

Science and a Better Way of Life for Farmers*

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The Scientific Attitude.

William Farrer was a man of broad vision and wide interests. His approach to either technical or social problems would have been that of the true scientist—one, that is, of careful observation and experimentation, and the accumulation of facts interpreted impartially and disinterestedly. This approach led him to believe that the major problem of wheat-growing during his lifetime, namely that of securing better and more rust resistant varieties, could only be solved by the tedious process of intercrossing followed by years of selection. The results Farrer obtained vindicated the use of the scientific method which he used. This and similar achievements in the realm of technical science have raised enormously the productive capacity of the land. It is doubtful whether the advance made possible by the application of technical knowledge to agriculture has added as much as it should to the material, social or spiritual progress of the farming community. Is this not due to failure, up to the present, to use the scientific method of approach to the economic and social problems with which agriculture is confronted?

Perhaps it was natural and right that most of the attention of scientific thinkers should earlier have been focussed on the solution of the technical problems of production, but the history of Australian agriculture, at least during and since the first world war, has surely moved the emphasis on to the difficulties associated with orderly marketing, efficient farm organisation and the planning of agricultural production. These problems, too, are surely capable of solution by using the methods of science. For science is but "common sense of the highest order" and differing "from the common sense of daily life in that it is completely freed from the influence of emotion, and is subject to the rigorous control of observation, experimentation and precise thought" (Nicholson, A. J., *J. Aust. Inst. Agric. Sci.*, 1: 18-21, 1935).

It is true, of course, that trained scientific workers have not a monopoly of the scientific method of thinking and that they are often unable to apply the same clear and impartial methods to the analysis of their personal and social problems as they try to employ in their technical researches. As biologists, chemists and physicists, scientists make careful observations and conduct well-designed experiments. All the results are then clearly and disinterestedly interpreted in a spirit of impartiality and scientific honesty. If the results are not as expected, other experiments are designed to find out why, since to ignore a negative result would be dishonest. Admittedly such branches of sciences are more exact than those, for example, concerned with international trade, social reconstruction or farm management. But the method used in their solution should be similar if there is to be a well-organised and progressive rural community and a "better way of life for farmers".

Science and Technical Progress.

Having considered briefly the meaning of science and the scientific method, we may pass on to review something of the rôle science has played and may yet play, in the history of agriculture in its various facets. The early history of farming is the history of the growth of civilization. When the Egyptians commenced to cultivate

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the date palm and the Chaldees their primitive cereals, their towns became centres of culture and progress. Later the "glory that was Greece" was closely associated with that phase of Greek culture which sought to find an explanation of the living things on which its progress depended. The philosophy of Socrates, Plato, Aristotle and Theophrastus was the philosophy of living things. It at least sought to explain natural phenomena in relationship to the problems of everyday life. Those who succeeded them erred in believing that science consisted only in a study of the works of these philosophers. Their attitude led to the scientific and intellectual stagnation of the "dark" ages. It was the challenge of men like Roger Bacon to this attitude of mind which brought light and progress. The "creative minority" which dared to challenge accepted beliefs was both ignored and persecuted. But those who followed the light of independent experiment and thought could not be turned back. Today as in the past, "how few think well of the thinking few, and how few think, who think they do".

Amongst the recent contributions of technical science to agriculture should be considered the greatly increased mechanisation of our larger farms, the use of artificial fertilisers, the principles of soil management and the control of pests and diseases. Mechanisation alone has allowed a modern wheat-grower in less than an hour to harvest an acre of a twenty-bushel wheat crop where it would have taken his grandfather a week of heavy toil with the sickle and flail to achieve the same result. It is less than a century ago that an epidemic of Irish Blight in potatoes precipitated a famine and a revolution in Ireland. It was as recently as 1861 that de Bary showed, as the result of careful researches, that this plant disease in common with others did not, as was previously assumed, spring spontaneously from the sap of the growing plant, but that it was in reality the result of a fungus attacking it from outside, and then only when moisture and temperature conditions were favourable. It was later the recognition of a happy accident which led to the use of bluestone sprays for the control of this blight and eventually to its successful application at intervals suggested by the life history of the parasite. Plant breeders, following the lead given by Farrer himself in breeding for disease resistance, are only now demonstrating how an easier and better method of control is possible, through the release of late blight resistant varieties such as Sebago and a number of unnamed hybrids with the wild *Solanum demissum* plants collected in Mexico.

Science and Plant Improvement.

Because of Australia's great debt to the pioneer wheat breeder, William Farrer, it is appropriate to direct the spotlight especially on achievements in plant improvement—"the oldest of arts but the newest of sciences". We will glance only at the work of the wheat breeders Carleton, Saunders, Farrer and Hayes.

