AN ECONOMIC SURVEY OF THE PRODUCTIVITY OF DAIRY FARMS ON THE RED BASALTIC SOILS OF THE FAR NORTH COAST OF NEW SOUTH WALES.

BY

ALISON M. KINGSLAND, Economics Research Officer.

INTRODUCTION.

In New South Wales outcrops of basalt-derived soils occur in the Lismore-Ballina-Byron Bay area, the Lower Tweed region, and on the Dorrigo, Comboyne and Robertson plateaux. The formation of the soils of each region has followed the same course but to different degrees according to climatic forces of which rainfall is the most important (1).

The basaltic soils have undergone the most intensive weathering in the humid subtropical climate of the Far North Coast. The resultant soils are deep, fertile, red loams. Three different phases have been observed but the deep red to red-brown clay loams called Wollongbar Clay Loam comprise the greatest part of the area.

The natural vegetation of this country was the big scrub, or brush forest, consisting of typical dense jungle vegetation. In the early days of settlement the big scrub was fired and the land completely cleared of vegetation. The first grasses used were blue couch, clover and buffalo grass. *Paspalum* pastures were established later and have since formed the basis of the dairy industry which developed in this area. The topography varies from gently undulating to deeply dissected.

A period of flush growth followed the clearing of the big scrub. The heavy accumulation of ash and the natural high fertility of the virgin soil produced pastures of allegedly high carrying capacity. The number of stock grazed was then insufficient to keep down the abundant growth of the pastures (2). The opinion held generally in the district is that the carrying capacity of the land began to decline after the first few years.

The type of dairy farm management which has developed on the Far North Coast differs considerably from that of other dairying districts of the State and indeed of most other countries. Pastures are relied on almost solely to provide the feed requirements of the cattle in both winter and summer. Very little feed is purchased and only small quantities are grown for supplementary feeding. Cultivation is kept at a minimum as most farmers believe it is too difficult to get the land back under pasture. On such undulating country, moreover, there is a real risk of heavy erosion when the land is left exposed to the heavy rainstorms which are often experienced in this region. Production is concentrated in the spring and summer months when pasture growth is at its peak. Fertilizers are used to a very limited extent as the general belief in the district is that very little, if any, response is obtained from the application of fertilizers. Where land is cropped superphosphate is sometimes applied. Lime is generally believed to be deficient in the soils.

However, fundamental facts concerning the soil and pastures are as yet incomplete. For instance, trials designed to determine the response to phosphatic fertilizers have so far given conflicting results.

Phosphate is present in the soil in considerable amount but appears to be largely unavailable to the plant. It has not been established to what extent liming is a paying proposition. White clover, which is the recognised legume of coastal pastures, does not do well in this district due to the unsuitability of either the soil and/or the climate. Dairy farm management under such conditions presents many problems.

The decline in butter production in recent years has brought into prominence the deficiency in fundamental knowledge of this region, especially as some farmers claim that the decline in production is a reflection of a decline in soil fertility.

Recognising that a study of the problems of the area would provide material for fundamental research as well as a means of solving practical difficulties, the Commonwealth Scientific and Industrial Research Organisation and the Department of Agriculture undertook an investigation of the soils and pastures of the red basaltic region of the Far North Coast. Pasture investigations have included such studies as the effect of lime and fertilizers on the *Paspalum* pastures and trials of introduced strains and species of pasture plants with a view to improvement of present pastures. Soil studies have included a soil survey, pH determinations, soil moisture estimations and lime requirement and phosphate content.

At the same time it was considered that an economic survey of the area should be made to determine whether production had declined and, if so, to what extent, and also whether economic factors had had any effect on production levels. This article deals with the methods, findings and conclusions of the economic survey.

METHOD OF INVESTIGATION.

Since the red soil country under investigation does not coincide with any one statistical division (it overlaps the boundaries of several police patrols) it was impossible to obtain statistics for the red soil area alone from figures compiled by the Government Statistician. Investigations in the district revealed that the only sources of information were the dairy factories and Pasture Protection Board records. Dairy factories could supply figures of production for individual farmers on a monthly basis but as far back as 1929 only. As some of the factories received supplies from areas both within and without the red soil area, it was unsatisfactory to measure merely total factory output. It would not have been possible to sort out and compile figures from every factory in the area so it was decided to select one factory which drew all its supplies from red soil farms and use production on these farms as a sample of production of the district. Alstonville was selected as a suitable district. The number of suppliers varied over the years and farms changed hands considerably so that it was impossible to trace the production of every supplier right through the seventeen years for which records were available. Monthly production records were obtained, therefore, of those farms where production had been carried on continuously under the same ownership or management for the entire period. A check was then made to ensure that these farms were all situated on red soil country. Eventually, forty-three farms for which all the required information was available were taken as the sample. All figures on an annual

basis refer to the financial year. This basis was considered to be the most satisfactory since the main production season in this district occurs during spring and summer months.

Records of the Pasture Protection Board covered information regarding number of large livestock, number of acres cultivated and total area of the holding each year. Large livestock included cattle of all ages and horses, but excluded pigs and any other small animals. No record of actual number of milking cows carried on the holdings each year was available.

By examining the group of farms from the Alstonville district as a sample of all farms in the red soil area, it should be possible to obtain a measure of trends in the dairying industry of the district since 1930. Any significant decline in productivity should be apparent over this period.

It is unfortunate that these trends cannot be traced back to the early years of settlement, but no reliable data are available. It is understood that the big scrub country was entirely cleared by about 1915. Therefore no allowance for area uncleared need be made for the period under review.

A detailed study has been made of the 43 farms for which data of production, number of livestock, area cultivated were obtained. Supplementary information such as labour supply, area of non-grazing land other than cultivated land, area devoted to pig grazing, etc., necessary to complete the picture for each was obtained by visiting each of the farms and personally interviewing the farm operator. Details of labour used throughout the period are necessarily approximate only, since the farmer merely relied on his memory to give just a general impression of how the labour supply on his farm had changed during the period under review. However, it is felt that the labour position presented is fairly indicative of what has actually taken place in the district. Since total large stock was the only figure available, this has been used as the basis for measuring change in number of cows carried. Numbers of bulls and horses on each holding were ascertained from each farmer and have been subtracted from total stock. Thus the stock figures used include dry and milking cows, heifers and calves. It is pointed out that while these figures do not measure the actual number of milking cows which produced the butter indicated, it may reasonably be assumed that the percentage of milking cows to total livestock has remained fairly constant over the years. Thus the measure of change in total stock number is also a measure of change in the number of milking cows carried.

Butter production alone has been used as a measure of productivity of the country. Pig production, the only other important source of income of farms in the district, has not been measured, mainly because reliable data was not available. Pigs contribute about 20 per cent to 30 per cent. of the total income of a farm. Other sources of income (such as bananas and peanuts) are almost negligible.

The acreage devoted to these forms of production other than butter has been excluded from the acreage figure used to calculate productivity per acre. Thus productivity *per acre* as measured by butter production is not affected by the exclusion of pig production except in so far as the quantity of skim milk fed to the pigs is concerned. Actual

values of production per farm and per person are underestimated when sideline production is not taken into account. However, it is argued that the *trend* in butter production is a measure of the *trend* in total productivity of the farm as the level of pig production depends on the level of milk production. Very little feed is purchased for the pigs, especially since the price of wheat has risen, skim milk, pasture and a little farm-grown feed being relied upon almost entirely. Figures of pig production supplied by the farmers show that the trend has followed much the same course as butter production. There has been an overall reduction in pig production during the period under review of approximately 23% (based on farmers' estimates).

TRENDS IN TOTAL PRODUCTION AND RELATED FACTORS.*

Over the seventeen year period 1930-1947, the total production of the 43 farms declined substantially. (Table I and Fig. I). For the first six years of this period total production per annum was maintained at the level of 400,000 to 500,000 lbs. of butter. Over the last six years of the period only once was production above the 400,000 lbs. mark.

At the same time the number of stock carried on these farms remained at much the same level. (Table I.)

The grazing area of the 43 farms has been extended gradually during the years from 4,997 acres in 1930-31 to 5,493 acres in 1946-47, to a small extent by reduction in area cultivated but mainly by purchase of extra land. (Table I and Fig. I.). The rate of stocking has been maintained only by bringing a larger area of land under production.

The area cultivated for the production of feed has decreased substantially, particularly over the last seven to eight years (Table I). Purchase of supplementary feed in this district is almost negligible. It is evident that less emphasis is being placed on the practice of supplementary feeding of roughage. The increase in total grazing acreage under production indicates that more reliance is being placed on pasture grazing. Apparently closely associated with the decline in feed grown on the farm is the decline in the number of persons engaged in farming on these holdings.

**Trends have been calculated by means of a five year moving average. In order to facilitate presentation graphically of trends in a number of factors an index of the moving average for each factor has been calculated, using the 1930-34 average as the base equal to 100.*

TABLE I.

Trends in Total Production and in Related Factors.

For Forty-three Red Soil Farms, 1930-31 to 1946-47.

[5 Year Moving Average.]

Year.	Butter Production.	Stock (excluding Bulls and Horses).	Grazing Area.	Labour (No. of persons).	Area Cultivated for Feed.
	lb.		Acres.		Acres.
1930–34	446,847	2,578	5,036	98	337
1931–35	451,963	2,644	5,082	98	332
1932–36	442,531	2,611	5,073	98	343
1933–37	445,486	2,598	5,122	98	341
1934–38	433,110	2,610	5,169	97.5	323
1935–39	409,195	2,610	5,218	97	317
1936–40	398,905	2,571	5,250	96	315
1937–41	393,216	2,540	5,317	93	293
1938–42	395,585	2,530	5,343	89	267
1939–43	391,670	2,563	5,400	86	237
1940–44	386,474	2,579	5,442	83	206
1941–45	374,746	2,630	5,463	80	182
1942–46	366,074	2,661	5,490	80	164

In addition, many farmers reported the purchase of milking machines in recent years to compensate for the labour shortage.

