Grower Summary

BOF 60

An on-line, low-cost, non-invasive MRI sensor of Basal Rot in Narcissus bulbs

Final 2011

Disclaimer

The results and conclusions in this report may be based on an investigation conducted over one year. Therefore, care must be taken with the interpretation of the results.

Use of pesticides

Only officially approved pesticides may be used in the UK. Approvals are normally granted only in relation to individual products and for specified uses. It is an offence to use non-approved products or to use approved products in a manner that does not comply with the statutory conditions of use, except where the crop or situation is the subject of an off-label extension of use.

Before using all pesticides check the approval status and conditions of use.

Read the label before use: use pesticides safely.

Further information

If you would like a copy of the full report, please email the HDC office (hdc@hdc.ahdb.org.uk), quoting your HDC number, alternatively contact the HDC at the address below.

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Project Number:	BOF 60
Project Title:	An on-line, low-cost, non-invasive MRI sensor of Basal Rot in Narcissus bulbs
Project Leader:	Dr. Brian Hills
Contractor:	Institute of Food Research
Industry Representative:	Gordon Flint, Winchester Growers
Report:	Final Report 2011
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Previous report/(s):	Interim report, March 2010
Start Date:	1st December 2010
End Date:	31st October 2011
Project Cost:	£7,000

Headline

We have shown that a low-cost, non-invasive, on-line MRI sensor should be able to detect basal rot in Narcissus bulbs with a high degree of confidence, although further work is needed to establish the commercial viability of the MRI sensor.

Background

Basal rot in Narcissus bulbs is a major problem for growers, but its automated, non-invasive detection with a high degree of confidence is not yet possible. At present, bulbs that have very extensive basal rot can be removed by hand sorting based on the softness of the bulb. This is a crude labour-intensive and expensive method that fails to detect basal rot in any but the most extreme cases of infection. This small scale project was therefore undertaken to investigate the feasibility of using a prototype MRI sensor for the automated detection of basal rot. This prototype had already been built and tested by the MRI research team at the IFR.

Summary

Basal rot continues to be the major disease of narcissus causing significant on farm losses of saleable bulbs, quality rejections by retailers and reduced yields of cut flowers.
The work reported here has shown that under laboratory conditions Basal rot can be detected in stationary Narcissus bulbs using an MRI sensor.

Further work is required to determine the practicality of using this technique on bulbs moving in a process flow situation.
In addition serious thought needs to be given to calculating the likely cost, to include all safety aspects, of an industrial sized sensor that could be used by the industry.
If the calculation indicates that the cost of such a machine is within the grasp of bulb growers/groups of bulbs grower (perhaps below £300k) then we should consider proposing to take the ‘project’ further.

50 intact Narcissus bulbs having varying degrees of basal rot were examined with the on-line MRI sensor. A 1-dimensional MRI relaxation spectrum was acquired for each of the bulbs and analyzed for the existence of basal rot to give a straightforward “yes or no” result. Each bulb was then cut open and photographed and classified as to whether or not there was basal rot. The MRI prediction was then compared with the photographic evidence. All 50

bulbs were correctly classified by the MRI method, although two cases gave the correct result but could be described as “borderline”.

This success needs to be qualified by two points:

1) To test the validity of the method the MRI measurements were done under ideal circumstances, namely with stationary bulbs and with 16 accumulated acquisitions of the MRI data on each bulb to improve the signal/noise in the data. In a real on-line situation the bulbs would be travelling on a conveyor in single file through the MRI sensor at speeds of up to 1.3m/s and there would then only be time for a single acquisition of the MRI data on each bulb, so signal/noise would be worse and, potentially, the degree of confidence in the detection of basal rot correspondingly less. If the project is to be taken further then this would involve measurements on moving bulbs with single shot acquisition to test the reliability under realistic conditions.
2) The MRI sensor is still at the prototype stage and would require serious financial investment before it could be sold commercially, although this would not be necessary if the sensor were run as a “service” for sorting bulbs and selling basal-rot free bulbs.

Financial Benefits

There are two business scenarios to be considered:

- The first involves the replacement of the hand-sorters on a conveyor belt with a commercial version of the MRI sensor. This would require serious financial investment in the development of a factory-safe, and noise-insulated commercial version of the existing prototype MRI sensor. It is doubtful whether this could be commercially viable, but no attempt has been made a quantifying the cost/benefit ratio.

- The second business scenario is where just a few MRI sensors are located in an optimized, noise-free environment and used to grade bulbs and remove any bulb containing basal rot. The basal-rot-free bulbs could then be sold on to growers and to the general public with the guarantee of being basal rot free. Input from growers would be required before any cost/benefit analysis could be undertaken on this second business strategy.

Action Points

The next step, which would require additional funding, is to repeat the experiments under the more realistic conditions of moving, single-file bulbs with single-shot acquisition. This would require optimizing the design of the MRI sensor slightly. In particular, a new radiofrequency probe would be built around the conveyor to optimize the signal/noise ratio.

Subject to approval by the growers, similar studies could be undertaken to detect bruising in Narcissus bulbs and also a separate study could be undertaken for the quality of Onions.