Grower Summary

FV 373

Carrots: Incidence of cavity spot in Commercial Crops

Annual 2012

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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

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Project Number:	FV 373
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Project Leader:	David Martin
Contractor:	Plantsystems Limited
Industry Representative:	Martin Evans, BCGA
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Headline

Altering the water input can have an effect on reducing cavity spot incidence.

Background

Cavity spot is a serious and recurring disease of commercial carrots in the UK. Current control systems rely on the use of a single soil applied fungicide treatment which is only partially successful and growers need improved methods of control.

In 2008-09 the British Carrot Growers Association developed a specific R&D strategy for Cavity Spot. This strategy has now been finalised following active and robust discussion from members of the BCGA technical committee and six target categories have been identified in the strategy. This project is intended to cover a gap under general agronomy and aims to document, as far as possible, the conditions relating to new outbreaks of cavity spot which together with site history and site conditions will add considerably to the knowledge bank and should help identify situations which should be avoided.

Summary of the results and main conclusions

- In 2010, increasing total water input (precipitation plus irrigation) from the end of July and throughout August increased the incidence of cavity spot observed in commercial maincrop carrots. This effect was less significant in 2011 than in 2010 but again showed a positive correlation.
- Increasing water input in early June had a beneficial effect on reducing disease levels; this effect was more marked in 2011 than in 2010.
- In 2011 increasing soil moisture positively increased disease but in 2010 a relationship could not be found with this variable.
- There was no correlation between soil temperature and disease in either year.

Thirty commercial carrot production sites provided by members of the BCGA and representative of the main carrot production areas of England and Scotland were monitored for total water input (precipitation and irrigation), soil moisture and soil temperature. At each site the incidence and severity of cavity spot disease was established by sampling prior to harvest and relationships were sought between the recorded site conditions and the incidence of disease.

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At each site an automatic soil moisture station was installed in a representative area of the field. This consisted of a Remote Transmission Unit (RTU) and SIM set up to log all data and communicate via GPRS network together with an automatic tipping bucket total water input sensor (resolution 0.2mm per tip) and soil moisture (SM) probe using an SDi12 interface. The SM probe consisted of a sealed tube containing capacitance sensors at 100, 200 and 300mm depths and an integrated temperature sensor at the middle level.

The station recorded the total water input (precipitation plus irrigation), soil temperature (degrees C) and soil moisture (% soil moisture at 3 levels).

Data was collected continuously from all of the RTUs from the time of installation (normally shortly after seeding) to just prior to harvest of the crop or just prior to strawing down. The resultant data file was converted to hourly values and then to daily summaries for analysis.

Crops were sampled when mature and before harvesting or strawing. At each site samples were collected and washed to reveal any cavity spot lesions. Each sample was recorded for the incidence of disease lesions (% roots affected) and the severity of the disease (scale 1 to 5)

Table 1: Summary of Incidence % and Severity (1 to 5) of Cavity Spot disease in 2011

ID	Location	% Incidence	1 to 5 Severity	ID	Location	% Incidence	1 to 5 Severity
1	Thompson	0.7	0.3	16	Crockey Hill	0.3	0.3
2	Alderton	6.7	1.7	17	Holme	20.7	1.0
3	Butley	12.7	1.7	18	Formby	1.7	1.0
4	Aldeburgh	0.0	0.0	19	Ainsdale	11.0	1.0
5	Thoresby	0.0	0.0	20	Bickerstaffe	37.0	2.3
6	Blidworth	0.0	0.0	21	Elveden	0.3	0.3
7	Worksop	0.7	0.3	22	Sutton	4.0	1.0
8	Cupar	0.0	0.0	23	Trimley	0.0	0.0
9	Dunshalt	14.7	2.0	24	Larling	0.0	0.0
10	Glenrothes	0.0	0.0	25	Cockley Cley	8.0	1.7
11	Hardwick	1.0	0.7	26	Iken	0.0	0.0
12	Torworth	1.0	1.3	27	Isleham	1.0	1.0
13	Heacham	2.3	1.0	28	Euston	0.0	0.0
14	Waddingham	0.0	0.0	29	Gt Cressingham	0.7	0.7
15	Babworth	0.3	0.7	30	Chatteris	4.3	2.0

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In 2011, cavity spot disease was recorded in 67% of sites. Of those sites which were affected the average score for disease severity was 1.1. In 2010 the data showed 53% sites with affected roots and an average severity score of 2.0.

Relationships were sought between each of the site variables and the development of disease. It was first necessary to generate daily summaries of the site data from the 15 minute values. Then for each of the recorded site conditions we calculated results for different periods of time and with different starting points.