During the first two years of the period under review the average annual price the farmer received for his butter was 12.5 to 13.0 pence respectively. In 1932-33 the price began to fall and reached the low level of 8.4 pence per lb. in 1933-34 (Table II). Thereafter price recovered fairly rapidly until 1937-38, after which it remained stable until 1941-42. Since then the price has risen steeply, reaching 19.4 pence in 1945-46. The trend of prices is illustrated in Fig. 1.

TABLE II.

Butter Prices (Monthly Average), 1930-31 to 1946-47

Year.	Price.	Adjusted Price.*	5-Yr. Moving Average.	Index.
	Pence per lb.	Pence per lb.	Pence per lb.	
1930–31	12.5	12.5	...	...
1931–32	13.0	14.6	...	...
1932–33	9.5	11.0	11.9	100
1933–34	8.4	10.3	11.9	100
1934–35	9.1	10.9	11.6	97
1935–36	10.8	12.7	11.6	97
1936–37	11.2	13.0	11.8	99
1937–38	12.5	11.0	12.2	103
1938–39	12.5	11.5	12.3	103
1939–40	12.3	12.9	12.3	103
1940–41	12.8	13.2	12.8	108
1941–42	12.7	13.0	13.8	116
1942–43	14.0	13.3	14.8	124
1943–44	17.3	16.4	15.8	133
1944–45	18.6	17.9	16.8	141
1945–46	19.4	18.5	...	...
1946–47	19.1	18.1	...	...

* Butter price has been weighted for cost of living.

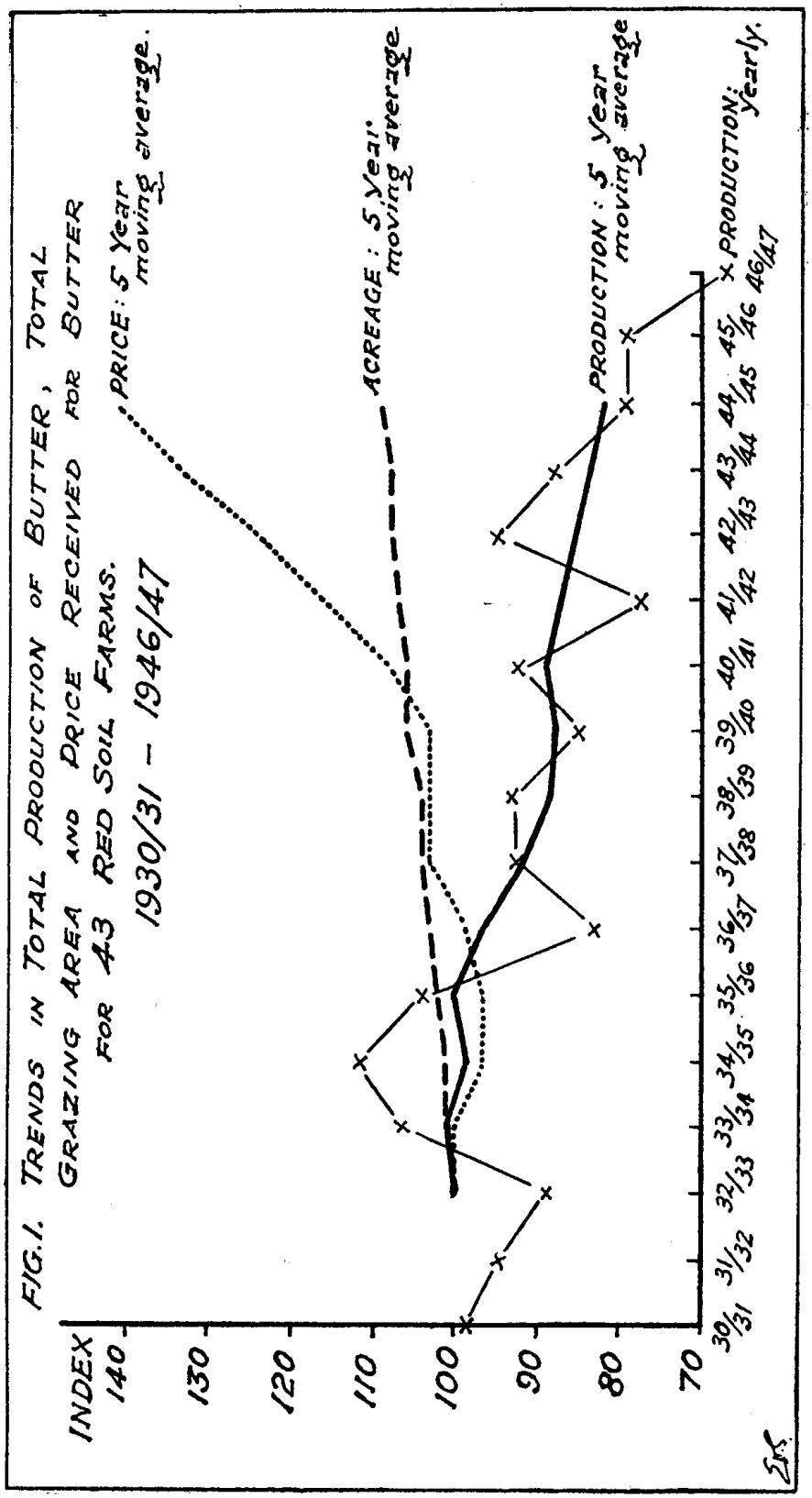
FIG. 1. TRENDS IN TOTAL PRODUCTION OF BUTTER, TOTAL GRAZING AREA AND PRICE RECEIVED FOR BUTTER FOR 43 RED SOIL FARMS. 1930/31 - 1946/47
PRICE: 5 Year moving average.
ACREAGE: 5 Year moving average
PRODUCTION: 5 Year moving average
PRODUCTION: Yearly.
INDEX
140
130
120
110
100
90
80
70
30/31
31/32
32/33
33/34
34/35
35/36
36/37
37/38
38/39
39/40
40/41
41/42
42/43
43/44
44/45
45/46
46/47

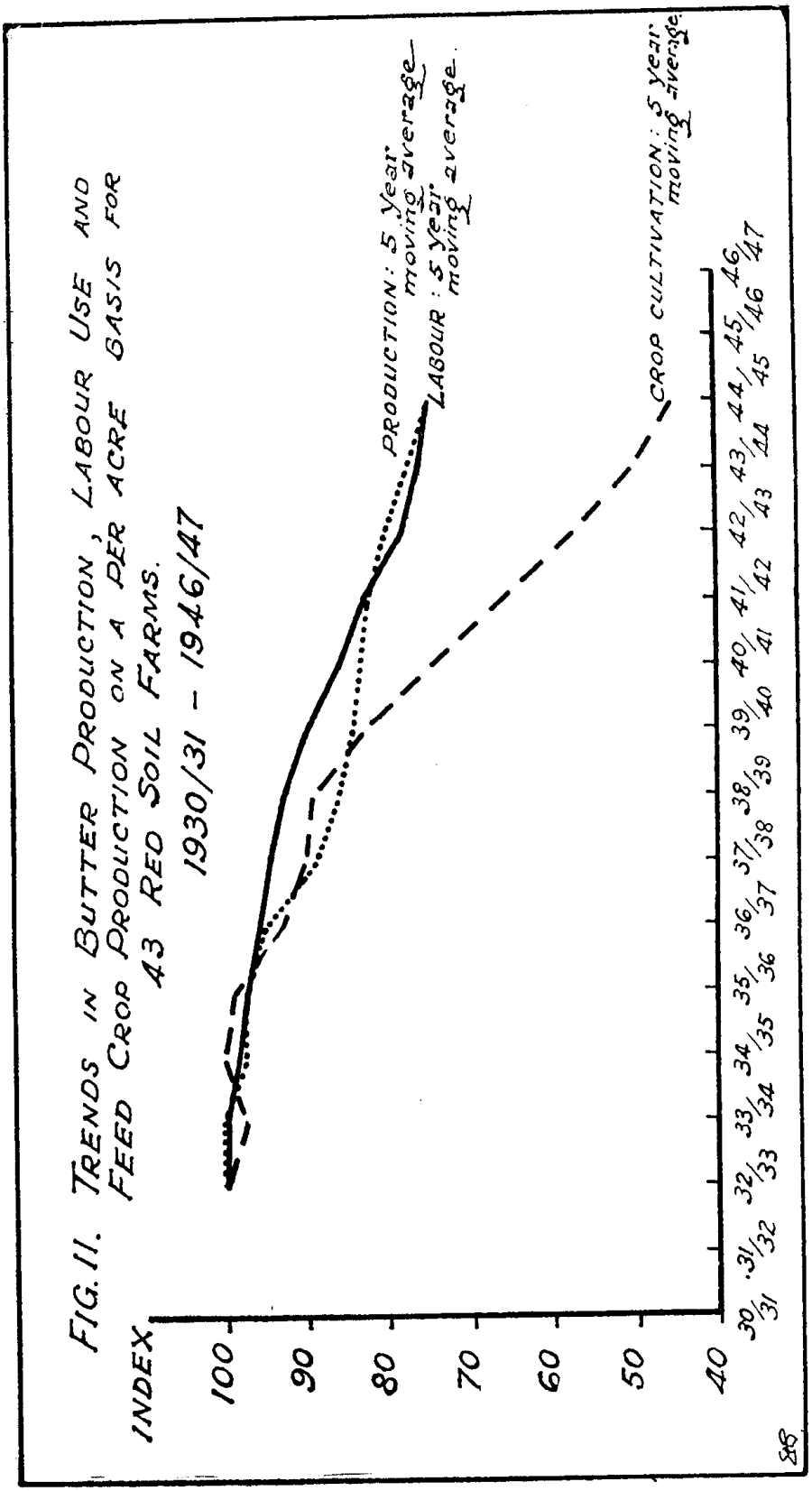
FIG. 11. TRENDS IN BUTTER PRODUCTION, LABOUR USE AND FEED CROP PRODUCTION ON A PER ACRE BASIS FOR 43 RED SOIL FARMS.
1930/31 - 1946/47
INDEX
100
90
80
70
60
50
40
PRODUCTION: 5 Year moving average
LABOUR: 5 year moving average
CROP CULTIVATION: 5 year moving average
30/31
31/32
32/33
33/34
34/35
35/36
36/37
37/38
38/39
39/40
40/41
41/42
42/43
43/44
44/45
45/46
46/47
88

