

Sickle Scythe and Reaping Machine

Innovation Patterns in Scotland

THE CUTTING OF THE CEREAL CROPS ON THE FARM occupies a central position in the farming year. It is a task of great urgency because of the need to get the grain under cover quickly and therefore in the days before mechanisation farmers had to lay a special degree of dependence on manpower. This manpower was not normally carried on the strength of the farm and had to be got specially for this seasonal task.

Because of the close links between the tools and the manpower the subject provides a sensitive ethnological indicator of regional patterns of innovation and change. Except on the very outermost edges of Scotland and in the areas where the terrain has not made it possible for farming to develop, sickle and scythe are almost things of the past. The study of these tools is now primarily a historical exercise.

A survey of the material produces, however, not a simple picture of gradual diffusion from innovating centres, but one of a complicated integration of regional variants due to types of crop, farm unit size, availability of manpower, work organisation in relation to wages, and also, for machines, the presence of supporting services and the nature of the field surface — i. e. a mixture of social, economic and technical factors. We have to do not with the spreading-repples-in-a-pool type of diffusion, but with an immensely more sophisticated pattern whose fuller interpretation requires a good deal of further study of the relevant Scottish sources.

THE SICKLE

FROM MEDIEVAL TIMES UNTIL THE EARLY NINETEENTH CENTURY the sickle was the chief instrument for cutting grain and occasionally grass as well. The Scottish name for the sickle is the *hook* and its action, *shearing*.

The close integration of the sickle with the agrarian system in general can be seen from the fact that the word *hook* can also apply to 1. an area of land, presumably the amount that could be cut by one sickle in one season¹ and 2. to the shearer himself or herself².

This instrument too exemplifies the way in which town and village can fade into the countryside for at the harvest period much of the farmers' additional labour requirements were met from these population concentrations. Shearers' markets were found in many of the towns in Scotland, some being established by Act of Parliament³, which in itself stresses the importance of this main food crop.

As regards *types of sickles*, the evidence is for two basic types. The main one was a toothed sickle, a sickle with saw teeth used over most of Lowland Scotland

1. *Records of the Sheriff Court of Aberdeenshire* (New Spalding Club) 1904 II. 487 (1639).

2. *Ibid.* I. 104, II. 487 (1511, 1639).

3. e. g. in the town of Airdrie, 1695. *Acts of the Parliaments of Scotland* X. 499, s. 94.

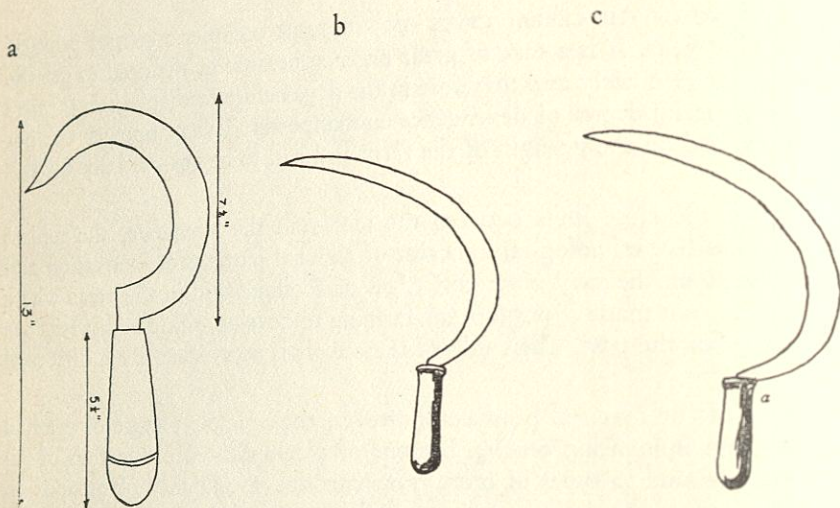


Figure 1. a. A small sickle from Shetland, with a smooth, semi-circular blade. b. A toothed sickle. After H. Stephens, *Book of the Farm*. 1844. c. A smooth-edged sickle. After H. Stephens, 1844.

(Fig. 1 b). In the Northern Isles of Scotland there was a smooth-bladed type of sickle, much smaller than the standard toothed sickle and with a semicircular blade. The available evidence for it lies between the periods 1633⁴ and 1900; however this had a very local distribution (Fig. 1 a). In the south of Scotland in the late eighteenth and nineteenth centuries an innovating type was a broad smooth-bladed sickle⁵ of the same shape as the toothed sickle but involving a different kind of action, a rather more sweeping motion which made it faster to operate. The line of movement of the shearer, instead of being along the cultivation ridge, tended to be across the ridge, as for the scythe (Fig. 1 c)⁶.

