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SCIENCE IN FARMING

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All thoughtful people are interested in seeing that provision is continually made for survival. Scientist and primary producer are workmates in this programme of survival which involves the production of ever-increasing requirements of food and fibre. In the process the farmer and grazier must also show a profit.

In a sense, the primary producer is a product of science, since the improvement in the food situation in the advanced nations is dependent upon the findings and applications of many scientific disciplines. But in addition the type of primary production developed within any country is as much governed by economic pressures within that country as by any other factor. To change to intensive farming, under our present social conditions, an attractive profit margin must be provided and this margin is often controlled less by soil type or soil fertility than by proximity to markets, population distribution pattern, and the economic pressures that arise therefrom. Bearing on this, it is of interest that the Vernon Report suggests that research be undertaken for devising improved forms of stabilization which do not impose rigidity of land usage or conservatism of management.

The scientist is often worried by the delays that exist between the finding of something new and its ready acceptance by the primary producer. This is not a constant problem in all types of research and yet the same problem must exist in relation to research in the industrial field. There is a tremendous gap between industrial research and product initiation, and the way of the scientist in the business world is well strewn with obstacles. This gap has been shown to exist for two reasons:

(1) The business climate discourages risk-taking by the kind of small business entrepreneur who is needed to commercialize a project of research; and
(2) The lack of imagination by industrial management, which either fails to provide incentives to inventors or worries about the threat a new project may be to an established line.

Whether or not these types of consideration also apply in the relationship between agricultural research and the primary producer is not certain. There is some lack of communication but this is being gradually overcome.

In comparing present with past, it must be remembered that in the early 1900's farms were almost self-sufficient, land values were low, little was spent and practically nothing wasted. Today farming is big business and many factors outside the control of the farmer can disrupt it, e.g. transport upsets, shortages of seed, fuel, fertilizer, spare parts or any breakdown of maintenance services.

The history of the development of the Poulsen properties since about 1900 will be used to illustrate the part that the application of agricultural science can play in farm development.

*This article is based on his Presidential Address to the Society in November 1965.

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These properties, now totalling 1,100 acres are situated in the Mary Valley in south-east Queensland. The rainfall is approximately 45 inches per annum. The properties were originally held in the partnership of P. E. & W. Poulsen and A. B. & A. M. Poulsen and were taken up in the early 1900's. The scrub lands were virgin vine scrub and the open Eucalypt forest country carried a ground layer of kangaroo grass (*Themeda australis*). The scrubs were felled out for the timber of the hoop pine, cedar and beech which they contained; the idea of pasture improvement was secondary. The forest lands provided grazing in the early days for horses of one of Cobb & Co's changing stations on Mulligan's Flats.

The technique of "driving" the scrub using a "king" tree, as developed in the big scrub areas of New South Wales, enabled the scrub lands to be cleared reasonably easily and economically, but left problems in providing shade trees. Fortunately, in their wisdom, the settlers did not clear the scrubs right to the river's edge or otherwise we may have had another shallow, sandy creek instead of the Mary River which has a relatively stable annual flow. Only in the last 20 to 25 years has the deep water along most of the river frontage of this property been sanded up. This no doubt is due to more recent felling of scrub along the riverside and the decline in soil fertility and vegetation cover caused by an unbalanced farming programme.

The scrub lands were grassed with *Paspalum dilatatum* brought up from New South Wales, and the first white clover came to the district in a match box. However, white clover did not establish readily until waggon loads of yardsweepings containing clover seed from a neighbouring property were spread on the ground. This was an early experience of the *Rhizobium* problem which has been elucidated in more recent times by scientific legume bacteriology.

For two generations formal agricultural college education has contributed considerably to an understanding of the scientific approach to farming. The present business is operated by the fraternal partnership of K. R. and D. E. Poulsen which took over managership of the property in 1938, Mrs. E. P. Poulsen having previously managed it since 1927. The second world war followed soon after with its shortage of labour, equipment and finance, and was a period of minimal development. After the war another family property, "Hostrup", was purchased.