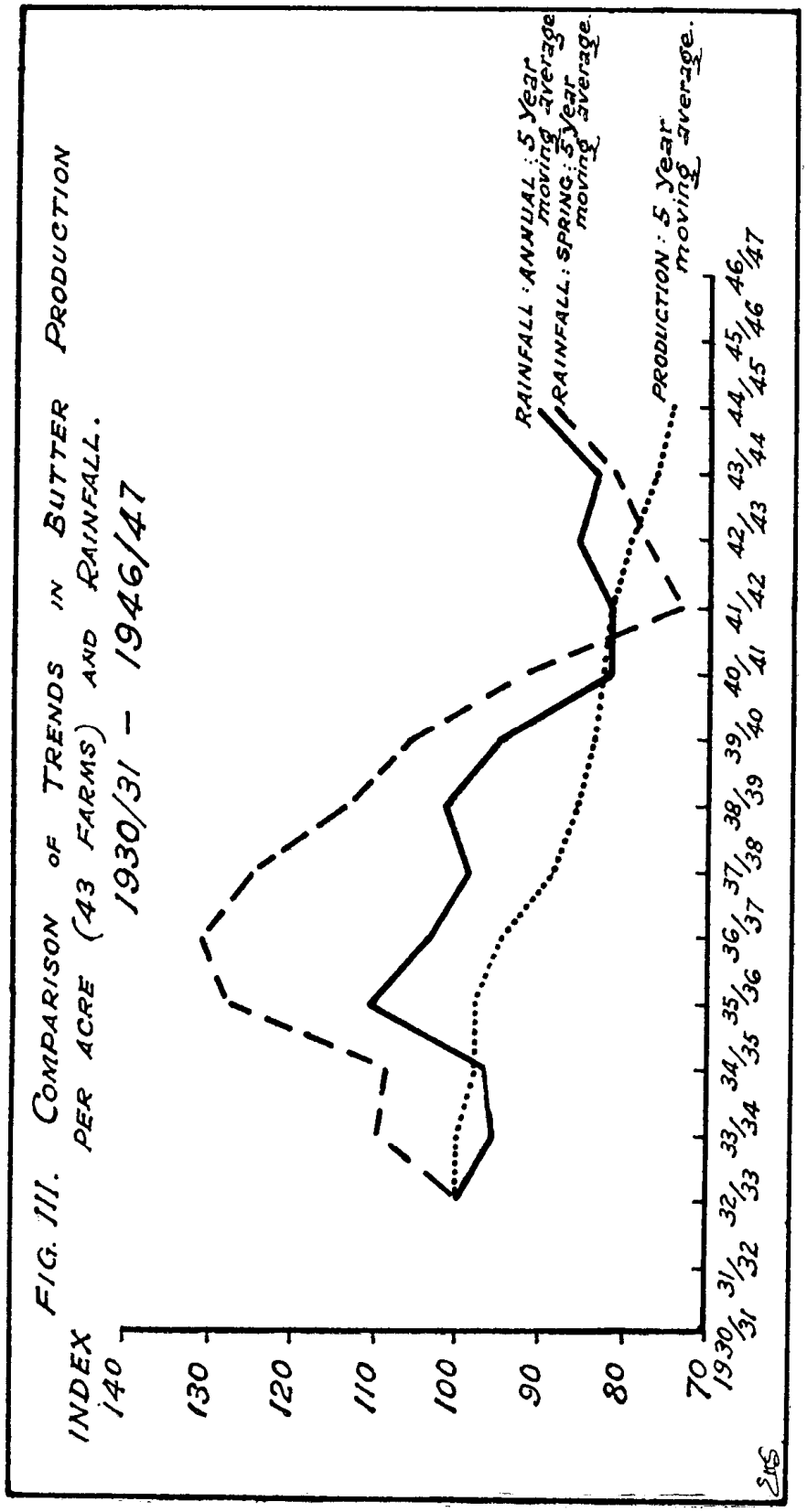
FIG. III. COMPARISON OF TRENDS IN BUTTER PRODUCTION PER ACRE (43 FARMS) AND RAINFALL.
1930/31 - 1946/47
INDEX
140
130
120
110
100
90
80
70
1930/31
31/32
32/33
33/34
34/35
35/36
36/37
37/38
38/39
39/40
40/41
41/42
42/43
43/44
44/45
45/46
46/47
RAINFALL: ANNUAL: 5 Year moving average
RAINFALL: SPRING: 5 Year moving average.
PRODUCTION: 5 Year moving average.

TREND IN PRODUCTIVITY OF THE LAND IN RELATION TO INFLUENCING FACTORS.

A comparison of trends in production per acre with trends in the various factors influencing the level of production has been made over the seventeen years (Fig. II). For the group of forty-three farms, there has been a marked decline in average annual production of butter per acre (Table III). Over the first six years of the period, production per acre averaged 88.8 lb. of butter. Production per acre reached the maximum of 98.9 lb. in 1934-35, the year of maximum total production. Since 1935-36, average annual production per acre has reached 80 lb. only once, in 1937-38, the mean for the eleven years being 70.7 lb. Lowest production per acre for the period occurred in 1946-47, when the average annual production was 55.0 lb. of butter. Fig. II shows the distinct downward trend in production per acre.

TABLE III.

**Production of Butter on Forty-three Farms.*

Year.	Total lb.	lb. Per Acre.	5-Yr. Moving Average. (lb. per acre.)	Index.
1930–31	438,958	88.2	...	...
1931–32	421,272	83.1	...	...
1932–33	398,088	79.1	88.7	100
1933–34	475,894	94.3	88.9	100
1934–35	500,023	98.9	86.7	98
1935–36	464,536	89.2	87.1	98
1936–37	374,114	71.9	83.9	95
1937–38	412,861	81.0	78.5	89
1938–39	414,014	78.4	76.0	86
1939–40	380,451	71.8	74.5	84
1940–41	413,085	76.9	74.0	83
1941–42	345,668	64.5	72.5	82
1942–43	424,706	78.6	71.0	80
1943–44	394,441	70.8	68.6	77
1944–45	354,470	64.4	66.7	75
1945–46	354,447	64.7	...	...
1946–47	302,306	55.0	...	...

* Includes third grade butter.

However, in spite of this decline in production per acre on red soil farms, it is generally considered that production per acre on these farms is still substantially in excess of production per acre on farms of other soil-types in the Richmond-Tweed region.

TREND IN RATE OF STOCKING.

The average number of stock per acre has declined only slightly (Table IV). During the first three years the rate of stocking was slightly higher, but since then it has remained fairly stable at about 0.49 head of stock per acre.

TABLE IV.

Trend in Rate of Stocking on Forty-three Farms.

Year.	Total Stock.	No. of Stock Per acre.	5-Yr. Moving Average. (Stock per acre.)	Index.
1930–31	2,798	0.56	...	...
1931–32	2,892	0.57	...	...
1932–33	2,656	0.53	0.53	100
1933–34	2,489	0.49	0.52	98
1934–35	2.577	0.51	0.51	96
1935–36	2,704	0.52	0.50	94
1936–37	2.631	0.51	0.50	94
1937–38	2,591	0.49	0.50	94
1938–39	2,545	0.48	0.49	93
1939–40	2,580	0.49	0.48	91
1940–41	2,507	0.47	0.47	89
1941–42	2,479	0.46	0.48	91
1942–43	2,537	0.47	0.47	89
1943–44	2,711	0.49	0.48	91
1944–45	2,661	0.48	0.48	91
1945–46	2,760	0.50	...	...
1946–47	2,635	0.48	...	...

TREND IN RAINFALL.

Annual rainfall has fluctuated widely from year to year. Highest rainfall recorded over the seventeen years, 10,382 points, was in 1937-38, and the lowest was in 1941-42 when only 3,360 points were registered (Table VA)

Many farmers, when interviewed, asserted that any decline in production was due to the adverse seasonal conditions which they believed had occurred over recent years. The adverse seasonal conditions were specified as a generally lower level of annual rainfall and unsatisfactory distribution of rainfall, since spring rains, which are regarded as most important, had been less than average in recent years. Comparison of production per acre with actual rainfall for the four-month period, July to October, suggests that these are the critical months as regards rainfall. Total annual rainfall, too, appears closely correlated with production, suggesting that spring rainfall, total annual rainfall and production are closely related. On the other hand, rain received during the summer months of January, February and March has not such an important effect on the level of production (Fig. III). Even in the years of comparatively low summer rainfall in this district the amount received seems to be sufficient to meet the requirement of pasture growth at that stage. Troughs in production occur in years when both spring and total annual rainfall are low. Above-average spring rainfall alone will not ensure above-average production, as the 1939 season indicates. In most years, however, spring rainfall appears to influence largely the level of production unless the total rainfall for the year or the immediate preceding years exerts a strong influence in either direction. Low production in 1944, in spite of high spring rainfall and slightly above-average rainfall for the year, may be due to the

cumulative effect on pastures of the lack of really good rains in the preceding five years. This combined effect of spring and annual rainfall may influence not only the degree of fluctuation in production, but also the general trend in production over the seventeen-year period. Since 1939 both spring and annual rainfall have been at a much lower level in general than previously. For three years annual rainfall was just above average, for the other five years below average. Since 1939, too, spring rainfall has been substantially above average once only, and for two years just above average. Spring rains in 1941, 1943 and 1946 were abnormally low.

TABLE VA.

Rainfall (Annual).

TABLE VB.

Rainfall (Spring, July-October).

