



2	Standard Programme				Siltra Xpro 0.6 l/ha + Bravo 500 1 l/ha		Siltra Xpro 0.4 l/ha + Bravo 500 1 l/ha		
3	Standard (No CTL)				Siltra Xpro 0.6 l/ha		Siltra Xpro 0.4 l/ha		
4	Aut T0 + Standard	Proline 275 0.25 l/ha			Siltra Xpro 0.6 l/ha + Bravo 500 1 l/ha		Siltra Xpro 0.4 l/ha + Bravo 500 1 l/ha		
5	Spr T0 + Standard		Proline 275 0.25 l/ha		Siltra Xpro 0.6 l/ha + Bravo 500 1 l/ha		Siltra Xpro 0.4 l/ha + Bravo 500 1 l/ha		
6	Standard + T3				Siltra Xpro 0.6 l/ha + Bravo 500 1 l/ha		Siltra Xpro 0.4 l/ha + Bravo 500 1 l/ha		Proline 275 0.25 l/ha
7	New 3 spray Program (with 2 x CTL)			Siltra Xpro 0.6 l/ha		Siltra Xpro 0.4 l/ha + CTL 1 l/ha		Proline 275 0.25 l/ha + Bravo 500 1 l/ha	
8	New 3 spray Program (3 x CTL)			Siltra Xpro 0.6 l/ha + Bravo 500 1 l/ha		Siltra Xpro 0.4 l/ha + CTL 1 l/ha		Proline 275 0.25 l/ha + Bravo 500 1 l/ha	
9	New 3 spray (1 CTL)			Siltra Xpro 0.6 l/ha		Siltra Xpro 0.4 l/ha		Proline 275 (0.25 l/ha ) + Bravo 500 1 l/ha	
10	New 3 spray Program (No CTL)			Siltra Xpro 0.6 l/ha		Siltra Xpro 0.4 l/ha		Proline 275 0.25 l/ha	

## Results

Table 1: Disease on untreated at all three sites

% Disease on untreated	Caythorpe leaf 2 06/06/19	East Malling leaf 1 07/06/19	Morley leaf 3 01/05/19
Net Blotch	4.3%	5%	4.3%
Brown Rust	4.3%		
Septoria nodorum		20%	

As in 2018, disease levels were low at both Caythorpe and Morley. At East Malling, disease levels were higher with, again, as in 2018, *Septoria nodorum* was the main disease recorded. Interestingly, the net blotch seen in May at Morley on leaf 3 was the spot form of net blotch but all disease in the untreated disappeared by June as the crop senesced.

Table 2: Yields at all three sites and 3 site mean

Description	Yield Caythorpe t/ha	Yield East Malling t/ha	Yield Morley t/ha	3 Site Mean (t/ha)
Untreated	6.36	4.10	5.68	5.38
Standard Programme	8.12	5.70	6.77	6.86
Standard (No CTL)	7.62	4.74	6.48	6.28
Aut T0 + Standard	8.53	5.51	6.84	6.96
Spr T0 + Standard	8.58	6.18	6.71	7.16

Standard + T3	8.65	5.71	6.69	7.02
New 3 spray Program (with 2 x CTL)	8.31	5.82	6.28	6.80
New 3 spray Program (3 x CTL)	8.68	6.17	7.09	7.31
New 3 spray (1 CTL)	8.62	6.64	6.94	7.40
New 3 spray Program (No CTL)	8.14	5.85	7.04	7.01
LSD	0.35	0.73	0.56	0.51
CV	2.5	7.5	4.9	4.3

