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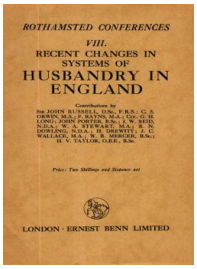

Changes in the Home of the Four-course Rotation

F. Rayns

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CHANGES IN THE HOME OF THE FOUR-COURSE ROTATION

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Well over a hundred years have elapsed since the four-course or Norfolk rotation was developed. Two Norfolk landowners—Coke of Holkham and Townshend of Raynham—evolved the ideas and put them into practice on poor land with such extraordinary results that Arthur Young, in *Agriculture in Norfolk, 1804*, is prompted to observe: "A county of rabbits and sheep-walk has been covered by some of the finest corn in the world; and, by dint of management, what was thus gained has been preserved and improved even to the present moment."

Since that time the Norfolk four-course shift has been the backbone of Norfolk farming and of that of many other counties. It is still the most generally adopted rotaion in the county from which it is named. Yet changes are taking place, and pioneers are breaking traditions, just as Coke and Townshend broke them many years ago. If, however, these changes are to be understood, it will be best to outline the farming of a typical four-course farm and to say something of the soils upon which it is practised. These are having a distinct influence upon the character of the breaks which have so far occurred.

The four-course shift of wheat (or rye), roots, barley and hay has always been associated with light land. The sheep and barley type of farming is merely a synonym of four-course rotation farming. The system was developed upon the light gravels which overlie the chalks of Norfolk, and for over a generation has kept them under the plough, clean and in good heart. Mutton, beef and barley are the chief objects of the four-course farmer. In Norfolk he frequently, although not invariably, has no more permanent grass-land than will carry his horses successfully through the summer. His stores for winter-feeding are bought from October onwards, and are chiefly large, polled, Irish shorthorns—polled because more can be fitted into the yards in winter, and large because they are expected to consume at least 120 to 150 lb. of roots per day. Enough of these 2½-3-year-old stores are kept to turn all the straw into manure—an operation which not infrequently employs the bullock-tender in his yards and boxes from October to June, while root-feeding and straw-trampling go on continuously. The beef upon which the county has made its reputation is made in this way, cotton and linseed-cakes and hay being the usual adjuncts.

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Condition of the land is maintained by dressings of yard manure to the mangolds and the wheat, and by the use of sheep. The four-course shift is not typical without its ewe flock. Flocks of pure-bred Suffolks are as common in Norfolk four-course husbandry as the swedes or the barley, and interfere but little with the smoothness of the cropping. Some catch-cropping is inevitable. Oats (or rye) and tares are drilled on some of the wheat stubbles and are followed by late-sown white turnips. Rye is often grown for early sheep-feed, and part of the hay shift used for the same purpose. Naturally there are other schemes for providing sheep-feed, but the purpose of this paper is not to give an exhaustive description of four-course farming, but sufficient of the essentials to enable the breaks from it to be recognized. It must be added, however, that fat lamb is sometimes the object, but more often the lambs are sold as stores at the July lamb sales to farmers possessing no ewe flock, or are fattened on swede turnips on the farm of their birth.

This is the rough outline of a system of farming which is being severely criticized by many farmers in Norfolk, some of whom are not afraid to make public the losses they have sustained by rigidly adhering to it. Their opinions and experiences are supported by a series of excellent economic and financial investigations made during the past five years by the Farm Economics Branch of the Cambridge Department of Agriculture. These reports, while not necessarily coinciding exactly with the kind of four-course farming which has been outlined, are to be issued finally over a period of four years. A rough four-course cropping may therefore be assumed, but since milk-production, potatoes and sugar-beet are grown on some of the farms for which the results are given below, some slight modification of the typical four-course form has taken place. In spite of this, losses have still resulted, and the state of East Anglian agriculture is disclosed as a very bad one indeed. Nothing but bold change in policy would appear to meet the case:

		Net Return as a Percentage on Assets, after deducting value of unpaid work and interest on capital
Lady Day Entry Farms		
1924-1925	Six farms	− 0·3 per cent.
1925-1926	Six farms	− 5·0 ,,
1926-1927	Seven farms	− 8·6 ,,
1927-1928	Five farms	− 9·8 ,,
Michaelmas Entry Farms		
1923-1924	Fourteen farms	− 6·6 ,,
1924-1925	Fifteen farms	+ 3·3 ,,
1925-1926	Thirteen farms	− 1·3 ,,
1926-1927	Fifteen farms	− 8·4 ,,

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There are, of course, many factors entering into the success of any business, but in this case it is difficult, after inspecting the results, to resist the conclusion that this system of farming has failed. The various departments of the farms, however, would be expected to show varying results and to indicate the places where four-course farming is or is not profitable.

Figures taken from the same Cambridge analyses show that cattle and sheep have lost money:

	Percentage of Return on Mean Capital invested	
	Cattle	*Sheep*
1923-1924	− 2·4 per cent.	... per cent.
1924-1925	+ 7·0 ,,	+ 11·5 ,,
1925-1926	− 13·0 ,,	− 41·6 ,,
1926-1927	− 5·8 ,,	− 23·7 ,,

These cattle and sheep eat the roots grown on Norfolk four-course farms and so control the financial success of at least one-quarter of the arable land. Neither is this the whole story, for a large part of the hay is used for the same purpose, and therefore, with the exception of some of the hay fed to the horses, the profit or loss on nearly half the farm depends upon the profit or loss on cattle and sheep, and the cash return upon the outlay is delayed until the sales of these have been effected. It must be remembered, too, that dealing plays as great a part in the production of beef as does the feeding, and that the farmer is usually in a disadvantageous position when meeting either the dealer in store cattle or the butcher. If, in spite of this handicap, the stock make money, the farm may be profitable; if they lose money, then the manure from the bullocks and the residues from the sheep are expensive, and the consequent charges which have to be made to the wheat and the barley are a severe handicap. Chances of profit then are slight. Hence it is in view of the important position which roots and stock hold in the economy of a four-course-shift farm that progressive local agriculturists have argued that this was one place to break away from tradition; that the root shift must therefore be made profitable and must bring in more direct cash. They have also argued that no more hay than is consistent with safety should be grown; that, while it is essential to maintain a full head of stock, an attempt must be made to make stock-feeding a less risky undertaking and to improve the condition of the land as the result of *profitable stock* management. No longer must the stock be excused for losing money because it leaves manure behind.

It is generally agreed that corn-growing is inevitable on the Norfolk light arable farms, for without straw and, consequently, manure they cannot be kept in good heart. This, however, does

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not supply a satisfactory reason for continuing to grow corn at a loss, and the question at once arises, "Is there any need to lose money in corn-growing or to grow corn for the sake of the straw?" Surely there must be some means by which corn-growing can be justified? Surely it is better, for instance, to grow more barley than wheat at places where the cultivation of barley is favoured, as it is in many districts in Norfolk? Surely higher yields of the cereal which is smiled upon by soil and climatic conditions should be possible? Men who spend their lives amongst farmers can conclude that only those who farm higher than their neighbours are the successful ones. Their yields are higher, their costs of production per unit of corn are lower, and they have fewer crop failures, for their land is in a state of continual improvement.