Year.	No. of Points.	5-Year Moving Average.	Index.	No. of Points.	5-Year Moving Average.	Index.
		Points.			Points.	
1930–31	7,005	...	...	961	...	...
1931–32	5,243	...	...	942	...	...
1932–33	5,920	6,775	100	1,061	1,336	100
1933–34	9,009	6,482	96	1,716	1,469	110
1934–35	6,698	6,595	97	2,001	1,456	109
1935–36	5,542	7,487	111	1,626	1,707	128
1936–37	5,804	7,011	104	875	1,744	131
1937–38	10,382	6,696	99	2,315	1,667	125
1938–39	6,631	6,935	102	1,905	1,523	114
1939–40	5,120	6,446	95	1,614	1,412	106
1940–41	6,736	5,557	82	904	1,224	92
1941–42	3,360	5,574	82	322	977	73
1942–43	5,939	5,857	86	1,373	1,039	78
1943–44	6,715	5,687	84	674	1,096	82
1944–45	6,533	6,148	91	1,920	1,183	89
1945–46	5,888	...	...	1,189	...	...
1946–47	5,666	...	...	757	...	...

TREND IN LABOUR.

Labour per acre declined gradually over the first eight to nine years of the period under review and then steeply in the years since the beginning of the war. This sharp decline in labour per acre is not merely a reflection of the increase in total acreage, but indicates the substantial deterioration in the labour position which took place during the war and which has not been rectified since. The increased use of milking machines to replace labour has to some extent compensated for the loss of labour. That the increase in mechanisation has not been sufficient to offset the loss of labour may be a contributing factor toward the decline in production.

TABLE VI

Trend in Labour on Forty-three Farms.

Year.	Total No.*	No. Per Acre.	5-Yr. Moving Average. (No. per acre.)	Index.
1930–31	98	0.0196	...	...
1931–32	98	0.0193	...	...
1932–33	98	0.0195	0.0194	100
1933–34	98	0.0194	0.0193	100
1934–35	98	0.0194	0.0192	99
1935–36	98	0.0188	0.0190	98
1936–37	98	0.0188	0.0187	96
1937–38	98	0.0186	0.0185	95
1938–39	95.5	0.0181	0.0181	93
1939–40	95.5	0.0180	0.0174	90
1940–41	92.5	0.0172	0.0167	86
1941–42	81.5	0.0152	0.0160	83
1942–43	81.5	0.0151	0.0152	78
1943–44	79.5	0.0143	0.0147	76
1944–45	79.5	0.0144	0.0146	75
1945–46	79.5	0.0145	...	...
1946–47	79.5	0.0145	...	...

* Casual and female labour has been rated as equivalent to 50 per cent. of one permanent employee.

TREND IN AREA CROPPED FOR FEED.

It is interesting to observe the big decrease which has occurred in the relative amount of land cultivated for the production of fodder crops used to supplement pastures. The area is a summer rainfall one, growth of the *Paspalum* and Kikuyu pastures occurring mainly in the spring and summer. These grasses constitute most of the pasture cover, white clover appearing for a short time in seasons when conditions are particularly suitable. In winter the pastures are almost dormant and supplementary feeding is usually necessary to enable the cattle to hold their condition. As feed purchased is negligible the acreage of crop feed grown should therefore provide an indication of the degree to which supplementary feeding of roughage has been practised. It is probable that this decline in hand feeding, accompanied by only a slight increase in grazing area has to some extent influenced the productivity of the cows.

The reason put forward by farmers for their failure to maintain crop cultivation was either the belief that cultivation of the red soil was ruining the country or that loss of labour had made it impossible to cultivate as much as previously Where once most farms had grown several different types of feed, now each generally had a couple of acres of cow cane and occasionally an acre or so of maize. Moreover, stall feeding of purchased feed is not a general practice in the district so that the tendency to grow less feed has not been offset by a tendency to buy more.

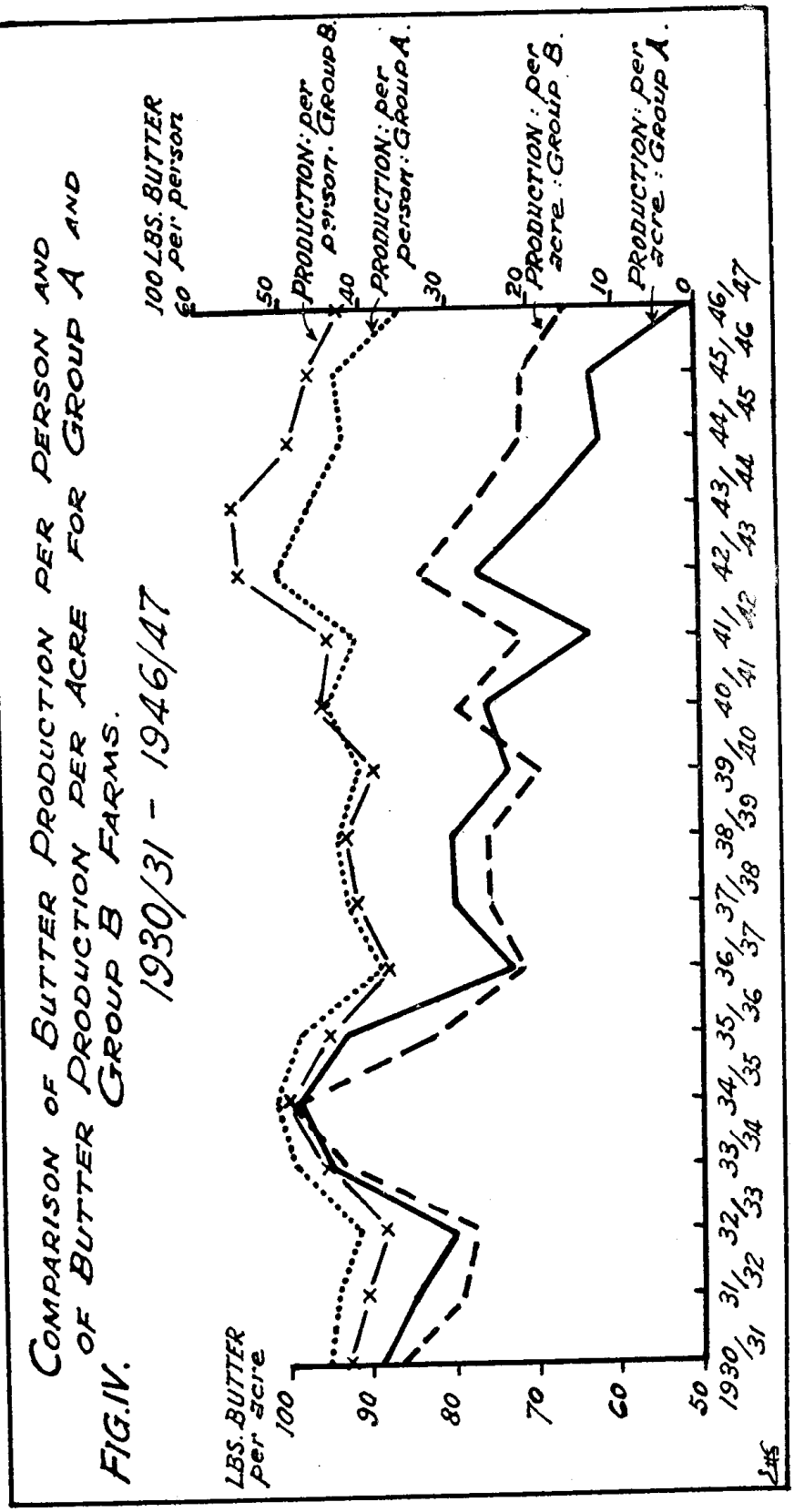
COMPARISON OF BUTTER PRODUCTION PER PERSON AND OF BUTTER PRODUCTION PER ACRE FOR GROUP A AND GROUP B FARMS.
1930/31 - 1946/47
FIG. IV.
LBS. BUTTER per acre
100 LBS. BUTTER per person
PRODUCTION: per person. Group B.
PRODUCTION: per person: Group A.
PRODUCTION: per acre: Group B.
PRODUCTION: per acre: Group A.
100
90
80
70
60
50
60
50
40
30
20
10
0
1930/31
31/32
32/33
33/34
34/35
35/36
36/37
37/38
38/39
39/40
40/41
41/42
42/43
43/44
44/45
45/46
46/47
L45

TABLE VII.

Trend in Crop Cultivation on Forty-three Farms.

Year.	Total Area.	Area Cultivated Per Acre Grazed.	5-Yr. Moving Average.	Index.
	Acres.	Acres.	Acres cultivated.	
1930–31	335	0.0673	...	...
1931–32	312	0.0615	...	...
1932–33	332	0.0660	0.0669	100
1933–34	373	0.0739	0.0654	98
1934–35	333	0.0659	0.0674	100
1935–36	311	0.0597	0.0661	99
1936–37	368	0.0707	0.0622	93
1937–38	318	0.0603	0.0604	90
1938–39	287	0.0543	0.0596	89
1939–40	301	0.0568	0.0552	83
1940–41	301	0.0561	0.0500	75
1941–42	260	0.0485	0.0441	66
1942–43	186	0.0344	0.0381	57
1943–44	137	0.0246	0.0335	50
1944–45	147	0.0267	0.0299	45
1945–46	181	0.0331	...	...
1946–47	168	0.0306	...	...

TREND IN PRICE LEVEL.

During the depression years when the price of butter was at its lowest level production per acre reached the highest levels of the period. As prices began to recover, production tended to fall off. During the war years, from 1941-42 on, the price of butter rose sharply but production continued to decline. It seems probable that, although the rainfall factor has influenced production to some extent, the price level of butter has exerted some influence on the level of production. During periods of low prices of agricultural products there is usually a tendency for production to expand as individual farmers attempt to maintain their incomes by selling more of their products at the depressed price.

