Centre for Agricultural Strategy

Food production and our rural environment – The way ahead

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5 Lower Input Systems: their effects on the Environment

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Much of the population of Europe in the years immediately following the Second World War were close to starvation; in Britain food rationing continued until 1952. The wide concensus that this must never happen again led every country in Europe to adopt an active policy to increase food output, through systems of farm restructuring and price support, backed up by major expansion of the research and advisory services. As a result much of European agriculture has been transformed from a largely craft industry to a highly intensive technology-based industry.

Yet agriculture in Britain – as in much of the rest of Europe – is now increasingly subject to a series of pressures which, although often apparently conflicting, seek some overall reduction in the intensity of agricultural production. The most immediate of these pressures results from the too successful adoption of new technology. This has lead to overproduction 'surpluses' of key commodities such as cereals and dairy products, which, because they are being produced at well above 'world' prices,* have created unacceptable budget costs. This has happened both within the European Economic Community, and in non-member countries such as Sweden and Austria, and has led to the progressive introduction of a range of measures, including price cuts and production quotas, such as that applied to milk output last April, aimed at limiting food production.

*An imprecise concept, for only a small part of total world food production is traded internationally; but, for example, New Zealand *does* produce butter and lamb more cheaply than the UK.

Thus farmers throughout Europe must now examine the costs and intensity of their production systems more critically than was necessary when support was more open-ended.

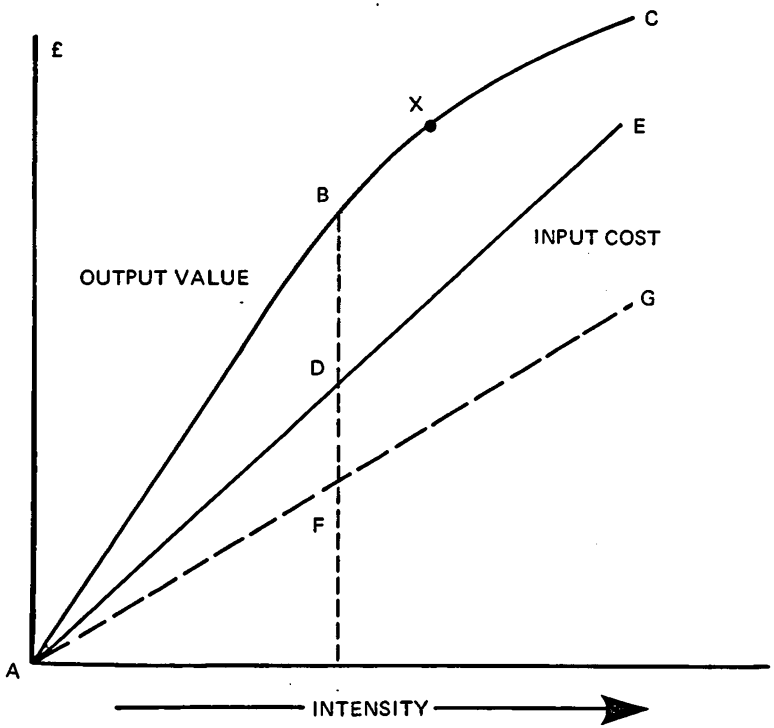
There has also been increasing public concern at what have been considered the undesirable consequences of intensive agricultural production, a concern with only limited effect as long as over-riding importance was given to food security. It is the coincidence of wider recognition that some intensive farming practices *are* damaging the environment with the new questioning of the need for further increase in food production that has stimulated the present debate. The risk, as the Conference brochure warns, is that this debate will polarise and divide; surprisingly though, the brochure also appears to question 'the assumption . . . that a compromise must be reached'. In my view there must be compromise, no matter how abused that word has become, seeking practical ways in which sufficient food of high quality can be produced at reasonable cost without further damaging the environment; ensuring ready access to the countryside for the increasing leisure pursuits of the 97% of our population who do not work on the land; yet at the same time ensuring adequate incomes and living conditions for the farmers and farm workers who will continue to underpin a dynamic rural society and infrastructure. The problem arises in the relative weightings to be given to 'sufficient', 'reasonable', 'ready' and 'adequate' within the above objectives – accepting, as do both Eric Carter and myself, that such weightings will not be uniform across the countryside. On much of our better land, active support should well continue for intensive agriculture, though with more attention than at present to the optimum use of inputs, because this will represent an efficient use of national resources. In contrast on more marginal, and probably less responsive, land much greater attention will have to be given to economy in inputs – even at the cost of some loss of output – coupled with measures to enhance their potential for tourism and recreation, which will provide an increasing part of 'farm' incomes in these areas.