The sickles were generally made by local blacksmiths. There was also a considerable import of sickles, probably from England, through south-west Scotland, in the sixteenth and seventeenth centuries⁷. Perhaps as an extension of this import, there was a movement in the eighteenth century of the smooth-bladed sickle, which was known as the *scythe hook*, eastwards and also to some extent northwards⁸ from south-west Scotland. Small sickle-making factories were established in south-west and in central Scotland⁹. At the same time there was a

4. R. Monteith *Description of the Islands of Orkney and Zetland* Edinburgh 1845. 18 (1633).

5. *Farmer's Magazine* May 1822. 285 (1760); J. Webster *General View of the Agriculture of Galloway* Edinburgh 1794. 15. It was not common before the very end of the 18th century.

6. W. Stephens *The Book of the Farm* Edinburgh and London 1844. III. 1059.

7. A. Murray in *Transactions of the Dumfries and Galloway Natural History and Antiquarian Society* 1965. XLII. 125—9. There were 178 dozen hooks in 1592—3, 168 dozen in 1593—4, and 7 „pakies“ or bundles in 1621.

8. P. Graham *General View of the Agriculture of Stirlingshire* Edinburgh 1812; P. Graham *General View of the Agriculture of Clackmannan* Edinburgh 1814. 273.

9. W. Aiton *General View of the Agriculture of the County of Ayr* Glasgow 1811. II. 605 (Ochiltree and New Cumnock); *New Statistical Account* 1845. VIII. 159—160 (Banton); F. H. Groome, *Ordnance Gazetteer of Scotland* Edinburgh 1885. I. s. v. Auchinmully.

considerable import of commercial English types of sickles and clearly, a good deal of experimenting and adapting in minor points was going on¹⁰. Apart from this spread of the *scythe hook* from the south-west eastwards however, there is no readily available information about the diffusion of the commercial types from the south.

As far as diffusion is concerned, however, not only the type of sickle has to be considered but also the techniques of use, because new implements, involving new techniques, meant the diffusion of that type of technique as well. Thus the toothed sickle was used for cutting only small quantities at a time and was wielded mainly, but not exclusively, by female workers. The smooth-bladed sickle, however, especially when used with a sweeping, striking motion, known by the special dialect name of *dinging-in*, was a tool used by men rather than women and involved much bigger bites at each stroke¹¹.

The only considerable innovation that was attempted was artificially fostered by the Royal Highland and Agricultural Society, when they tried to introduce the Hainault scythe into Scotland. Two Flemish reapers travelled extensively in Scotland in 1825 demonstrating the way of using this short-handled scythe one-handed in conjunction with a wooden hook, but though shearing with this tool was equivalent to the English system known as *bagging*, in which a sickle of ordinary shape but much larger size was used in conjunction with a hook, it did not gain favour in Scotland in spite of newspaper publicity¹². Nevertheless, this remains an example of how deliberate efforts to introduce new things do not necessarily succeed if they do not arise out of the traditions or normal working techniques of the people who are required to use them.

THE WORK TEAM

THERE WERE MARKED REGIONAL DIFFERENCES in the constitution of the work team and in the ways in which they were paid. These differences in turn were reflected in the techniques used to cut the grain as well as to some extent in the tools used for the task. In south and east central Scotland a common method was to cut in teams known as *bandwins*, a term first recorded in the seventeenth century¹³, just when agricultural improvement was beginning to increase the cropping acreages. The *bandwin* varied in size according to the width of the ridge. Normally two ridges were cut at a time with three people on each ridge, making a total of six shearers, plus one man, the *bandster*, who tied the cut

10. W. Drummond & Sons *Report of Exhibition of Agricultural Productions* 1833. 42.

11. H. Stephens op. cit. 1844. III. 1080.

12. H. Stephens On the Flemish Scythe, in *Transactions of the Highland and Agricultural Society of Scotland* 1829. VII. 244—249. This form of the *bagging* technique may have been introduced into Scotland by Irish seasonal migrant harvesters, since these are known to have introduced it to south-east Ireland, from England, in the 1880s (E. J. T. Collins, *Sickle to Combine* 1969. 14).

