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SELECTED ARTICLE

The Impact of Science on Agriculture

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In spite of considerable diversity, agricultural systems in the prescientific days usually possessed two features in common; they aimed first and foremost at providing complete subsistence for the community, money crops being a subordinate consideration; and they included measures for conserving the productiveness of the land, either by the so-called fallowing, or by letting the land revert to the wild state, or by some other device. Although these systems had a low level of productiveness they provided food for indefinitely long periods of time, and in addition possessed certain social advantages. In the system followed in Great Britain, around the Baltic, in Northern India and elsewhere, the land was divided into strips which were shared out among the participants for the purposes of ensuring equitable distribution of good and bad land. The whole complex of peasant life developed some creative art which showed itself in a love of colour, folk music and dancing, embroidery, wood carving, pottery, iron work and other peasant arts and crafts.

Unfortunately, the strip system of farming was incapable of improvement by scientific means, and as soon as the peasants insisted on a higher standard of living it had to go. The method of change varied in different countries, Russia adopted one way and Poland another. Instead of scattered strips the agricultural holding was brought into one self-contained unit. Here science was able to play its part. Unfortunately, as science came in so the peasants' arts and crafts, the colour, the singing and the dancing got somehow crowded out; they ceased to be spontaneous peasant activities and are becoming only museum pieces. It would be a great advantage to the country side if, somehow, this apparent antagonism could be overcome.

In Great Britain the change to unified holdings had been made before the scientific era and so we were able at once to introduce science into our agriculture. It led to great improvements and in the 1860's and 1870's our farming superiority was widely admitted. Then came a remarkable sequence of events illustrating the difficulty of anything less than 'total' application of science to agriculture. The prairies of North America were gradually being opened up for settlement. The development of implement design made cereal cultivation possible, while plant selection and breeding—then only in their early stages—provided suitable varieties. Transport and business agencies arranged to take and pay for the produce. A very cheap agricultural system was worked out, and the operations were on so large a scale that considerable economies were possible with the result that wheat was put on British markets at prices below those at which our farmers could grow it. Similar developments occurred in the production of butter, cheese and meat, mitigated somewhat in the latter case by the fact that British produce always had a superior quality and so had some preference in the market. Our farmers could not compete, and British agriculture fell in the 1890's to a very low level. Then a more comprehensive application of science was attempted which was gradually directed to an increase in the output per man-hour, so allowing a higher rate of wage sufficient to keep some of the men on the land. This effort was so far successful that before the War our output per man-hour was higher in money value than in any country in Europe. It proved very difficult, however, to combine this high output per man with high output per acre: indeed there appeared to be some sort of inverse relation between them. Our output per acre was considerably

lower than in the smaller Western European countries of small holdings, and our agriculture remained solvent only by reducing the numbers of paid workers; in England and Wales the fall was from 803,000 in 1925 to 593,000 in 1937–38

The increased efficiency of the worker rather more than counterbalanced the fall in numbers so that the gross value of the output rose somewhat even after allowing for differences in price.

Meanwhile a striking change had come over large sections of the prairie regions, the development of which had been the cause of so much trouble to British agriculturists. The system of agriculture proved destructive of the soil texture, the original crumb structure broke down, the soil changed to dust and in the high winds blew away. Soil erosion took place on a gigantic scale, and vast areas fell out of cultivation, some never to come back into agricultural use so far as we can see. The United States suffered most and led the way in the search for causes and remedies. It was sown that mixed farming, with alternations of grass and arable husbandry, was the surest way of preventing erosion and the best curative treatment for land not yet ruined beyond repair. But this meant a complete change in the commercial arrangements, and a reversion to the old principles, which included farming for subsistence, and the recognition of responsibility for the conservation of the soil. Far-reaching social changes are likely to result.

A somewhat different problem arose in tropical Africa and parts of India. The climate favoured the production of certain commodities of high commercial value, such as oil, fibre, tea, coffee, etc. The large supply of very cheap native labour ensured cheap production. So a plantation industry was developed and proved highly susceptible to scientific treatment; striking developments occurred. Then, however, arose certain difficulties. These new crops, helped by the aid of science, pushed out the native food crops; the subsistence agriculture gave away before plantation cropping, and the natives received pay for their work but not food. This substitution of money for food led to social difficulties, unrest, malnutrition, etc. Further, a change in the market requirements might render the produce of a whole region more or less superfluous thereby causing great financial loss; the history of sugar-cane in the West Indies is an example. In short, the intense specialization which followed the too exclusive emphasis on efficiency of production had two grave defects; it lacked the permanency of the older system and it did not adequately provide for the needs of the community.