The need to reduce inputs

Overall however the need to reduce inputs will assume greater importance, and, striving for still higher output rather less importance, than previously. This argument is summarised, and probably over-simplified, in Figure 1. As farm output becomes more intensive, output increases. More importantly, over a wide range of intensities the value of output, AB, rises faster than the cost of the inputs needed, AD; thus the Gross Margin, BD, increases with increasing intensity. If *unit* output price falls the farmer's intitial response is to maintain his margin BD by further intensifying so as to produce more units of output.

This response is clearly illustrated in the performance of the UK dairy

Figure 1
The relation of output value to input costs at different levels of intensity of agricultural production.



industry, which since 1976 has increased its output by 20% despite a 20% fall in the 'real' price received for milk, and by cereal growers, who have doubled wheat production even though the price of wheat has fallen by 26%.

Clearly however there must be a level of price reduction that will persuade enough farmers to cease production, or to farm less intensively, that total output does fall. But in the case of milk it was concluded that this would operate too slowly to ensure the required check to production in the EEC, hence the introduction of milk quotas (already operating, incidentally, in Switzerland, Finland and Austria). Quotas forclose the existing option of increasing milk output so as to offset lower unit returns; to maintain incomes it is now necessary

to produce the permitted quota, B, by using only inputs F, rather than the present D, by adopting a new lower-input production strategy AFG.

Cereal quotas present greater problems, if only because cereals are easier to move between farms. Thus present policy to restrain cereal production depends on price cuts, coupled with stricter Intervention standards. The effect of this must be to reduce the level of production intensity at which output value begins to rise more slowly than input costs and there is a diminishing return to further intensity (point X in Figure 1). So far there is little evidence that this point has been reached in UK farming; the most widely-quoted is that reported by ADAS at Wheat '83, which indicated a reduced Gross Margin from wheat grown at the highest level of inputs (Table 1). The medium level is close to that already used on many farms (Anon, 1983); if the level of price support is progressively reduced, with no corresponding fall in unit input prices, diminishing returns could become more evident. If production is to remain profitable the amount of inputs must then be reduced.

Table 1
The gross margins from winter wheat grown at three different levels of input

Level of input

Input	Yield tonnes/ha	Variable Cost £/ha	Gross Margins* £/ha
High	9.23	325	874
Medium	8.90	198	920
Low	8.03	148	816

*These figures differ from those given at Wheat '83, as they include differential wheat prices according to protein level, which were higher at the higher levels of input.

Source: Data from Wheat '83, report in ADAS (1984)

Not all authorities would of course agree with this conclusion, which would reverse the whole thrust towards greater intensity and output of post-war agriculture. Thus in recent reports the NFU (1984) has been more cautious about the need to reduce inputs to agriculture than the CLA (1984) – reflecting in part a concern that this could lead to a big fall in farm output. The argument underlying Figure 1 is that this need not happen; the problem is that we lack adequate firm evidence that inputs can be reduced without a proportionate fall in output, and if so how this can be done in practice.

The scope for lower inputs

We lack this information because both research and practice have given so much greater priority to increasing farm output than to seeking economy in inputs; certainly there has been no comprehensive study of lower-input systems (towards AFG in Figure 1) comparable to that applied to the Laloux and Schleswig-Holstein wheat systems, or to the 'blueprints' for intensive potato production. However relevant information from a range of sources (Raymond, 1984) is summarised in the following paragraphs.

Cultivations:

The paraquat herbicides allow direct drilling on many soils, giving considerable savings compared with conventional cultivations; on soils where this leads to soil compaction costs can also be reduced by using rotary cultivators and low-ground-pressure tractors (Patterson, 1982). Against this, however, must be set the likely increase in cultivation costs as straw-burning is progressively restricted; more research on alternative uses for straw, both on-farm and off-farm is urgently needed.

Fertilisers:

These are a major input cost; they also contribute greatly to the yield of both crops and grassland and it has thus been suggested that a tax on fertilizers would be a way of cutting farm output. However, as England (1984) has calculated, doubling the price of N fertiliser would lead farmers to apply only about 10% less N to winter wheat, with yield falling by only 2%, although the profit from growing the crop would fall sharply. But this conclusion was based on present regimes of fertiliser application; more research on the optimum timing of N application coupled with improved soil analysis and meteorological data, offers scope for significant reduction in rate of N use without a corresponding reduction in yield and profitability. Much better use could also be made in crop production of the nutrients in animal manures.