Following these very general arguments, breaks from the four-course shift have taken place in Norfolk during the last few years. Three examples are given. The first two have been found on all soils between the clays and the lightest of the sands, and the cropping given below of five farms reduced to a common unit—*i.e.* per hundred acres of arable—will facilitate comparison:

Crop	*As Per Cent. of Total Arable Acreage*				
	Farm 1	*Farm* 2	*Farm* 3	*Farm* 4	*Farm* 5
Winter wheat . .	4	2	9	...	4
Sugar-beet . .	40	39	40	42	48
Potatoes . . .	...	5	3	...	...
Hay	15	9	12	4	14
Peas	...	4	4	...	2
Spring barley . .	32	32	28	44	25
Spring oats . .	9	5	4	8	7
Black-currants . .	...	4	...	...	...
Total acres . .	572	300	569	136	269

These are essentially sugar-beet-growing farms, and the basis of the rotation is a three-course one of barley, sugar-beet or hay, sugar-beet. In practice, complications in the cropping arise: the peas, potatoes, wheat and oats have to be fitted in. Such complications, however, are the fate of all farmers and need cause no further concern here, for so long as the principles of rotations are observed, a mathematically accurate distribution and regular sequence in the cropping are of no great practical interest. One-third of these farms is mucked each year and one-third is hoed. The cropping

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of four other farms given below illustrates the same principles: less hay, less wheat, more barley, more saleable roots than on the Norfolk rotation. Some stock-feeding roots, however, are retained. A five- or six-course rotation is adopted: barley, hay, wheat or oats, barley, sugar-beet or potatoes or mangolds or swedes. Occasionally a third straw crop is taken after the hay:

Crop	*As Per Cent. of Total Arable Acreage*			
	Farm 6	*Farm 7*	*Farm 8*	*Farm 9*
Winter wheat	22	18	12	13
Sugar-beet	10	13	9	26
Potatoes	3	...	...	...
Other roots	6	9	12	3
Hay	17	20	12	14
Barley	36	40	48	32
Oats	6	...	7	12
Total arable acres	439	173	170	160

The cropping of nine farms has now been given. Each farmer has attempted to modify or discard the four-course shift because each felt that it did not meet the changed conditions. Each has adopted parallel lines. The cereal crop which suits the county has been extended as far as is practicable: sugar-beet has been used to replace stock-feeding roots, with the result that the work immediately after harvest has been intensified. Compensations, which fortunately have aided rather than hindered the changes, have been necessary. Wheat-sowing and mangold harvest interfere with sugar-beet lifting; mangolds are therefore reduced and wheat is kept as low as thatching requirements will allow. There has been less time for muck-carting and ploughings for wheat in the autumn. More spring corn has followed logically, and the policy has been cemented by the fact that in most seasons good yields of malting barley can be grown after sugar-beet with the aid of 3 to 4 cwt. of a complete manure.

The ewe flock and even the fattening hogget have disappeared from these farms. The beet tops are carted off and fed in the yards to stock less mature than formerly. On farms with 20 per cent. or so of permanent grass the tops are fed to dairy cattle. As a rule, however, the feeding of bullocks in yards has continued, and for stock food great reliance has, perforce, been placed upon sugar-beet tops and dried pulp. Omitting the dairying interests,

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the stock policy on these farms has changed in that no great attempt is being made to produce beef. Cattle weighing from 6 to 8 cwt. live weight are usually bought and run cheaply in the yards during the winter, but kept sufficiently forward to be very desirable material for the grass feeder, to whom they are sold in the spring. The tops usually last until Christmas, when sugar-beet-top silage, a few roots or pulp replace them. Hay and an allowance of a mixture of concentrated foods balanced from the cheapest ingredients contributes the remainder of the feeding. On this treatment some of the cattle usually become fat enough to go through the fat-stock ring, and are saleable because they are neither too fat nor too big. This method may only be local in its application, for there are not in every county fattening pastures like the ones adjoining the sea in Norfolk, and consequently there may not be the same demand for this type of store. The fact remains, however, that these farmers have found their solution and escape from the winter feeding for beef in the production of forward stores for the grass feeders in their own county. They are meeting a local demand and marketing a desirable commodity. They have recognized that their brother farmers are usually better purchasers than the dealers or the butchers, and that there is always a demand for stores in good condition to eat the early grass. They get on to the market before the Irishman can produce animals with sufficient meat on them. It can be said for this method that there is less risk and a very reasonable chance that the bullock will leave a little more than his muck and his memory. The root shift is then likely to be profitable and the stranglehold on the corn removed. It will be as well, perhaps, to emphasize that cattle under two years old require care when feeding on sugar-beet tops. These, although theoretically superior to roots, have not proved quite equal to them in practice. But they are satisfactory, and the care required in their feeding will be readily bestowed by a man who is keen on his job. If he is not, he can hardly expect success.