13. *Records of the Sheriff Court of Aberdeenshire* (New Spalding Club) 1904. III. 37 (1642).

grain into sheaves and set it up in the form of stooks¹⁴. Such a team could deal adequately with ridges 15—18 feet (4,6—5,5 m) wide, and could cut 2—2,5 acres a day¹⁵. Such an organisation was particularly suitable for shearing grain by the acre. Where large numbers of shearers were involved, up to 70 or 100 on occasion, a good deal of organisation was involved in keeping them all at work, and in arranging the teams¹⁶. The shearers could be a combined team of men and women, but in that case the man normally went in the centre on the crown of the ridge where the corn (out of which the bands were made) was longest and strongest, and the women were on the outside, where the corn was shorter and where they had to bend lower to cut into the furrows on each side of the ridges. The woman on the right hand side of each ridge had a particularly laborious task, because she had to clear the furrow right across to the next ridge¹⁷. Since the efficiency of such a team depended very much on a reasonable equality of strength and fitness, no *bandwin* team cared to have a weak member in it. Old or infirm people were, therefore, excluded. Numerous stories are told of how *bandwin* teams struggled to reach the end of their ridges first in a battle which was known as *kemping*.

A second kind of work team with a much looser organisation worked by the piece according to a system known as *threaving*. A *threave* was 24 sheaves of oats or 28 sheaves of wheat, i. e. two stooks. In this case, individual shearers worked on their individual ridges, or family groups might work together on ridges in which case the younger members of the group received a form of training in the methods of shearing grain. This also meant that the weaker or more infirm could get a job cutting corn because they simply worked at their ridge at their own speed and were paid according to the amount cut. The *threaving* groups did not have a *bandster* as an essential part of the team; instead, the *bandster* was normally employed by the farmer to set up the stooks on the individual ridges as the grain was cut, and at the end of each day the farmer or his steward came along the ridge checking the stooks that had been cut by each shearer and the workers were paid on this basis¹⁸.

The choice of the *bandwin* or the *threaving* system depended chiefly on social factors. It seems that where labour was hired on a highly organised basis, as on the bigger farms of southern and east-central Scotland, the *bandwin* system was prevalent. *Threaving* is more closely related to areas where abundant extra harvest labour could be got locally from nearby towns and where tenants were bound to undertake a certain amount of shearing each year as part of the conditions of their lease.

Another method, if it can be so called, was practised on the smaller farms or on the less highly developed estates. This involved no more than existing farm

14. R. Kerr, *General View of the Agriculture of Berwick* 1809. 226; H. Stephens op. cit. 1844. III. 1051.

15. G. Robertson, *General View of the Agriculture of Midlothian* 1793. 62—3; H. Stephens op. cit. 1844. III. 1051.

16. *George Hope of Fenton Barns* (compiled by his daughter) 1881. 26—27.

17. H. Stephens op. cit. 1844. III. 1057—8.

18. H. Stephens op. cit. 1884. III. 1051—3, 1061—2.

labour, plus such extra help as was available from the wives of the farm workers or from local tradesmen and their families who were willing to lend a hand, or from the house servants who were normally employed in the house and not in the fields. This can be seen very well from the records of the shearing on the Aberdeenshire estate of Monymusk in the first quarter of the eighteenth century, when people of each of these categories were employed, some working regularly day after day, some coming only for a third or half or two-thirds of a day to do a small bit of shearing for which they were paid accordingly. In effect this was a version of the *threaving* system¹⁹.

Generally speaking the *bandwin* system belonged to the days of vastly improved yields and expanded acreages and applied especially to the primarily arable areas of southern and east-central Scotland. In order to deal with the increased crops in anything like a commercial way the shearing system had to be sophisticated to a considerable degree and the nineteenth century evidence therefore is for a dynamic situation that involved continual innovations in the work organisation.