However, whether due to conscious expansion of production or to the particularly good seasons which occurred then, peak production did coincide with the depression years of the early thirties. The combination of low price and good seasons, therefore, was responsible for the comparatively high level of production at the beginning of the period reviewed, *i.e.*, the early thirties. It is unlikely that soil fertility would be responsible for such a peak in production. The fact that production of the red soil farms probably rose from a generally lower level to form a peak extending just over this period is substantiated by the graph of butter production for the whole of the North Coast extending back several years before the beginning of the seventeen-year period (see Fig. VIII). (Comparison of production graphs for the sample farms and the North Coast Division show a

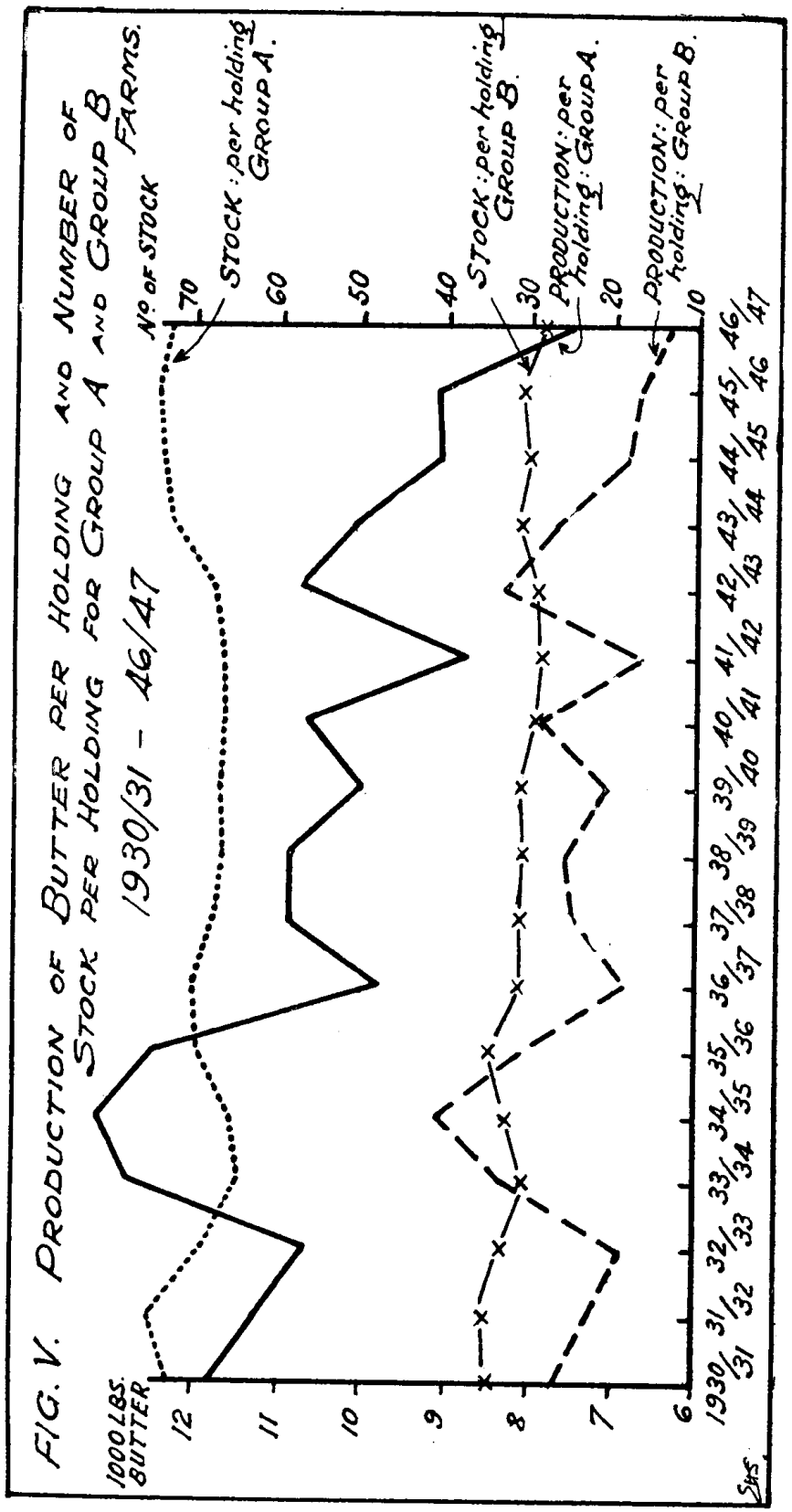
FIG. V. PRODUCTION OF BUTTER PER HOLDING AND NUMBER OF STOCK PER HOLDING FOR GROUP A AND GROUP B FARMS.
1930/31 - 46/47
1000 LBS. BUTTER
No. OF STOCK
STOCK: per Holding GROUP A.
STOCK: per Holding GROUP B.
PRODUCTION: per Holding: GROUP A.
PRODUCTION: per Holding: GROUP B.
12
11
10
9
8
7
6
70
60
50
40
30
20
10
1930/31
31/32
32/33
33/34
34/35
35/36
36/37
37/38
38/39
39/40
40/41
41/42
42/43
43/44
44/45
45/46
46/47

similar trend over the seventeen-year period under review. Thus it may reasonably be assumed that production of the sample farms would show a similar trend to that of the North Coast over the years previous to the period studied.)

HOW PRODUCTION HAS BEEN AFFECTED ON INDIVIDUAL FARMS.

The question now arises: Is this decline in production common to all or, at any rate, to the majority of farms in the sample, or is there a steep decline on a small number of farms which has had a more than proportionate effect on the trend of the total production of the sample farms?

Of the forty-three farms, total production of twenty-two farms showed a definite downward trend over the seventeen years. Four of the farms which showed no marked decline in total production showed a definite decline in production per acre. Total production on each of these four farms was maintained by increasing considerably the acreage in production. For the other seventeen farms production was more or less maintained, any tendency being toward a slight decrease.

Trends in production of these two groups of farms (twenty-six showing declining production and seventeen showing very little change) have been compared on a per acre basis in Figure IV. The former group of farms are referred to as Group A farms, and the latter as Group B farms. Group A farms showed slightly higher production per acre than Group B farms until about 1940, when production per acre dropped below that of Group B. Production per acre for Group A farms continued to fall off and at an increasing rate. Production of Group B farms did show a slight downward trend over the whole period, but after the main drop in production in 1936-37 maintained a fairly stable level. Disregarding the peak of the depression years, the level of production on these farms has been fairly well maintained.

CHARACTERISTICS OF DECLINING AND NON-DECLINING FARMS.

Production per farm for Group A was at a considerably higher level throughout, indicating a tendency for larger farms to fall within this group (see Fig. V and Table VIII). Production per farm in Group A has declined at a similar rate as production per acre. Production per farm in Group B has been at a lower level than for Group A, indicating that smaller farms tend to fall within Group B. However, Group B farms showed no downward trend in production per farm, the increase in acreage evidently being sufficient to compensate for the slight decline in production per acre. Since production per farm in Group A is considerably above the level of production per farm in Group B (and this has been maintained throughout in spite of a narrowing of the margin between the two groups), there is evidently a tendency for the larger farms to be most affected by the factors causing the decline in production.

TABLE VIII.

Trend in Production for Group A and Group B Farms.

Year.	Production Per Acre lb. Butter.		Production/Holding lb. Butter.		Production/Person lb. Butter.	
	Group A.	Group B.	Group A.	Group B.	Group A.	Group B.
1930–31	88.9	86.6	11,837	7,718	4,593	4,232
1931–32	84.8	79.3	11,398	7,348	4,423	4,030
1932–33	80.0	77.0	10,768	6,948	4,179	3,810
1933–34	95.2	92.5	12,846	8,347	4,985	4,578
1934–35	98.7	99.6	13,276	9,109	5,152	4,995
1935–36	92.7	82.0	12,508	8,196	4,854	4,494
1936–37	72.3	70.9	9,869	6,913	3,830	3,791
1937–38	79.9	74.9	10,939	7,556	4,245	4,144
1938–39	80.0	75.1	10,942	7,619	4,377	4,247
1939–40	73.1	69.1	10,013	7,065	4,005	3,938
1940–41	75.9	79.2	10,701	7,933	4,416	4,572
1941–42	63.3	71.3	8,893	6,733	4,129	4,489
1942–43	76.3	83.6	10,855	8,381	5,040	5,587
1943–44	68.2	76.7	10,106	7,747	4,692	5,604
1944–45	61.6	70.7	9,128	6,891	4,238	4,985
1945–46	62.3	70.4	9,193	6,790	4,346	4,711
1946–47	50.7	65.1	7,498	6,316	3,544	4,382

The higher average production per farm for Group A farms is obtained from larger average herds. Group A farms carried an average of 74.5 head of stock per year, Group B farms carried an average of 52 head per year. Distribution of farms according to size of herd indicates that there was a tendency for Group A farms to comprise larger herds than Group B. Practically all Group B farms had herds of 70 or less, whereas only 58 per cent. of Group A farms had herds within this size group.

TABLE IX.

Distribution of Farms by Size of Herd.

Size of Herd.	Group A.	Group B.
Less than 30	1	3
30–49	5	5
50–69	9	8
70–89	5	...
90–109	3	1
110–119	3	...

Comparison of the average size of herd per farm for the two groups throughout the seventeen-year period shows that, although the average area of the farms increased slightly, the number of cattle in the average herd of Group B farms tended to decrease, while for Group A farms there was only a slight overall change (Table X). Moreover, the rate of stocking per acre for Group B farms had declined more than for Group A farms.

