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SPATIAL-TEMPORAL VARIATION IN CROP PRODUCTION IN THE REPUBLIC OF IRELAND¹

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ABSTRACT

The agriculture of any area is a very complex phenomenon. In this paper attention is focussed on spatio-temporal variations in the production of five crops in Ireland—wheat, oats, barley, sugar beet and potatoes. The main trends observed over the period 1950–71 result from governmental decisions and advances in agricultural technology. Spatial variations in the intensity of the temporal trends have been due to physical and social factors. Important social and demographic factors have been the decline of the agricultural labour force, the gradual transformation of Irish rural society and, possibly, different evaluations of particular crops by farmers in different regions of the country. Since 1950 there has been some evidence of a trend towards greater concentration of production into primary producing areas, rather than towards diversification.

INTRODUCTION

Although Ireland is a small island, the geography of its agriculture is very complex. This situation arises from the great variety of physical conditions found within the island and also from the long history of human occupation. It is accentuated by the impact of continued urban development and by government intervention in agriculture, and more recently by E.E.C. intervention. There have been many changes in Irish agriculture, in terms of volume of output, crops grown and modes of production, since 1950. However, these changes have not occurred at a uniform rate over the island.

This paper attempts to account for spatial variations in some long term trends in crop production in the Republic of Ireland over the period 1950–71. Spatio-temporal variations in the production of five crops—wheat, oats, feeding barley, sugar beet and potatoes—are outlined. These trends are related to trends in other aspects of agriculture, such as, the pig and cattle populations, the number of males engaged in agriculture and the degree of agricultural mechanisation. External factors, such as the

¹ This paper is a revised version of part of a B.A. dissertation, "Changes in the Irish Agricultural Landscape, 1950–1971," submitted to Department of Geography, University College, Dublin, Autumn, 1974.

influence of government policies and the gradual transformation of Irish rural society, are also considered. Finally, shifts in the location of agricultural production are examined.

Since the agriculture of Ireland is "based largely on livestock production as a consequence of topographic, climatic, edaphic, historical and economic factors" (1), crop production accounts for a relatively small proportion of total agricultural output. In 1971, the value of output of cultivated crops constituted 22.06% of the total net agricultural output. The area under cereal and root crops amounted to 11.08% of the total crop and pastureland available.

Data

The data used in this paper are derived from the annual census of agriculture carried out by the Central Statistics Office, Dublin, on June 1. The figures for 1960, 1965, and 1970 are from a complete enumeration of the twenty six counties. For all other years, except 1956 and 1957, the figures are derived from sample returns covering approximately 60% of the country. The 1956 and 1957 statistics are estimates based on returns covering 25% of the country. The maps, figures and tables contained in this paper are based on the above listed data, unless otherwise stated.

The working unit used is the county because annual agricultural statistics are not available for smaller administrative units, except for the years when a complete enumeration was taken. This is unfortunate because data at county level have serious limitations, arising from the great variety of physical conditions found within some counties. These limitations have to be borne in mind when considering the results of this study.

Choice of study period

Nineteen fifty was taken as the starting point for two reasons. Firstly, the changes that have occurred since 1950 are, in the last analysis, the result of voluntary decisions taken by Irish farmers. Prior to 1950, a Compulsory Tillage Act, which came into force during the Second World War and lasted until 1948, meant that the acreages of certain crops grown were not entirely the result of voluntary decisions by farmers. Secondly, the 1950's are a watershed in Irish economic history. Since then Ireland has experienced fairly rapid economic expansion.

The choice of 1971 as the terminal point was partly determined by the unavailability of agricultural statistics on a county basis for a later date, when this study was commenced. However, this terminal date is important for Irish agriculture for another reason. Since then some of the decisions affecting the agricultural system originate from Brussels, as a result of Ireland's entry into the E.E.C.

Also, this study was originally part of a larger study of spatio-temporal variations in Irish agriculture (2). The objectives and the methodology suggested for spatio-temporal analysis in that study determined to a large extent the choice of working unit and the length of time interval to be studied.

TRENDS IN CEREAL PRODUCTION

The proportion of the total crop and pasture acreage under cereals declined from 9.57% in 1950 to 8.09% in 1971. Despite the decline, the contribution of the three main cereal crops—wheat, oats and barley to the estimated value of total agricultural output increased from 7.67% in 1950 to 8.56% in 1971. This increase reflects the very substantial increases in yield per acre of these crops. However, the fact that these figures have remained reasonably steady should not be allowed to obscure the very large changes that have occurred.

The total area under cereals declined by 145,000 acres (13%) between 1950–71. However, this trend was not universal (Fig. 1). A clear contrast is evident between the counties along the east and south coasts, where the cereal acreage has been increasing,

