PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B BIOLOGICAL SCIENCES

Closing Remarks

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Closing remarks

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In this meeting for Discussion we have had an authoritative and wide-ranging survey of the prospects for agriculture in the middle term. We have limited ourselves to a period over which the major trends can be assessed with some confidence. Attention has been given particularly to the agriculture of the developed countries, as was the intention of the organizers. The result has been a discussion of extraordinary interest and of real significance for planning at the farm level, in the research field, and in Government policy.

We have been concerned with potential rather than with laying down lines to follow, and in conclusion I want to make an assessment of some of the options open to us, rather than a forecast of probable events.

1. The world food balance

Dr Boerma, in his masterly review of the world situation, reminded us that agricultural production is a world-wide enterprise, and we in this country make our contribution in a world context. World production has to meet two needs, first a balance between the relatively constant demand per head and the variable yield per unit area resulting from seasonal variation, and secondly a steady increase over time so long as population increase continues. The increase is the easier of the two problems to solve, and our success is measured by the size of the population increase we have met and provided for. The balance is very much more difficult. It cannot be too strongly emphasized that surfeit and shortage are equally serious agricultural problems. The whole trend of Professor Ashton's paper was that we need to plan to avoid surfeit. The greater part of the world's food planning, with which Dr Boerma is concerned, is directed to avoiding shortages. Even in western countries, the precarious nature of the world's food situation is reflected at the present time in rapidly rising food prices.

The margin between surfeit and shortage is narrow, and the world situation can change in a season. Adjustment to maintain a long-term balance, on the other hand, takes a long time to achieve. We want more beef, and the price goes up. The proper response to this is to forecast whether the increased demand will persist for three years, and if it is likely so to do, to withdraw females from the beef market now to breed stock to meet the demand three years hence. So planning for the future not only does not help in the short run; it actually aggravates the current situation.

Short-term climatic fluctuations can only be met by transport, redistributing food supplies from areas of abundance to areas of shortage; and by storage, the maintenance of stocks in excess of what is required to carry over from one season to the next. We have never yet accepted the need for massive storage, but it must come. Some years ago, the American cereal surplus grew to such a size as to jeopardize the whole United States' agricultural policy. Two years' bad harvests in the north temperate zone, and it melted away like snow in summer. I believe that for the security of the vast populations of today we need a reserve of that size, and countries

such as ours, which have grown to believe that we can always buy what we want somewhere, ought in our own interests and as part of the obligation of a rich country to its poor neighbours, to carry a substantial load of cereals in store against adverse seasons.

2. The men in the agricultural industry

The representative of the National Union of Agricultural Workers remarked that we have had no address on labour relations. We have, however, had references to the men engaged in agriculture in almost every paper. It is a sign of the times that all the references we have had have been in the context of reducing the size of the human resource in the industry, whether it be in terms of reducing the number of small farms or of saving labour by capital intensification. The case for so doing is always strongly made, but let us remember that as spokesmen for agriculture we are a heavily biased sample. Our small farmers are at home doing the milking and getting in the sugar beet. They, and the farm worker, do not attend conferences in the apartments of the Royal Society. From my own contacts I am satisfied that if they were here we should listen to a very different interpretation of the trends in farm size and the worth and viability of the small farm.

Be that as it may, the deliberations of those of us who are here give rise to serious questioning of the trends in which we are involved. All of Professor Ashton's examples of rapid structural change are in fact examples of rapid shedding of labour. Where do they go? Who wants them? I am not concerned about the individual who goes out of farming in his thirties. He is well-trained and versatile and he is unlikely to find a place in an unemployment queue. But I remember the advice of Australian agricultural economists – 'get big or get out'. Until we tell the small man in his fifties where to get out to, he is not going to listen to us. And those of us with experience in the Third World cannot but view with concern this almost unthinking acceptance of a reduction of the human resources in the industry as a good and necessary thing. We tell the Third World to use to the full their abundant resource, which is labour, and go carefully on the one that is limiting, which is capital. Capital may not be limiting in Britain, but as Mr Jenkins reminded us, it is very expensive. His concept of efficient management ensuring effective participation of labour in the proper use of mechanization was well made.

I believe that labour saving has become a habit, and that in present circumstances it is a bad one. It must be said, however, that a great deal of the loss of labour from agriculture has been the result of the attraction of urban conditions in contrast to the comparative isolation and austerity of the rural areas. For the farmer, especially the large farmers, there are rewards and benefits that are not to be measured in economic terms. Hence, while there is a continuing drain of labour from the land, the demand for land to farm remains unsatisfied. These considerations, and a thoughtful appraisal of their probable effects in the next two decades, were set out by Lord Walston. His sensitive account of farming structure in Britain was the more valuable for his inclusion in it of reference to the demand for conservation, amenity, and access for the town dweller to the countryside.

