Horticultural Development Company

Grower summary

FV 341

Asparagus: integrated management of Stemphylium purple spot

Annual Report 2010

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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.

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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.org.uk), quoting your HDC number, alternatively contact the HDC at the address below.

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Headline

A five-spray fungicide programme (Signum, Plover, Dithane 945, Plover, Signum) at 2-3 week intervals from mid-July, was effective in reducing the incidence and severity of Stemphylium purple spot on asparagus, and resulted in increased levels of root carbohydrate at crown dormancy, compared with an untreated control.

Background and expected deliverables

Stemphylium purple spot on asparagus spears and ferns is caused by the fungus *Stemphylium vesicarium* (also known as *Pleospora herbarum*). Purple lesions can occur on spears during the harvest season but mainly develop on the asparagus ferns, affecting the needles, secondary branches and main stems. Severe infection often results in premature defoliation, with the potential to significantly reduce yields in subsequent seasons. Survival structures of the fungus can overwinter on fern debris and this is often the main source of the disease during the following harvest season.

Despite the availability of suitable fungicides, UK growers still report Stemphylium outbreaks. The sporadic nature of the disease means that it may not be cost effective to use a prophylactic spray programme. However, disease development can occur rapidly and control may be lost when the timing of specific fungicide applications is not optimised in relation to infection events.

HDC Factsheet 18/07 summarises available information on Stemphylium biology and potential management strategies. Based on knowledge gaps identified in the factsheet, experimental work is needed to develop integrated strategies for the management of Stemphylium on asparagus. The specific objectives are to:

1. Determine the efficacy of approved and potential fungicides for control of asparagus Stemphylium in inoculated pot experiments.
2. Monitor leaf wetness / temperature and record Stemphylium development in untreated crop areas, to determine the frequency of infection periods and provide the basis for setting thresholds in a disease model (Tom-Cast).
3. Evaluate fungicide programmes for Stemphylium control on asparagus ferns and effects on root carbohydrate levels.
4. Determine the efficacy of some chemical practices for reducing inoculum of Stemphylium overwintering on asparagus fern debris.
5. Prepare an updated factsheet on integrated management of asparagus Stemphylium.

Summary of the project and main conclusions

Efficacy of fungicides for Stemphylium control in an inoculated pot experiment

A pot experiment was established in 2009 at ADAS Boxworth (Cambs) to determine the efficacy of fungicides applied at different times in relation to infection, on the control of Stemphylium purple spot on asparagus. Fungicides were applied to fern in September, 3 days before or 3 days after artificial inoculation with a spore suspension of *Stemphylium vesicarium*. Fungicides used (all at full rates) were Amistar (azoxystrobin), Amistar Top (azoxystrobin + difenoconazole), Dithane 945 (mancozeb), Olympus (azoxystrobin + chlorothalonil), Plover (difenoconazole), Signum (boscalid + pyraclostrobin) and Switch (cyprodinil + fludioxonil). Following artificial inoculation, disease development occurred gradually on all plant parts; at 21 days after inoculation, mean severity scores for fungicide treatments and the untreated control were very low (less than 10 lesions). Because of the low disease levels present it was not possible to clearly discern fungicide treatment and timing effects on disease development. None of the fungicide treatments tested had phytotoxic effects on the plants during this experiment.

Development of Stemphylium purple spot

Development of Stemphylium purple spot symptoms was monitored at two commercial sites in 2009. At Warwicks, where infested debris was abundant on the soil surface, the disease commenced from stem bases (Figure 1). Although all plant parts were subsequently affected, stem bases remained most severely affected through the season. This pattern of symptom development was consistent with a series of primary infections being initiated from ascospores of *P. herbarum* released from fruiting bodies (pseudothecia) on asparagus debris. At Norfolk, infested debris was less abundant on the soil surface and disease severity remained lower throughout the season. Symptoms were also first observed at stem bases but were subsequently more prevalent on mid-stems and secondary branches, indicative of secondary spread of the disease via conidia of *S. vesicarium*, either from stem base lesions or incoming from neighbouring asparagus crops.

Figure 1. Lesions of Stemphylium purple spot on the stem base of asparagus fern.