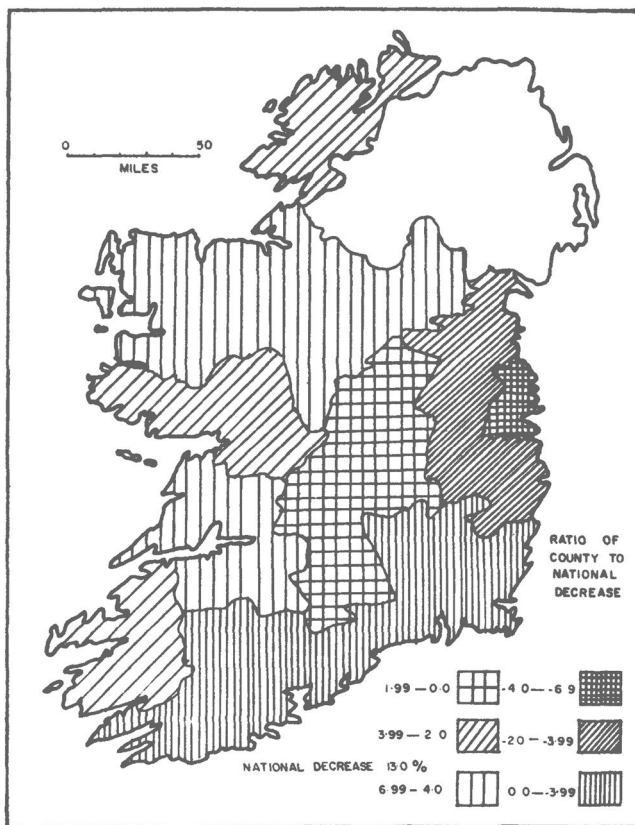


Fig. 1: Change in percentage of each county under cereal crops, 1950-1971

and those along the Western Seaboard and in the North Midlands area, where cereal production has been gradually declining. This contrast is largely due to topographic, climatic and edaphic factors. Increase in percentage of total area under cereals ranged from 0.33% in Wexford to 6.93% in Dublin, while the decline ranged from 0.04% in Westmeath to 8.4% in Monaghan. To explain these spatial variations in the modification of the total cereal acreage, it is necessary to look at trends in the actual cereal crops grown.

The total cereal acreage in 1950 was composed of 33% wheat, 53.4% oats and 11.11% barley. However, by 1971 the figures were 23.3% wheat, 15.25% oats and 60.23% barley, indicating the major expansion of barley production and the contraction of the oats acreage. There have been large deviations from the national mean in these trends (Fig. 2). In 1950, in most counties the total cereal acreage was composed of over 40% oats and generally less than 10% barley. However, in some eastern counties, the proportion of oats had been reduced to between 20–40% and the proportion of barley increased to between 10 and 30%. In 1971, two distinct groupings of counties had emerged—only the counties of Connaught and Ulster plus Clare and Longford still had over 50% of their cereal acreage under oats, but the proportions of barley had increased to between 20 and 50%. Another group of counties had emerged with, generally, less than 25% of their cereal acreage in oats and over 60% in barley. It will be noticed that the areas where oats is still dominant are the areas where cereal production is declining most rapidly. Trends in the three cereals are inter-related but they will be treated separately in the following sections.

Feeding barley

The upward trend in the feeding barley acreage began in 1950 when 123,000 acres were sown (Fig. 3). A sharp increase occurred in 1951 and 1952, by which time 225,000 acres were sown. This was followed by an almost equally sharp decline in acreage between 1952 and 1954, which was complemented by an increase in wheat acreage. However, since 1954 the upward trend in the barley acreage was unbroken until 1965, when a temporary recession occurred that lasted until 1968. Since 1968, the barley acreage has continued to rise at a rapid rate, reaching 581,000 acres in 1971.

The main reason for growing increasing amounts of feeding barley has been a structural shift in Irish agriculture towards increased and more intensive livestock production. Associated with this shift was an increased demand for concentrated feedingstuffs that require a large amount of feeding barley. However, it is possible that the acreage of feeding barley would have increased independently of these policy changes. On the production side, the crop can be grown almost everywhere that oats is grown. However, barley is a higher yielding crop and requires a shorter growth season. This last characteristic is a very important one, given the vagaries of the Irish climate. The average yield per acre of barley has increased considerably from 19.3 cwt/acre (396.7 kg/ha) in 1950 to 32.64 cwt/acre (671.0 kg/ha) in 1968. The crop can also give a good return even in poor climatic conditions. Undoubtedly, this last factor

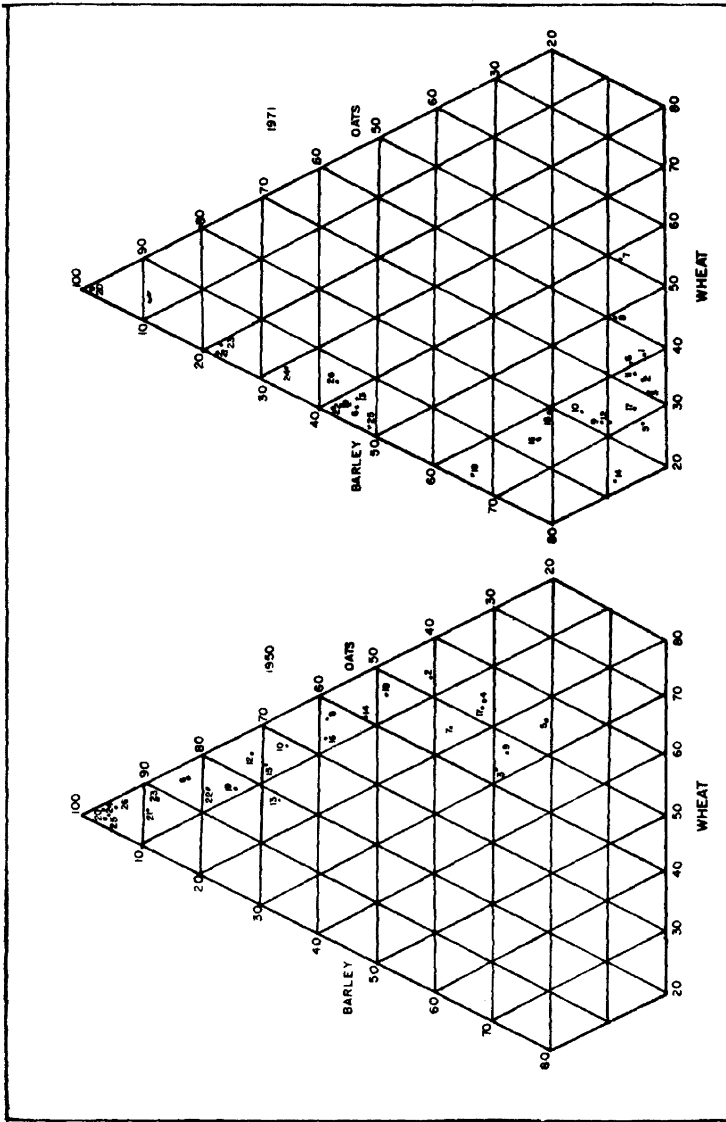


Fig. 2: Percentage of wheat, oats and barley in total cereal acreage of each county, in 1950 and 1971