Pesticides:

There is increasing pressure on farming to reduce the amounts of pesticides used, both because of their cost and because of the environmental risks they pose. Thus much greater attention needs to be given to exploiting integrated pest management (IPM), which seeks to reduce pesticide use by combining 'resistant' crop varieties and wider crop rotations to spread the risk of pest attack with better pest monitoring and warning systems to permit the tactical, rather than the present routine use of pesticides. Leaving headland strips unsprayed, as in the current Game Conservancy trials, should also protect headland flora and

fauna and save pesticide. There is also potential for saving through improved methods of pesticide application – with present methods of spraying as much as 80% of the chemical used may miss the target (Matthews, 1982a). Thus priority must be given to the further development of methods such as controlled-droplet application and electrostatic spraying, which could greatly reduce the amounts of chemicals that need to be applied for effective pest control.

Grassland:
Surveys have shown that on most grassland farms more fertiliser Nitrogen could profitably be used to allow reduction in the amounts of cereals and concentrates now being fed to livestock. More importantly however on most farms there is also considerable scope for using the grass already being grown more efficiently, by grazing it more intensively and by reducing the losses when it is conserved as hay or silage. Only when this has been done will the use of more fertiliser to grow more grass be fully justified. Undoubtedly, though many farmers are dissuaded from more reliance on grass because of its unreliable production, which can vary by nearly two-to-one between years because of differences in rainfall. Thus if future livestock production is to be more securely based on grass there must be a strong case for more grassland to be irrigated – for water should be an effectively unlimited resource in the UK (ACAH, 1979).

Livestock production:
The livestock sector in UK farming has suffered a greater fall in profitability than arable farming since 1976, and now has less margin to withstand new economic pressure; also, as well as problems such as the introduction of milk quotas, both the milk and the meat sectors are now likely to have to adjust to a fall in consumer demand for animal fats, following the recommendations in the recent COMA report (1984). Further economy in production costs will thus be essential, including more grass and less concentrate feeds in milk and beef production. Beef and sheep breeds and crosses must be selected to give leaner carcasses, and possibly larger carcasses if the meat industry will accept new cutting techniques such as those being developed by MLC; more animals should also be kept as entire males, which grow faster and convert their feed better than castrates, yet give leaner carcasses. The main trend with the non-ruminant animals, pigs and poultry, has been toward concentration into larger intensively managed units. However these are being challenged on welfare grounds, and critical study of alternative, less intensive, systems is urgently needed. Already MLC data (1984) indicate that outdoor rearing of sows can compete with intensive housing (the much-criticised sow-stalls) because, while more food and labour are needed the costs of buildings and heating are reduced. Outdoor

rearing could also provide a useful 'break' crop on lighter land, on which cereal growing could become less profitable.

Machinery and buildings:
Investment in buildings and equipment has been actively encouraged by high investment allowances and grants; these have greatly reduced farm labour costs per hectare but Murphy (1983) has concluded that in many cases they may have raised the costs of food production. Following changes in the 1984 budget, investment is now less attractive, and there could be some reduction in the rate of expenditure in particular on machinery replacement.

This will demand more attention to repair and maintenance. Manby (1984) has also reviewed the considerable scope for operating equipment more efficiently. Thus up to 40% of the fuel used by farm tractors can be saved by operating in optimum gear and at close to maximum power; fuel can be saved in crop drying and glasshouse heating by more precise temperature control; sprayer efficiency can be improved by proper maintenance and operation. More attention is also being given to power economy in equipment design; thus new cutting mechanisms in forage harvesters should use much less power than present designs.

Lower inputs and the environment.
It is generally accepted that, if some check is to be applied to the output from agriculture, this will require some reduction in the level and intensity of the inputs used. It is also generally assumed that this is likely to benefit the rural environment. But this may not necessarily be the case.

Firstly, while there may be an overall reduction in the intensity of production, this may not occur uniformly across the country. Thus on some better land (Grades 1 and 2) production could become more intensive because there is room for further economic response to still higher inputs and increased sophistication. This could be matched by a disproportionate fall in output from poorer grades of land which are likely to be less responsive to inputs. This scenario could lead simultaneously to an extension on better land of practices considered to be environmentally damaging (removal of hedges to enlarge fields; higher levels of fertiliser and pesticide use; more indoor housing of livestock) and on more marginal land to an only partly-farmed countryside and an increasingly derelict landscape. To produce the required amount of food (the 'quota' if you like), UK agriculture might thus develop into two environmentally undesirable sectors.

