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THE COMPREHENSIVE FARMING SURVEY

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THE WRITER'S outlook and opinions are naturally coloured by his experience. Unfortunately except for a brief interlude on arable farmland—a sort of sugar beet pastorale—he has been mostly concerned with animals. His several interests in the last few years have been human dietetics, methods of beef production in England, the efficiency of pig production in Europe including the United Kingdom, and the Empire possibilities of what in England is known as grass cake, whilst at the present time he is engaged on an economic survey of animal husbandry in the British Empire. If his instances, arguments and analogies seem to depend too much on animal industry, the reader is asked, therefore, to complete or destroy the picture with cases drawn from wider fields —from crop husbandry and pure economics. On the other hand in his drift from dietetics to agricultural economics the writer has dwelt temporarily in several more or less isolated camps and this wandering has, he believes, enabled him to see agricultural research as a cross section rather than as the single cell on which, if he had been a specialist, his attention might have been concentrated.

The bee hive has a good organisation and what appears to us to be a mediocre ideal; agricultural research as a world force has a mediocre organisation but a great ideal. The latter is but one hive in a gigantic apiary, yet it is a hive with a great purpose and, rightly used, of enormous leavening power to the rural population of the world, that is, to about two-thirds of humanity. Nevertheless, the writer contends, it lacks coordination and, in particular, horizontal organisation. Correct these faults and agricultural research would more than double its efficiency and utility; it would square it.

So much by way of preamble. Now let us examine the matter in greater detail but on a scale that will allow us to survey our subject as a whole. First, let us define our ideal; second, pass rapidly over the present system and its organisation; third, put forward our suggestions for improvement; fourth, examine the advantages and disadvantages of our proposals; and lastly, define our conclusions.

IDEAL SYSTEM

Our ideal is our problem. How to increase the purchasing power of the rural population? In a perfect state how should we attack it? First, the writer suggests, by surveying farming as a whole and attempting to measure the economic significance of each factor that limits rural prosperity. Second, having ascertained the absolute and relative weight of each problem, to hand it over to the specialist investigator. Third, when the specialist supplies the answer from his laboratory, to find out how his solution will merge into the farming fabric to determine whether the cure is economically worse than the disease. Fourth, to hand the answer over to the farmer and see that he adopts it. This last step, as we all know, is the most difficult of all.

Thus, we want a coordinated, cooperative research machine that measures the problems, solves them and weaves the solution into farming practice. The motto of agricultural research should be: "Veni, Vidi, Vici"—I came, I saw, I conquered. I came on the land; I saw, the problems and the man who fought them; I conquered, not only the problems, but, by winning his confidence, the innate caution of the farmer himself.

CRITICISM OF THE PRESENT SYSTEM

Our main criticism of agricultural research is that its organisation has a vertical instead of a horizontal bias. Vertical organisation may be easy of administration but, as in industry, it is not synonymous with efficiency. Take practically any agricultural research institute. There will be an economic department carrying out, say, farm management surveys and one or two special investigations. There will be a number of field workers collecting information from and advising farmers on crops and stock. They will be badly handicapped, however, by lack of quantitative data with which to substantiate their arguments or to compare one farmer's methods with another. There will be a number of laboratory workers probing a host of problems of more or less practical significance.

Each department will have its own head and there will be a director or professor or president in charge of the whole. A typical vertical organisation. True, some of the workers will be working in consultation and may even cooperate for given pieces

of work, or may be in more or less close contact with other workers in similar fields elsewhere. But even among laboratory workers effective horizontal coordination is generally absent. How much more so does this apply to field workers and economists with no exact scientific standards? The survey method of measuring and sometimes solving farming problems is everywhere coming into more general use; the scientist is realising that the statistical analysis of farm data may not only confirm his small scale work, but will reveal fresh fields to conquer and new problems to solve. What is the result? Vertical organization rushes into the field. Workers hurry about the countryside on a variety of surveys, different workers often visiting the same farmers in the same week. Such a plethora of survey workers not only means a duplication of effort, a duplication of routes and high travelling expenses and operating costs, but in time upsets the farmer. The writer is acquainted with one large agricultural research centre serving an important English province where at one and the same time the following quantitative surveys were in operation: (1) costings of a limited number of farms, (2) a special economic sugar beet survey, (3) a cereal variety yield survey, (4) a soil survey, (5) a survey covering the causes of wastage in dairy herds, (6) a pig recording scheme, (7) a survey of stallion fertility and (8) a herd testing of cows. There were possibly others.