Figure 1: 3 site mean yield in 2019

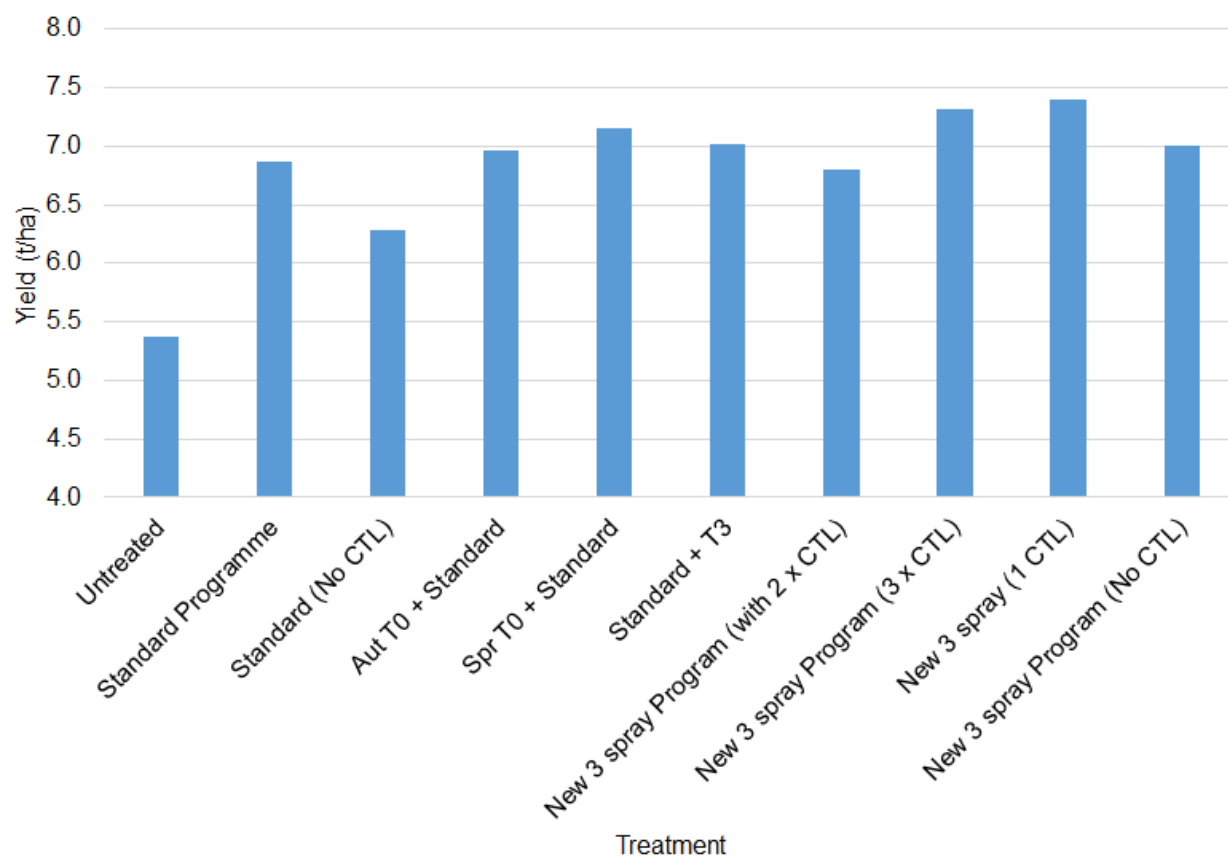


Table 3: Multi-site yield and margin versus the long-term mean

Comparison	3 Site Mean Yield Response in 2019	Margin over Fungicide Cost @ £125/t (£/ha)	3 Site Mean Response 2008-2019 (t/ha)
Benefit of T1 + T2 vs untreated	1.48	£136	1.19
Benefit of T3 vs 2 spray standard	0.16	£9	0.38
Benefit of T0 (Spring) vs 2 spray standard	0.30	£27	0.25
Benefit of T0 (Autumn) vs 2 spray standard	0.10	£2	0.08
Total Response to all fungicides	2.04	£174	1.90
Benefit of 3 spray programme(with 2 x CTL) vs 2 spray standard	-0.06	-£19	0.31 (2018 only)

Table 3 shows the yield response and marginal returns for each spray timing. As seen previously, the response to an autumn T0 spray was small and not economic. The spring T0 response was higher than the multi-year mean and gave a positive return. T3 seems to have given a small response and, as in most years, the T1 and T2 treatments showed the largest yield and margin response.

Overall, the average total response in 2019 to all fungicides was 2.04 t/ha which was only slightly higher than the 10 year average of 1.90 t/ha but not as high as 2018 when we saw a 2.74 t/ha average response, in a low disease year.