- Key: 1. Carlow; 2. Dublin; 3. Kildare; 4. Kilkenny; 5. Laois; 6. Longford; 7. Louth; 8. Meath; 9. Offaly; 10. Westmeath; 11. Wexford; 12. Wicklow; 13. Clare; 14. Cork; 15. Kerry; 16. Limerick; 17. Tipperary; 18. Waterford; 19. Galway; 20. Leitrim; 21. Mayo; 22. Roscommon; 23. Sligo; 24. Cavan; 25. Donegal; 26. Monaghan.

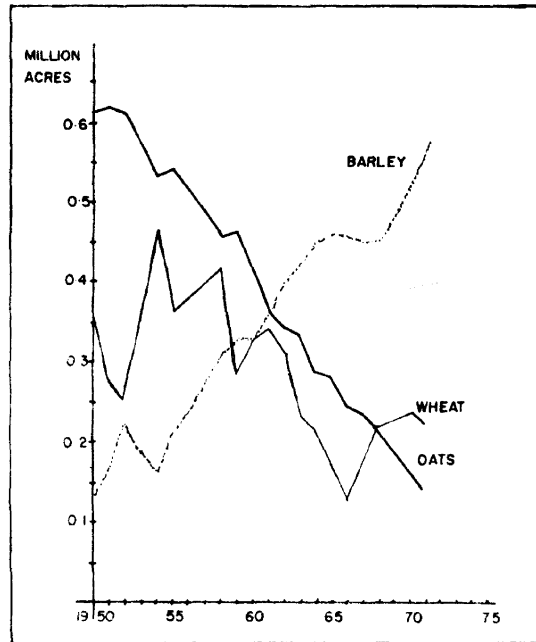


Fig. 3: Total acreage of main cereal crops, 1950-1971

has attracted the attention of many former wheat growers, who had been dealing with a crop that was much more sensitive to climatic conditions.

On the demand side, it may be well to note some of the factors that have contributed to the expansion in the use of compound feeding-stuffs in Ireland from 127,500 tons in 1950 to 1,083,600 tons in 1971 (3). These may be summarised as follows: 1) a growing realisation among farmers of the value of balanced rations for livestock feeding, 2) the decline in farm labour; considerably less labour is required if balanced rations are used, and 3) the impracticality for the average farmer of mixing highly specialised rations to the exact standards demanded for poultry flocks and pig herds fed intensively.

The Provender Milling Industry Report, 1964, showed that "variations in prices have had little significance in influencing the trend towards greater production of feeding barley" (4). The price per ton paid to growers fell from £24 in 1954 to £20 in 1955, 1956 and 1957, but over the same period the acreage increased from 163,000 in 1954 to 306,000 acres in 1957. The further drop in price from £20 to £18.50 per ton in 1958 and 1959 coincided with an increase in area grown to 333,000 acres in 1959. The modest increase to £19 per ton in 1961 and 1962 was accompanied by a consid-

erable increase to 406,000 acres in 1962. The Report concluded that growers tend to look on the crop as a secure source of cash income, a crop which does not appear to be significantly influenced by weather conditions, since in even poor climatic conditions, it gives a fruitful return. Thus, here we have a case of an expanding crop acreage being due to both physical (high yielding ability and shorter growth season), and social factors (increasing amount of information being made available to farmers, declining agricultural labour force, and farmers' perceptions of the crop), while being relatively independent of the price factor.

The increased barley acreage has had effects not only on the acreage of other cereals, but also on the growth of the pig population, since pigs are the largest consumers of compound feedingstuffs. In 1971, pig rations represented 60% of the total compound production. However, the relative percentage was much higher in the past, being about 78% in 1961. Since 1950, the pig population has increased by 137%. In the fifties when the growing of increased amounts of feeding barley was being advocated, the policy objective was that barley growers would become pig producers. This did not happen, but a considerable trade developed, with feedingstuffs compounders mainly acting as middle men between the larger farmer (the grain grower),

TABLE 1: Distribution of pig population and feeding barley acreage by area, 1971

County	Pig population		Feeding barley	
	No. ('000)	% of total	Acres ('000)	% of total
Carlow	21.0	1.59	13.6	3.02
Dublin	17.0	1.28	16.7	3.70
Kildare	21.4	1.62	19.2	4.26
Kilkenny	53.6	4.05	29.3	6.50
Laois	45.6	3.45	11.5	2.55
Longford	17.5	1.32	1.2	0.27
Louth	15.6	1.18	9.0	1.99
Meath	23.1	1.74	27.7	6.15
Offaly	28.1	2.12	10.1	2.24
Westmeath	19.3	1.46	10.5	2.33
Wexford	79.9	6.04	35.1	7.79
Wicklow	26.3	1.99	26.4	5.86
Clare	18.1	1.37	1.3	0.29
Cork	279.4	21.13	126.8	28.13
Kerry	74.7	5.65	9.1	2.02
Limerick	54.2	4.10	2.8	0.62
Tipperary	119.6	9.04	30.2	6.70
Waterford	40.2	3.04	24.1	5.35
Galway	29.2	4.21	14.2	3.15
Leitrim	4.9	1.41	0.0	0.0
Mayo	18.1	3.08	3.4	0.75
Roscommon	13.4	1.33	2.9	0.64
Sligo	8.2	1.65	0.7	0.16
Cavan	29.6	6.89	1.2	0.27
Donegal	12.9	3.74	20.4	4.53
Monaghan	71.3	5.48	3.4	0.75