Owing to vertical organization, effective coordination is often absent among laboratory and experimental farm workers. This deficiency is aggravated among survey workers, who may see each other only at long intervals. How much more necessary, therefore, is horizontal survey organisation in order (a) to save operating costs per unit of information obtained, (b) to keep the farmer "sweet" and (c) to ensure that workers are brought frequently into contact. The immense potentialities of the survey method in every branch of agricultural science have been or are being recognized, but if we are to flood the countryside with survey workers, let us make sure that the man collecting data on the correlation between red and white stripes and prolificacy in pigs—in his haste to get on with the job—does not crash at a cross roads into an investigator in another field; let us say "the influence of the time wasted in garrulity on the cost of wheat production." Why should not one and the same man *collect* this information?

CLASSES OF SURVEYS

The writer assumes the concurrence of the reader and now passes to the consideration of the principal thesis of this paper, which is the use of the comprehensive farm survey—the setting up of an ubiquitous farm survey organisation for collecting, analysing and crystallising the information required by the farmer, the research worker, and the State. Before discussing this suggestion and its concomitants, let us delay for a moment to consider the classes of information required. We are to attempt to satisfy the requirements of the farmer, all types of research workers, and the State, and measure the efficiency of land utilization and rural problems on a large scale. The following general classes suggest themselves:

1. Cash efficiency.
2. Mechanical efficiency.
3. Natural efficiency.

Exact definitions of the class limits is of course impossible; there will be many inter-grade subjects, and the groups will merge the one into the other. Nevertheless this classification will, it is hoped, suffice to illustrate the arguments.

NATURAL EFFICIENCY

Natural efficiency is the province of the scientist—the man who works in grammes. The sun determines climate. And climate has not only made but has largely determined the varying natures and distribution of soils. In addition it is closely correlated with the natural vegetation, the type of farming, prosperity, and the history of humanity, and, in fact, with everything that we call Life. What use do we make of the sun, that is, of the climate? An academic concept perhaps, yet, after all, it is the basic measure and is therefore directly or indirectly the province of the scientist. The scientist is the man who seeks maximum not optimum production and efficiency, and his outlook, unconsciously perhaps, is coloured by the conception of increasing natural efficiency. He may only be determining the digestibility of a foodstuff by a particular strain of, say, poultry. But he finds that the food or the strain under examination is less or more efficient than others, and if his results were not to be applied by a material world, the

academic man would wish us to use the most theoretically efficient methods he could find. In other words he wants to obtain the maximum natural efficiency. If we are to help him in his work we must therefore make sure that fundamental data on these natural factors are available. It is not enough for us to say—the soil is loamy clay, the vegetation is temperate grassland, the annual rainfall is about 30 inches. He wants to know, for instance, the size of the clay particles, the species distribution of the grassland, the monthly distribution and annual variation of the rainfall, and a host of other facts. In our comprehensive surveys therefore we must expect to be asked to obtain for the scientist a certain amount of fundamental data to supplement that which is already avaliable. We may be asked to collect information of which we cannot see the immediate significance.

MECHANICAL EFFICIENCY

Mechanical efficiency is the province of the fieldman, the crop and animal husbandman—the man who works in pounds, gallons and bushels. Here we might also include applied biologists—the entomologists, plant pathologists and the veterinarians.

The fieldman occupies the centre span of the three-arched bridge of natural, mechanical and cash efficiency that leads to agricultural prosperity. He is interested in the efficiency of the machinery, the acre of land, the dairy cow and the labourer. He wants to increase the bushels per acre and the foot-pounds of work comfortably done by the man on the land. His ideal, shall we say, lies somewhere between the desires of the scientist for maximum natural efficiency and of the economist for optimum cash efficiency. If maximum efficiency is too abstract an ideal, and optimum efficiency too material, then the fieldman seeks something intermediate which we might call max-optimum efficiency. The scientist as conceived in this paper is not interested in the law of diminishing returns; the economist is governed by it, and if he does not maintain mental touch with the scientist is apt to become obsessed by it. The fieldman is aware of its existence, but in general he does not let it perturb him.

What will the fieldman demand from our comprehensive surveys? He is not, we think, generally satisfied with the data provided by farm management surveys. It is not enough to tell him

that the average yield per acre was 20 bushels, that the production per cow was 400 gallons, that the number of pigs sold per sow per annum was 12, or that 4 men were employed per 100 acres. He will want to know the variety, the manuring and the cultivation history of the crops; the feeding, the breed, the dates of calving and the wastage of the dairy herd; the management, the strain, the weight at slaughter of, and the incidence of disease amongst the pigs; the hours of work, the number of rest periods, the race of the employees and the workers' methods of using tools. So with the fieldman, as with the scientist, we must expect to be asked to collect a quota of information of which the economic significance may seem ill defined.

