

PLANT CHEMISTRY LABORATORY

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THE NITROGEN CYCLE

The trials conducted by the Grasslands Division on the effect of clovers in the sward have yielded interesting information regarding the nitrogen cycle in pastures. Nitrogen is supplied by clover to the associated grasses by both underground and overground routes. Quantitatively the former is of less importance than the latter, and no clear-cut evidence is available as to the mechanism whereby underground transport of nitrogen takes place. Overground transport is effected almost solely through the grazing animal, and the amount of plant nutrients returned in dung and urine to a high-production sward is many times greater than the amount applied as artificial fertilizer.

Of the nitrogen voided by the sheep, about 75 per cent. is excreted in the urine, while 75 per cent. of the urinary nitrogen consists of urea. Studies have been made of the fate of this urea when applied to soil, and the following are the important points :—

- (1) The rate of breakdown of urea to ammonia in soil is markedly affected by temperature, only 2 per cent. being hydrolysed in twenty-four hours at 41°F. and up to 35 per cent. at 77°F.
- (2) Urea applied as urine is broken down much more rapidly than are pure urea solutions.
- (3) The rapid production of ammonia in urine patches in summer markedly raises the pH of the top layer of soil, the highest value recorded in the field being well over 8.
- (4) This may lead to serious losses of ammonia to the atmosphere, and such losses have been shown to occur to the extent of over 20 per cent. when solid urea is used as top-dressing.
- (5) The conversion of ammonia to nitrate lowers the alkalinity of the top soil layers in a urine patch, although the effect lasts for some weeks. This conversion is stimulated by other urinary constituents.
- (6) Urea is readily leached from the soil and may be lost to drainage water during periods of high rainfall.

Urine is the primary agent in producing grass-dominant pasture swards, and further work on the fate of urinary substances when voided on the sward is required. Corresponding work with faeces, which contain all the lime and phosphate excreted by the animal, is equally desirable.

NITROGEN METABOLISM IN PLANTS

These studies have their counterpart in the investigations of nitrogen metabolism of pasture plants which have been pursued for a number of years. Urea is taken up very rapidly by rye-grass roots, and urea concentration in the leaf rises markedly within a few hours after urea application to the soil. This is also probably true to a lesser degree of other urinary constituents, and indicates that the accepted nitrogen cycle in soil—where all organic nitrogen must be changed at least as far as ammonia, and ultimately to nitrate, before being utilized by the plant—requires revision under pasture conditions.

Work on the urea metabolism of green leaves is being vigorously pursued, primarily with the object of determining whether the urea-urease system acts merely as an internal source of ammonia or whether urea can be used by the leaf as a raw material for synthesis. Simultaneously investigations are being made of the free amino acids of green leaves, the amino-N fraction being quantitatively the most important of the major