Grower Summary

FV 326a

Impact of irrigation practices on Rijnsburger bulb onion husbandry, quality and storability - II

Annual/Final 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.

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Project Number:	FV 326a
Project Title:	Impact of irrigation practices on Rijnsburger bulb onion husbandry, quality and storability - II
Project Leader:	Dr Tim Lacey
Contractor:	Vegetable Consultancy Services (Developments) Ltd
Industry Representative:	Tim Jolly, WO & PO Jolly Ltd
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Start Date:	18 March 2010
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Project Cost:	£148,940

Headline

This project is aiming to provide best practice irrigation guidelines to increase the yield and quality of onions

Background

An estimated 85% of dry bulb onion crops in the UK are irrigated, following a drive in the industry for production on light soils to improve quality and aid crop management. There are however, concerns that existing irrigation practices may be compromising crop yield, quality and storability. Furthermore, there is little scientific evidence to support current practices, either for crop production or to justify irrigation water use and demonstrate efficiency for abstraction licence renewal in the future.

This project builds on findings from a 1-year HDC trial FV 326 (2007-8), which strongly indicated that irrigation practices had a significant impact on crop performance. Due to inherent limitations of FV 326, further, large-scale field-based trials were required to fully evaluate the impact of irrigation regimes, particularly on crop quality and storability. This follow-on project proposes to address these issues by extending the original study to one commercial-scale field trial plus one rain-shelter trial over a period of 3 seasons.

Ultimately, this project will identify optimum, “best-practice” irrigation guidelines, designed to help growers maximise marketable percentages and increase the storage period of bulb onions. Furthermore, the findings will assist growers at abstraction licence renewal and may show benefits for nutrient and weed management.

This report summarises the available data for year 3 of the trial (2012 season) and also presents the storage data from 2011. Note that all other data from 2011 and 2010 were reported in the year 1 and year 2 annual reports.

Summary

- Irrigating with “little and often” up to bulb initiation tends to increase bulb onion canopy growth, biomass and yield, but may encourage bolting.

- Water stress in the period up to bulb initiation can reduce crop yield potential by up to 30%.

- More frequent overhead irrigation and/or rainfall events appear to reduce onion thrip damage, but may increase disease risk (especially downy mildew), nitrate leaching and weed flushes.

- Conclusions on whether irrigation regimes can adversely affect onion bulb quality cannot be drawn until storage trials have been completed.

A description of the irrigation regimes applied at the rain-shelter site and the open-field commercial site is given in Table 1. Treatment A represents typical field practice for bulb onion irrigation. Both sites were on sandy loam near Bury St Edmunds.

The open-field site received frequent rain, including heavy showers, from early April through to harvest (with the exception of short periods at the end of May and during September). Consequently, few irrigation events were scheduled on this site, and little differences between treatments were observed. Therefore, most data observations relate to the rain-shelter site only in this summary.

Table 1 Irrigation regimes investigated in 2012.

Trt	Name	L May to Initiation (E July)		Initiation (E July) to egg stage (E Aug)		Egg stage (E Aug) to stop (50% FO)		Stop
		Trigger	Target App^{n}	Trigger	Target App^{n}	Trigger	Target App^{n}	
A	Typical, end season stress	50% AWC	Return to FC	50% AWC	Return to FC	75% AWC	50% of AWC	50% FO
B	Typical with mid+end season stress	50% AWC	Return to FC	75% AWC	50% of AWC	75% AWC	50% of AWC	50% FO
C	Typical with early+end season stress	75% AWC	50% of AWC	50% AWC	Return to FC	75% AWC	50% of AWC	50% FO
D	Less more often, no stress	25% AWC	Return to FC	25% AWC	Return to FC	25% AWC	Return to FC	50% FO
E	Less more often, end season stress	25% AWC	Return to FC	25% AWC	Return to FC	75% AWC	50% of AWC	50% FO
F	Less more often, end season stress irrigation at 100% FO	25% AWC	Return to FC	25% AWC	Return to FC	75% AWC	50% of AWC	50% FO but 10mm @ 2 days before harvest
G	Less more often early season, typical mid season, end season stress	25% AWC	Return to FC	50% AWC	Return to FC	*75% AWC*	50% of AWC	50% FO
H	Stress all season	75% AWC	50% of AWC	75% AWC	50% of AWC	75% AWC	50% of AWC	50% FO