CASH EFFICIENCY

Cash efficiency is the province of the economist—the man who works in pounds sterling, dollars, horse days, and sheep units.

Let us for the purposes of this paper assume that the economist is interested only in subjects that have a direct financial bearing on agriculture. He wants to measure and increase the cash efficiency of the human capital and currency capital invested in the land. He desires to ascertain under which system and what conditions in any one area the optimum return per acre of land is obtained for each £100 or $500 of capital and for each individual human invested on the land. But like the fieldman and the scientist, superficial economic data will not satisfy him. The price and amount of raw materials consumed, and the total sales of each commodity is not enough. He must know the system and acreage of tenure, the head of stock carried, the price of labour, the methods and time of marketing, the cost of transport, and the nature of the legislation affecting agricultural production and a host of other details. Thus the economist, like the fieldman and the scientist, requires detailed information which to the latter might appear irrelevant.[1]

The reader will gather from the foregoing remarks that with an ideal comprehensive farm survey the amount of detail required to meet the requirements of the economist, the fieldman and the scientist in our efforts to measure and improve cash, mechanical and natural efficiency is nothing less than colossal. To cover even

[1] A fourth measure might be added, that of human efficiency—the province of the psychologist or the eugenist—the man who works with humanity.

a small sample of the land and the farming population on this basis, a very large expenditure, a complex and intricate organisation and a farmer with more than human patience must be postulated. In sketching out our ideal survey system therefore we must attempt to simplify and reduce our requirements considerably. It

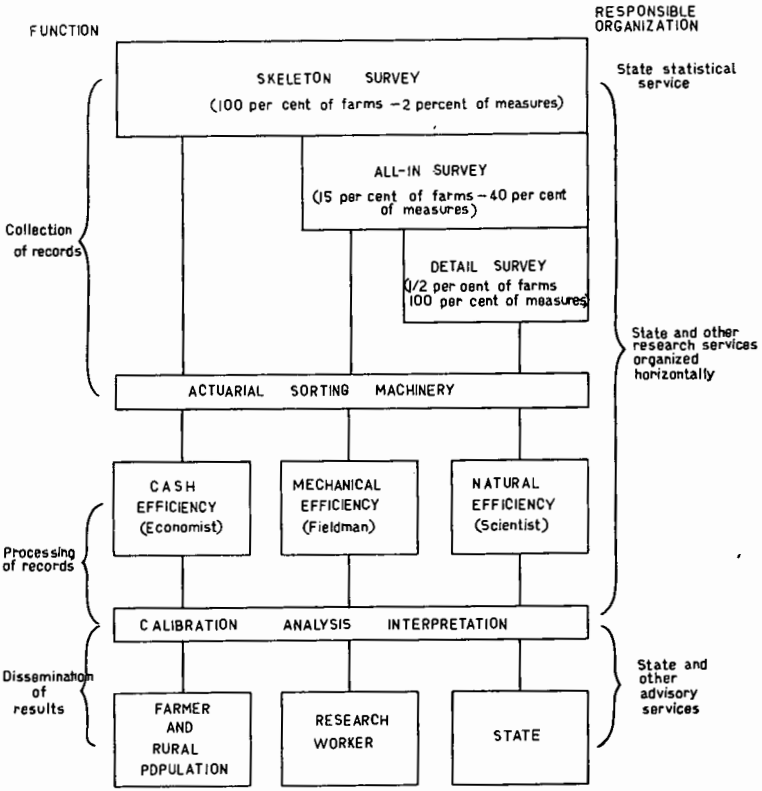

FIGURE 1. THE COMPREHENSIVE FARMING SURVEY

is hoped, however, that the proposals elaborated below will at least indicate possible methods of overcoming these difficulties.

OUTLINES OF A COMPREHENSIVE FARM SURVEY METHOD

In broad outline our proposal is this: to collect the maximum of data on the cash, mechanical and natural efficiency of the land and its workers with the minimum of expense and trouble. Or, to put it another way, to satisfy the economist, the fieldman, and the

scientist, without incurring the opposition of the State treasury and the farmer.

It is suggested that this could be done by having a graduated survey system, which would be detailed on a minority and broad on the majority of the farms surveyed. On say 1 per cent of the farms full details of every aspect of farming, theoretical and applied, would be secured. A skeleton survey would be applied to 100 per cent of the farms. Data collected on the detailed surveys would be used to interpret and calibrate the measures obtained by the general survey. The information yielded by the latter, would be used in the same way to interpret and calibrate the simpler measures collected by the skeleton survey. The complete system would include methods that look at farming through instruments varying from microscopes to inverted telescopes. Our comprehensive survey would range from the barest facts to the most detailed and accurate measurements. The larger the sample, the smaller the number of measurements; the smaller the sample the greater the intensity and detail of accurate observation. In short —we would have a graduated and calibrated comprehensive survey system.