and the small farmer (the pig producer). Also, considerable internal trade in Ireland developed, with some areas, especially Dublin, Kildare, Meath, Wicklow, Kilkenny and Cork producing a surplus of compound feedingstuffs in relation to their pig population, while other areas, particularly Cavan, Monaghan, Kerry, Limerick and the province of Connaught were deficient in this respect (Table 1). When the percentage increases in acreage of barley and in pig population were correlated for 25 counties, excluding Dublin, a correlation coefficient of 0.824 ($r^2=0.679$) was obtained, significant at the 99% level, indicating the strong association between these two aspects of Irish agriculture.

Oats

The decline in acreage of oats from 614,000 acres in 1950 to 148,000 in 1971 has been a consistent one, except for minor increases in 1955 and 1959 (Fig. 3). In fact it has been almost a straight line which indicates a situation in which no effective forces are operating.

One factor which must be partially responsible for the decline was the relatively minor improvement in average yield from 17.2 cwt/acre (353.6 kg/ha) in 1950 to 25.7 cwt/acre (528.3 kg/ha) in 1968, thus reducing its competitive ability against barley. Other important factors are the decline of almost 70% in the national population of horses and ponies used for agricultural purposes, and also the change from oats to barley as the main cereal feed for all livestock.

The relationship between oats acreage and equine population is well known and is a feature of many European countries. However, there has been considerable spatial variation within Ireland in the strength of this relationship. In fact an attempt to correlate the rate of decline in the proportion of oats in the total cereal acreage with the decline in the equine population for the Republic of Ireland yields a correlation coefficient of only 0.07, not significant at the 95% level. However, when groupings of counties are chosen, significant correlations can be achieved. For instance, taking a group of twelve counties, Dublin, Kildare, Kilkenny, Laois, Louth, Meath, Offaly, Westmeath, Wexford, Wicklow, Cork and Tipperary, and applying the same test as above, there is a correlation coefficient of $r_1=0.703$ ($r_1^2=0.4945$), significant at the 95% level. Taking Longford, Mayo, Roscommon, Cavan, Donegal and Monaghan and applying the same test, yields a correlation coefficient $r_2=0.8965$ ($r_2^2=0.8037$), significant at 95% level. Similarly, the group comprising Clare, Galway, Kerry, Limerick and Waterford, gives a correlation coefficient of $r_3=0.9954$ ($r_3^2=0.9908$), significant at 99% level.* Comparing these coefficients we note that r_1 is not significantly different from r_2 and r_2 is not significantly different from r_3 , at the 95% level. However, there is a significant difference between r_1 and r_3 at the 99% level (5). The weakness of the relationship for the counties in the first group may be explained by

*Clearly, the last two correlation coefficients must be accepted with caution since only six and five observations respectively have been used in their calculation.

the fact that these counties had a higher tractor density in 1950 than the rest of the country, and also the degree of mechanization has increased at a faster rate in these counties than elsewhere. The converse of this argument probably explains the high correlation in the latter group of counties.

Some marked regional variations are evident in the decline of the oats acreage. A decline in absolute acreage and also in proportion of total cereal acreage occurred in all counties except Leitrim where the latter has increased to 100%. The decline in the proportion of oats in the total cereal acreage exhibits a marked contrast north and south of a line extending from South-West Cork to North County Louth (Fig. 4). This contrast may reflect a possible influence of climatic and edaphic factors on a farmer's choice of cereals to grow; farmers in the climatically and edaphically more favoured south-east having a wider range of crops to choose from. Perhaps, of more importance, is the possibility that the contrast may reflect differences in the perception

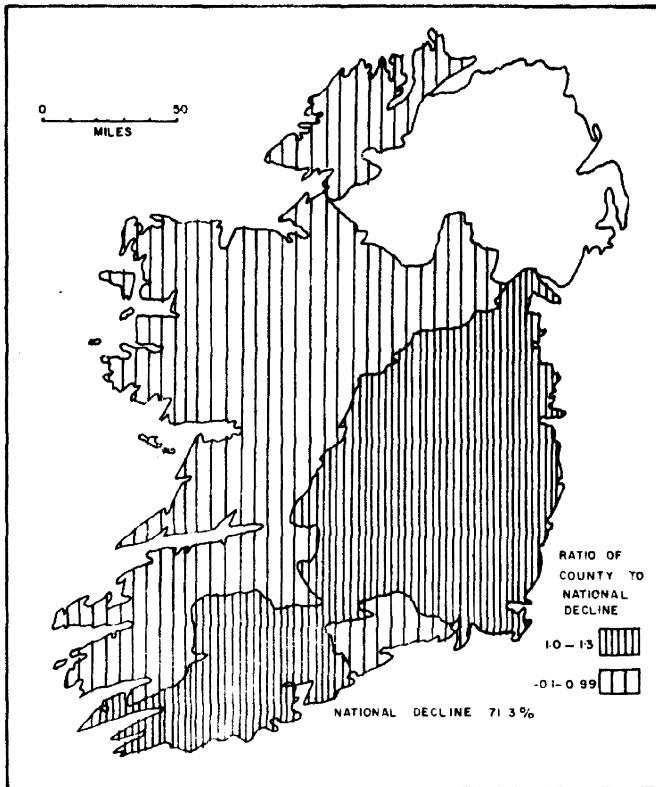


Fig. 4: Change in percentage of oats in total cereal acreage, 1950-1971

of the utility of the crop. Generally, the yield of grain and straw from the oats crop is high and of good quality. In composition, the grain is well balanced, and it is, therefore, suitable for use, either whole or crushed as feed for all livestock. The straw, if it is well saved, can be used as fodder for cattle; it is superior to either wheat or barley straw for this purpose (6). The whole crop can thus be utilised to a greater extent for feeding purposes than can the produce of any other cereal, and in the system of mixed farming still pursued in Western Ireland, centering as it does around the production of livestock and livestock produce, oats provide a cheap, economic and wholesome home grown food material. All counties with a decline in the proportion of oats in their total cereal acreage less than the national average had oats as their main cereal crop in 1950, and also in 1971, except for counties Waterford and Limerick, where barley took over as the main cereal crop in 1961 and 1962, respectively.