As a student at the Kansas Experiment Station, Carleton had seen the mid-western American farmers, with high hopes, plant in the autumn the wheats which during the winter or early spring would often be killed out completely by the intense cold. Many farmers left in despair, but not all, for a few Russian Mennonites, he found, had not been frozen out by the winter killing of their wheat crops. They had brought a few pounds of wheat seed with them from the Russian Steppes. He put seed from their crops alongside that being used by the men who were being driven from their farms. The seed from the Russians survived, that from the other men's fields died. Carleton studied the map of Russia. He saw its climatic and geographic similarity to North America and eventually, and in spite of the opposition of Washington officialdom, Carleton collected hundreds of samples of both winter and durum wheats from the fields of the Russian peasants. Within a few years over twenty million acres of these hard red winter wheats were being sown on the Great Plains of the United States and mostly with the varieties distributed by Carleton.

His Russian Kubanka wheat, also, became the standard of excellence for American macaroni manufacture.

A thousand miles further north on the Canadian prairies the problem was different. It was the early autumn frosts which destroyed the wheats as they ripened. Many of those who had answered the call "go west, young man" were disillusioned. Those who remained produced from their Red Fife crops the world's best baking quality wheat—when it was not frosted. It was William Saunders, the first Director of the Dominion Experiment Farms, who suggested that the high baking quality but late-maturing Red Fife wheat should be crossed with the insignificant but early-maturing Hard Red Calcutta received from India. It was his son, later Sir Charles Saunders, who eventually selected from this cross a strain which at Indian Head in 1907, matured a plump grain while everywhere round it were shrivelled ears of frozen wheat. Within a few years this wheat, Marquis, still the standard of baking quality throughout the world, occupied 90 per cent. of the Canadian spring wheat belt and is estimated to have added £20,000,000 annually to the Dominion's income.

But Marquis, too, has now been displaced by its stem-rust resistant progeny Thatcher, which in 1940 was estimated to have been sown on 17½ million acres of the North American spring wheat belt. Since its release in 1935, Thatcher has been unaffected by the rust "demon" which has destroyed millions of acres of other varieties during the same period. Hayes of Minnesota was not satisfied with the researches which claimed that the rust resistance of the durum or macaroni wheats could not be transferred to the bread wheats. He crossed Marquis with the highly resistant durum wheat called Iumillo. From this cross he selected the "impossible"—a rust resistant bread wheat which, twenty years after the original cross was made, gave rise, through further crossing, to Thatcher. In Canada it is now claimed that stem rust susceptible varieties have "practically disappeared from the 'rust areas' since 1936"—a triumph for scientific plant breeding.

It is over fifty years ago that William Farrer led the way in this science of plant improvement. We are apt to think only of Farrer's contributions to the Australian wheat farmer, of his partial combination in Federation, for example, of the baking quality of the Fife wheats with the early maturity of the Indian wheats and the yield of the Purple Straws. Largely through the release of such early-maturing and high-yielding varieties as Federation and Bobs a threefold increase in wheat acreage occurred within a period of twenty years, thereby introducing Australia as a significant contributor to the world's wheat market. It was because of these achievements that the late Mr. George Walker was wont to refer to Farrer as "Australia's greatest benefactor". We can think of him too as Australia's greatest agricultural scientist—one who, during the brief twenty years of his wheat researches, demonstrated the success of the scientific approach to plant improvement by the creation of such relatively stem-rust resistant wheats as Warren and Florence, such strong-flour wheats as Cedar, Jonathan and Comeback, such a leaf-rust resistant wheat as Thew and such moderately bunt resistant wheats as Florence and Genoa. That was William Farrer, the retired Maths. Wrangler of Cambridge University, toiling at Lambrigg with the optimism of youth in an effort to prove a brilliant guess—that rust resistance, bunt resistance and high baking quality were heritable characters capable of being synthesised in a perfect wheat variety.

Science and Social Progress.

It is perhaps more than mere coincidence that these plant improvers were trained scientific thinkers. They were successful in the acceleration and direction of plant evolution because they used the scientific approach to their problems. The acceleration and direction of the social and economic evolution of our rural life and

the rational organisation of farm production is surely no less in need of the application of scientific thought.

Admittedly, as attention is directed to the field of the less exact social and economic sciences, difficulties of investigation are increased because of those human frailties which are themselves so largely the result of the chaotic and therefore unscientific environment in which we live. Difficulties there are, caused by emotional ties with methods no longer of intrinsic value, and by our inability to be entirely disinterested in considering changes which may appear to run contrary to our personal objectives.