THE SKELETON SURVEY

In nearly all countries the obvious organisation to handle the skeleton survey already exists. That organisation is of course the government department or departments responsible for the collection of agricultural statistics. It is surprising how some agricultural statistics approximate to general or specialised economic surveys. The trouble in general is, we think, that the statistics as published deal too often in totals and means and do not give us sufficient statistical or geographical measures of dispersion. Let us for instance consider sheep and wool production in Australia, the greatest wool producer in the world. For the Commonwealth, and for each State, we have data of sheep population which, considered in relation to available information as to size of holdings and size of flocks, enable us to form a fairly adequate picture not only of the geographical distribution of the sheep but also of carrying capacity and methods of sheep raising. Yet the addition of one question to the statistical returns: "Did you supplement the natural grazing on your sheep station by any other kind of feed during any part of the last year for any of your sheep"? would be of im-

mense value in enabling us to obtain a better and more accurate picture of Australian conditions. In the same way, in Australia, data are available on the yield and production of wool and the number of ewes mated and lambs born each year. In one State (Queensland) this information on mechanical efficiency is supplemented by data on the causes of sheep mortality—drought, accident, lambing, disease and so forth. In fact in Australia as far as sheep are concerned, the addition of one or two simple questions to the agricultural return would provide all we required for our skeleton survey. Similar instances could be multiplied almost indefinitely.

It may be said that in many cases the requirements of our skeleton survey would be met by slight modifications and the greater availability of existing statistics. In those countries where the value and quantity of agricultural output is not obtained yearly, it might be necessary to take steps to get this. Probably rather less information than that required by the world agricultural census now in progress would be demanded, with the possible addition of some rough data regarding rent, capital invested and total wages paid, amount of machinery used and so forth.[2] The information thus supplied by the annual farming statistics supplemented by data from other government departments on say land-tenure, meteorology, the output of wheat, butter, wheat flour from factories and so forth, would constitute our skeleton survey. But to be effective it would necessitate the cooperation in most countries of several government departments and here as in the case of research work, horizontal organisation is required.

THE GENERAL SURVEY

The skeleton survey, we have suggested, should be operated by the relevant government department. The data for the general or all-in survey would either be collected by the agricultural economics divisions of universities and colleges as in the United Kingdom and the United States or by the government agricultural department as, for instance, in New Zealand, Kenya and elsewhere. We have tentatively postulated in our scheme that the all-in survey would be applied to 15 per cent of farms each year. This figure is probably much too high when probable cash resources

[2] The data would be gathered either by the filling in of a single form or by one visit from one official.

are considered—10 per cent would probably suffice. But here we come to a difficult point. Are we to take the same 15 per cent every year and thus obtain the great advantage of continuity of records, or are we to take a fresh sample every twelve months in order to cover wider ground? Could we not compromise? Let 3 per cent of the farms be permanently covered by the general survey, and take a fresh 12 per cent sample each year. In this way, if such an ideal were realised, all the farms would be covered in less than a decade, whilst the influence of price and other trends could be gauged on the 3 per cent sample.

What measurements are we to take, what questions are we to ask, on the general survey? How are we to arrive at that discreet balance that will satisfy the three parties to research without plaguing the farmer? For each farm we shall, of course, have our skeleton survey data. To these we may add the type of information already collected for farm management and other economic surveys, possibly simplified, and the minimum requirements of the fieldman and the scientist. In discussing the three classes of efficiency we indicated above the range of these desiderata. The crop husbandman will want to know cultivation and manuring history, and the variety of cereals; the animal husbandman, will want to know the breed of animals and the form of the lactation curve, the weight and age of the beef animals at disposal, and the total consumption of feedstuffs. The scientist will probably not be so easy to satisfy as the fieldman, so we must ask him to devote his attention more to the detailed survey farms.

It would be advisable if possible to extend our horizontal organisation under the general survey to include herd testing and milk recording and other similar methods of measuring mechanical efficiency. The farmer would be required to keep a number of simple records; the recorder or collector would call, say, at monthly intervals, and in addition to collecting records of sales and purchases, would note the production records of the dairy cows, pigs, and so forth.

A difficulty that must be faced here is that some farmers would want to participate only in one part of the general survey, say the herd-testing or the manurial history of the wheat crop. This would be the case particularly with the more progressive farmers who had previously made use of such instruments of progress or who wished

to continue these measurements after their survey year. In other words, based on the skeleton survey, arrangements would have to be made for a certain fluidity in the make up of the general survey. It would have to be constructed as a series of independent units which, in combination, would complete the picture.