3. Power on the farm

This leads on to power on the farm, discussed by Dr Lindvall and Professor O'Callaghan. Dr Lindvall was concerned with the relation between manpower and machine power. In the advanced countries tractors and equipment get larger. They must do if there is to be any further

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saving in labour. But on the one hand the bigger the equipment, the greater is the damage to soil structure, and on the other, large equipment is only effective on large farms. Professor O'Callaghan pointed out that we do have an option in this respect. Labour saving can be gained by increasing speed of operation instead of increasing size of machine. Doubtless the problems of providing stability and comfort in machines moving fast over rough ground have influenced manufacturers in choosing size rather than speed.

Professor Moss reminded us that agricultural engineers build equipment to meet demand, and if the demand is for the big, labour-saving tractors and implements, this is what will be produced. I remember a study, some years ago, of the tractor market. It appeared that in general, new tractors were bought by large farmers in eastern England. A progressive depreciation policy, aided by the taxation system, resulted in these tractors going into the second-hand market in good condition, and over the years moving onto smaller farms, thus enabling small farmers to reap the benefits of advanced mechanization at second hand. But the demand the manufacturer met was the demand of the big farmer. The small farmer takes what he disposes of. That this is not the only demand is evidenced by the price that can be realized for old small tractors, long since written off the books but still useful for small jobs and for small farms.

As Dr Lindvall pointed out, mechanization is to be expected in the Third World. It will go on slowly, partly because of the limited capital resources available, but substantially because there is not alternative employment for the agricultural labour force. In the United States in 1972, according to Dr Lindvall, the off-farm earnings of farmers exceeded their farm earnings. In the Third World, all too often the alternative to subsistence on the farm is destitution in the shanty town margins of a tropical city. In such circumstances mechanization is socially disadvantageous.

One needs to distinguish, in this as in so many other market situations, what is good for an industry or for a community from what is good for the individual who in fact makes the decisions. Indeed, in a perfect agricultural world it would often be profitable to use a pair of horses. One would thereby avoid using a heavy tool to bust up the soil pounded down by the previous passage of that same heavy tractor. In this respect, it is relevant to note the emphasis by several speakers on the importance of the involvement of the men who do the job in the determination of the extent and nature of mechanization. It is probably true that with the small working teams in agriculture, communication and consultation is better than in most industries, but in such matters as tractor cab design and the choice of tools to handle dirty and unpleasant jobs, the views of the men who operate the equipment are of great importance.

4. Increasing productivity

Professor Donald made the point that efficiency of production is not an intrinsic quality of an animal – or a plant – population. Efficiency is judged by response to criteria set by man in the context of the offtake of a surplus by man. Thus in the pursuit of efficiency, man-made controls have been established on crop and livestock performance, on the diseases and pests to which they are subject, and on post-harvest and post-slaughter wastage. Professor Ivins's discussion of the extent to which total photosynthesis per unit area and the partition of assimilates can be altered to man's advantage sets out the extent to which there are still unrealized potentials, even in intensive cropping systems. Likewise Dr Edson's account of the chemical control of wastage from pests and diseases applies particularly to advanced agricultural systems.

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Plant breeding has a contribution to make at all levels of productivity, and Dr Simmonds has pointed to the breeders' increased interest in disease resistance and in quality, two characters as important in low as in high fertility farming systems.

On livestock, Dr Wilson was concerned with further intensification of livestock management, an intensification that must depend on the production of feed from arable agriculture rather than from grass. As Professor Bowman put it, Dr Wilson was talking about animals eating, or being persuaded to eat, what we can eat. We ought to be devoting more attention to livestock systems dependent on what we cannot eat, and on land that we cannot otherwise use. In this respect Dr Paterson maintained a balance. His masterly account of the position and prospects of control of animal disease, was concerned with the improvement of low input, grazing based, as well as with intensive arable based systems of production.

Low input systems are of great importance, and can be efficient in their own way. In the countries with which Dr Boerma is particularly concerned, there are vast areas where efficiency means the ability to realize a small, but fairly stable, offtake from land of low productive potential. Even in this country there are large areas where this kind of efficiency is important. It can be improved, and we have heard of the rising efficiency of production at Redesdale Experimental Husbandry Farm. But it is not the kind of plant and animal efficiency that Professor Ivins and Dr Wilson have been talking about. Nor do I think that their kind of efficiency is going to be the most important pattern in the 1980s. Dr Preuschen pointed out that intensive mechanization is expensive. It is only remunerative if it leads to very high productivity, and if it leads to very high productivity we saddle ourselves with surplus.