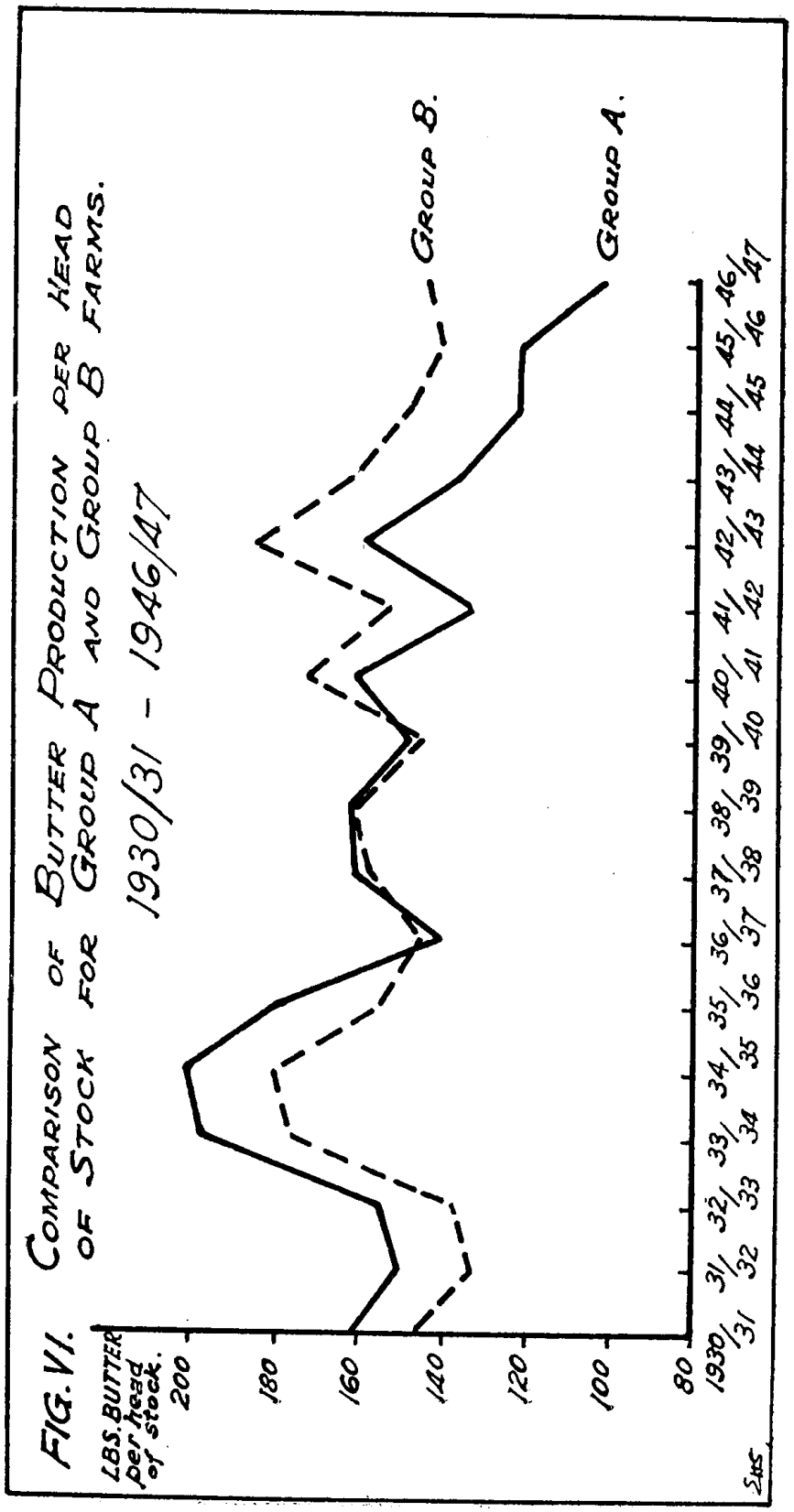
FIG. VI.
COMPARISON OF BUTTER PRODUCTION PER HEAD OF STOCK FOR GROUP A AND GROUP B FARMS.
1930/31 - 1946/47
LBS. BUTTER per head of stock.
200
180
160
140
120
100
80
GROUP B.
GROUP A.
1930/31
31/32
32/33
33/34
34/35
35/36
36/37
37/38
38/39
39/40
40/41
41/42
42/43
43/44
44/45
45/46
46/47
S&S

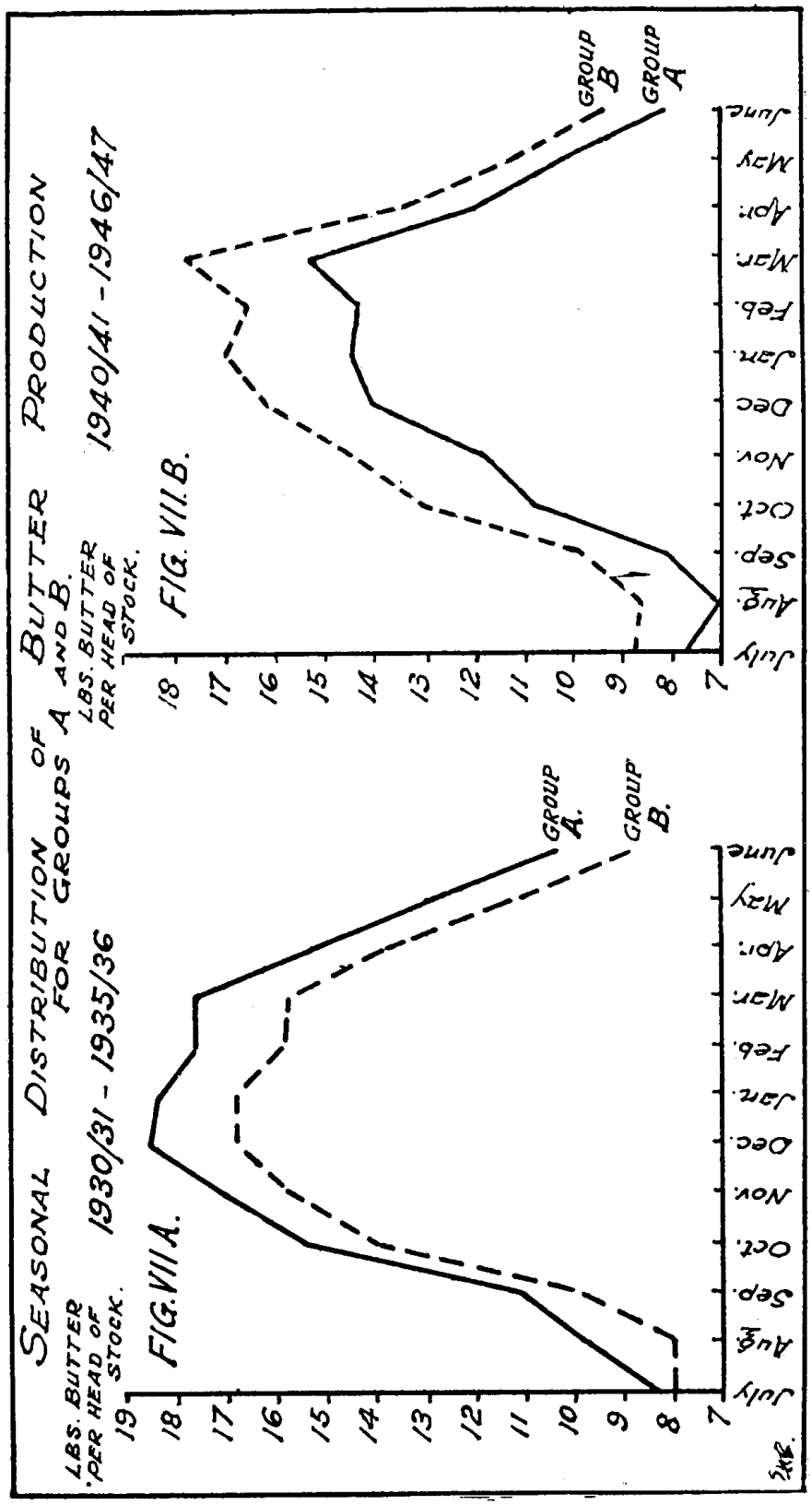
SEASONAL DISTRIBUTION OF BUTTER PRODUCTION
FOR GROUPS A AND B.
LBS. BUTTER PER HEAD OF STOCK.
FIG. VII A.
1930/31 - 1935/36
GROUP A.
GROUP B.
FIG. VII B.
1940/41 - 1946/47
GROUP B
GROUP A
July
Aug.
Sep.
Oct.
Nov.
Dec.
Jan.
Feb.
Mar.
Apr.
May
June

TABLE X.

Trend in Carrying Capacity of Group A and Group B Farms.

Year.	Total Stock.		Stock Per Holding.		Rate of Stocking. (Per Acre.)	
	Group A.	Group B.	Group A.	Group B.	Group A.	Group B.
1930–31	1,901	897	73.1	34.5	0.55	0.59
1931–32	1,964	928	75.5	35.7	0.56	0.59
1932–33	1,804	852	69.4	32.8	0.52	0.56
1933–34	1,685	804	64.8	30.9	0.48	0.52
1934–35	1,720	857	66.2	33.0	0.49	0.55
1935–36	1,807	897	69.5	34.5	0.52	0.52
1936–37	1,821	810	70.0	31.2	0.51	0.49
1937–38	1.775	816	68.3	31.4	0.50	0.48
1938–39	1,745	800	67.1	30.8	0.49	0.46
1939–40	1,753	827	67.4	31.8	0.49	0.48
1940–41	1,731	776	66.6	29.8	0.47	0.46
1941–42	1,732	747	66.6	28.7	0.47	0.44
1942–43	1,772	765	68.2	29.4	0.48	0.45
1943–44	1,906	805	73.3	31.0	0.50	0.47
1944–45	1,925	786	74.0	30.2	0.50	0.47
1945–46	1,946	814	74.8	31.3	0.51	0.50
1946–47	1,897	738	73.0	28.4	0.49	0.45

Group A farms which averaged higher production per farm and larger herds per farm also had larger areas available for grazing (Table XI). 69 per cent. of Group A farms were between 100 and 200 acres in size, whereas only 35 per cent. of Group B farms fell into this size class. The majority of Group B farms were between 50 and 150 acres in size.

TABLE XI.

Distribution of Farms by Area.

Acres.	No. of Farms.	
	Group A.	Group B.
Under 50	1	3
50–99	3	8
100–149	12	4
150–199	6	2
200–249	4	...