THE DETAIL SURVEY

On a very small percentage of farms, say one in 200 to 400, we would carry out a detailed survey. The economist would obtain full costings data week by week for each field and group of animals, and almost as much other information as he wanted. The fieldman would be able to study the variations in yield occurring in each field, or accurate information on the feeding of the class or group of pigs or the number of pasture-days yielded by, and the carrying capacity of, each field. The scientist would be able to analyse the soil, to record the length of oestrus at different times of the year, to measure the length of the awn in certain "sports" occurring in the wheat fields, and generally to obtain commercial farming data under the most favourable circumstances.

Naturally, to collect from such farms the amount of information which we visualise would be a considerable labour and even if farmers could be found willing to submit their farms to such a joint miscroscopic examination, they would not be prepared to bear the cost of the additional clerical and recording work necessary for this detailed survey. On each such farm, or at least one in two, it would probably be found desirable to have a whole time man, a combination of clerk-recorder and observer. But as such a man could not be expected to have the necessary observational and measuring technique of the specialist, periodic visits by fieldmen and scientists would be made to collect the more accurate and difficult measurements.

This group of farms, which would of course also be recorded under the skeleton and general surveys, might well include the standard and demonstration farms of various agricultural colleges and departments such as, for instance, the Dominion Experimental Farms System in Canada or the Duthie Experimental Stock Farm at Aberdeen, Scotland.

This small, accurately recorded, group of farms would provide

records with which to standardise and calibrate the results of the general survey. The costings and the farm management survey methods, at present too often considered as opposing but in reality complementary, would be conjoined for the general good and, so conjoined, this would more than double their utility. In the same way, to draw an example from a method of measuring mechanical efficiency of which the writer has had experience, that is, pig recording, the pig testing station and the survey method of pig control could be brought together. Until about 1928, the well known pig testing station system of Denmark and the survey pig recording system of Sweden, East Prussia, and England were regarded as two different and opposing methods of measuring pig keeping efficiency. One measures intensively, the other extensively. They have been shown to be complementary. It should be the same, we suggest, with costings and survey methods. One is intensive, the other extensive but they are essentially complementary if methods of collecting and analysing data are coordinated.

INTERPRETATION AND ANALYSIS OF RESULTS

Let it be assumed for the moment that the samples of farms covered by the general and detail surveys are essentially and sufficiently representative.

We shall be faced with a considerable mass of paper. We must digest the data. But we shall have a large smooth organisation run on actuarial lines and with adequate automatic sorting machinery to deal with the pooled records. The primary sorting accomplished, the information will be fed into the channels which measure cash, mechanical, and natural efficiency respectively, for analysis and interpretation. The net results will be broadcast to agricultural research workers dealing with specific problems, as well as to the farmer and the State (see figure 1). Considered as a whole the results will enable us to see farming in a clearer and balanced light; considered in detail we shall be able as specialists to obtain the information we require.

ADVANTAGES OF THE COMPREHENSIVE SURVEY

For the purpose of exploring the advantages of our proposals we take this assumption as agreed, *viz,* that any progress which materially benefits the entrepreneur ultimately reacts favourably

on both labour and capital; that the increased income of the farmer ultimately raises also the purchasing power of the agricultural labourer and the rural landlord. We need therefore only consider the advantages of the comprehensive survey as they affect the farmer, the research worker and the State.

TO THE FARMER

What would this scheme offer the farmer? First, herd testing, pig recording and other services which he now enjoys. Second, an economic service that measured the efficiency of his use of capital invested in labour, raw materials, land and dead stock; third, it would be of little use, if it were not supported by an adequate advisory service.

The two last points depend on the efficiency of the advisory service. If simplicity is to be the key note in collecting the data—the minimum of clerical work must devolve on the farmer—personal contact should be the rule to guide those charged with interpretation. Personal visits may be expensive but they are undoubtedly a more effective educational agent than correspondence, bulletins or the press—if the visit is made by the right man.

But who is this advisor to be? Ought he to be the man who collects the records? Should he be the county agricultural agent or organiser or his counterpart, or should he be the expert? If the man who collected the records were to be the advisor, it would add to the general expenses considerably; in any case it may be doubted whether such a procedure would be advisable. The results for each individual farm might be sent to the county organiser with notes on the salient points of the results, to assist in his explanations to the farmer. An increase in the number and the functions of the county organisers might be the cheapest way of getting the results and the changes they suggest, across to the farmer, but in the writer's opinion the specialist is the man. In his experience the expert is the man best qualified to help and the man to whom the farmer will effectively listen.

