Grower Summary

FV 341b

Asparagus purple spot: field evaluation of soil treatments to enhance crop debris degradation and reduce disease on the emerging new crop

Final 2013

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 Title:	Asparagus purple spot: field evaluation of soil treatments to enhance crop debris degradation and reduce disease on the emerging new crop
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Headline

Urea applied as a spray to asparagus debris at 100 kg N/ha, either as a single application or as 2 applications of 50 kg N/ha post ridging, gave a significant reduction in spore release for up to 28 days post application.

Background

Stemphylium purple spot of asparagus caused by the fungus *Stemphylium vesicarium* often occurs on emerged spears during the harvest season and can lead to problems of quality and customer acceptability in the harvested product. Following harvest, the disease can also develop on asparagus fern affecting main stems, secondary branches and needles leading to premature defoliation and decreased yields in subsequent years where not adequately controlled. The sexual stage of the disease produces survival structures (pseudothecia) (Figure 1) which overwinter on fern debris and are the initial source of the disease in the following spring. Once purple spot is present in a crop, asexual spores (conidia) are produced on lesions in wet weather and are readily spread by wind and water splash leading to rapid disease increase. The disease can be very difficult to control once established, and most growers rely on preventative fungicide programmes to preserve green fern area through summer into autumn, the aim being to providing adequate carbohydrate return to the root system for harvest the following year. A typical fungicide programme consists of four or five applications and represents a substantial cost in time and effort to the grower.

Figure 1. Overwintering resting bodies (pseudothecia) of *Stemphylium vesicarium* which are seen as raised black dots on asparagus debris remaining on the soil surface in early spring, 2013.

Following spring cultivations, fern debris from the previous season is commonly found on the soil surface as spears emerge. Burial of this debris by ridging up after flailing to remove the fern reduces the potential amount of *Stemphylium* spore release in the following spring, but

in older crops where crowns and roots develop closer to the soil surface this can be difficult due to the risk of damage to the extensive root system, so large amounts of debris may remain on the surface. Heavy rainfall can also cause the debris to become exposed again. Previous work in FV 341 indicated the potential of urea as a treatment for reducing *S. vesicarium* inoculum overwintering on asparagus fern debris. The aim of this project was to determine the efficacy of urea and Perlka (calcium cyanamide) debris treatments in field crops by examining their effect on (i) level and persistence of spore production from debris and (ii) occurrence of purple spot on spears.

Summary

Two field experiments were carried out in 2013 using commercial crops of asparagus cv. Gijnlim. The experiments were located in Norfolk and Herefordshire. Each field site had a known history of *Stemphylium* purple spot and resting bodies (pseudothecia) of the pathogen were present on the debris at each site and treatment timing. Nine treatments were applied to the crop over three timings as shown in Table 1 below.

Table 1. Detail of the urea and Perlka treatments applied to asparagus crops in 2013.

			Application rate and timing (kg N/ha)		
Treatment	Product	Water volume (l/ha)	T1 Jan/Feb (post flailing)	T2 Mar (post ridging but pre herbicide)	T3 + 4 weeks after T2
1		-	0	0	0
2 (standard)	urea*	1000	0	100	0
3	urea*	400	0	100	0
4	urea*	400	0	50	0
5	urea*	400	50	0	0
6	urea*	400	0	50	50
7	urea*	400	50	50	0
8	Perlka	top dressing	60	0	0
9	Perlka	top dressing	0	60	0

** urea applied with Silwett – L77 (wetter) at 0.025%*

There were three treatment timings as shown and these were as follows;

- **Timing 1 –** The first treatments were applied January/February after the grower had flailed the fern from the previous season
- **Timing 2 –** The second treatments were applied in March/April after ridging but before the pre-harvest residual herbicide application, and at least 4 weeks after T1
- **Timing 3 –** The third treatments were applied 4 weeks after Timing 2.

The treatment timings were chosen in relation to when the ascospores would be maturing or released based on the findings in of HDC project FV 341. This showed that from January to March mature pseudothecia contained abundant ascospores, which were starting to erupt through the epidermal stem tissues and that the proportion of pseudothecia erupting through

skin tissue increased from January to March. Therefore Timing 1 and 2 were included to test whether treatment application to debris on the soil surface in late winter or early spring could delay or prevent release of ascospores. An application of urea at Timing 3 in addition to Timing 2 was included to compare if two later treatments post-ridging gave better efficacy than two treatments applied pre and post-ridging.