THE SCYTHE

ALTHOUGH IT WAS NOT UNKNOWN FOR THE SCYTHE TO BE USED FOR CUTTING GRAIN in the medieval period²⁰, its chief use was for hay. Its cutting action is

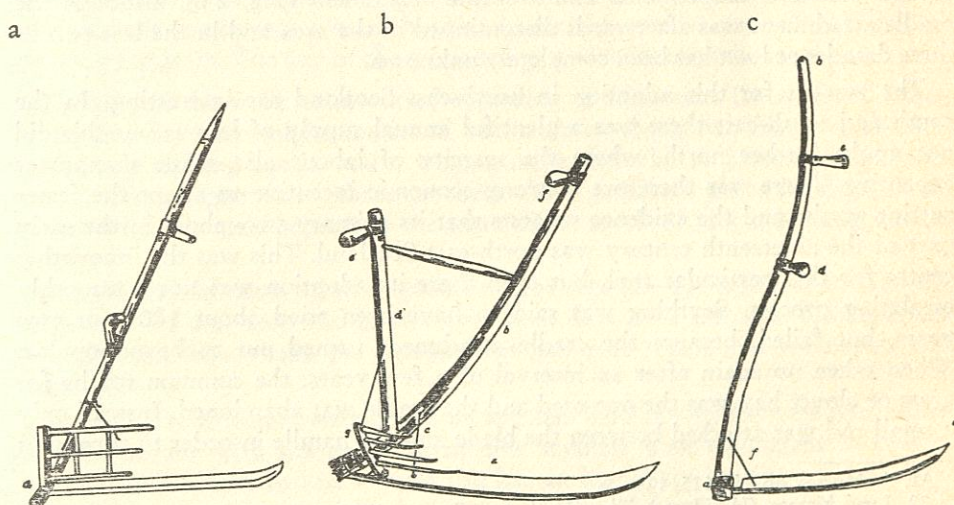


Figure 2. a. A straight-handled scythe. After H. Stephens, 1844. b. A cradle-scythe with a Y-shaped handle. After Stephens, 1844. c. A scythe with an S-curved handle. After Stephens, 1844.

19. H. Hamilton *Selections from the Monymusk Papers (1713—1755)* (Scottish History Society) 1945. 110—111.

20. *Abstracts of Protocols of the Town Clerks of Glasgow 1894—1900*. IV. 70 (1535); *Acts of the Parliaments of Scotland* III. 422/1 (1585); J. Nicoll *A Diary of Public Transactions and other Occurrences 1661*. 347.

normally called *mowing*. There was clearly a good demand for scythes for, as with sickles, scythes were imported into south-west Scotland, via Dumfries, in considerable quantities in the sixteenth century²¹. Before the nineteenth century, the scythe with a straight *sned* or handle appears to have been the normal type (Fig. 2 a).

As a deliberately innovating harvest tool for cutting grain crops, the scythe was used in several experiments, especially in the south of Scotland, but these were short lived²². A relevant factor was the need for having smooth stone-free²³ ground in order that the blade should be able to work easily without risk. The ground had to be well rolled and the development of horse-drawn rollers took place chiefly in the first part of the nineteenth century. In the early stages the use of the scythe as a harvesting tool was sporadic and confined to innovating individuals. After 1800 in the south of Scotland it made little further progress. Farmers thought that wheat was too easily shaken by the scythe and in any case, shearers using sickles were available in adequate quantities in the form of immigrant seasonal labour from the Highlands or Ireland, or from the towns and villages of the area.

A different picture appears in north-east Scotland. In Morayshire, and even more in Aberdeenshire and Banffshire, there was a steady increase in the use of the scythe as a grain cutting tool from about 1805 onwards²⁴. This coincided with what appears to have been the regional development of a special type of scythe with a Y-shaped *sned* and a cradle attachment (Fig. 2 b), although the cradle attachment was afterwards discontinued in the area and in the last two or three decades at least has been completely unknown.

The reasons for this adoption in north-east Scotland are interesting. In the south and south-east there was a plentiful annual supply of labour but this did not apply further north, where the scarcity of labour also made manpower expensive. There was therefore a strong economic incentive to adopt the faster cutting scythe and the evidence suggests that its primary stronghold in the early part of the nineteenth century was north-east Scotland. This was the innovating centre for this particular tool, but even there its adoption was not a smoothly escalating process. Scything was said to have been tried about 1805 for two years, but failed, because the cradle attachment turned out to be unpopular. When taken up again after an interval of a few years, the common scythe for grass or clover hay was the one used and the cradle was abandoned. Instead only a small rod was attached between the blade and the handle in order to turn light

21. A. Murray op. cit. 125, 128—9.

22. Lord Kames (H. Home) *The Gentleman Farmer* 1776. 147; Lowe, A. and Bruce, A. *A General View of the Agriculture of Berwick* 1794. 45; J. Thomson *General View of the Agriculture of Fife* 1800. 129; R. Sommerville, *General View of the Agriculture of East Lothian* 1805. 71—2; R. Kerr, *General View of the Agriculture of Berwick* 1809. 225.