Comparison of the average production per person of the two groups of farms is made in Fig. IV. Average production per person for Group A farms was slightly higher than for Group B farms until 1936-37 when it was the same for both groups. After 1936-37 productivity of labour for Group B farms began to show an upward trend, while for Group A farms it remained more or less at the same level. Thus Group B farms have shown more efficient management in the long run than Group A farms by achieving not only higher production per acre but also by achieving increasing productivity per head.

The trend in butter production per head of stock for the two groups has been plotted in Fig. VI. Although not representing the actual values of production per cow, this may be used as an indication of the trend in production per cow since the percentage of milking cows in the herd would remain fairly constant over the years. From this graph, therefore, it may be seen that production per cow has tended to fall off during the latter half of the period compared with the first half. For Group B farms, however, no such decline was evident.

Further comparison of the two groups may give some idea of the reasons for the difference in behaviour of the two groups of farms, why some farms have been able to maintain production while others have allowed production to decline over the years. Reduction in labour has occurred mostly on farms in Group A (Table XII). Nine of the twenty-six farms suffered loss of labour in this group, while only four from Group B have been affected by reduction in labour. One of these farms was considerably reduced in acreage so that any effect from loss of labour was cancelled out. Thirteen of the twenty-six farms of Group A and ten of Group B reduced the amount of area cultivated for feed production (Table XII).

TABLE XII.

Farms on which Labour has Declined.	Farms on which Area Cultivated for Feed had Declined.
Farm No.	Farm No.
2	* 3
* 3	* 4
* 9	5
†19	6
20	* 7
*25	* 8
30	10
*32	13
*33	*14
*35	19
*36	20
*37	22
*39	*24
...	*29
...	30
...	31
...	*32
...	*36
...	*37
...	*39
...	41
...	*43

Key—

* *Farms of Group A.*

† Acreage of this Group B farm was reduced.

The smaller farms with less heavily stocked land have been able to maintain total production throughout the seventeen-year period. Although production per acre on these farms has shown a slight decline, since 1940-41 the level of production per acre has been well above the level of Group A farms.

TABLE XIII.

Production Per Head of Stock (lb. Butter).

	Average 17 years.		Average 1930–1 to 1935–36.		Average 1933–34 to 1939–40.		Average 1940–41 to 1946–47.	
	Group A.	Group B.	Group A.	Group B.	Group A.	Group B.	Group A.	Group B.
July	8·5	8·3	8·3	8·0	8·8	7·9	8·7	7·6
August	8·2	8·3	9·8	8·0	8·6	8·0	8·6	7·1
September ...	9·5	10·0	11·2	10·0	10·4	10·2	9·9	8·1
October	12·8	13·6	15·4	14·0	14·6	14·5	13·1	10·7
November ...	14·3	15·3·	17·1	15·7	16·8	16·8	14·4	11·8
December ...	15·9	16·4	18·5	16·8	17·9	17·3	16·2	14·0
January	16·2	16·7	18·4	16·8	19·1	18·4	17·0	14·4
February ...	15·8	16·2	17·6	15·9	15·4	16·8	16·6	14·3
March	16·5	16·8	17·6	15·8	18·2	17·3	17·7	15·3
April	13·8	13·8	15·3	13·7	15·5	14·7	13·4	12.0
May	11·5	11·1	12·8	11·2	12·3	11·3	11·1	10.1
June	9·2	9·0	10·3	8·7	9·7	8·7	9·3	8.1

Figs. VIIA and VIIB and Table XIII compare the relative changes in seasonal production of the two groups throughout the period. The figures for monthly production per head of stock cannot be taken as a measure of actual monthly production per cow as the figure used for stock is the average annual figure. Since the number of cows milked during the winter is considerably less than during spring and summer, the difference between the actual yield per cow in summer and winter months would be considerably less.

Assuming that the percentage of cows milked to total stock is the same for each group at any time, production per head may be used to compare relative levels of production per cow each month for the two groups. It may also be used as a measure of the volume and distribution of total production throughout the season. There is little difference between the two groups of farms regarding the general pattern of seasonal variation in production when production is averaged for the seventeen years (Table XIII). For both groups production is concentrated in the summer months of December, January, February and March. Production is at its lowest in the winter months of June, July, August and September.

The pattern of seasonal production coinciding with the changing level of productivity of the two groups is illustrated by Figs. VIIA and VIIB. Fig. VIIA illustrates the average monthly production of butter per head of stock during the first six years of the period, 1930-31 to 1935-36. During this period the level of production per acre was higher for Group A than for Group B. This difference between the two groups was mainly due to the difference in production per cow during the months of peak production.

Fig. VIIB, which shows the seasonal distribution averaged for the last seven years of the period, *i.e.*, 1940-41 to 1946-47, illustrates how the level of productivity of Group A cows has fallen for each month throughout the year. As more cows are milked during the spring and summer months than during the rest of the year most of the difference in annual production of the two groups is due to the difference in production per cow during those months. The level of production

throughout the season for Group B farms by the end of the 17 years had risen to practically the same level as that of Group A farms during the first few years of the period reviewed.

By the end of the period, production of Group A farms, during the winter months, had fallen to a much lower level than the production of Group B farms during the beginning of the period. Assuming that there has been no change in the percentage of cows in milk throughout the years the lower production per cow seems to indicate a lower level of nutrition. This suggests that cows of Group B obtain more adequate feed during winter months than Group A cows. It is possible that, as a result, Group B cows can more readily take advantage of the spring and summer pasture growth and thus achieve a much higher level of production during those months.

Points arising from studying the 43 farms individually may be summarised as follows:—

(*a*) Production has not fallen off on all farms. On 17 farms (Group B) the level of total production has been maintained throughout the period under review, while on the remaining 26 farms there has been a marked decline (Group A).

(*b*) On a per acre basis, Group B farms have shown a slight decline.

(*c*) Production per acre on Group A farms, although initially higher than Group B farms, declined at a more rapid rate so that by 1940-41 Group B farms were producing more per acre than Group A farms. Since 1940-41 the margin between the production levels of the two groups has continued to widen, Group B farms more or less maintaining the level of productivity achieved over the previous few years.

A similar relationship was found between production per person for the two groups. However, for these values production per person did not show a decline but was maintained on Group A farms and was increased slightly on Group B farms.

(*d*) Total production per farm of Group A was considerably higher than per farm of Group B. At the same time, while total production on the average Group B farms was maintained over the years, there was a definite decline in the total production of the average Group A farm.

(*e*) Group A farms tended to be larger units than Group B farms. There was a tendency for larger acreage, larger herds, and consequently higher total production per farm. While the first two factors remained more or less fixed over the years' average total production per farm of Group A tended to approach that of the average Group B farm.

(*f*) Group A farms appear to have lost more labour than Group B farms. Since Group A farms tended to be larger units than those of Group B, Group A farms were more affected by loss of labour.

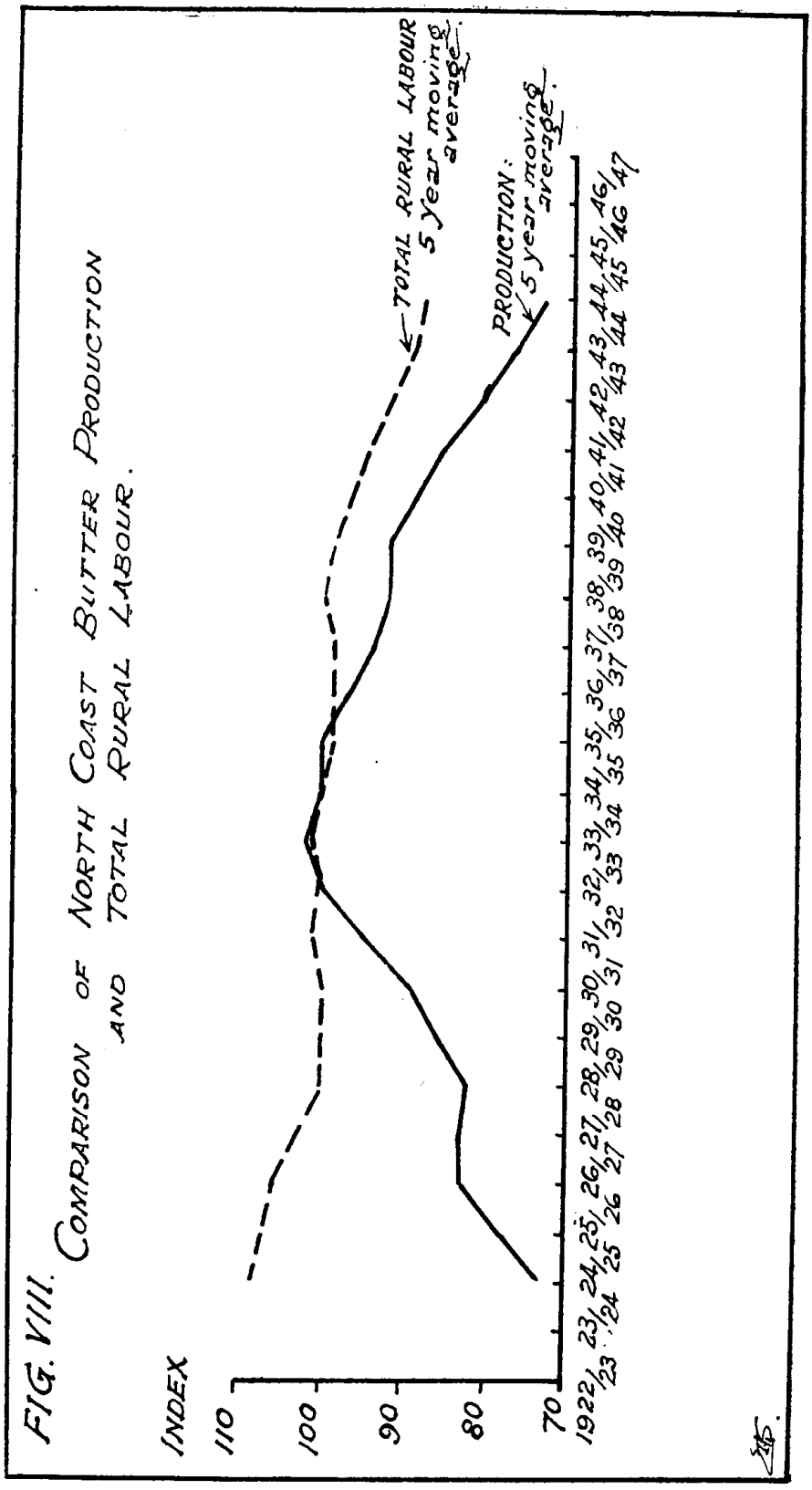
FIG. VIII.
COMPARISON OF NORTH COAST BUTTER PRODUCTION AND TOTAL RURAL LABOUR.
INDEX
110
100
90
80
70
TOTAL RURAL LABOUR 5 year moving average.
PRODUCTION: 5 year moving average.
1922/23 23/24 24/25 25/26 26/27 27/28 28/29 29/30 30/31 31/32 32/33 33/34 34/35 35/36 36/37 37/38 38/39 39/40 40/41 41/42 42/43 43/44 44/45 45/46 46/47

(*g*) Reduction in labour supply has in some cases caused reduction of size of herd but herd size has declined more on the whole for Group B than Group A farms. It may have been responsible also for the reduction in acreage cultivated for feed. Decline in the latter, however, was considerable for both groups.