Effect of urea application on spore release

Urea applied as a spray to asparagus debris at the rate of 100 kg N/ha post ridging gave a statistically significant reduction in spore release for 28 days post application compared to the untreated (Table 2). Statistical significance was maintained when 100 kg N/ha was applied at either 1000 l/ha or 400 l/ha, or as 2 applications of 50 kg N/ha post ridging (Timing 2 and 3) at 400 l/ha, at both experimental sites. A rate of 50 kg N/ha applied at 400 l/ha as two early applications (Timing 1 and 2) or once only gave a reduction in spores but this was not consistently significant at all assessments. Urea applied as an early treatment at 50 kg N/ha at a volume of 400l/ha post-flailing, but pre-ridging gave a significant reduction in spore release at both sites for 28 days post application. Perlka did not consistently reduce spore release from the debris at either site.

Table 2. Summary of the effect of urea and Perlka treatments on production of *Stemphylium vesicarium* ascospores from asparagus crop debris – 2013

Treatment and application timing					% spore production (untreated = 100) at one and two months after treatment			
		T1	T2	T3	Hereford		Norfolk	
			kg N/ha		28 Days after T1	56 Days after T1	28 Days after T1	56 Days after T1
1	Untreated	0	0	0	100	100	100	100
2	urea	0	100*	0	**15**	**24**	**45**	108
3	urea	0	100	0	**63**	**67**	**34**	90
4	urea	0	50	0	94	95	76	82
5	urea	50	0	0	**69**	87	**51**	87
6	urea	0	50	50	**46**	**49**	**50**	**49**
7	urea	50	50	0	**52 (38)**	98 **(35)**	**32** (84)	47 (74)
8	Perlka	60**	0	0	108	133	97	113
9	Perlka	0	60**	0	73	89	**24**	**13**

Values in bold are significantly different from the untreated
Figures in brackets are days after T2 treatment was applied
*1,000 l/ha **top dressed

Effect of urea applications on purple spot in the emerging crop

The application of urea at 100 kg N/ha either at 400 l/ha or 1000 l/ha significantly reduced purple spot on the spears at one assessment out of three carried out at the Hereford site (Figure 2). These assessments were carried out during harvest and freshly emerged spears

were assessed each time. When considering the data from the spear assessments, it is necessary to take into account movement of spores between plots in high winds as the crop is very sparse and open at this point. Although the plots are large, the openness of the crop may have led to the lack of differences between treatments in the earlier assessments as these were carried out just after periods where winds were recorded up to 20 mph.

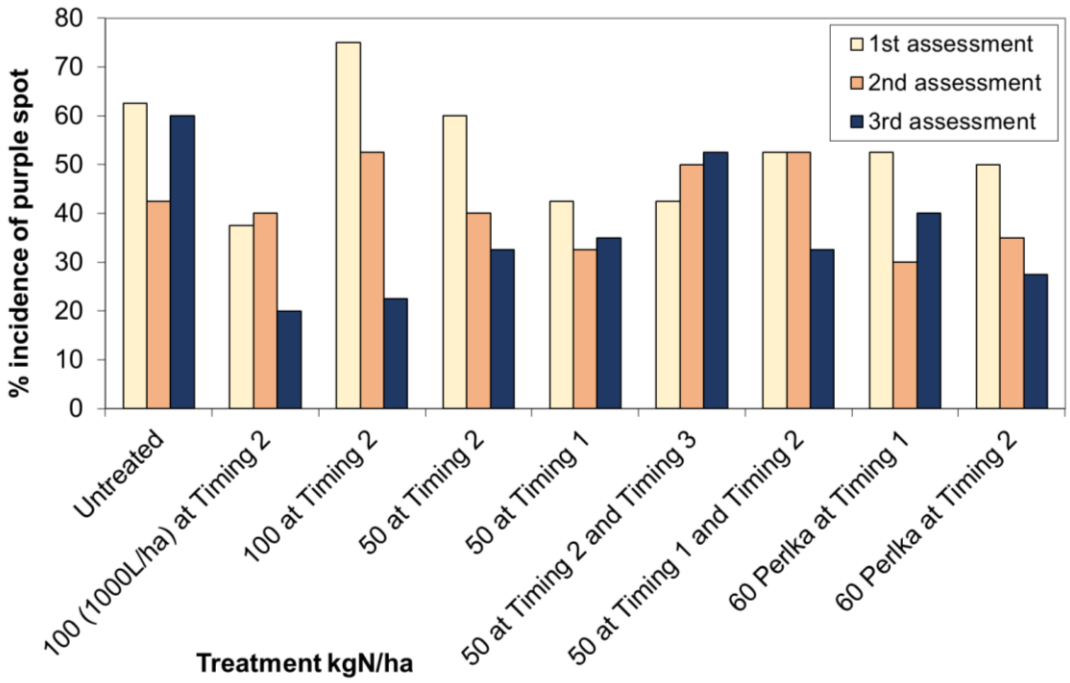

Figure 2. Incidence of purple spot on the emerging spears at assessments on 18 May, 31 May and 2 June, Hereford, 2013.