Our economists are continually emphasizing the importance of the men at the helm as the dominating factor in farming enterprise. It would appear that the days of the smooth-running four-course shift, with its seasonal precision, its simple feeding, its shirking of all breeding responsibilities, except in the case of sheep, have gone. At least this is the opinion of the men who are prepared to supplement it with that commercial enterprise and business opportunism which present conditions demand. On each of the farms quoted the change from a four-course shift has increased the labour. This is eminently desirable provided the value of the output is increased a little more than proportionately. It may, therefore, be appropriate to show how the stock-carrying capacity and the labour requirement have been influenced on one of the farms. This is given on page 23.

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It may be as well to observe, before these figures are studied, that stock-feeding without roots is easier and absorbs less labour than the swede and mangold, notorious for the amount of carting and manual labour required in their preparation. Dried pulp, fed soaked, has been shown to be just as satisfactory as roots.

CROPPING OF ROOT SHIFT—FARM 156 ACRES ARABLE

Year	*Swedes and Mangolds*	*Sugar-Beet*	*Head of Stock*		*No. of Men*	
			Cattle	*Pigs*	*Regular*	*Casual*
1923	31 acres	0 acres	45	...	8	...
1924	31 ,,	4 ,,	41	...	8	...
1925	24 ,,	4 ,,	36	30	8	...
1926	17 ,,	17 ,,	40	...	7	...
1927	9 ,,	30 ,,	34	56	7	2
1928[1]	8 ,,	27 ,,	49	116	7	2
1929[2]	4 ,,	39 ,,	...	...	7	3

The change from eight to seven regular hands in 1926 was due to one man being placed permanently in charge of poultry established on land previously arable. Black-currants, developed at the same time, reduced the arable land to be cropped with roots, corn and hay. The black-currant labour is not included in the Table. The point of importance is the one at which the proportion of sugar-beet to the remaining roots caused the employment of extra labour. This did not take place until over half the root shift became sugar-beet. In respect of the additional labour required for beet, much depends upon the way it is handled, the proximity of means of transport and the weather. It is likely to vary from year to year, but there seems no reason to assume that the variation would be great. On another farm of 174 acres of arable land, 14 acres of sugar-beet in a root shift of 31 acres were handled entirely by the normal staff of nine men employed, two of whom were stock-tenders and did not help with the beet.

Perhaps a more interesting break in Norfolk has taken place on the gravelly soils over chalk, which are so light in places that blowing sand is by no means an uncommon sight. These soils are the natural home of the Norfolk sheep and barley farms, and it is not too much to say that many of them have been kept in cultivation by the use of arable sheep alone. Rents of five shillings an acre and less are not uncommon on this land. Yields, however, are controlled by the weather: drought in May or June usually heralds a year of loss, for, in spite of constant sheeping and manure-carting, equally continuous ploughing and cultivation keep the humus contents of these soils low. There is little retention of water or manures in the land and no power of drought-resistance. A successful break on such lands started by the introduction of a five-years' ley—

[1] 20 tons pulp purchased and tops fed for the first time. [2] Anticipated.

