 6 continued

Code number	Fields	Cattle
G.B.12	Field (B) a "fattening field". Field (A) "store field" but fattened cattle in 1958. Badly poached during Winter. Unfertilised field limed.	All Irish cattle. Well matched over the whole season.
G.B. 7	Field divided. Halves matched. A poor field. Limed August, 1958.	Cattle home reared. All by same bull. Well matched for condition. Single suckled 1957.
G.B.10	Field even and divided. Clover content improved on field (A). May have fattened cattle but regarded as a "store field".	Cattle home reared. Hereford crosses on one area, Angus crosses on the other. Cattle could have been moved more often. Stocking rate as high as possible.
G.B.16	Each field was well matched. Not a "fattening field". Clover content improved on fertilised fields. Might have carried more stock in early Summer.	Cattle home reared. Angus crosses. Well matched but possibly a little poorer on field (C).

EVALUATION OF RESULTS :

In evaluating the results the following points must be borne in mind.

- (a) The small size of the sample.

There were wide variations in the fields in the sample which make it difficult to draw very firm conclusions.

(b) One year is far too short a period in which to assess the economic consequences of fertiliser application.

(c) The application of these fertilisers may have had some effect in changing the botanical composition e.g. increase in clover content, which may increase the productivity of the sward in future years.

(d) Seasonal effect.

This was the wettest Summer for a number of years. It was the general opinion among the co-operating farmers, that cattle had not "grown" as well as in a drier year.

(e) Present manurial status.

As the experimental fields have not yet been sampled for C_2O , P_2O_5 , and K_2O , it has been impossible to bring this factor into this analysis.

CONCLUSIONS :

The average price of fat cattle sold in the Summer and Autumn of 1958 was approximately £7. per live hundredweight (including deficiency payments). If it is assumed that the store cattle were

also bought for this price, the extra liveweight gain can be valued at £7. per hundredweight.

The average cost of the fertiliser applied in March, 1958, was £4. 15s. Od. per acre and at £7. per live hundredweight about 76 lbs. of extra liveweight gain per acre were required to cover this cost.

In fact the average extra gain in 1958 (the year of application) was only 37 lbs. or sufficient to pay for about half the fertiliser applied.

A full assessment of the economics of applying fertilisers to permanent grass must, however, take into account any residual effects the fertiliser applied may have in future years.

The view of the specialist officers consulted is that the compound applied in 1958 may have had a higher content of potash than was necessary. It is, therefore, recommended that the fertiliser application for 1959 should be 3 cwts. per acre of a 8:12:8 compound.