AWC = Available Water Content within rooting zone (assumed to be 30cm)
FC = Field Capacity within rooting zone (assumed to be 30cm)
FO = canopy fall-over

At the rain-shelter site, crop growth and vigour was significantly influenced by the irrigation regime applied (see Figure 1). Irrigation regimes that applied “less more often” achieved a larger canopy with greater biomass quicker than regimes that applied less water or with less frequent irrigations. In particular, regimes that maintained low soil moisture deficits early in the season (up to bulb initiation) promoted the greatest canopy growth and those with early season stress significantly reduced canopy growth rate and overall potential.

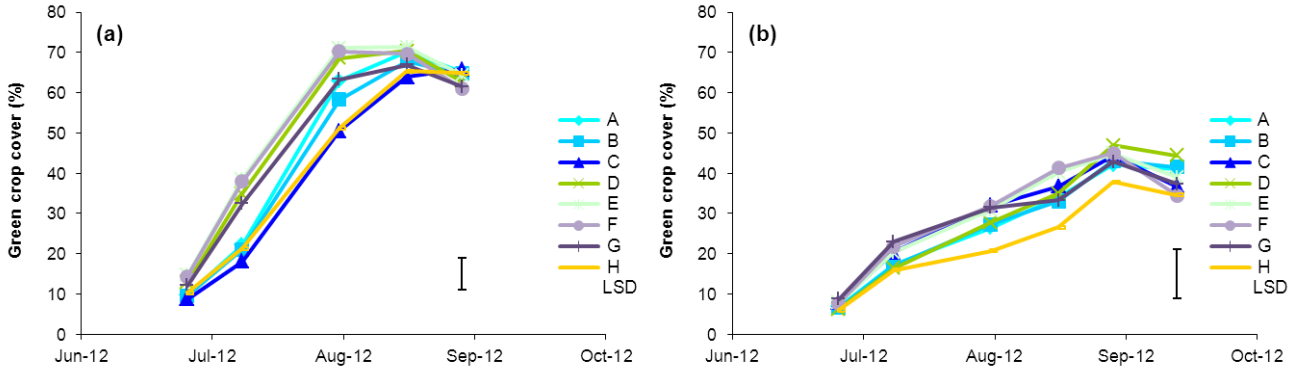

Figure 1 Crop canopy growth as % green cover at rain-shelter site (a) and open-field site (b). Error bars show least significant difference (LSD).

The differences in crop canopy translated into significant differences in green crop yield (Figure 2). Water stress early in the season (up to bulb initiation) significantly reduced green yields in "typical" type regimes by 13% (up to a 30% reduction was observed in 2011). Irrigating through to 50% fall-over produced a further yield increase of 13% over a regime with the standard practice of imposing water stress at the end of the season. Contrary to 2010 and 2011 trials, "little and often" regimes in 2012 resulted in slightly lower green yields when compared to equivalent "typical" regimes.