23. J. Headrick, *General View of the Agriculture of Angus* 1813. 315 — „stones and an unequal surface make it (the scythe) awkward“.

24. W. Leslie, *General View of the Agriculture — of Nairn and Moray* 1811. 154—5; G. S. Keith, *General View of the Agriculture of Aberdeenshire* 1811. 258; D. Souter, *General View of the Agriculture of Banff* 1812. 271, footnote; *New Statistical Account* 1845. XII. 174 (refers to 1810, parish of Fintry, Aberdeenshire).

crops more effectively over to one side. By the end of the second decade of the 1800s this scythe was well entrenched as the harvesting tool and the sickle was virtually displaced except in the higher lying, stonier areas²⁵. The scythe remained the basic tool for cutting grain until the 1870s when reapers began to be widely bought by the farmers on these relatively small sized holdings. From this centre of innovation the scythe with the Y-shaped sned spread south into Kincardine, and into Angus where its use tapered off gradually, and north and west into the crofting counties where its source of origin is well demonstrated by its name, the "Aberdeenshire slasher". In some of the smaller islands it was replacing the sickle only within the last few years. Some southward movement of the Y-shaped sned is still evident since it appears to be partly displacing a type of scythe with a shallow S-shaped sned (Fig. 2c) that came from England following the commercial production and distribution of scythes from about 1820—30. This English type is prevalent in the Scottish borders and in those parts of west Scotland that were subject to influence from southern Scotland.

THE SCYTHE AND ITS WORK TEAM

THE ADOPTION OF THE SCYTHE FOR REAPING GRAIN led to some fundamental changes in the work team. Men and women more or less reversed their original roles, for the scythe was a man's tool and now the women made the bands and gathered the grain. The size of the work group was reduced at the same time.

The size of the work team varied according to farm size. On a farm of moderate size the team might consist of two male scythers, two female gatherers, two people making bands, and a woman using the rake to gather up the loose straws. On a bigger farm, three scythers, three gatherers, three bandsters, and a raker who was male because of the extra effort involved, might be used, and so on²⁶.

A scythe could cut a swathe seven or eight feet (2—2.4 m) wide by 12—15 inches (30—38 cm) deep and in an eleven hour day, 2—2 1/2 acres of oats could be dealt with. For wheat, the amount was just over 1 acre and for barley just under 2²⁷.

According to different estimates, five workers with the scythe were equivalent to nine workers with sickles, or again nine scythers were equivalent to twelve people with sickles²⁸. In fact — and this has an important bearing on the retention of shearers with sickles in the southern parts of Scotland — the costs per

25. J. Farquharson, On Cutting Grain Crops with the Common Scythe as practised in Aberdeenshire, in *Transactions of the Highland and Agricultural Society of Scotland* 1835. X. 1864—7, 192—4, 197).

26. G. Robertson *Rural Recollections* 1829. 247; H. Stephens op. cit. 1844. III. 1050.

27. J. Farquharson op. cit. 1835. 188, 193; H. Stephens op. cit. 1844. III 1064; J. Allan, in *The Deeside Field* 1927. 32.

28. G. Robertson op. cit. 1829. 247.

head of mowing with the scythe could sometimes be greater because men got more pay than women. This of course did not matter on farms where the members of the family were the people who wielded the scythes but where staff had to be employed it had a degree of economic importance. The relative costs of using the sickle and the scythe have been worked out in detail by Henry Stephens in his *Book of the Farm*²⁹. He estimated that the cost of food and wages per head for shearers in the 1840s amounted to approximately 9s. 5 1/4 d. per acre, whereas scythers could be paid 5s. 2 1/2d. for oats, 6s. 3d. for barley or 7s. 9 3/4d. for wheat. There was clearly a distinct economic advantage in using the scythe. There were also indirect advantages because the scythe cut lower, so providing more straw for fodder, and permitted quicker harvesting, this including quicker drying in the sheaf because sheaves bound from scythe-cut straw

Fig. 3.