For example, if science is but "common sense . . . freed from the influence of emotion", is it scientific to decline to investigate fully and impartially systems of finance, land tenure and agricultural production, which have proved successful elsewhere, only because they do not appear to be in keeping with British traditions or with the individualism so necessary in the great Australian pioneers and in the earlier developmental stages of agriculture.

In considering the organisational disorders of our rural life, it is only possible to draw attention to some existing weaknesses and to suggest alternatives, which might be tested out, if we are prepared to think and act scientifically in the field of the social and economic sciences. Are we prepared to accept the advice of our trained technical experts when dealing with the diseases of our crops and stock, but to treat as visionary and unpractical those who seek to diagnose impartially and treat scientifically our problems of rural organisation?

National and International Planning.

Nationally we still boast of our sovereign rights in a fast contracting world and individually of our independence and "rugged individualism". We are content to engage in cut-throat competition on the world's markets, at least while prices are good, and to appeal for contributions from the public coffers when they are not. Yet even in Australia, there has been considerable control of production in industries such as sugar, rice, flax, dried fruits and even wheat. The United States has gone as far as attempting to stabilise producers' incomes by all-risk crop-insurance schemes which insure even against drought. Is it not possible that the orderly production on a world scale, and according to plan, of the major primary products at controlled prices would give a far greater degree of security and real welfare to farmers and therefore to the towns and cities so largely dependent on them?

There can surely be no question of Australian producers wishing in the post-war period to revert to a policy of *laissez-faire*. The danger of an unscientific attitude developing lies chiefly in the probable unwillingness of sectional interests to cooperate fully when open competition on the world's markets may appear to be to their immediate advantage. The desire of such sections of producers to capitalise on a probable shortage of raw materials in the immediate post-war period may react drastically, however, against their future security. The active participation of Australia in plans such as those initiated at the recent United Nations Food Conference at Hot Springs, Virginia, U.S.A., is surely, even on the lowest plane, a matter of self preservation for a nation which exports in normal times approximately sixty per cent. of its primary produce.

International planning implies also the need for planning on a national basis. Already Soviet Russia, the United States and, to a lesser extent, Great Britain, have largely planned the production of their individual farms, so that the nation as a whole will produce what is required in the quantities required. Conservation of soil fertility as a national asset has been an additional objective in planning.

Under the stress of war, our Commonwealth agricultural administration has been strengthened. The Commonwealth Food Controller has recently been granted

wide powers to control the production, marketing and processing of agricultural products. Without the continuation of adequate Federal powers in the post-war reconstruction period, however, there may well be chaos in our national life. Yet, in the proposed Commonwealth Powers Bill, primary production is specifically excluded from the Federal sphere of control except by consent of the States. Can such an omission as agriculture from Commonwealth control, already assumed for purposes of war, be considered rational or scientific?

There is a justifiable fear in the minds of farmers that the planning and control of primary production might lead to regimentation. Such control may, however, be reduced merely to coordination at "the top" if producers themselves will cooperate fully in agricultural administration through District War Agricultural Committees and Local Committees. Such activities should also help materially to increase our social consciousness and develop a sense of community responsibility. It is significant that in U.S.A. since 1933 and in Great Britain and Australia under war-time conditions, increased control of primary production has been closely associated with, and dependent upon, the development of local committees of farmers. If in Australia at war or at peace such agricultural committees are to be successful as a democratic arm of government, backed by the weight of farmers' opinion, then care will be needed to see that such government "from the bottom up" is expanded while that "from the top down" is reduced.

That there is need for more scientific planning in Australian agriculture can scarcely be denied if attention is directed, for example, to the relatively low standard of technical efficiency on some farms, the wide and rapid fluctuations which have occurred in the prices of many farm products, the increasing indebtedness of the rural community, the high proportion of production claimed by capital as rent or under share-farming agreements, the existence of farms which are too small for efficient working alongside undeveloped and landlocked areas, the instability of rural awards and the absence of housing standards in country districts. Many of these troubles are beyond the control of the individual farmer. They are due primarily to the incompleteness of design in a system of farming, the evolution of which has been largely haphazard.