Wheat

The national wheat acreage declined by 38.6% between 1950 and 1971. However, this decline was not a consistent one; production fluctuated considerably, with relatively large acreages in 1954, 1958, 1961 and 1970, followed in all cases by a sharp decline (Fig. 3).

However, total production of wheat did not drop correspondingly. In fact, production increased from 6,552,000 tons in 1950 to 8,116,000 tons in 1968, an increase of almost 26%. Due to increased supplies of artificial fertilisers, high yielding varieties and a general improvement in farming techniques, increased yields have been obtained from all crops and particularly from wheat. Average yield of 36.3 cwt/acre (746.2 kg/ha) in 1968 was almost 103% higher than that of 17.9 cwt/acre (368.0 kg/ha) in 1950. The introduction of a Seed Certification Scheme in 1954 by the government has ensured supplies of high quality seed of relatively high yielding varieties.

Variation in the prices payable for wheat have had considerable influence in determining the acreage sown. In 1954/55, the basic price payable to growers was 82/6d per barrel for wheat with a bushel weight of 63 lb or over and with a moisture content of less than 23%. At this price 486,000 acres were sown. For the 1955/56 harvest the basic price of similar quality wheat was reduced to 70/- per barrel. The result was a decline to 358,000 acres, a reduction of 26%. For the following season the basic price was increased to 78/6d per barrel for wheat of 64 lb bushel weight or over and with a moisture content of less than 22%. The result was an increase of nearly 20% in the area sown. Therefore, it is clear that price variations had a significant effect on the acreage of wheat sown, contrary to the situation with regard to barley acreage.

However, in the years after 1957, the basic price remained unchanged until 1964, but the wheat acreage varied considerably (Fig. 3). These variations were due almost completely to the output and the quality of the wheat produced, which were governed by climatic conditions. For example, after the disastrous harvest of 1958, when only approximately 10% of the harvested crop was millable, there was a drop of about one third in the wheat acreage of 1959 (8).

Another factor responsible for the reduction in the wheat acreage has been the advance in living standards in this period of economic growth. As living standards have improved, flour and bread consumption has declined. For example, flour sales per head of population declined from 263.7 lb in 1949/50 to 199.7 lb in 1962/63.

Wheat acreage has declined, though by different amounts, in all counties, except Louth, where 27.3% more wheat was grown in 1971 than in 1950. However, when the proportion of wheat in the total cereal acreage in 1950 is compared with that in 1971, an increase is observed in counties Meath, Louth, Cavan and Monaghan (Fig. 5). The high rates of increase in Cavan and Monaghan are partly a reflection of the slow introduction of the crop into these counties. The relatively stable situation along the rest of the East coast reflects the superior nature of the physical environment in this area, allowing the crop to compete successfully, with other agricultural enterprises.

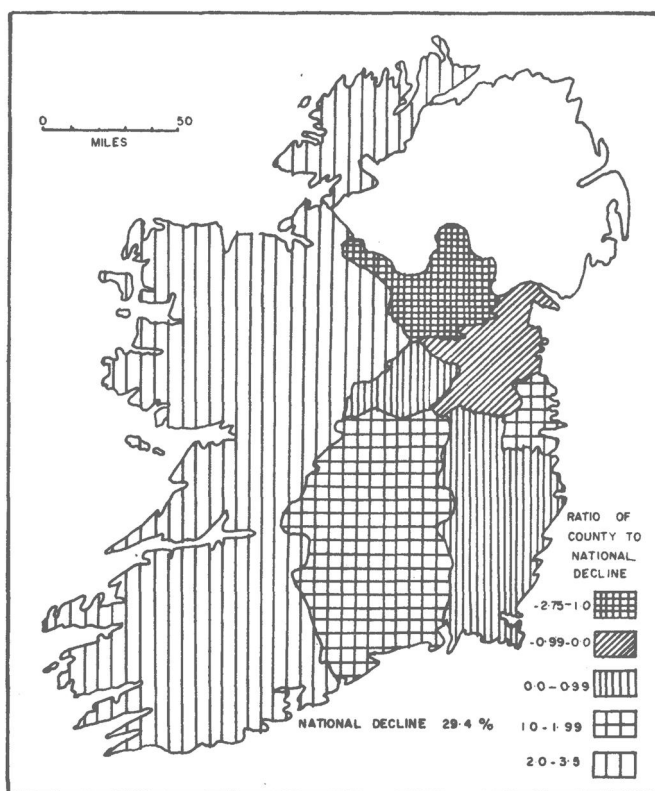


Fig. 5: Change in percentage of wheat in total cereal acreage, 1950-1971

Fig. 5 again shows the contrast between eastern and western Ireland in relation to cereal trends.