All other assessments of purple spot on the spears, the stem bases of ferns, or the fern canopy showed no significant differences. However urea did reduce purple spot, but this was not consistent across all assessments at either site. Some treatments (100 kg N/ha applied at either 1000 l/ha or 400 l/ha, or 50 kg N/ha applied at two timings) appeared to reduce incidence in the spears, on the stem bases, or in the fern canopy, but these reductions did not achieve statistical significance or consistent effects in assessments at both sites. This may be because disease incidence was generally low in 2013. However, these treatments warrant further investigation in another season where disease levels may be higher and differences easier to separate.

The most promising treatments based on the reduction of spore release were 100 kg N/ha applied at either 1000 l/ha or 400 l/ha, or 50 kg N/ha applied at two timings. The former treatment is certainly too high a volume to be commercially practical, especially on a large scale. Results showed a water volume of 400 l/ha giving a result comparable to 1000 l/ha in

terms of reduction of purple spot in the emerging crop. Although this represents an improvement, lower volumes would be preferable from a commercial point of view. Applying the majority of the nitrogen requirement as urea at 100 kg N/ha just prior to spear growth also represents poor environmental practice given that N uptake is very low in early spring and bearing in mind the N_{max} for asparagus in an NVZ is 180 kg N/ha. Such practice would increase the risk of N loss to leaching in a wet spring or to volatilization in a dry spring. To reduce spore release with fewer compromises in terms of crop nutrition or increased environmental risk, applying urea twice as 50 kg N/ha instead of rather than in addition to any other nitrogen fertiliser could be considered since this gave comparable results to 100 kg N/ha at 400l/ha (Table 2).

Further work

Although the significant reduction in spore release did not result in a consistent reduction of Stemphylium purple spot, the most promising treatments warrant further investigation in another season as it is difficult to make firm conclusions based on data from one year of study in a low disease year. Additionally, an application of urea between spear harvest and fern growth was not considered in this study, but could be a useful timing to look at in further work to see if additional control closer to fern growth could be more beneficial if spores are still being released from the resting bodies. There are also commercially available urea formulations available such as Nufol 20 which may be more practical to use than the technical grade urea used in the study, and work on their efficacy against spore release would be useful.

Financial Benefits

The project shows that urea reduces spore release from debris for 28 days post application. When applied instead of or as an additional fertiliser application after ridging and prior to spear emergence, urea has potential to reduce the inoculum pressure during harvest. The urea spray would most likely be best used as part of an integrated approach to disease control alongside existing fungicide and fertiliser programmes. It could be argued that with reduced inoculum pressure post-harvest, the first spray application could be delayed and numbers of sprays reduced. However since most available fungicides are primarily protectant in activity, then this would probably be inadvisable. The use of urea for *Stemphylium* control therefore represents an additional input on top of any fungicide programs.

Applying an extra urea spray as well as ammonium nitrate and alongside a fungicide programme may well add to input costs for disease control by c. £60/ha using current urea costs of £280/tonne. However urea provides another potential method for *Stemphylium*

control by reducing spore release and infection at the stem bases, in turn possibly reducing the risk of infection, in an area which is difficult to reach with fungicide sprays when the canopy is closed. Assuming an average yield of 1 tonne/ha and a farm gate price of £5,500/tonne, a yield loss of only 1.1 % represents a reduction in sales equivalent to the cost of the additional urea input. Therefore if urea provides a following year yield benefit greater than 1.1% by additional control of *Stemphylium*, it is worth considering as part of an integrated programme of *Stemphylium* control in asparagus at current urea prices.

Action Point

- Application of urea as a spray to asparagus debris post-ridging, reduces spore release from *Stemphylium* resting bodies seen on asparagus debris. The most effective rate and timing post-ridging is 100 kg N/ha in either 1000 l/ha or 400 l/ha water volume. However this is not the most practical rate and timing as N uptake by the crop at this time is low and the practice would lead to diffuse pollution. Growers should consider applying 50 kg N/ha as two applications pre-harvest as this still gives comparable reduction in spore release, and may be a useful addition to the fertiliser regime whilst reducing the risk to the environment.