Grower Summary

CP 083

Minimising postharvest losses in radish through an understanding of pre and postharvest factors that influence root splitting

Annual 2013
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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.

HDC
Stoneleigh Park
Kenilworth
Warwickshire
CV8 2TL

Tel – 0247 669 2051

HDC is a division of the Agriculture and Horticulture Development Board.
Headline

Radish splitting is correlated with the moisture content of the growing medium at the point of secondary thickening. A period of drying down at the point of secondary thickening followed by irrigation gives reduced pre-harvest splits with no loss of marketable yield.

Splitting postharvest as a result of mechanical damage can be reduced by having lower hypocotyl water content.

Background

Splitting in radish is an important problem for growers as levels of splits can be as high as 30% on arrival at the pack house thus exceeding supermarket tolerances of 10%. This leads to batches having to be sorted by hand which is costly. Hypocotyl splitting in radish usually occurs pre-harvest or shortly postharvest (1-2 days) during storage. Despite these problems, little is known about the environmental and physiological causes of splitting particularly in European radishes. Identification of the factors governing splitting or splitting susceptibility may allow the development of field production, harvesting and handling practices which minimise hypocotyl damage.

European radish has a rapid growth cycle; characteristically 4 weeks from planting to harvest. With such fast growth rates the requirement for water are high and so water availability and irrigation management may play an important role on radish splitting. Previous field scale research into splitting in larger Asian or Daikon radish types has shown irrigation frequency (Wan and Kang, 2006) and quantity (Kang and Wan, 2005) have significant effects on splitting at harvest but there has been no reported investigation into the effects of irrigation on splitting in European radishes. Irrigation and water availability during growth may also affect hypocotyl water contents at harvest. Marcelis (1999) found increased salinity and consequently decreased water availability during growth resulted in a higher percentage of dry matter in the radish hypocotyl at harvest, though salinity effects on osmotic potentials can be complex. Similarly, postharvest handling of radish, e.g. washing, where water can be taken up or storage in open containers where water can be lost prior to packing may result in variable hypocotyl water contents; all of which may affect splitting postharvest by increasing turgor pressure as McGarry (1993, 1995) reported that failure force in carrot tissue was negatively correlated with tissue turgor and water potential. There have been no reported investigations into the effects of hypocotyl water content on splitting susceptibility in European radishes.
The aims of the research this year were to identify pre and postharvest factors which affect splitting in radish hypocotyls. The specific objectives were to:

1. Investigate the splitting susceptibility of different radish (*Raphanus sativus*) cultivars

2. Establish a growth stage key for the stages of development of radish

3. Investigate the effects of water availability on splitting

4. Investigate the effects of radish hypocotyl water content on the susceptibility of postharvest splitting

**Summary**

In 2012/2013 experiments were carried out to identify pre and postharvest factors which affect splitting in radish hypocotyls.

**Objective 1. To investigate the splitting susceptibility of different radish cultivars**

Cultivars were shown to have different splitting susceptibilities. Of the cultivars tested *Raphanus sativus* ‘Rudi’ displayed the most splitting at harvest and *R. sativus* ‘Celesta’ showed the least. A non-significant trend was observed linking the thickness of the periderm with the splitting susceptibility. The cultivars with a thinner periderm tended to split less and within the same cultivar the radishes with a thicker periderm also split more.

**Objective 2. To establish a key for the stages of development of radish**

A key was established for the growth stages of radishes. Timings for the growth stages of the cultivar ‘Rudi’ were also recorded although further work is required to determine how available water content and other environmental factors affect growth rate and how variable these timings can be for different cultivars. For ‘Rudi’ growth stage 4.1: secondary thickening started on day 15 and had finished by 17.

**Objective 3. To investigate the effects of water availability on splitting**

The amount of splitting increased with higher volumetric water content (VWC) on day 17 which was shown in objective 2 to be the time when secondary thickening occurs.

The highest marketable yield for all experiments in this objective was observed for radish which received a drying down period from day 8 to day 17.
High VWC at drilling appeared to both retard growth and have a detrimental effect on splitting at harvest.

**Objective 4. To investigate the effects of radish hypocotyl water content on the susceptibility to postharvest splitting**

Radish hypocotyls are more susceptible to damage from dropping and puncture at high water contents. As hypocotyl water content increased the force required to puncture the periderm decreased and a sharp increase was observed in the number of radishes which split as a result of a 1.4 m drop at hypocotyl water contents at or in excess of 96.5%. Hypocotyl water contents of 96.6% have been found at harvest in trials carried out this year but the water content of commercial radishes at harvest is not known.

No correlation was found between the compression failure force and hypocotyl water content.

**Financial Benefits**

UK radish producers encounter frequent problems with postharvest splitting in radish which has a significant commercial impact in terms of product wastage. Identification and removal of splits is both time consuming and wasteful and is not always successful which results in depot rejection and further cost. The direct impact on the consumer is not known, but is thought that the split roots and drying/deterioration of the split surfaces may also deter sales.

**Action Points**

- Do not irrigate plants for the period from day 7 to secondary thickening. Water requirement at this stage is less than later in development and excessive water prior to secondary thickening tends to increase the number of splits at harvest.

- Ensure plants have adequate water in later growth. Increased irrigation in the final 10 days increases yield.

- Avoid having very high hypocotyl water contents postharvest as radishes are more prone to splitting as a result of puncture or dropping at high hypocotyl water contents.