Evaluation of fungicide programmes

A field experiment was conducted in 2009 at two commercial asparagus holdings on fields with a history of Stemphylium purple spot. The aim of the experiment was to determine the effect of fungicide programmes on the severity of Stemphylium during the fern production season using currently approved fungicides (Table 1). The effect of fungicide programmes on subsequent root carbohydrate levels was also determined by measurement of Brix% values in roots collected at crown dormancy and through use of the ***AspireUK*** decision support system.

Table 1. Fungicide spray programmes for asparagus Stemphylium at two sites, 2009

Programmes		Spray 1	Spray 2	Spray 3	Spray 4	Spray 5	Spray 6
	Spray dates:						
	Warwicks	3 Jul	16 Jul	3 Aug	18 Aug	7 Sep	21 Sep
	Norfolk	22 Jun	3 Jul	20 Jul	3 Aug	17 Aug	31 Aug
1	Untreated	-	-	-	-	-	-
2	AT/A/P/D/P/A	Amistar Top	Amistar	Plover	Dithane 945	Plover	Amistar
3	AT/S/P/D/P/S	Amistar Top	Signum	Plover	Dithane 945	Plover	Signum
4	AT/Sw/P/Sw/P/Sw	Amistar Top	Switch	Plover	Switch	Plover	Switch
5	A/P/D/P/A/-	Amistar	Plover	Dithane 945	Plover	Amistar	-
6	S/P/D/P/S/-	Signum	Plover	Dithane 945	Plover	Signum	-
7	-/A/P/D/P/S	-	Amistar	Plover	Dithane 945	Plover	Amistar
8	-/S/P/D/P/S	-	Signum	Plover	Dithane 945	Plover	Signum

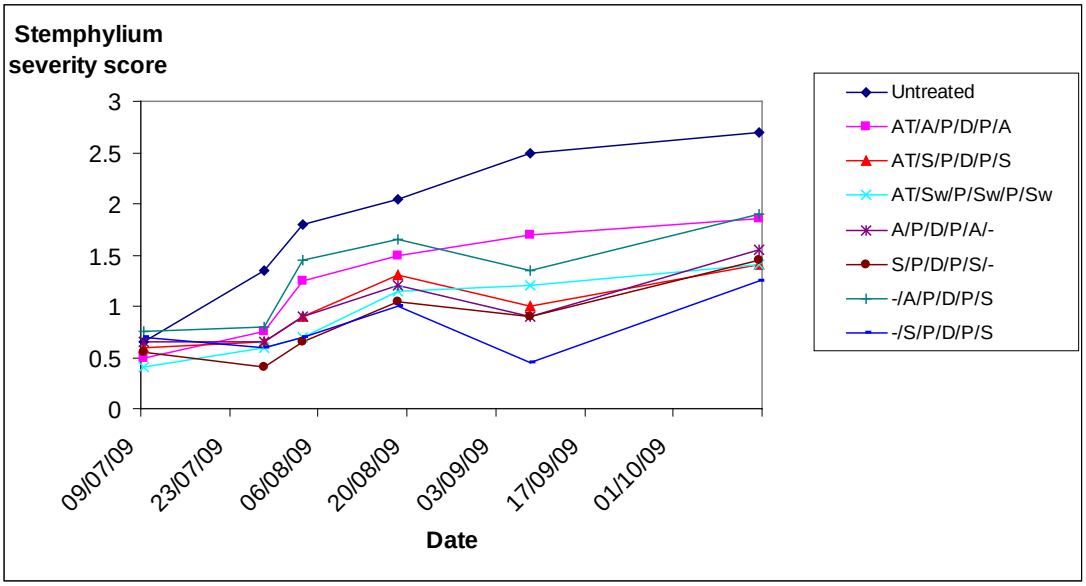
Rates:

Product	Active ingredient	Product rate/ha	Approval
Amistar	Azoxystrobin	1.0 L	On-label
Amistar Top	Azoxystrobin + difenoconazole	1.0 L	SOLA 0831/07
Dithane 945	Mancozeb	2.0 kg	SOLA 0381/06
Plover	Difenoconazole	0.5 L	SOLA 0158/05
Signum	Boscalid + pyraclostrobin	1.5 kg	SOLA 0262/08
Switch	Cyprodinil + fludioxonil	1.0 kg	SOLA 0235/07