As an example, for total water input we calculated the values at each site for periods of one week, two weeks and so on up to 6 weeks starting from 1 June. We repeated this using June 2nd, June 3rd and so on as starting points, so that we obtained a detailed summary of water inputs at each site and various time periods over the whole period of interest.

This process was repeated for soil moisture and soil temperature. The only difference here was that we looked at average soil moisture and temperature rather than total.

For each site we had two measures of the extent of cavity spot disease - incidence and severity. From these two measures we created a third measure which had three classes, no disease, low and high disease.

In order to see if there was any relationship between the presence of cavity spot and any of the site variables the correlation between each of the calculated weather values and the three measures of disease was assessed.

The range of correlations was examined and those time periods that produced correlations > 0.4 were noted in order to determine those weather variables and time periods that gave an indication of the likelihood of disease being present.

Total water input (precipitation plus irrigation) and its effect on disease

In 2010 the highest correlation of 0.61 between presence of the disease and total water input occurred in data from a period around the end of July for 5 weeks , so this showed that incident water in August seemed to be the main climatic factor positively influencing disease development.

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When the 2011 data was examined the correlation figures around that period were much lower. The best correlation that was obtained was 0.30 for period of 6 weeks from 4 Aug. This was a positive correlation indicating, as in 2010 that an increase in water input in August increased the likelihood of disease.

For 2011 the highest correlations actually occurred right at the beginning of the period under review (See Table below)

Table 2: Correlation between severity of disease and water input (early June)

	01-Jun	02-Jun	03-Jun	04-Jun	05-Jun	06-Jun	07-Jun	08-Jun
1week	-0.27	-0.30	-0.30	-0.39	**-0.42**	**-0.52**	**-0.51**	**-0.52**
2week	**-0.49**	**-0.50**	**-0.54**	**-0.56**	**-0.58**	**-0.57**	**-0.60**	**-0.47**
3week	**-0.50**	**-0.54**	**-0.54**	**-0.53**	**-0.52**	**-0.52**	**-0.40**	**-0.45**
4week	**-0.54**	**-0.53**	-0.49	-0.48	**-0.50**	**-0.50**	**-0.44**	**-0.47**
5week	**-0.53**	-0.33	-0.28	-0.25	-0.25	-0.21	-0.14	-0.14
6week	-0.20	-0.20	-0.23	-0.21	-0.18	-0.15	-0.10	-0.10

Note: Figures in bold indicate that correlation is significant (P<0.05)

The table above shows these relationships are negatively correlated i.e. the level of disease drops as the water input increases in early June. Looking back at the 2010 results the correlations for the early June period were not so high reaching a maximum of about -0.35 but again it was a negative correlation suggesting that perhaps this is a real effect .

A similar procedure was carried out on soil moisture and soil temperature

Soil moisture (% soil water) and its effect on disease

The highest correlations for the soil moisture and disease relationship occurred in the data for the second half of August and the correlations were all positive – see Table 2. This was completely different from the 2010 results which showed highest correlation in June, but more importantly showed negative correlations.

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Table 3: Correlation between soil moisture and severity of disease (mid August)

	14-Aug	15-Aug	16-Aug	17-Aug	18-Aug	19-Aug	20-Aug
1 week	**0.45**	**0.45**	**0.44**	**0.43**	**0.44**	**0.44**	**0.44**
2 week	**0.47**	**0.48**	**0.49**	**0.50**	**0.50**	**0.51**	**0.45**
3 week	**0.48**	**0.49**	**0.51**	**0.52**	**0.53**	**0.53**	**0.48**
4 week	**0.50**	**0.51**	**0.51**	**0.51**	**0.51**	**0.51**	**0.45**
5 week	**0.48**	**0.48**	**0.49**	**0.50**	**0.50**	**0.50**	**0.43**
6 week	**0.47**	**0.47**	**0.47**	**0.48**	**0.48**	**0.48**	**0.42**

Note: Figures in bold indicate that correlation is significant (P<0.05)

The 2011 data shows positive correlation throughout the whole season i.e. the more soil moisture the more likely there is to be disease.

Soil temperature and its effect on disease

The correlation between soil temperature and disease was very poor, never getting much above 0.2.

Financial benefits

In this study of commercial crops the average loss due to cavity spot was 4.3% representing a loss of c£11 million retail sales value (RSV). In 2010 the estimated loss of value was c£20million RSV. On completion of the project and implementation of improved management practices and controls this loss should be able to be reduced.

Action points for growers

- The results from year 2 combined with year 1 lead to an indication that for maincrop carrots, growers should ensure that total water input (precipitation plus irrigation) during August is minimised.

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