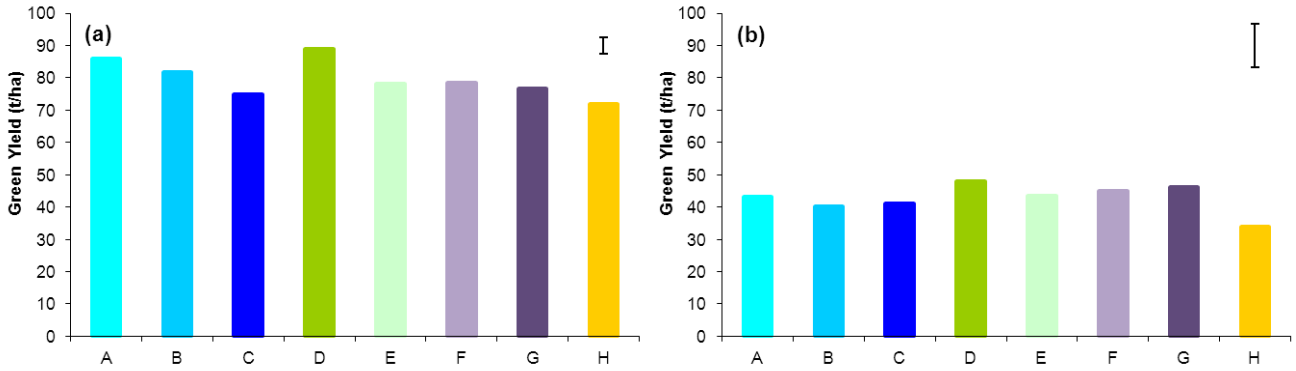

Figure 2 Crop green yield at rain-shelter site (a) and open-field site (b). Error bars show LSD.

Preliminary work on 2010, 2011 and 2012 data shows a strong relationship between total water received by an onion crop (up to c300mm) and green yield, resulting in a yield increase of approximately 0.25-0.3 tonnes/ha per mm. Beyond a total water input of 300mm, the relationship tends to plateau and perhaps decrease. The nature of this relationship requires further investigation and will be reported in greater detail in the final report.

Onions harvested for green yield in 2012 are currently in storage under commercial conditions to be assessed for quality and marketability (including size, skin finish, shape, doubles, disease, regrowth and dry matter content) in April/May 2013.

Storage data from 2011 closely reflected the green yield described in the year 1 report (January 2012). Size grading indicated that the irrigation regimes which promoted the greatest crop growth and green yield tended to have a greater proportion of larger bulbs and fewer smaller bulbs. Contrary to expectations (but reflecting 2010 season results), quality assessments indicated that there were few differences in storage diseases, dry matter, regrowth and other defects resulting from the irrigation treatments applied.

Although thrip levels were much lower than previous years, observations at the rain-shelter site continue to support the assertion that overhead irrigation assists in onion thrip control. There was some indication that regimes with frequent applications during mid or late season could increase the incidence of downy mildew, but other diseases (leaf blight, leaf spot and bacterial infections) appeared to be largely unaffected.

There was some indication that irrigation regimes which applied water earlier and/or had more frequent irrigations may retain less N in the soil than current practice or “stress” irrigation Soil ammonium N and nitrate data were however highly variable so definitive conclusions cannot be drawn at this time.

Weed pressure was generally higher where irrigation regimes kept the soil surface moist (i.e. more frequent irrigations), but the effect of rainfall, grower intervention and timing of water application are likely to be more important than the irrigation regime when managing weed burden.

In summary, data from the third year of trials support the 2010 and 2011 data from FV326a and previous FV 326 findings (despite the poor weather on the open-field site). Onions respond well to water, with more frequent applications of smaller amounts tending to drive canopy development, crop vigour and biomass more than typical applications of c25mm every 7-10 days. In particular, early season irrigation (prior to bulb initiation) appears key to driving crop development. Some caution does however need to be applied to prevent excess canopy developing too early, thus increasing the bolting risk. Increased canopy development largely translates into greater yield, although late application of water also tends to increase yields, most likely due to direct water uptake by the bulb. At the time of this report, crop quality and storability from 2012 have not been assessed. Indications from 2010 and 2011 storage assessments were that different irrigation regimes did not affect storability; however, this is largely contrary to commercial experience.

Financial Benefits

No indication of financial benefits can be given until all data from the 3-year trial has been collected and analysed. This will be presented in the final project report.

Action Points

At this stage of the project, it is not advised that growers make any extensive changes to their irrigation regimes based on the information contained in this report: further data is required on crop quality and marketability and all results require analysis collectively to support any changes in irrigation practice. It is, however, becoming relatively clear that growers should consider prioritising the irrigation of their onions in the early season to promote canopy, at least up to the point of bulb initiation – bearing in mind the potential for increased bolting in excessively forward crops.