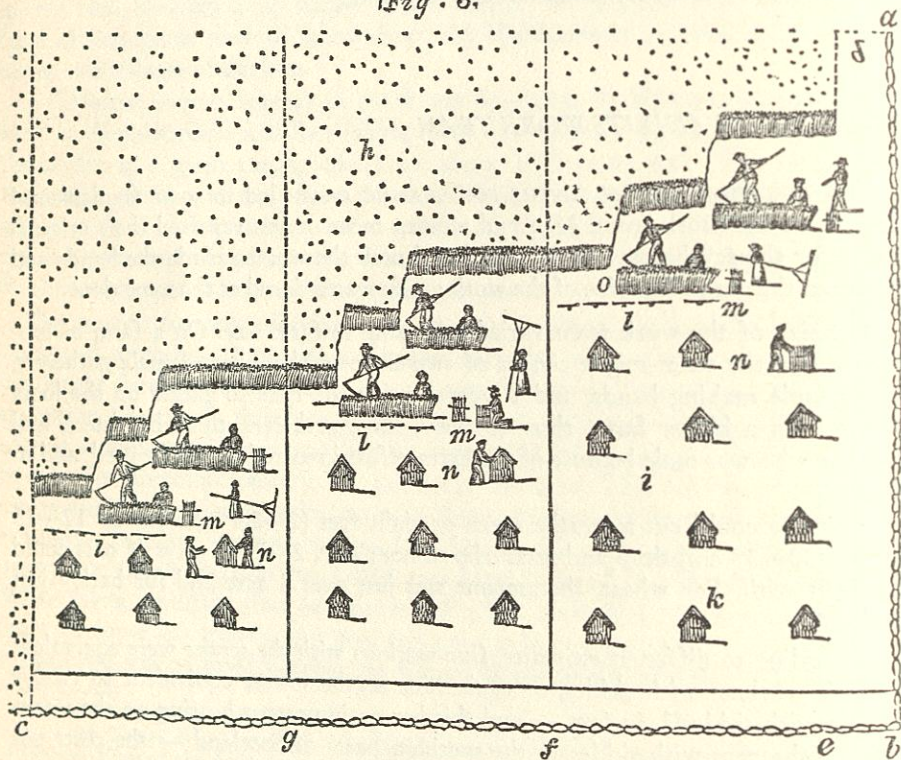


Figure 3. Cutting grain with scythes, across the ridges; with the work team. ab is the windward side; d is the space first opened up; ef, fg and gc are each spaces of 12 ridges of 15 feet (4.6 m.) width; h is the standing corn; i is the stubble; k the stooks (diagrammatic); lll are the bands laid ready for the sheaves; mmm are the sheaves ready to be bound up; nnn are the bandsters setting up the stooks; o is the corn in the swathe (from *The Quarterly Journal of Agriculture* 1834. IV. 364).

29. H. Stephens op. cit. 1844. III 1067—1069.

were not so tightly compressed as sheaves made from sickle-cut straw which was tightly squeezed in the shearer's hand before being passed over to the *bandster*. It is impossible to say, therefore, that it was entirely due to economics that the scythe was not adopted more widely and more quickly in the south of Scotland. Rather must it be due to the fact that farmers were unwilling to change or risk changing when they had a ready pool of seasonal labour, and furthermore, as far as this labour was concerned, since they often travelled for very long distances, it was impractical for them to carry the large ungainly and indeed dangerous scythes, whereas sickles were very easy to carry. There was certainly also a lack of desire to experiment when this valuable crop was at risk.

Thus the pattern of retention and adoption of the scythe is a very close indicator both of economic and of demographic conditions. There was also, of course, the factor of new techniques which again could not readily be altered when the labour supply was seasonal. The use of the smooth-bladed *scythe hook* had previously introduced a small scale innovation in the method of cutting with the sickle which was further developed and extended by the scythe. Both the *scythe hook* and the scythe cut across the ridge (Fig. 3) and it was not easily possible therefore to combine the cutting techniques of the older toothed sickle, which worked along the ridges, with the cutting techniques of either the scythe hook or the scythe, which cut across the ridges, in one field. It was easier to take the line of least resistance and conform to the customary method of the incoming seasonal labour supply on which the quick harvest of the crop depended. The scythe could cut costs, it could reduce the manpower requirements, but on farms with considerable acreages it could not so reduce these factors that its adoption became automatic and the real revolution in harvesting in south and east central Scotland came only with the spread of the horse-operated reaping machine after about 1850.

In the north-east of Scotland however the farms were on the average much smaller and the labour requirements were less, their financial turnover was small and they had to manage their harvesting requirements as far as possible on the basis of their own manpower resources or with the help of neighbours. On these largely family sized farms, the question of paying higher wages to a scythesman than to a reaper with a sickle was less relevant since the workers were frequently part of the family. At the same time as agricultural improvement led to heavier crops and increased cereal acreages, there was an increasing need for quicker working equipment to get the crop into safety. The scythe was the almost inevitable answer to the problem.