Is there not room for more scientific planning when farmers grow more but receive less? Between 1927 and 1939 rural indebtedness in Australia increased by approximately 20 to 25 per cent., and this in spite of a rise in total production of approximately the same order. Average prices received for farm products declined considerably further during this period than did the average cost of commodities purchased by producers. If as Mr. T. H. Bath, a Trustee of the Wheat Pool of Western Australia, states, it now requires in Australia $2\frac{1}{4}$ bushels of wheat to buy the same amount of goods as was purchased by one bushel in 1911, then it is little wonder that, in spite of increased productivity per head, none but the most enterprising and efficient farmers have been able to bridge the gap between costs and prices. Indeed as late as November, 1942, Mr. Chifley, Federal Treasurer, placed the indebtedness of Australian farmers at over £400,000,000.

Planning Better Farms.

In view of the above trends, it is little wonder that many farmers have not paid labour a living wage; until the necessity for increased war-time production forced a solution, or that health standards are insisted upon when building homes in towns, while outside the municipalities any hovel is apparently good enough. Even many of the better farm homes are deprived, perhaps unnecessarily, of adequate sanitation, water supply, electrification and medical and educational facilities. It is suggested that a more scientific planning of the utilisation of Australia's national resources according to need could remedy most of these disabilities within a decade.

It is true that many Australian farms, which as a class are commercial farms operating for profit, are highly efficient. There are many farmers, however, who are not prepared to adopt well tested scientific methods of production. Could not many of these men do more useful work and enjoy a fuller life as members of a cooperatively organised food-producing team? It has been suggested that the resource in shortest supply in the dairy industry is managerial ability. Whether this is so or not, it can scarcely be claimed that due weight has been given to, or adequate experiments conducted with, alternative methods of cooperative or community farming designed to raise the efficiency of production by better management, greater specialisation of personnel, reduced capitalisation and the fuller use of technical improvements which, at the present time, are available only to a minority of farmers.

In this respect, it is of interest that the New South Wales Government has recently recognised its responsibility for increased efficiency in the dairying districts by providing mechanised units to be community-owned and community-operated. If efficient operation results in more economical production, this innovation might well prove the basis of revolutionary changes, by placing the benefits of technical progress more completely at the disposal of many of the smaller Australian farmers. That barely twenty per cent. of our dairy farmers use milking machines is further evidence of a lag between technical progress and practices.

Of wheat-farmers, too, only about half use tractors. Many of these are not the best procurable for the tillage, sowing and harvesting implements in use or for the size of the farm, which in some instances has not altered since the "horse and buggy" days of settlement. Many farms are too small to allow the effective use of the large and efficient power units now available.

There are farmers also who are unwilling or unable to use rotational practices which have been proved to be profitable and to maintain soil fertility. Surely the community should exercise some control over the conservation for posterity of national soil resources rather than that the landholder should continue to retain power of "life and death" over his property. It is surely legitimate for the State, preferably through farmers' committees, to assume some responsibility for the preservation of soil fertility, as it did in many European countries prior to the growth of the rank individualism of the eighteenth century.

The time appears opportune for Australia to plan production, using subsidies on soil improving crops and better farming practices as a means of achieving a long-range policy of soil conservation. Such a policy has been achieved in the United States an extension of better husbandry, which propaganda alone never could have achieved. There is a danger in Australia of subsidies paid in the form of increased commodity prices alone, lowering rather than raising the efficiency of farm production.

The stabilisation of exchange values for at least the major primary products on the lines of the American "parity" concept may represent a palliative to many of the farmers' disabilities, especially if coupled with other devices for securing farm incomes. Amongst these are control of land values and interest rates, all-risk crop insurance and the food-stamp plans used for the distribution of some surpluses. Is it not probable, however, that the root causes of increasing indebtedness, rural poverty, inefficiency and soil exploitation lie deeper—perhaps in a decaying system from the mould of which fresh life will spring? At least there should be more willingness to analyse scientifically systems of land tenure and farm organisation, if this land, which is still ours, is to be more fully developed. It cannot much longer remain the most sparsely populated country in the world though situated alongside the most densely populated. To develop it, attention should be paid not only to world markets as an outlet for primary production but also to a higher living standard for the people and to population increase both natural and immigrant. With this should be coupled a policy of planned decentralisation dictated by national needs and not solely by commercial and financial interests.

In spite of an arid interior, almost limitless possibilities lie ahead if a planned agriculture is integrated with planned secondary industries. Does not the history of those, who like Farrer have carried the torch of scientific progress thus far, urge us to see to it that in future the only limit to development in Australia is set by what can be achieved by "seven million pairs of hands"?

These things will be when, in sufficient numbers, we awake to a realisation of the wealth of material and spiritual resources which awaits, not the transformation of the alchemist but the gradual and perhaps disturbing influence of scientific thinkers, who are prepared to observe closely, test carefully, plan loyally and act boldly in the interests of human progress.

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