The experiment demonstrated that under high disease pressure, there is scope for reducing the incidence and severity of Stemphylium purple spot using fungicide programmes. While there was no individual programme that performed considerably better than others, Treatment 8 (Signum / Plover / Dithane 945 / Plover / Signum, at 2-3 weeks intervals) was

the most consistent (Figure 2). At the Warwicks site, this fungicide programme reduced disease incidence (Table 2) and severity, reduced % dead stems in early November, and resulted in higher root carbohydrate levels (Table 3). In addition, following this treatment, there was a trend for lower disease incidence at Norfolk (data not shown) and higher Brix% values (both sites, Table 3). Outputs from ***AspireUK*** regarding root carbohydrate (CHO) levels for treatments tested are shown below in Table 3. The fact that the most effective programme comprised five rather than six applications (commencing around 5 weeks after close of harvest) indicates that timing of appropriate products is likely to be more important for effective control than numbers of applications.

Overall, programmes that performed well were treatments 3, 4, 6 and 8. Treatments 3, 6 and 8 each included two applications of Signum alternating with difenoconazole products, and use of Dithane 945 as a protectant mid-season. Equivalent programmes using Amistar in place of Signum were less effective, suggesting that Signum may be a stronger product for control of Stemphylium purple spot on asparagus. There were also some good results obtained with treatment 4, commencing with Amistar Top, then alternating Switch with Plover, although this programme did not contribute to delayed senescence as effectively as programmes that contained two or three strobilurin products and finished with a strobilurin.



Severity score: 0 = no symptoms, 1 = 1-10 lesions, 2 = 11-100 lesions, 3 = >100 lesions

Key:
A Amistar
AT Amistar Top
D Dithane 945
P Plover
S Signum

Sw Switch

Figure 2. Effect of fungicide programmes on the development of Stemphylium purple spot on asparagus stem bases (Warwicks, 2009).

Table 2. Effect of fungicide programmes on the incidence of Stemphylium purple spot on different parts of asparagus fern (18 August 2009, Warwicks)

	Fungicide programme	% incidence Stemphylium purple spot									
		Base stem		Mid stem		Top stem		Secondary branches		Tertiary branches / needles	
1	Untreated control	95	(4.1)	95	(6.0)	65	(15.0)	35	(11.6)	40	(9.6)
2	AT / A / P / D / P / A	100	(-)	85	(9.6)	65	(15.0)	40	(11.9)	25	(8.5)
3	AT / S / P / D / P / S	95	(4.1)	**55**	(12.3)	30	(14.4)	20	(9.7)	**5**	(4.3)
4	AT / Sw / P / Sw / P / Sw	90	(5.5)	60	(12.3)	20	(12.7)	10	(7.3)	**5**	(4.3)
5	A / P / D / P / A / -	85	(6.4)	85	(9.6)	25	(13.7)	30	(11.1)	15	(7.0)
6	S / P / D / P / S / -	85	(6.4)	**45**	(12.0)	**10**	(9.6)	15	(8.7)	**0**	(-)
7	- / A / P / D / P / S	100	(-)	95	(6.0)	75	(13.7)	40	(11.9)	35	(9.4)
8	- / S / P / D / P / S	**70**	(7.9)	**55**	(12.3)	20	(12.7)	10	(7.3)	**0**	(-)

Values in bold are significantly less than the untreated control at P<0.05

Table 3. Effect of treatments on Brix% values from asparagus roots at dormancy (winter 2009/2010) at two sites

	Fungicide programme	Mean Brix% value*		Root CHO content mg/g**	
		Warwicks	Norfolk	Warwicks	Norfolk
1	Untreated control	18.5	18.3	489 (450-550)	478 (450-550)
3	AT / S / P / D / P / S	19.8	-	534 (450-550)	-
4	AT / Sw / P / Sw / P / Sw	18.3	-	468 (450-550)	-
6	S / P / D / P / S / -	21.0	-	542 (450-550)	-
8	- / S / P / D / P / S	23.3	20.4	591 (550-750)	519 (450-550)

*Mean of five plants per plot, from four plots
**Determined using *AspireUK*; actual CHO content shown, with ranges for that category in parentheses
Carbohydrate analysis was done only on treatments that significantly reduced Stemphylium compared with the untreated control.

