DISCUSSION OF PAPER OF P. W. WILSON AND ORVILLE WYSS

D. B. Johnstone-Wallace

My approach to the problem of nitrogen assimilation by legumes is that of an agrostologist working along the lines of applied ecology.

In applied research the ultimate aim is the discovery of a way in which some agricultural practice may be improved. The ultimate aim of the investigations for which I am responsible is the improvement of New York pastures.

The complicated nature of pasture problems makes it difficult, and sometimes impossible, to separate many factors which together constitute a fact readily determined. Papers such as that presented by Dr. P. W. Wilson dealing with fundamental problems are of great value to workers in the field of applied research because they make it possible to rebuild agricultural practices on the sound basis of fact rather than surmise.

Those who attended the Fourth International Grassland Congress in Great Britain last July, will appreciate that pasture research in Great Britain has been built around the use of pasture legumes as an essential part of the practice of pasture improvement and management. One legume which has been found to be of outstanding value in British pastures, is wild white clover. This value is associated with its true perennial character and its ability to supply economically the enormous amount of nitrogen required for the production of high yields of pasture herbage.

Historically the recognition of the value of wild white clover in pasture improvement is the result of experiments established at the Cockle Park Experiment Station of the University of Durham by the late Professor Sir William Somerville in 1897, and to the development of this work by the late Professor Douglas A. Gilchrist, with whom it was my privilege to work.

Experiments at Cornell University (2) have indicated that wild white clover is equally important, and perhaps even more important, in the improvement of New York pastures.

Virtanen (1) in his paper read before the Grassland Congress last July presented evidence in support of the excretion of nitrogen by leguminous plants and drew conclusions which have considerable bearing upon the problems of pasture improvement. Some of these have been ably discussed by Wilson in his paper today and additional conclusions have been drawn.

The conclusions drawn by Virtanen which are of particular interest because of their bearing upon pasture improvement are these:

1. Nitrogen is excreted into the soil by leguminous plants and this excretion is associated with the nodules and the legume bacteria and does not take place from the roots.

2. The excreted nitrogen compounds are mainly amino acids primarily L-aspartic acid. Ammonia is not excreted.

3. The excretion of amino acids involves not only nitrogen but also organic carbon. The C : N ratio of the excreted material is 3.5 : 1.

4. The excretion of nitrogen is proportionately highest at an early stage when the nodules are quite young.

5. Increased illumination promotes, up to a certain limit, the assimilation, fixation, and excretion of nitrogen.

6. Excretion of nitrogen is influenced by temperature and shade and depends upon the harmonious development of the species grown together.

7. Pot experiments with white clover, red clover and alsike show that the nitrogen rendered available by the decay of roots, nodules, and dead plants, is relatively low in proportion to the excreted nitrogen.

8. In order that satisfactory results may be obtained associated cultures of legumes and non-legumes must not contain disproportionately large numbers of non-legumes.

9. The extent of excretion is generally higher in associated cultures than in corresponding cultures of legumes alone, due to the uptake of amino acids by the legumes.