MACHINE REAPING

AS THE AGRICULTURAL REVOLUTION GOT INTO ITS STRIDE, the idea of a machine to reap the grain quickly was very much in the minds of the improvers. From as early as 1780 the Society of Arts of London was offering a premium for the

invention of such a machine. The first patent for the reaping machine was taken out in Britain in 1799, and in Scotland the Highland and Agricultural Society offered a prize in 1803³⁰.

It is significant of the conditions of agricultural improvement and the rate at which they were advancing in Scotland that a great deal of the early thinking that went into pioneering reaping machines of a practical nature was carried out in this country. The first Scot to win a prize for his machine was Gladstone of Castle Douglas in 1805 and he was followed by Smith of Deanston in 1812. Their reapers were pushed by horses from behind and had rotary blades surmounted by conical gathering drums³¹. Similar reapers with rotary blades were produced by Alexander Kerr of Edinburgh and by Mr Scott of Ormiston³². A little later, in Cumberland, Joseph Mann was also working on a reaper with a rotary blade, but instead of being circular, based on a series of rapidly revolving sickles, it was polygonal in construction and had twelve scythes, each of which was a separate readily replaceable blade³³. That the use of a rotary blade was a feasible idea is made quite certain by the fact that modern tractor-drawn equipment makes use of this idea but at this earlier period, before the ground surfaces had been smoothed and cleared of stones properly and as long as the ground was ploughed and cropped in a series of ridges and furrows, this particular form was relatively ineffective.

It has been said that the first great achievement of the nineteenth century was the invention of the reaper and for this a good deal of the credit must go to a young divinity student, Patrick Bell, the son of a farmer in the parish of Auchterhouse in Angus. He later became a minister. He evolved his reaping machine from first principles, although he had seen a picture of Smith of Deanston's machine. It is said that the sight of a pair of garden shears sticking in the hedge of his father's garden gave him the idea of mechanical scissors as a basis for the development of a reaper blade and this really gave the reaping machine the breakthrough that was needed. Bell did not himself take out a patent for his machine, which he saw as a means of relieving the burden of labour that the sickle and scythe annually imposed on the farmworkers.

Locally and indeed generally, his reaper was before its time. The course of agricultural improvements had not yet prepared farms or farmers for it. At the same time the cutting mechanism was relatively complicated and there was an absolute lack of supporting technical services for the repair and maintenance of the machine. It was long and difficult to manoeuvre, and farmers and farm workers had to learn by experience how to carry out the necessary adjustments to the machine as it went along. About a dozen people in east-central Scotland kept

30. *Report on Present State of Agriculture in Scotland* 1878. 153—4.

31. P. Graham, *General View of the Agriculture of Clademannan* 1814. 275—9; *Prize Essay of the Highland and Agricultural Society of Scotland* X, p. xi; H. Stephens, op. cit. 1844. III 1076; J. Slight, *Report on Reaping Machines in The North British Agriculturist* 1852. 18; *Report* op. cit. 1878. 154; G. E. Fussell *The Farmer's Tools: AD 1500—1900* 1952. 115—139.

32. *Report*, op. cit. 1878. 154.

33. H. Stephens, op. cit. 1844. III 1077—8.

on using Bell's machine after it had been produced, but it did not gain particularly wide favour. Some examples of it were exported to America, Australia, and even to Poland and by 1832 ten machines made by Bell or on the analogy of Bell's machine cut 400 acres in Scotland. Thus the main primary effect of Bell's machine as an innovation was felt only sporadically and in a very limited area of Scotland³⁴.

Meantime in America a young Virginian farmer, Cyrus McCormick, was experimenting with his own particular reaping machine which may or may not have owed something to Bell's prototype, and in 1831 it was put on public trial. It was patented in 1834. An example reached Austria in 1850 and another was shown at the Great International Exhibition in London in 1851. This was the real turning point. In addition to McCormick's reaper, another American make, the Hussey, was also shown at this exhibition, the latter being extremely simple in construction and completely lacking a reel to gather the grain back against the teeth, and also any form of delivery device.