Dairy Production: During the period 1954-58 the annual dairy production of commercial butterfat (CB) was 13,200 lb. In 1959 production had increased to 20,600 lb CB, while for 1964 it was 30,200 lb CB. For the first six months of 1965 more than 17,000 lb CB was produced and up to the present date (Nov. 1965), production is running between 375 and 500 lb CB per month above the corresponding months of last year. This is in spite of the first three months of 1965 being the driest on record. Furthermore, this has been achieved with an increase of only 20 per cent in herd size (i.e. 113 as opposed to 94 cows). Once this year's sowings of improved pastures come into production, we expect to be able to increase our herd number to 150 without decreasing our average production per cow.

Two important questions may well be asked, firstly, why is it necessary to engage in pasture improvement and secondly, what part is science playing in this? The first question is important since, with the improvement in the whole of the economy, the gross national production has risen at an annual rate of three to five per cent. It is therefore necessary to double gross income on a property in a period of 15 to 25 years,

in order to maintain a state of balance with the rest of the community. This has been achieved on this property in the ten years from 1954 to 1964, and further considerable increases are anticipated as production per cow and per acre continue to improve. The rise in production per acre of commercial butter has been from 57 lb in 1954 to 116 lb in 1964, with a low of 37 lb in the drought year of 1957.

In the second instance a scientific approach has led us to an understanding of the value of crop rotation, which has been practised since 1936. Furthermore, since 1954 when the first six acres of Ladino clover pastures was planted, a ley farming system based on legume-grass pastures has been practised. Large scale fertilizing of pasture was also initiated in 1954 at a cost of $1,000. On this property today 173 out of 260 acres are sown to improved pasture and the whole property is fertilized each year. Fodder has been conserved as silage since the drought year of 1957, when one thousand tons was stored in trenches. In 1959, with the assistance of the Irrigation and Water Supply Commission, and the availability of long term finance, the irrigation capacity was greatly increased so that pastures based on temperate clover species considerably boosted winter pasture production. Dairy production from 92 cows rose from 14,585 to 20,612 CB representing a per cow increase of from 154 to 234 lb CB and a per acre increase of from 57 to 79 lb CB. In this period the area of sown pasture increased from six to 42 acres and the use of fertilizer increased from 18 cwt to 126 cwt.

The total rainfall of 27 inches in 1960 and its seasonal distribution corresponded well with the drought year of 1957. However, in 1960 it was possible to irrigate 32 of the 42 acres of sown pasture with the equivalent of 36.35 inches of water, which resulted in the maintenance of dairy production at 20,312 lb CB from 92 cows. In 1957 production dropped to 10,326 lb CB and it was necessary to reduce the herd to 80 head of milking cows.

In 1963, hay-making equipment was purchased and it is anticipated that 8,000 bales of pasture hay will be fed to stock each year. Dairy production for 1964 increased by 4,400 lb CB over that of 1963 with 15 more cows. For the first 11 months of 1965 butterfat production was higher than the whole of the preceeding year and may well reach an excess of 40,000 lb for the full 12 months.

In addition to the butterfat increase outlined above, since 1962 the dry stock carrying capacity of the property was increased by 50 one and two year old heifers. This parallels both the increase in area of sown pasture from 80 to 148 acres and the increased use of conserved feed. As a result production on a per cow, per acre and per man basis has increased.

Fertilizing

The use of fertilizer has expanded rapidly with the increase in gross output. By using a modified form of crop logging (C. S. Andrew, Pers. commun.) it has been possible to reduce applications of superphosphate and molybdenum over much of the property, and to concentrate it on other areas where the fertility is not yet at a satisfactory level. Generally 6 to 8 cwt of superphosphate per acre is required initially for satisfactory responses. More recently pastures are beginning to respond to potash.