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hayed in the first year and grazed afterwards. In this way the number of times the land is ploughed over a number of years is lessened and the land is given a period of natural recuperation. After that it is usually possible to grow fair crops of corn. There is nothing new in a five-years' ley. It is interesting in this case, however, because the land is light and the rainfall much lower than in the Northern Counties, where the long ley is common. Light land and low rainfall are supposed to render pasture-making impossible. They have not done so in the last five years provided the work has been done well and the grass properly grazed, although it would be idle to pretend that the grazing is of the Midland or Western pasture order of excellence, or that at the end of three years the leys are as good as on the North-Western or Aberdeenshire farms. They are, however, good enough to carry a fair head of sheep and cattle. Similar methods made Coke of Holkham famous, and he insisted upon a ley of longer duration than one year, and studied the grasses and clover very carefully. It is extraordinary how little the present-day Norfolk farmer knows of the methods of this master, and interesting to find a return to his longer ley as a part solution of present difficulties on the same class of land.

The stock policy is essentially a combination of breeding, rearing and feeding. The sheep—Mashams—range the temporary leys and are crossed with a Suffolk ram. A proportion of the lambs are fattened on the grass and marketed in the late summer. The remainder of the lambs bred are finished on sugar-beet tops. The aim in the cattle policy is to produce beef at or about eighteen to twenty months old. Lincoln Red heifers are crossed with an Aberdeen-Angus bull; they calve with the grass and rear their own and one or two other Lincoln calves. The best of these heifers' calves replenish the breeding herd.

The whole of the root shift is sugar-beet, except a few mangolds grown for the Mashams at lambing. For the winter-feeding of cattle great reliance is placed upon sugar-beet pulp.

Every crop except the hay is a cash crop, for the rotation is in principle the same as on the better land mentioned above. It is barley, sugar-beet, barley, five-years' ley, barley: a little rye is grown for thatching. Only the merest outline of these farms has been given. The methods are important in Norfolk, for they have so far proved a financial success on land which was becoming derelict under the Norfolk four-course rotation.

Recent breaks from the four-course rotation in Norfolk have embodied the following principles:

(1) Rotations of longer duration than four years. The better lands have been cropped on a three- five- or six-course shift.

(2) More saleable roots, at least half the root shift being sugar-beet or potatoes.

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(3) Weight has been placed upon the acreage of barley—the corn crop for which the soils and the climate of the county are best suited. Wheat has disappeared from some of the farms.

(4) The area of hay has been kept as low as stock-feeding requirements permit.

(5) Less and less stock-feeding roots are being grown. Sugar-beet tops, sugar-beet-top silage and pulp are being substituted in stock-feeding.

(6) Sheep are being discarded or arable flocks replaced by the much cheaper grass-land sheep.

(7) On the lighter lands the temporary ley is being used. In spite of adverse circumstances it is proving successful.

(8) Smaller joints of beef and mutton, cattle fat at a more tender age, and breeding, rearing and feeding on the same farm are striking changes.

(9) Greater interest is being taken in poultry-keeping.

(10) On the better land black-currants and other fruit is extending.

THE ENTRY OF SUGAR-BEET INTO THE ECONOMY OF THE FARM

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The extension of the sugar-beet industry of recent years, particularly in the root-growing areas of the Eastern Counties, has perhaps opened up more revolutionary ideas in the four-course shift of farming since its introduction by Coke of Holkham in the early part of the last century.

That sugar-beet can be grown in this country equally as well—both as regards weight per acre and sugar content—as in the best sugar-beet areas on the Continent has now been proved without doubt, and, under present conditions, profitably.

The problem now confronting the industry is the future prospect when the period of subsidy ends. The industry can be then carried on successfully only if the farmer makes full economic use of the crop. It is not proposed in this paper to deal with the costs of growing and harvesting the sugar-beet crop, as this has been fully done in a recent publication,[1] from which the following typical figures are taken:

AVERAGE PROFITS PER ACRE AND PER TON OF WASHED BEET (1927)

Number of fields costed	172
Average washed yield	7·71 tons
Sugar per cent.	16·1

[1] Carslaw, Burgess and Rogers, *Sugar-Beet in the Eastern Counties*, 1927.

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