We may, however, suggest a compromise. The county or local agricultural agent would call on the farmer, and, on the basis of the latter's results, would discuss with him the whole position. From the quantitative pool of farming experience which the survey would yield, the local advisor could point out where the farmer

failed and why, how he could economically improve his methods of production and marketing, and how he could increase his income. There will probably be some project on which the farmer is failing badly or where he uses unsuitable methods. In such cases the expert would be called in either by the local agricultural agent or by the farmer or on the instructions of the district survey organisation. To a dairy husbandman, to the marketing specialist, to the agronomist or the plant pathologist, the farmer will listen, and subsequently act on advice given, if the expert in question can talk in terms of cash, particularly when his arguments are based on the farmer's results. Such expert advisors, it will be noted, may be either economists, fieldmen or scientists.

TO THE RESEARCH WORKER

How would the scheme benefit the research worker? First, it will show him the problems of most economic significance. Second, the data on natural efficiency will help to obtain large scale confirmation or contradiction of his small scale laboratory results. Third, and pre-eminently important, it would bring him into real contact with the farmer, and enable him to understand the latter's outlook. At the same time, it would be a powerful instrument of educational progress. Fourth, analysis of the data would throw light on and solve certain problems.

Let us consider the first of these postulated advantages. It will be generally admitted that, nowadays, even taking due cognisance of the immense importance of fundamental scientific research, the agricultural scientist may spend years investigating a problem of negligible economic significance and of doubtful value even as a contribution to the sum total of knowledge or for the side-lights it casts on other aspects of science. At the same time, because there is in existence no effective machinery for measuring the weight of the farmers' several problems, money may be spent on a difficulty which can have no effect on the ultimate rural prosperity even of a small group of people. But neither the scientist nor the farmer can collectively be blamed if we have no adequate method of ascertaining the relative importance of a problem. The comprehensive survey should go a long way to overcome this difficulty.

To illustrate the second point—the large scale confirmation or contradiction of laboratory or small scale results—the writer may

perhaps be permitted once more to draw on his own experience. Experimental work by a colleague had shown the effect of protein deficient diets in pigs on the onset of oestrus after weaning. Field records of the writer confirmed this work. The same could be said of other work on the effect of feeding on conformation, and no doubt the instances could be multiplied almost indefinitely from other branches of agricultural science. Thus, work at Cambridge on the value of young grass is confirmed by the methods of husbandry adopted in Friesland, Holland.

The third point, contact of research with the farmer, needs no elaboration. At present the isolation of these two parties is one of the tragedies of agricultural research. Between the farmer and the scientist, as between nation and nation, isolation breeds mutual dislike and distrust.

One instance will suffice to illustrate the fourth point—the statistical solution of scientific problems. The work of Gowen, Sanders and others on milk yields has cleared up many points regarding the physiology of reproduction and milk production in the dairy cow. One could point to many similar cases taken from the field of animal husbandry (Examples: Jesse-Sanders on variety of feeds and milk yields, Larsson, Duckham, and others on sex-ratios and differential sex mortality in pigs.)

TO THE STATE

How would the comprehensive survey profit the State? First, it would be a barometer of the financial state of agriculture. Second, it would enable the governments to frame sound policies. Third, it would show them where restrictive or other legislation was necessary, or could be removed. Fourth, the balanced application of the information yielded by the above three points should increase rural purchasing power and thus benefit the secondary producer. Fifth, by eliminating useless competition, by cutting out over-lapping, and by horizontal organisation, it would, in fact, lead to the rationalisation of agricultural research and advisory services. If the scheme as a whole did not reduce the cost of these services, it would at least ensure that the State's financial contribution was better spent.

There are few countries in the world where the agricultural statistical and economic services are sufficiently coordinated or

elaborate to give the executive governmental machine an adequate picture either of the state of agriculture, or of its many and various problems. In the absence of quantitative data, the State is forced to listen to qualitative opinions which it is not in a position either to confirm or dispute. Groups that squeal loudest and most persistently are heard best and appear to succeed, because no one has the facts and figures with which to check their statements or accurately examine the real purport of the proposals they put forward. Some agricultural policies, especially in States where the bulk of the agricultural output is consumed internally, are under these circumstances difficult to formulate. Legislation tends to become haphazard and designed only to meet immediate needs. Irksome restrictions are directly or indirectly placed on some forms of production, while in other cases disease or malpractices may be allowed to run free simply because no yardsticks exist.