What McCormick had been able to achieve was really an ingenious development and combination of existing principles. He brought together seven important features not previously combined in a single machine, but all used on subsequent harvesting machinery right up to the time when the combine harvester took over. These features, as has been pointed out by Svend Nielsen (in *Tools and Tillage* 1970. I:3.170) were as follows: (1) the knife that cut the grain by working to and fro; (2) the fingers that gripped the stalks during cutting; (3) the reel directing the grain onto the machine and controlling it during and just after cutting; (4) the platform where the cut grain was gathered; (5) the straw divider on the outside of the platform, separating the cut from the standing grain; (6) the driving wheel placed directly behind the horses and later the tractor, carrying most of the machine's weight and driving the knife, reel, etc.; (7) the offset draught, whereby the horses walked in front of the machine and at the side of the grain that was to be cut. It was a combination of these features that in the end allowed McCormick's reaper or reapers of his type to carry the day³⁵.

Bell's reaper had a small further extension of life since its two pioneering features, the revolving reel and the sloping endless belt which allowed the corn to be delivered to the land side were developed by Crosskill of Beverley in the north of England in the 1850s and 1860s. The higher cost and greater cumbersome-ness of this Bell-derived machine did not allow it to compete favourably, however, with the American types³⁶.

34. Watson & Hobbs *Great Farmers* 1951. 47—53; Drummond & Sons *Third Report of the Agricultural Museum* 1835; H. Stephens op. cit. 1844. III 1077; J. C. Morton *Cyclopedia of Agriculture* 1871. II. 746—7.

35. Report op. cit. 1878. 155—6; S. Nielsen, *The First Reaping Machines in Denmark*, in *Tools and Tillage* 1970. I/3. 170.

36. Watson & Hobbs, op. cit. 1951. 52—53; Morton, op. cit. 1871. II. 747; C. S. Orwin & E. H. Whetham, *History of British Agriculture 1846—1914*. 1964. 112.

Reaping machines spread only slowly in Scotland at first throughout the areas where there were big farms in south and east-central Scotland and only in the later part of the nineteenth century did they begin to spread to any great extent in the family sized farm areas of the north-east and south-west. The commercial reaper that had most initial influence was the American Hussey which was extremely popular in the north of England and southern Scotland³⁷. The reason for this is interesting. It provided little more than the bare essentials of a cutting blade and because the cut swathe lay in the path of the machine's next run it required a relatively large amount of manpower and effort to keep the field clear for quick progress. As a result it was a suitable machine for areas where seasonal manpower availability had not decreased too seriously.

The actual details of the spread of the reaping machine in Scotland as a whole remain to be plotted from newspapers, farm diaries, local accounts and so on, but this is a study of a very different kind from that of the sickle and scythe. The story of the reaping-machine, and later the binder and combine-harvester, is one of invention by named experimenters followed by diffusion, whereas the regional developments that took place in sickles and scythes and their technique of use belong much more to the field of endogenous, anonymous development.

THE SCOTTISH SITUATION MAY BE SUMMED UP AS FOLLOWS:

1. THE SICKLE AS A TOOL FOR HARVESTING THE CROP remained in extensive use until well through the nineteenth century especially in the primary arable districts of Scotland and survived in many parts of the Highlands and Islands almost till the present day. In south-Scotland the manpower situation had a retardation effect; elsewhere this was due to geographical factors. In both situations it may be possible to speak of a kind of negative endogenous development.
2. The scythe does not have the character of an innovating tool, since it was not taken over from another cultural system and cannot be dissociated from its traditional function except in relation to the nature of the crop it cut. Its adoption for cutting grain crops was a purely endogenous development. It can be studied as a very sensitive indicator of local conditions.
3. In the south and south-east the change over when it came was effectively from the sickle to the reaper rather than from the sickle to the scythe and then to the reaper, although the scythe hook played a small intermediary part. In the north-east and other parts of the country the change was much more gradual, from sickle to scythe and eventually to reaper where conditions permitted such progress to be made.
4. It is only with the reaping-machine that questions of invention, innovation and diffusion really come into play.

37. Morton op. cit. 1871. II. 743—5, 746—7; *The Journal of Agriculture* July 1855.

In the foregoing study, an attempt was made to look at a concrete example from first principles, to see what it had to say for itself on the general problems of innovation. It soon became apparent that the problems raised in this field were not simple, but exceedingly complicated. They had to do not with single occurrences, but with a whole series of phenomena, an amalgam of development and retardation factors due to local geographical and economic factors, that lie close to the roots of historical ethnology. The concept of endogenous development, in particular, comes clearly into view as one that is basic to the subject studied.