Extract from ***AspireUK*** output for Warwicks (treatments 1, 3, 4 and 6) and Norfolk (treatments 1 and 8):

> Root CHO content is satisfactory, but not as high as it could be by the end of the season. Values in this range, especially at the low end, indicate good but incomplete replenishment of CHO reserves in the roots during fern growth.

Extract from ***AspireUK*** output from Warwicks treatment 8:

The root system is full of CHO, as it should be by the end of the season. The high CHO content means that a good harvest is likely next year, especially if the crop has a large root system. CHO content is seldom much greater than 550 mg/g in established crops with large root systems. This occurs when they have been well managed during the past year, with optimised spear harvest followed by healthy, active fern growth.

Values above 600 mg/g are more likely in crops with small root systems. However, even though these systems are about as full of CHO as they can get, spear yield can be limited by lack of total available CHO. This usually occurs in either (a) young establishing crops with small but expanding systems or (b) older crops with declining systems, indicated by a high proportion of dead roots. A high CHO level is a positive indicator for young crops because it shows that the root system is full, although it is still small and expanding. On the other hand, a high CHO content in older crops indicates that yield may be limited by the declining size of the root system.

Monitoring of leaf wetness and temperature

Research in Michigan State, USA and France has shown that use of a simple programme (Tom-Cast) can help to minimise sprays for Stemphylium control without compromising fern health, because sprays are only applied when environmental conditions are high risk for disease development. This system is being used on 75% of the asparagus tonneage in Michigan State. Experimental work is required to determine appropriate thresholds for spray timing in the UK, since results from France and the USA vary in this respect.

In the Tom-Cast programme, leaf wetness duration and the average temperature during wetness periods are used to derive Disease Severity Values (DSVs) and associated thresholds from which spray timing is determined. Researchers in Michigan State showed that fungicides applied according to Tom-Cast (DSV=15), resulted in a reduction in sprays compared with 7, 10 and 14-day programmes. Moreover, applying fungicides according to Tom-Cast or every 7 days resulted in significantly reduced lesion severity compared with 10 and 14 day programmes.

In this experiment, leaf wetness and temperatures were monitored using a sensor (SpectrumTechnologies) at two commercial sites during fern production in 2008 and 2009. Examination of the data using the Tom-Cast model established the number of sprays that would have been triggered at each site, based on different DSV thresholds. DSVs of 5 and 7 gave spray numbers comparable to commercial programmes although at different timings to grower applications. DSVs of 10 or higher would have triggered fewer sprays than commercial programmes at both sites / seasons. A field trial in 2010 will compare disease development following spray programmes based on DSVs of 5, 7 and 10. A further

consideration will be whether a fungicide application soon after close of harvest to young fern could provide useful protection particularly in situations where infested debris on the soil surface is present as a primary source of inoculum.

Financial benefits

Financial losses due to Stemphylium have not been quantified in the UK but it is well known that fern damage in one season can have a deleterious effect on spear yield in subsequent seasons. Financial losses can also occur due to application of unnecessary fungicides when conditions are low risk for disease development. The expected benefit to the industry is a set of guidelines that will enable effective management of Stemphylium on asparagus with minimum fungicide usage.

Action points for growers

- Read HDC Factsheet 18/07 to be aware of Stemphylium symptoms, the disease cycle and high risk conditions for disease development.
- Be aware that Stemphylium survives on asparagus debris between seasons. Infested debris on the soil surface is an important source of the disease. Ridging-up so that debris is covered can help to reduce this risk.
- Note that premature defoliation due to Stemphylium can lead to decreased carbohydrate transfer to roots with subsequent effect on yields in subsequent seasons.
- When using fungicides for Stemphylium control, be aware of FRAG guidelines (see www.pesticides.gov.uk) and manufacturer's guidelines for minimising risk of developing fungicide resistance risk through over-use of strobilurin products.