

PRESIDENTIAL ADDRESS

AGRONOMY: A MULTIDISCIPLINARY RESEARCH

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M.A. Carleton, in his presidential address to the first American Agronomy Society conference in 1907, gave the current dictionary definition of agronomy as the study of rural economy and land administration. A definition relating closely to the literal translation of the Greek words 'agros', a field and 'nemos', to manage: i.e. the management of fields. He drew attention to the change in emphasis that had occurred since 1900 towards taking the crop rather than the field as the unit of study in agronomy. He redefined agronomy as then practised as the study of field crops and their relations to the environment. He noted also the increasing number of disciplines with which the agronomist needed to be familiar and, because of this, the growing tendency for specialisation according to the crop e.g. Cerealist, tobacconist.

Carleton's definition of agronomy remains as true now as then. Yet the simple statement 'the study of field crops and their relations to the environment' belies the extensive and intensive nature of the subject today. The intervening years have seen a steady increase in the depth and breadth of knowledge on the functioning of the plant, soil and microclimate and their interactions in the plant community, the crop. In addition, advances in plant breeding, weed, insect and disease control have brought further dimensions to the study of crop production. Of necessity, time has led to further specialisation both according to the crop and the individual aspects of its production.

Crop productivity is the sum of the complex interactions between the plant community and its field environment over time. Because of the interaction between many of the factors affecting crop growth and commercial yield, the value of assessing the effect of individual factors on crop productivity, in isolation in the field, is limited. In seeking to improve productivity, to find a solution to a production problem, to introduce a new crop or an alternative system of production, it is necessary to bring into play many of the different disciplines involved in agronomy. The individual agronomist in his research draws on his own, understandably restricted, knowledge of the other disciplines and backs it up by consultation with specialists in the appropriate disciplines in working to resolve production problems. Because of the restricted input of the individual and because of the number of different aspects to be considered, it requires a protracted period of time to evaluate and resolve a problem.

The individualistic approach to problem solving does not match up with the requirement today to find out most rapidly and economically an answer to the question posed. As crop production approaches the biological limit the law of diminishing returns operates in research. To achieve the same gain in productivity, greater effort and involvement is needed to evaluate, understand and provide a solution to a production problem. It is not sufficient to record just what occurred. It is important to know also why the effect occurred as this answer can provide the stepping stone to further improvements in productivity.

Undoubtedly the individual can provide useful information in agronomic research but there is an increasing need for a team effort or task force approach to resolving question on crop production more rapidly. Such a research team may well need to involve the end user of the crop product as well as those immediately involved in production of the crop. The team effort approach involves the comprehensive study of a topic for a limited, defined, period of time compared to the prolonged period of restricted input accorded the individual.

To take a specific example at this point, one with which I am familiar and which is particularly pertinent to this approach, I cite the case of the efforts to introduce soybeans as a crop. The crop was first considered for production about 1910 and again at intervals around 1930 and 1970. A period of 70 years in total. Predominately over this period the potential for the crop was assessed on the basis of the yield of varieties suitably adapted to the length of the growing season. In 1910 the crop was seen as marginally acceptable. Despite improvement in yield through research into variety, weed control, population and planting date, the position of the crop remains the same because of the inconsistency in performance across years. Blair *et al.* (1966) gave it as their considered opinion that summer temperatures were not high enough for satisfactory production of the crop in Canterbury. Later, McCormick (1974) pointed out the close association between summer temperatures during flowering and yield in the Waikato. Yet at no time during the period has a thorough investigation been made into why the crop did not yield well and whether the crop could be improved through breeding and selection to make it commercially acceptable. Only in the past year have physiological studies (Hume and Jackson, 1980) shown that the low temperatures often experienced during flowering can restrict pollination, pod setting and yield in the common, USA, cultivars in current use here. Fortuitously, the same work has confirmed the existence of varieties with the trait for greater cold tolerance during flowering. These cultivars have been derived from Japanese varieties as a result of breeding work in Sweden by Holmberg (1973) and Voldeng in Canada. The identification of the problem and its probable solution have now reopened the case for the possible successful production of the soybean crop.

Taken that it is desirable to produce the crop, I would submit that it would be a more effective approach to commit part or whole of the time of a group of researchers of the appropriate disciplines, for a limited period, to make a complete assessment of the potentials and limitations for producing the crop. The setting of a time limit on the research and then reviewing the situation are critical to the approach. At the point of review the crop maybe rejected completely or lines of research identified on aspects of the crop which are seen as limiting but which, with modification, could make the crop a viable proposition.

In the case of the soybean, ten years ago and certainly today, the true limitations of the environment to its production could have been identified in a period of five years or less from the crop's first introduction had this approach been adopted. Other situations which offer possibilities for the same approach for example are: reduced/no tillage cropping, the value of crop rotations and the use of maize as an alternative to or within a pasture system.

The task force approach, operating maybe at the expense of the individual, is a somewhat alien concept to agronomic research as opposed to its more frequent use in industry. However, use of the approach would appear to be justified in making the best use of limited resources. The approach can be said to restrict the individual researcher but alternatively it can be said to direct his abilities along a common line or goal. In itself the team approach can provide a stimulus. It removes the frustration of being able to provide only part of the answer to the whole question at any one time. It presents a short term goal with a finite end yet need not restrict the individual in his field.

There are problems in the approach. In logistics, personality conflicts and individual assessment and reward. I appreciate this but do not intend to dwell on them. The point I wish to emphasise is that agronomy is a multi discipline and in crop production research these disciplines must be brought together in an effective way to solve problems in as short a time as possible.

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