Improved Species

The introduction of better adapted pasture species has been beneficial. The environment provides the opportunity of using both temperate species for winter

production and tropical species for summer production. Ladino clover, as a winter growing species, filled the gap to provide year-round pasture legume production.

A suitable and persistent winter grass was provided by Priebe's prairie grass which was introduced in the 1960's. Now of course, we have a range of tropical legumes and grasses which promise still greater increases in production. These include; Siratro, green and silver leaf desmodiums, glycine, lotononis, setaria, Rhodes grass, and green panic, to mention only the more promising.

Stocking

The establishment and maintenance of improved pastures over the whole property has led to considerable increases in the stock carried. In addition to increasing the size of the dairy herd it has been possible to include 150 yearlings for beef production in the enterprise. Furthermore, the replacement dairy heifers are of much better quality and in their first lactation are averaging above the herd average. By feeding improved pasture and hay, and practising parasite control, the dairy heifers are producing at least 50 lb more butterfat in their first lactation than previously. The vealer and heifer rearing project was begun in 1960 using irrigated pastures and on two occasions up to the present liveweight gains of approximately 1,000 lb per acre per annum have been achieved.

Parasite control

Irrigated pastures and high stocking rates bring problems, and internal parasites became a major factor. By means of drenching and careful paddock management it has been possible to keep parasites to a minimum.

Seed Production

Seed production of tropical legumes and grasses, which is a very recent venture, requires just as much help from scientific research as have the other agricultural ventures on the property. In this respect good progress has already been made. Commercial production of several of the newer releases of tropical legumes and grasses is well under way with a group of co-operating farmers in the Ridgewood-Cooroy-Eumundi area and is this year producing considerable supplies of high quality seed. This operation has been organised in association with a leading firm to ensure the efficient marketing of the seed as well as the careful production of a high quality commodity.

Ley farming has been primarily responsible in giving five-fold increases in yields of maize and other cereal crops. Two hundred bushels of Q692 maize per acre was grown on land which previously grew crops so poor they were fed off because of low yield. This yield was achieved after seven years of unirrigated Ladino clover pasture fertilized annually with 2 cwt of superphosphate, the maize receiving 360 lb of a 5-13-5 mixture.

Conclusion

In summary the points to which success may be attributed are set out below and they may equally well be applied to many other undeveloped properties.

1. The use of adequate amounts of fertilizer over the whole property, with careful following through to check the efficiency of use of the fertilizer by crop and animal logging.

2. The use of adapted plant species.

3. The conservation and feeding back of farm-grown fodder.

4. The implementation of a farming policy which recognises the close relationship between plant and animal.

5. Increasing the efficiency of overall management, ability, realising that this is a team effort.

6. Achieving a satisfactory relationship with the banking institutions as indicated here by the initial expenditure of money on fertilizer in 1954 and subsequently, the financing of the irrigation project.

There are two important ways in which financial help can be given to the progressive farmer. One could take the form of special banking practice to cover the financial requirements of approved development e.g. fodder and water conservation, pasture improvement, in the shape of direct grants on a percentage basis. The other would be to follow U.K. practice in allowing a 45% rebate for probate purposes on agricultural land, because of the recognised lower earning rate of capital invested in agriculture rather than in industry. This is done in the U.K. in addition to agricultural grants, deficiency payments and subsidies being made.

In retrospect, the educational facilities available to our youth have enabled us to apply some of the more recent findings of science to farming. For the farmers of the future, it will be even more necessary to have the ability and training to adopt and apply new practices and principles which affect every facet of the farming business. This means more agricultural colleges, the setting up of farm institutes and the extension of university facilities for agricultural education.

Science and farming, as with theory and practice, are necessary to one another, and hence scientists and farmers have much in common. To-day's successful farmers are applying many findings of research very successfully. It is this that will further stimulate scientists to continue their endeavours with the resultant benefits to the world at large.