It is probable that on the fifth of the above points—the better expenditure of the State's contribution to agricultural services—the method could justify itself on its merits. There is no need to elaborate the existence of over-lapping, competition, and lack of coordination—in one way or another it is only too apparent in most countries. Lastly, the survey results would show the State where financial and other assistance was most needed and why.

DISADVANTAGES AND DIFFICULTIES

The disadvantages, and more particularly the difficulties presented by the scheme proposed are, of course, enormous. Further, if such a scheme were ever put into operation, even the greatest prescience could not prevent a crop of unforseen difficulties. The scheme may be characterised as too bold, too fanciful or too ideal in conception; but such criticism is in itself not an argument against its adoption. Let us examine a few of the principal difficulties and probable criticisms. The writer admits that his list is by no means exhaustive and that he has probably overlooked several other difficulties.

USE OF EXISTING SERVICES

A criticism that at first sight would seem justifiable is that such comprehensive surveys would necessitate the formation of new organisations and machinery, but on closer examination it will be

observed that the proposals are largely based on the use of existing machinery—the State statistical services, the research and advisory services provided by State, university, college and other educational and research centres, and the county or local agent or organiser. The only new machinery essential to the scheme would be a coordinating body to effect this horizontal rationalisation.

EXCESSIVE CENTRALISATION

This is a possible danger, which could, however, largely be avoided by the use of existing local or provincial machinery which in most countries is semi-automatic. Centralised machinery might be used for sorting but for interpretation and analysis the records would be returned to the local research and advisory organisations.

EXCESSIVE RIGIDITY

This is another possible danger to which consideration must be given. It has already been suggested that in building up the all-in survey which is to be applied to 15 per cent of the farms, the principle of independent units should be used. The all-in survey might be compared to a chess board design completely or partially covered by removable pawns. It would not be necessary to use all the pawns at any one time to obtain valuable information, and an unsuitable or badly fitting pawn could be removed altogether, or replaced by one of more suitable design. Such an organisation would retain considerable flexibility of operation and could largely obviate the difficulty of rigidity. Imagine each local survey service as such a chess board. In every area certain squares would be covered by certain ordinary types of pawns. Part or all of the remaining squares could be covered with types designed to meet local conditions. Further, if such an organisation could be adopted, it could not be pleaded that the plan did not allow of progressive experimentation.

It is obvious, however, that a considerable amount of forethought and close thinking based on experience would have to be done if the survey is to be effectively designed on such chess board lines, and if drastic changes are to be avoided. Frivolous or constant changes of the pawn type would not only render nugatory the continuity of results and thus handicap the possibilities of studying trends, but would also disgruntle the farmer. The same principles,

which admittedly would be difficult to apply, could be used in designing detail surveys.

But, whereas with the all-in and detail surveys preliminary runs on sample areas could be made to test the efficiency of the chess board design, with the skeleton survey, involving as it might, changes in the method of collecting agricultural statistics, such a procedure would not be possible. Very great care would be necessary in drawing up the proposed statistical changes. The difficulties caused by variations in the classification of agricultural statistics of various countries are only too well known.

SAMPLING

The difficulties of obtaining adequate and representative samples would be great. It could hardly be expected to find that the farms covered by the detailed survey were representative—only the more advanced type of farmer would be likely to consent to the additional labour and inconvenience they would inevitably create. As regards the general survey farms, we should experience, no doubt, the same trouble—only the more progressive type of farmer would be prepared to cooperate and to understand that the primary objective of the survey was to increase and not to decrease his income. The problem, however, would be less acute than with the detailed costings farms and the samples available whether obtained by random or selective methods would probably be found to be nearer the mean of all farms when compared with the figures of the skeleton survey.

COOPERATION

The difficulties of obtaining farmers' participation would not, however, be the only problem to be surmounted. Effective coordination would necessarily mean that a certain proportion of research centres, farmers, herd testing associations, and individuals, would have to sink their identity for the common weal. Great diplomacy and convincing arguments would be required to overcome the love of autonomy, and the petty jealousies involved in human relationships.

COST

This matter would perhaps prove the greatest stumbling block of all. Estimates are of course dangerous things, and essentially

unscientific but it is felt that at least an estimate, however wild or rough, must be made to illustrate at least the possible order of expenditure. Costs would obviously vary considerably not only between areas of intensive and extensive farming and between districts of small and large holdings but also with the amount of information and the number of measurements recorded. To some extent the large number of holdings in intensive areas would offset the greater distances to be travelled in areas of extensive farming and large holdings, but this would of course largely depend on the geographical concentration of the sample.