There have also been modifications in the method of cereal crop production. In the early 1950's most of the cultivation was done manually and using horse drawn implements. However, since then there have been major technological advances in machinery use, weed control and harvesting equipment which have considerably reduced the labour requirements. But the adoption of these advances has not progressed at the same speed all over the country. For example, the introduction of the combine harvester was a major innovation and took time to diffuse across the country, the main direction of diffusion being from East to West. The innovating counties in this sphere were Dublin and Kildare. Adoption was slow in the counties along the western seaboard. It has been estimated that the time lag between the achievement of similar densities of combine harvesters in Dublin and Kildare and in the Irish late adoption zone (Connaught, Clare, Offaly, Westmeath, Longford), has been 15 to 20 years (9).

All the counties with slow adoption rates have shown higher than national average declines in their cereal acreage. It is suggested that the situation of a rapidly declining cereal acreage lent itself to a slow adoption of combine harvesters, the farmer or the agricultural contractor regarding the risk involved in the amount of capital employed, too great. Where this type of situation prevails, the slow adoption of modern methods tends to maintain high harvesting costs and causes a further reduction in the farmer's income. This in turn is an added incentive for him to further reduce his acreage, especially if his farm is of very limited size, as is generally the case in the west of Ireland. The converse of this argument can be applied to the situation in Leinster, Cork and Tipperary. We now turn to a consideration of spatio-temporal variations in the other major category of crop production in Ireland, root and green crops.

ROOT AND GREEN CROPS

The total root and green crop acreage—hereafter called root crop acreage—declined by approximately 290,000 acres (45.45%) between 1950 and 1971. This decline has been a consistent one (Fig. 6). The spatial variations in this trend are very similar to those for the cereal acreages (see Figs. 1 and 7). When the decline in root crop acreage is correlated with the change in cereal acreage for 25 counties, excluding Dublin, a correlation coefficient of 0.6385 ($r^2=0.4096$) is obtained, significant at the 99% level. This association is due to climatic and edaphic factors. The basic climatic conditions of high rainfall coupled with low summer and relatively high winter temperatures create the condition that yields of tillage crops need to be fairly high to enable tillage to compete with grassland. The need for high yields places strong demands on the crop producing capacities of the soil. One method of restoring them was to return the corn land to pasture frequently and for long periods. However, as Crotty has demon-

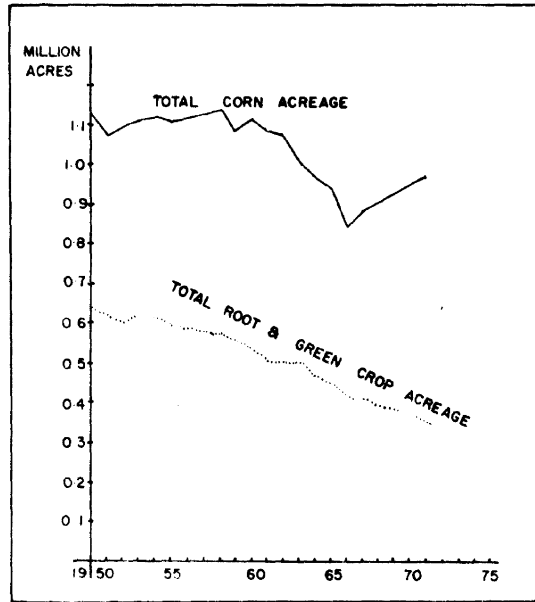


Fig. 6: Trends in total cropland acreage, 1950-1971

strated, the growing of a root crop as an alternative is a quicker way of restoring land than letting it down to grass. The root crop is manured with farmyard manure and leaves the soil in a high state of fertility, it requires and permits hoeing the land while the crop grows, so that most weeds can be eradicated; coming between cereals, it breaks the life cycle of cereal diseases and pests and leaves the land healthier for succeeding crops of cereals (10). However, some of the practices just listed are fast disappearing, with more and more use being made of the precision seeder for planting and chemical sprays for weed control. Therefore, the strength of this relationship may be less in the future.

Of the total root crop acreage in 1950, 52.82% was under potatoes, 9.41% under sugar beet, and 37.77% under other root crops. By 1971 the figures were 36.70% potatoes, 21.18% sugar beet and 42.12% under other root crops. These figures indicate a shift from potato to sugar beet growing.

The other root crops were turnips, mangels and fodder beet, mostly produced for direct consumption by livestock on the farm, while sugar beet and potatoes were produced as cash crops. As with cereals, there are strong regional contrasts in root crop production in Ireland (Fig. 8). Two distinct groupings of counties were evident in 1950, 1) the "potato" counties, where the root crop acreage is generally composed of

over 50% potatoes and less than 5% sugar beet, and 2) the mixed root crop counties, with generally 25–40% potatoes and 10–30% sugar beet. The former group comprises the western half of the country plus Dublin, Meath, Louth and Wicklow. The dominance of potatoes in the west is due to the unsuitability of the soils there for sugar beet production. The dominance around Dublin reflects a purely locational factor, proximity to a large market. In 1971, the situation was generally the same, but the distinction between the two groups of counties was greater. In the “potato area,” the percentage under potatoes was still over 40, while the sugar beet percentage was still less than 5%. However, in the mixed area the potato percentage had dropped to between 10 and 25%, while that for sugar beet ranged between 10% and 50%, with a mean of 30.41%, and a median of 34.76%. Wicklow was the only county to move