During the past thirty years a great change has come over our ideas of administration, and it is now recognized that subsistence farming must be fully developed so as to ensure abundance of suitable food for the home population. This is necessitating a much broader utilization of science than in the earlier days.

Even in regions of the world where plantation cropping was not practised, the limited scientific intervention first attempted led to unexpected and undesirable results. The efficient medical and veterinary services greatly reduced the incidence of human and animal disease and so curtailed an important check on the population; the numbers of men and of animals increased and put great pressure on the land. The old system of shifting cultivation which had allowed of recuperation of fertility could no longer function; soil deterioration and in many cases soil erosion set in and a crop of troubles—social and technical—arose. These have necessitated great schemes of investigation. The general result is as before the need for a more varied type of farming, making more use of grass and leguminous crops and taking other steps to ensure soil conservation; also a large but better organized production of crops for human and animal food; this of course involves collaboration with the veterinary and the medical staffs so as to ensure that the right foods are grown.

The War has imposed upon us in Great Britain the necessity for finding some solution of the very difficult technical problem of combining high output per acre with high output per man. The fundamental difficulty is the slowness of agricultural production, which science seems powerless to hasten. In spite of a hundred years of agricultural science crops still take as long to grow as ever they did, further, a lamb still takes five months in getting born and a calf takes nine months or more; all the big vital processes are in the main outside our control. Many of them are very dependent on season. Crops and animals are rarely ready for sale in less than 15 or 18 months after expenditure on them has begun, and as it is impossible to forecast prices for so long farmers are bound to play for 'safety first'. So it comes about that well-recognized improvements cannot be adopted because of the uncertainty whether the prices ultimately obtained will justify them. Probably there is no greater cause of frustration of agricultural science than this uncertainty about price of produce.

In war-time this difficulty disappears and farming is virtually run on contracts like other businesses. Prices and wages are fixed, and farmers know exactly where they are and exactly how far they can go in adopting improved methods. So in spite of almost unparalled difficulties the output per acre now seems to be rising without any corresponding diminution in the output per man. On all grounds it is essential that British agriculture should continue to function effectively after the War. It will be needed for three purposes: (1) to help in solving the difficult social problems that will certainly arise; standards of population, national nutrition, unemployment, etc. (2) to add to the national wealth and provide food for the community; (3) to remain as an effective protection when next a military adventurer starts a war in Central Europe.

The great need after the War will be for careful planning as to what exactly agriculture in Great Britain is wanted to do. Is it to slacken down considerably to allow of heavy imports of food for the benefit of shipping and commerce, or is it to produce as much as possible? Some sort of compromise will probably be reached. If the imports of food continue to be organized centrally it should be possible to allocate the various items among the different producing countries, giving a certain share to the home farmer at a price which enables him to pay the statutory wages without having continually to reduce the number of workers. So the different problem of combining high output per man with high output per acre can be solved. As an insurance against starvation in the next war it will be imperative to maintain a certain level of agricultural production.

A planned agriculture would allow of the comprehensive application of science, anything short of which may, as we have seen, have unexpectedly bad results. But the planning must not destory the individual initiative that still remains one of the most potent factors of success in agriculture. (*Nature, September 12, 1942.*)

Gleanings

Banana fibre for bags According to Fransico Linares of Cuba banana fibre offers numerous advantages over jute for the making of sugar bags. It is easily obtained from a trunk of high yield, and is manipulated without difficulty. It is stronger than hemp, yet light and silky. It can be obtained immediately in almost any amount and could very well serve as raw material for the production of the bags necessary for the packing of Cuban sugar. (*Int. Sug. J. Jan. 1943.*)

A method of storing sweet potatoes Sweet potatoes can be stored without deterioration for two years or more if they are treated in the following manner. The tubers are dug and then wilted for two or three days. They are next placed in cold water which is brought to the boil and kept boiling for about an hour.