In food above all things, enough is enough, and in our search for efficient production we need to pay a great deal of attention to gearing productivity to the estimated demand for food, and to the other demands that are increasingly being made of agriculture. In that framework we must decide what pattern of efficiency we should aim for. The chicken comes top of the class and the sheep bottom on Dr Wilson's examination. But the revulsion against intensive methods of production may well affect poultry management in the 1980s, and in the utilization of high, wet, and remote areas, to be managed for amenity and recreation as well as production, the sheep is top.

5. Climate and soil

We cannot cover the whole range of agriculture in two days, and of the resources we have not discussed, climate and soil are the most important. And they do determine to a very large extent the limits to what we can do. Climate I have referred to in that its vagaries determine the need for storage. It also determines the limits to our cropping patterns. Much of the 'green revolution' literature of today refers to multiple cropping, as if the breeding of a short-term crop automatically opened up the prospect of introducing a second or even a third crop. It may do, but more often it will simply minimize the risks attached to the main crop by getting it off before drought or cold make further productive growth impossible.

Soil is the long-suffering Cinderella of the agricultural world. All we have done in these two days is to make passing reference to the damage heavy machinery can do to it, comfortable in the assumption that if we knock it about badly, we can give it a further knocking about, and it will recover. In this country our soils are sufficiently robust for us very often to get away with it. But not all soils are. In Uganda we did in 10 years more damage to our soil by a modest programme of intensification than has been suffered by the alluvium of the Punjab under three millenia of intensive farming.

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Two achievements are to our credit in soils, the overall raising of fertility levels that has gone on in the past half century and the increased depth of soil that has come from powered ploughing. I am not enamoured of minimum cultivations because I have seen the soil of England deepened by as much as 10 cm in my lifetime. With the added root room gained thereby, I have seen my brother escape the effects of drought in rainfall régimes that would have brought ruin to my father's crops on the same land.

We do not really understand why. The plant breeder exploits the higher fertility, and gets the credit for it. He can launch out into genetic studies and he can recruit the best students because his subject has become a prestige discipline. But the soil scientist, surveying the world's most variable resource, and providing the basis for the plant breeder's success, gains neither the prestige nor the support to develop his understanding of the soil in any way adequate to its importance.

An understanding of the interaction of climate and soil is of particular importance for the next advance in agricultural productivity. Climate is beyond our control, but the management of soil and crop variety to conform to climatic limitations is the essence of husbandry. With the control of fertility now open to us, husbandry has entered a new era. Indeed, one of the most exciting prospects in agriculture today is that of integrating fertility level and crop duration with the management of monsoon water to create a high production agriculture on the rainfed lands of the Indian sub-continent.

6. Substitute foods

Professor Moss has discussed adaptation versus innovation in agricultural engineering. Adaptation is the continuation and improvement of present trends, and in this sense embraces most of what we have been discussing. The establishment of new trends involves innovation, and Professor Holmes's account of substitute foods holds the prospect of a whole series of innovations. These foods are significant particularly in terms of the opportunities they offer of improving the diet of the underprivileged. They are particularly relevant to the circumstances of the underprivileged in western societies, since they almost always involve industrial processes of considerable sophistication.

7. Opportunity and responsibility

In discussing agriculture in the 1980s we have naturally, and inevitably, projected our experience into the future. More than once speakers have made the explicit qualification, 'if present trends continue . . .'. They are likely to continue, if only because, as other speakers have said, 'we do as our masters tell us'. The opportunities that lie in the continuation of present trends have been extensively explored. We have devoted less time and thought to consideration of whether our progress could profitably be redirected.

Dr Hagberg has reminded us that we cannot wait for our goals to be defined for us. Ours must always be a long-term view, and in a society dominated by short-term considerations, the responsibility for long-term thinking and planning lies with those of us who are concerned with research and development. We need not be unduly discouraged by the evident fact that most of us, most of the time, have to do as our masters tell us. Those who made this point are among those best able to put the right instructions into their masters' mouths. It is our responsibility to define our goals, and in general the community as a whole is content that it should be so.

The greatest, and indeed the vital, resource in agriculture is the people in it. The exodus

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of the past two centuries was almost unforseen and quite unplanned. We have now reached a point in this country where the continuing loss means dissatisfaction with the rewards in agriculture rather than the attraction of a better use of talent in other sectors of the economy. The urban sector has little need of more people from the countryside. This is abundantly clear in the Third World, and is becoming apparent in our own community. So in determining our goals we must give a high priority to devising an economical, well-serviced, good life for the people in the basic human industry, the production of food. This will call for innovation, for the planning of a system in which capital is invested, not to supplant the men in the industry, but to serve them. Mr Jenkins, with the farmer's grasp of the interrelation of management, labour and capital, set the matter in the context of the farming system. On large farms as well as small, it is the people involved who determine both the economic efficiency and the social worth of the enterprise.

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