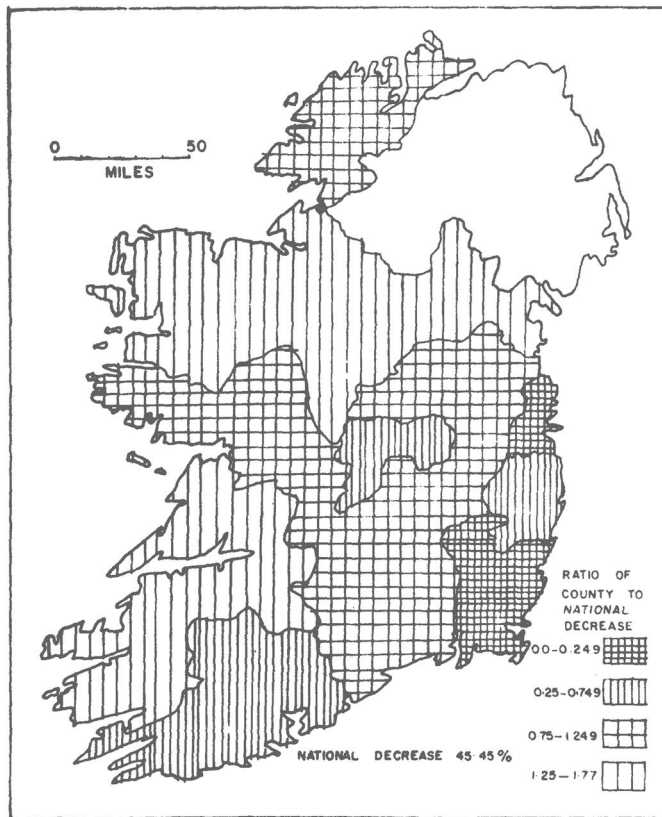


Fig. 7: Change in percentage of each county under root and green crops, 1950-1971

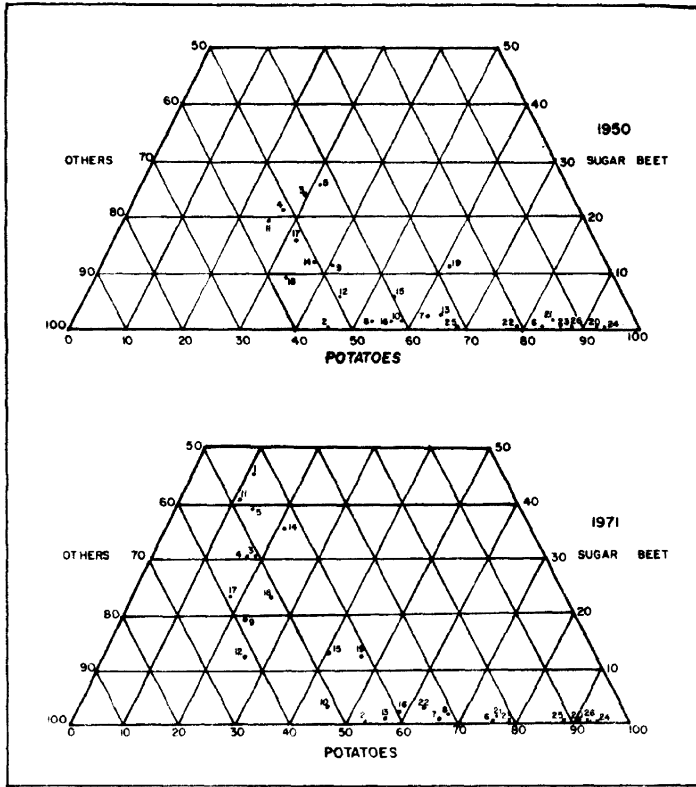


Fig. 8: Percentage of potatoes and sugar beet in total root and green crop acreage of each county, in 1950 and 1971. Key: as for Fig. 2

from the former to the latter group and no county moved the other way. Thus, the division of Ireland according to root crop characteristics has shown remarkable stability.

Potatoes

The potato crop has been in the past a major element of Irish agriculture. It is a crop that can be grown successfully throughout the island, and is characterised by a high yield per unit area. In the early nineteenth century, extensive cultivation of the crop facilitated an extremely rapid growth in population. However, between 1950 and 1971, the total acreage of potatoes declined by 62%. This decline was due to a number of factors. Production was severely curtailed by the decline in the agricultural labour force, as potatoes demanded a high labour input from sowing to harvesting. The

number of males engaged in agriculture declined by 42% between 1951 and 1971. The dietary habits of the main consumers have also been altered. The quality of human diet has improved with a gradual substitution of protein foods for starchy ones. There has been an increased use of concentrated rations instead of potatoes for pigs and poultry. The decline in the cultivation of potatoes is an indication of the trend away from mixed farming to specialised commercially-oriented agriculture. In fact, in recent years many specialised single enterprise farmers do not even grow potatoes for "home" use.

Sugar beet

In Ireland sugar beet is grown on contract for Comhlucht Siúicre Éireann (the Irish Sugar Company). The acreage grown has not varied very much, being 60,000 acres in 1950 and 73,000 in 1971. The acreage has been maintained at this level, despite competition from other crops, because of guaranteed prices offered by the Sugar Company. Also, the Sugar Company provides some attractive services for growers, such as providing seeds and fertilisers on credit and offering beet pulp at reduced prices. Most of the crop is grown in counties Cork, Wexford, Tipperary, Laois, Carlow, Kilkenny, Kildare and East Galway. In recent years there has been a trend towards concentrating production of the crop on larger farms. Cultivation on scattered plots of one or two acres has posed serious problems for planning the harvest and also results in wasteful use of expensive harvesting machinery. This leads to the final aspect of change that is considered in this paper, change in the location of production.

LOCATION OF PRODUCTION

Of fundamental importance to geographers has been the question, "where are certain objects produced?" However, a knowledge of the distribution of production at one point in time is not sufficient for an understanding of what is essentially a dynamic landscape. We must also be aware of the ways that distribution changes. If we make the reasonable assumptions that, (1) as the economy of a country develops inter-regional movement of goods will increase, and (2) as farmers try to derive maximum utility from their labour, they will devote their land resources to the enterprise or enterprises to which they are best suited, then one would expect crop production to become gradually concentrated into the locations most favourable for it. Here we test this hypothesis for the five crops that have been examined.