To prevent this it may be necessary to place some restriction on the extent of further intensification on better land, coupled with measures to ensure that marginal land continues to be farmed, though possibly at a reduced output level and with more emphasis placed on landscape conservation — as envisaged

in the Countryside Commission's uplands report (1983), and the system of revised livestock headage payments proposed by Potter (1984).

Secondly lower inputs themselves may not necessarily be beneficial. Certainly less pesticides should be used if IPM is skillfully applied, and development of new uses for straw could reduce damage from straw burning. On the other hand more intensive grazing of grassland could reduce biological diversity, particularly on the permanent pastures which are still a distinctive feature of much Grades 3 and 4 land; there could be greater dominance of ryegrass in swards. Also, although use of more N on grassland could cut net feed costs by reducing the amounts of concentrates needed it could add to the longer-term problem of nitrate in water supplies.

The main concern though must be when cutting costs leads to the risk of 'cutting corners'; when lower-input farming means careless farming. Examples would be the use of wide-spectrum chemicals because they are cheaper than more selective and potentially less damaging agents; adopting less controlled but cheaper methods of spraying; erecting sub-standard buildings and cutting down on repair and maintenance of existing buildings; dilapidation of walls and fences. Even changes adopted to improve animal welfare (often linked with environmental objectives) may be damaging; the current proliferation of pig arks does little to enhance the landscape of the chalk downlands.

The farm workforce and the environment.

The previous sections have examined ways of reducing physical inputs to agriculture. It is evident though that the input most likely to be cut is that of farm labour. This can of course be seen merely as a continuation of the post-war policy of reducing the number of farmers and farm workers, both to share the income to agriculture among fewer people so as to improve individual incomes, and to release labour 'for productive employment in industry and commerce'. Jobs are no longer readily available for labour released from agriculture. Yet shedding labour is seen as the most ready response to the renewed economic pressure on farming typified by the introduction of milk quotas; one man's wages will buy a lot of herbicide.

But a further reduction in the farm workforce must make it increasingly difficult for farms to adopt other ways of reducing their inputs – integrated pest management; better straw handling and use of animal manures; less wastage in grass conservation, and better maintenance and operation of equipment. These are likely to need more rather than less labour; they will certainly need more skilled labour.

Less farm labour could also lead to the 'cutting corners', already noted – less care in the application of sprays and fertilisers; less individual attention to

animal welfare; neglect of maintenance of buildings and walls; poorer management of hedges and woodlands. All these risk damage to the environment.

Fewer farmers and workers would also further speed the changes already taking place in the social environment of the countryside. The impact of the New Villagers (Walston, 1984) can be exaggerated; but as more of those who live in the countryside have no direct involvement with agriculture, they could seek to place restraints on farming practice which, by making farming less profitable, could in fact damage the environment they seek to preserve. On more marginal land this could precipitate a return to the derelict rural landscapes of the 1930's agricultural depression; this is not what most of those who live in the country seek.

Concern for the *total* rural environment, rather than the need to produce more food thus underlies the discussion, at both Community and national levels, of ways of avoiding further reduction in the farm workforce. We know that close to present levels of food output could be produced by fewer farmers and workers farming our better land more intensively; but this would effectively mean ceasing farming on much of our marginal land. If the consequences, both environmental and social, are considered to be unacceptable, then an alternative strategy may be needed, in which the required amount of food production would come from a slightly less intensive management of our better land, coupled with support for farming on more marginal land aimed at conservation rather than food production. This policy would require more farm labour; in this it would be counter to policy in all other sectors of the national economy, in which saving labour remains a priority objective. It must thus be explicitly justified as seeking to ensure conservation of natural diversity and of the landscape and amenity values of the countryside.

This paper has examined ways in which the cost of inputs to agriculture might be reduced, without a proportionate reduction in output, as a response to the new economic pressures on the industry. On many farms the first 'input' that is likely to be cut is that of farm labour; it is argued that this must make adoption of other ways of reducing inputs more difficult, and that it could also have undesirable consequences, both social and environmental, in the countryside. It is concluded that priority must be given to reducing the physical rather than the labour inputs to agriculture.

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