(*h*) As the result of the interaction of these various factors, the level of productivity of the cows has been affected. Production per cow on Group A farms, previously higher than Group B farms had fallen below that of Group B farms during the last seven years of the period reviewed. The difference in level of production per annum between the two groups was largely the effect of a different level of production per cow during the months of peak production, *i.e.*, during spring and summer.

Some evidence is available that nutrition of cows during winter months, as evidenced by the level of production of cows milked then, affects the subsequent level of production during the most important months of production.

TABLE XIV.

Butter Production and Labour Trends for the North Coast Division.

Year.	Million lb.	5-Year Moving Average.	Index.	Total* Labour.	5-Year Moving Average.	Index.
		million lb.		No. of persons.	No. of persons.	
1930–31	62.9	...	...	24,049	...	...
1931–32	63.6	...	...	24,691	...	...
1932–33	65.2	69.0	100	25,597	25,156	100
1933–34	76.6	70.2	102	26,141	25,329	101
1934–35	76.8	68.9	100	25,303	25,229	100
1935–36	68.7	69.3	100	24,912	24,992	99
1936–37	57.2	67.1	97	24,194	24,826	99
1937–38	67.4	65.2	94	24,411	24,983	99
1938–39	65.3	63.8	92	25,309	25,154	100
1939–40	67.3	63.2	92	26,091	24,932	99
1940–41	61.6	61.7	89	25,767	24,500	97
1941–42	54.3	59.4	86	23,082	23,871	95
1942–43	60.1	55.6	81	22,251	23,189	92
1943–44	53.9	53.2	77	22,163	22,452	89
1944–45	48.3	50.3	73	22,681	22,189	88
1945–46	49.6	...	...	22,082	...	...
1946–47	39.6	...	...	21,766	...	...

* Includes all labour engaged in rural production.

TREND IN BUTTER PRODUCTION IN THE NORTH COAST DIVISION.

Trend in production of butter for the North Coast Division is illustrated in Figure VIII and Table XIII. This shows that total production over the seventeen years period has declined on the whole of the North Coast at approximately the same rate as production on the red soil area. At the same time there has been a drop in the number of persons permanently employed in rural occupations in that Division.

It follows then, that the decline in total production is not a feature of the red soil country only, but is common to the dairying industry of the North Coast as a whole.

Discussion.

What, then, has been the cause of this overall decline in production in the red soil country and incidentally on the entire North Coast? There are several factors which singly or collectively could be held responsible.

First for consideration are the two main factors advanced by farmers when interviewed. Some held that declining fertility of the red soils was solely responsible for decreased productivity. However, as has been shown, a similar decline in production has taken place for the whole of the dairying district of the North Coast which embraces a number of different soil types. Thus, if declining fertility of the soil is held to be the cause, any decline which may have taken place has been common to all soils of the North Coast and has not been solely a feature of the red basaltic soils. It is suggested, however, that soil decline has had very little, if any, effect on the trend on production. The fact that production per acre has not declined on all farms suggests that the *main* cause, at least, is not a factor operating equally for all farms. If there has been a decline in red soil fertility it has occurred to no greater degree than in other soils of the North Coast. The personal element in farm management is difficult to assess and could possibly be responsible for the ability of some farmers to maintain production in spite of declining soil fertility, where others failed. However, any difference in farm management practices between the two groups would more likely be due to the influence of existing economic conditions on farm management policy.

The slight drop in production per acre which was noted for Group B farms as a whole, could possibly be a reflection of soil fertility decline but is more probably a rainfall effect. The total annual rainfall does appear to have been at a lower level in general during the latter half of the period under review. To what degree rainfall has influenced production is difficult to determine at this stage but it does seem likely that there has been some effect on the level of production.

It seems probable that the effect of economic factors such as availability of labour, price received for butter, have been of far greater significance than natural factors. The slight decline in the labour force which occurred up to 1939 was probably compensated to some extent by the increasing use of milking machines. After 1939 the labour supply fell off rapidly and it is unlikely that the further increase in the use of milking machines which occurred during the war years could compensate for such a large reduction in labour. Although the increased use of milking machines could compensate for the labour required for milking, there was no way of compensating for labour used in the care of the herds and pastures and in the production of feed crops. Group B farms maintained production per cow in spite of some labour loss and the effect of drought on the pastures by reducing the number of stock run per acre. Group A farms, on the whole, have maintained the same herd size since 1932-33. The effect of less adequate

feed for the cows resulting from drought-affected pastures, less supplementary feeding and other labour effects has been a decline in production per cow rather than a reduction in the number of cows milked.

It is suggested that Group A farms, which tend to be larger units, were more sensitive to difficulties in the labour supply than were Group B farms. Larger farms depend to some extent on paid employees or on considerable unpaid family labour. Since there had been a definite decline in both these types of labour in the red soil district as well as in the whole North Coast dairying district (Fig. VIII), it is to be expected that the larger farms would be affected to a greater degree than the smaller units which are usually worked by the farm operator and one or two members of the family.

No doubt, other factors operate at the same time. It is probable that the effect of price of labour, which has increased substantially in recent years, has operated at the same time to maintain a reduced labour force by causing adjustment of the factors of production, to suit changing conditions. Many farmers stated that it would not pay them to employ as much labour as previously even if it were available. Closely allied to this effect is the fact that the price of butter received by the farmer has increased substantially over the past few years. It is a feature of primary industries that when prices of rural products fall, production tends to expand. On recovery of prices production tends to be adjusted to a "normal" level. The beginning of the seventeen year period coincided with depression years of high production and low prices. The latter part of the period coincided with a steeply rising price and at the same time, decreasing production.

Shortage and high price of labour, high price received for butter, and high taxation may well have combined to cause the farmers, particularly those on larger farms, to change their production policy. Under such economic conditions the producer may find he can make just as high a profit with less effort and lower production as when he was receiving a lower price for a large turnover.

Smaller farm units which were probably only just making a living during years of depressed prices could not afford to follow such a policy but would endeavour to maintain production when prices were high in order to obtain a reasonably high profit from their farms.

SUMMARY OF CONCLUSIONS.

1. On the basis of a sample of 43 farms, it may be concluded that total production of butter on the red soil area has declined significantly between the years 1930-31 and 1946-47. A similar decline has taken place on the whole of the North Coast so that this decline in productivity of the soil is not a feature of red soil country only.

2. Although the total number of stock run has not been reduced and at the same time the total acreage has increased slightly, production *per acre* has declined substantially over the period. There has been a tendency for this decline to be more marked on larger farms. The farms which showed only a slight decline in production per acre

tended to be smaller units and were able to maintain production per farm although slightly increasing the area under production. However, production per acre on red soil farms is still considerably greater than on farms of other soil types on the North Coast.

3. Since the farms which maintained their production were scattered amongst those on which a marked decline in production had occurred it seems unlikely that the decline in productivity could be due to a general decline in red soil fertility. Moreover, the same trend in production was observed for the whole of the North Coast, which indicates that the cause of the decline is not confined to the red basaltic soils alone.

4. All farms show the "bump" in production which occurred during the early part of the period under review. This is believed to be the result of the combined effect of good seasons and the low prices of the depression years. The gradual decline for the whole sample, which continued to take place after this "bump" in production, is largely explained by the comparison of the two groups of farms, those on which production showed no further downward trend and those on which there was a marked decline. It is suggested that this decline has resulted from the interaction of several factors, labour supply, price of labour, and price received for butter. Deterioration in the supply of labour available, an increase in the cost of labour, and an increased price received for butter have, under present conditions of high taxation, doubtless had some depressing effect on production. The fact that some farms showed a marked decline in production per acre while others did not may be attributed partly to the size-of-farm factor. The farms on which production declined substantially tended to be larger units. The larger farms would be more severely affected by inadequacy of labour and, moreover, could more readily afford to let total production slide when price of butter was high especially with the factors of high cost of labour and high taxation operating at the same time. The fact that it has been possible for some farms to maintain production throughout points to farm management, as affected by changing economic conditions, as the key factor in production decline rather than a general decline in soil fertility.

REFERENCES AND ACKNOWLEDGEMENT.

1. Parbery, N. H.

"The Problems of Declining Fertility in Red Laterite Soils," *The Agricultural Gazette of New South Wales,* Vol. 57, pp. 291-297.

2. Prescott, J. A.

"Report on a Visit to Richmond River and Dorrigo Red Soil District of New South Wales," *C.S.I.R.O. Divisional Report* No. 9/46.

It is desired to acknowledge the assistance given by Mr. K. D. Nicolls, Research Officer, Division of Soils, C.S.I.R.O., in providing information regarding the soils of the district and for helpful criticism in the preparation of the report. However, the author is solely responsible for the views expressed.

Sydney: Alfred Henry Pettifer, Government Printer—1950.