Because of data limitations only intercounty shifts in the volume of production can be compared. In 1950, the main wheat growing areas were counties Wexford, Tipperary, Cork, Meath, Kilkenny, Louth and Kildare, 61.5% of the total acreage being concentrated in these counties. However, in 1971, 71% of the total acreage was

in these counties. In the case of oats the percentage of the total acreage grown in counties Cork, Galway, Mayo and Donegal increased by ten units between 1950 and 1971. In 1950, 31.2% of the total potato acreage was in counties Galway, Cork, Donegal, Meath and Dublin. However, by 1971, the proportion had increased to 44.8%. In the case of sugar beet, Cork and Wexford were the main producing areas in 1950, growing almost 28% of the national acreage. Other important beet areas in 1950 were Tipperary, Laois, East Galway, Carlow, Kilkenny and Kildare, 57.45% of the total acreage being grown in these counties. In 1971, these eight counties were still the main beet areas. However, 45% of the total acreage was then concentrated in Cork and Wexford and only 42.55% in the other six counties. Therefore, between 1950 and 1971 there was marked stability in the location of the main beet growing areas, but within this region there has been a tendency towards greater concentration on the primary producing districts. The remaining crop, barley, does not satisfy the hypothesis, 60% of the total acreage being grown in counties Cork, Wexford, Tipperary, Kildare, Kilkenny and Meath in both 1950 and 1971. It is suggested that this anomaly is due to the relatively recent recognition of the value of this crop. It was noted earlier that the price factor had little influence on the acreage of barley sown, farmers tending to look on the crop more as a source of cash income. The evidence from the first four crops tends to suggest that, as there is greater specialisation of urban landuse with urban growth, so also, in general, there may be greater specialisation of rural landuse with economic growth. A similar trend occurred in the U.S.A. in the inter-war period. Weaver, while examining crop combination regions in the mid-west noted that the tendency was "more that of concentration on the primary (crop) than diffusion toward diversity" (11).

SUMMARY AND DISCUSSION

There has been a large reduction in the tillage acreage in Ireland between 1950 and 1971. The total cereal acreage declined by 13%. However, this was not a universal trend, an increase in acreage occurring in the counties along the eastern and southern coasts. A significant change occurred in the relative proportions of the three main cereals grown. Oats was replaced as the dominant cereal, in terms of acreage grown, by barley. Again this trend did not occur all over the island, oats still being the dominant cereal in a greatly reduced cereal acreage in the western counties. The mode of cereal production has also been altered considerably by rapid technological advances. Once again, the pace of this technological advancement varied throughout the country.

The total root and green crop acreage declined by 45%. A decline, though of varying magnitude, occurred in all counties. Spatial variations in the magnitude of the decline were significantly correlated with the change in cereal acreage. The division

of Ireland according to the proportion of the various root crops grown has shown remarkable stability. Most of the decline in the root crop acreage has been due to the decline in the cultivation of potatoes, which has been largely due to a combination of social factors.

There have been major spatial variations in most of the temporal trends examined, the dominant contrast being between the east and south-east on the one hand and the west and north-west, on the other hand, the transition zone running from South West Cork to North County Louth. A more rigorous regionalisation using 39 variables produced four distinct uniformly adaptive regions, the largest and most uniform one containing all of east and south east Ireland (12).

With regard to location of production, there appeared to be a general trend towards concentration into primary producing areas, rather than towards spatial diversification.

The main factors responsible for the long-term trends at a national level appear to have been governmental decisions and advances in technology. The importance of the governmental factor can be seen in the effects of the decisions to promote increased and more intensive livestock production and to encourage the growth of feeding barley. Of course, in part these decisions were attempts to revoke the results of an earlier enactment, the Compulsory Tillage Act, and were thus, just an attempt to re-establish the firmer livestock basis of Irish agriculture. Advances in technology have resulted in a decline in the equine population and the agricultural labour force. However, in the late adoption zone, adoption of mechanised means of cultivation and harvesting often result from the reduced agricultural labour force. Therefore, in these areas the changing nature of the agricultural landscape may be a response to the gradual transformation of Irish rural society (13). The main factors responsible for spatial variations in the temporal trends can be categorised as either physical or social. Important physical factors are topography, climate and soils. These are important in any consideration of spatial variations, though they may not be of primary importance. Three important social factors were identified. First, the decline in the agricultural labour force, particularly the very large number of young, energetic, innovative people that have left the land in western Ireland, leaving behind a very large proportion of elderly, heirless, conservative farmers (14). Secondly, the spatial variation in the rate of transformation of Irish rural society, and the emergence of highly individualised commercially oriented farmers. The third social factor considered to be important was the possibility of different evaluations of certain crops by farmers in different regions. This factor was suggested as being important for explaining the continued dominance of oats in western Ireland but this needs to be investigated more thoroughly. It was also noted that one factor, that may be highly important for explaining one trend, may not be important at all for explaining another, the example here being the importance of the price factor in explaining fluctuations in the wheat crop acreage in the 1950s, while this factor appeared to be of little importance in explaining the growth of the barley acreage.

The factors identified as important in this paper help us to explain spatial variation in agricultural trends over a number of years. The next step is to identify the factors responsible for spatial variations in the annual fluctuations about these trends. With this knowledge, we may then be able to attempt forecasting agricultural trends.

CONCLUSION

The agriculture of any country is generally a very complex phenomenon. An important factor accentuating this complexity is the dynamic nature of agriculture. There is a very great need for more work on this subject. Hitherto, most of the work by agricultural geographers has been on the statics of agriculture. Any model attempting to explain the dynamics of agriculture will have to be very complex, taking account of physical, technological and social factors, in all their manifestations. More spatio-temporal studies in varying physical and social environments, employing many more variables, are needed.

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