As a concrete instance let us imagine that the scheme is in operation in an area of fairly intensive farming where the holdings average from 100 to 150 acres, the wheat yield from 20 to 25 bushels per acre, and the milk yields from 300 to 350 gallons per cow. First, there will be the cost of the skeleton survey—the State statistical service. This may be put arbitrarily at 15 shillings per holding or £75 per 100 farms. Second, assuming that the full sample of 15 per cent of all farms is being recorded, there is the cost of the all-in survey. Allowing £350 to £400 a year to keep a recorder in the field and for his share of the central sorting and analytic and advisory expenses, and assuming a working year of 300 days and a visiting rate of one farm per day once a month throughout the year, the cost per all-in survey farm would be £15 per annum. Third, assume that the cost of maintaining a full time recorder and his share of the overhead would be £400 per annum for each detailed costing survey farm, the rate per 100 farms covered under the whole comprehensive survey will be as follows:

Skeleton survey	100 farms at 15 shillings	£ 75
All-in survey	15 farms at £15	£225
Detailed costings survey	½ farm at £400	£200
Total		£500
Cost per farm		£ 5

For English conditions these estimates would probably be on the high side, but it is obvious that if the whole comprehensive scheme were applied, say to 100,000 holdings the gross cost would be considerable—roughly £500,000. Against this gross cost however must be set the money that is already being spent by the State on statis-

tical, economic, herd-testing and other services. Further, certain services such as herd-testing, whilst not self-supporting are at least to some extent revenue producing. To what extent these considerations would reduce the cost per holding it is difficult to say. In any case it must be emphasised once more that this estimate is only put forward to indicate the *order* of expenditure. More accurate estimates could be made by those better qualified and more experienced in these matters than the writer. But if £5 per farm can directly increase the farm income by £10, disregarding the other indirect advantages to the research worker and the State, such a scheme, it is submitted, would be justified.

SUMMARY

The object of agricultural research is to increase the purchasing power of the farming population. This should be achieved by measuring the problems which limit rural prosperity, solving them and blending the solution into farming practice. The motto of agricultural research should be "Veni, Vidi, Vici," I came on the land; I saw, the problems and the man who fought them; I conquered, not only his problems, but, by winning his confidence, the innate caution of the farmer himself. Under present conditions this ideal is far from being realised, largely, the writer thinks (a) because the organisation of agricultural research is too vertical and lacks horizontal coordination—in fact, it needs rationalising and (b) because sufficient quantitative data about farming problems and conditions is not available. It is suggested that comprehensive surveys, involving the setting up of an ubiquitous farm survey organisation for collecting, analysing, and interpreting the information required by the farmer, the research worker and the State, would largely overcome these difficulties. Under this rationalised scheme, information as to financial, mechanical and natural efficiency to satisfy the requirements of the economist, the fieldman, and the scientist respectively, would be collected and utilised on the following lines: A skeleton survey operated by the state statistical and census services would supplement the present agricultural statistics by a few additional questions and measures on *all farms*. A general survey on the lines of the present day farm management surveys, but obtaining some additional information for the fieldman and the scientist, would be operated on from

10 to 20 per cent of the farms. A detailed survey would be applied to one-half of one per cent of the farms and would obtain full costings data and other detailed information for the benefit of the economist, the fieldman, and the scientist. The general and detailed surveys would be operated by the State and for other existing research services. The results of all three types of survey would be pooled and the records of the detailed survey would be used to interpret and calibrate those of the general survey whilst the records of the latter would, in their turn, be utilized for the interpretation and calibration of the skeleton survey. The comprehensive farm survey would absorb existing farm management surveys, costings schemes, demonstration farms, milk recording, and herd testing services, and weld them into a coordinated and complementary whole, capable of measuring profits, problems, and progress. Such a scheme would more than double the value of existing services to the farmer, the research worker and the State. Backed by a suitable advisory and interpretative service it would show the farmer from his own records where and how he could improve his methods and enhance his profits. It would show the research worker the problems that most deserve his attention, provide data to confirm his laboratory work, bring him into contact with the farmer, and statistical analysis of the records would throw light on many scientific problems. It would offer the State better value for the money it spends on agricultural research and advisory services, it would help to frame sound policies, it would show where legislation or financial assistance was necessary, and it would provide a financial barometer of the state of agriculture. Aided by a coordinating body, existing services would be utilised for the comprehensive survey. By constructing the survey as far as possible as a series of independent units which, in combination, would provide a complete picture, flexibility of design and operation would be obtained thus allowing local conditions to be met and at the same time permitting progressive experimentation and limited individualism. Considerable care and forethought would be necessary in designing such comprehensive surveys but the difficulties of obtaining representative samples and the problem of cost would appear to be amongst the chief limiting factors to the adoption of this method but there is no outstanding reason why they should not be overcome.

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