

Rapid sap test for monitoring the nitrogen status of crops

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Within the Australian farming community there has been growing interest in the economic benefits of applying N fertilizer, either at sowing or as a topdressing to a wide range of crops. This has largely resulted from the need to improve crop yields and quality in the face of declining soil fertility and increasing market pressures. In order to optimize N fertilizer usage it is necessary to have a rapid field test which can be used by growers or agronomists to monitor the N status of a crop. In this way, decisions on topdressing can be made during the season, ensuring N fertilizer is not applied to crops that have adequate N reserves. Such a test using Merkoquant test strips has been used overseas to monitor sap nitrate levels in various crops, and several researchers are now using this technology in Australia. This paper describes the use of this test for maize, wheat, oilseed rape and sunflower crops.

Method

Fifty to 100 individual plant samples are collected depending on crop area and uniformity. For cereals, whole plants are cut at ground level whereas for other crops, petioles from the youngest fully expanded leaf are collected. Approximately 5mm is cut from each stem or petiole base. The bulked sample is placed into a garlic press and sap squeezed onto a test strip which reacts with nitrate to form a magenta colour. The colour intensity is proportional to nitrate concentrations up to 500 ppm, while the time to reach the 500 ppm colour is proportional to nitrate concentrations between 500 and 10,000 ppm. The colour is measured visually against a colour scale supplied with the test strips or in a simple reflectometer similar to a blood glucose meter. The meter must be calibrated against standard nitrate solutions.

Results and discussion

This simple test is rapid, inexpensive, easy to perform and does not require skilled operators nor use dangerous chemicals. It is extremely "user friendly" and has high acceptance in the farming community. The reflectometer reduces variability between readings from about 30% to less than 10% and provides a continuous reading between 0 and 500 ppm rather than the 6 step colour scale. Precision and accuracy of the test could be further improved by diluting the exuded sap, until nitrate levels are between 100 and 500 ppm. However, we feel that this procedure makes the test unnecessarily complex and would retard its acceptance by the farming community. Consequently we have opted to use undiluted sap when calibrating the test against crop N status. The test requires extensive calibration in the field for each crop, and to date it has been calibrated for wheat, oilseed rape, maize and sunflowers and partially calibrated for tomatoes, tobacco and potatoes. Other papers in these proceedings report on the results of some of this work.