Figure 2: Yield at individual sites in 2019

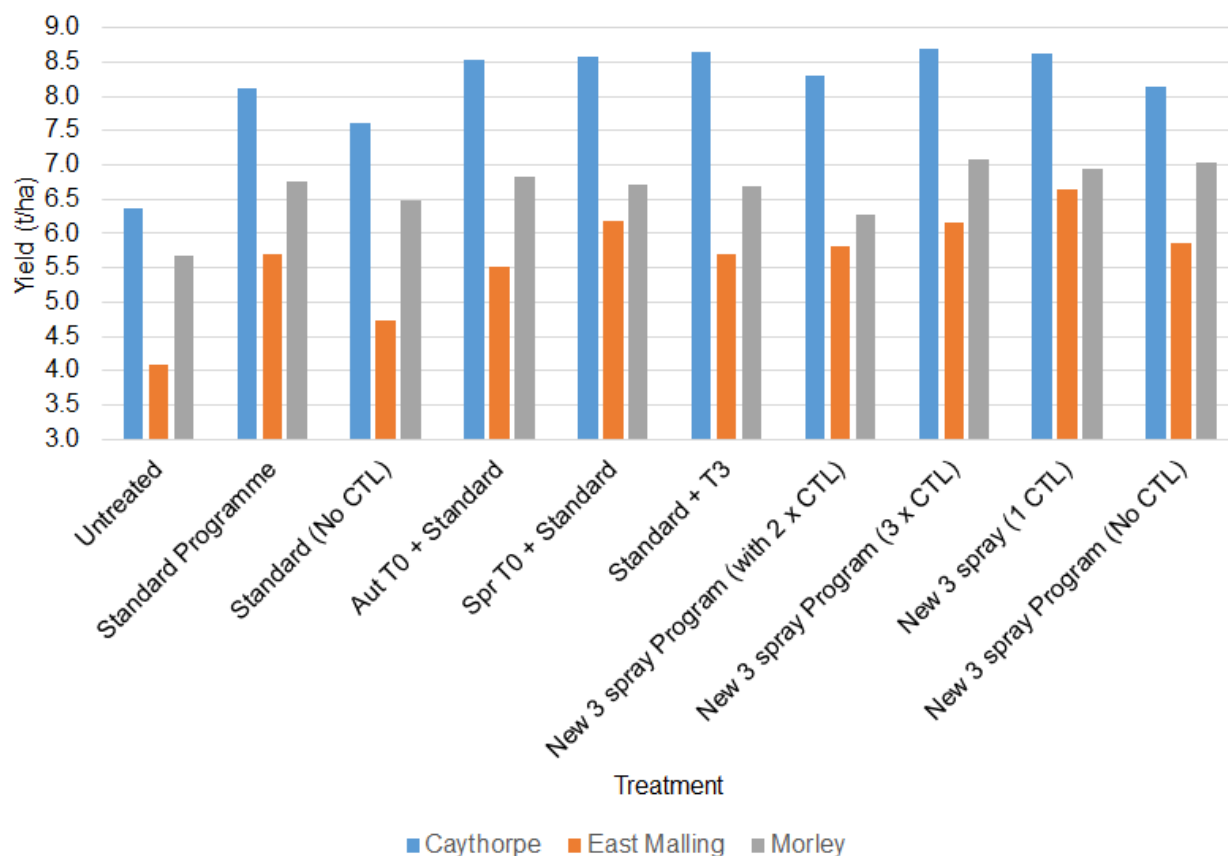


Table 2 and figure 2 show the treatment yields at each site. All sites showed a significant response to fungicide use versus the untreated. At East Malling, which had the most disease, the untreated yield was relatively low and Caythorpe was the highest yielding site.

Figure 2 clearly shows the benefit of adding chlorothalonil to the standard programme (trt 2) versus no chlorothalonil (trt 3). This chlorothalonil response was around 0.29 t/ha at Morley, 0.5 t/ha at Caythorpe and 0.96 t/ha at East Malling although none of the sites recorded any ramularia.

In 2018, the 3 spray programme yielded up to 0.6 t/ha more than the standard 2 spray programme. However, in 2019, the differences were smaller.(Table 4 below).

Table 4: Yield response at each site

Comparison	Yield Response 2019- Caythorpe (t/ha)	Yield Response 2019- East Malling (t/ha)	Yield Response 2019- Morley (t/ha)
Benefit of T1 + T2 vs untreated	1.76	1.60	1.09
Benefit of T3 vs 2 spray standard	0.53	0.01	-0.08
Benefit of T0 (Spring) vs 2 spray standard	0.46	0.48	-0.06
Total response to T0+T1+T2+T3	2.75	2.09	0.95
Benefit of T0 (Autumn) vs 2 spray standard	0.41	-0.19	0.07
Benefit of 3 spray programme(with 2 x CTL) vs 2 spray standard	0.19	0.12	-0.49
LSD	0.35	0.73	0.56

CV%	2.5	7.5	4.9
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Table 4 above also shows that Caythorpe had the highest overall fungicide response at 2.75 t/ha with Morley at just less than 1 t/ha. East Malling had around a 2 t/ha fungicide response.

Table 5: Mean multi-site yield response by fungicide timing 2008-2019

	Autumn T0	Spring T0	T1+T2	T3	3 Spray versus 2 spray Programme
2008	0.05	0.10	1.75	no data	
2011	0.00	0.08	0.37	0.00	
2012	0.65	0.73	0.34	0.36	
2013	0.01	0.00	0.51	0.33	
2014	0.12	0.27	1.87	0.53	
2015	0.47	0.49	0.35	0.67	
2016	0.00	0.04	1.24	0.56	
2017	0.00	0.13	1.73	0.36	
2018	0.05	0.08	2.29	0.32	0.31
2019	0.10	0.30	1.48	0.16	-0.06
Mean	0.08	0.25	1.19	0.38	0.13

For multi-site and annual yield responses (Table 5 and figure 3 to 6 below), if a colour is missing from a specific year column in figures 3 to 6, that treatment did not give a yield benefit.

However, in Table 6 below, the actual negative responses are shown and these negative figures are used in the multi-year means for each site and the 3 site multi-year mean, shown in figures 3 to 6 (and the multi-year mean row for Table 5 above).

Negative responses for the 3 spray fungicide programmes are shown in Tables 5 and 6 but this data is not represented in figures 3 to 6 below.

Figure 3: Winter barley fungicide response over 10 years (3 sites) - 10 year mean: Aut T0 = 0.08 t/ha, Spr T0 = 0.25 t/ha, T1+T2 = 1.19 t/ha, T3 = 0.38 t/ha, Total = 1.90 t/ha

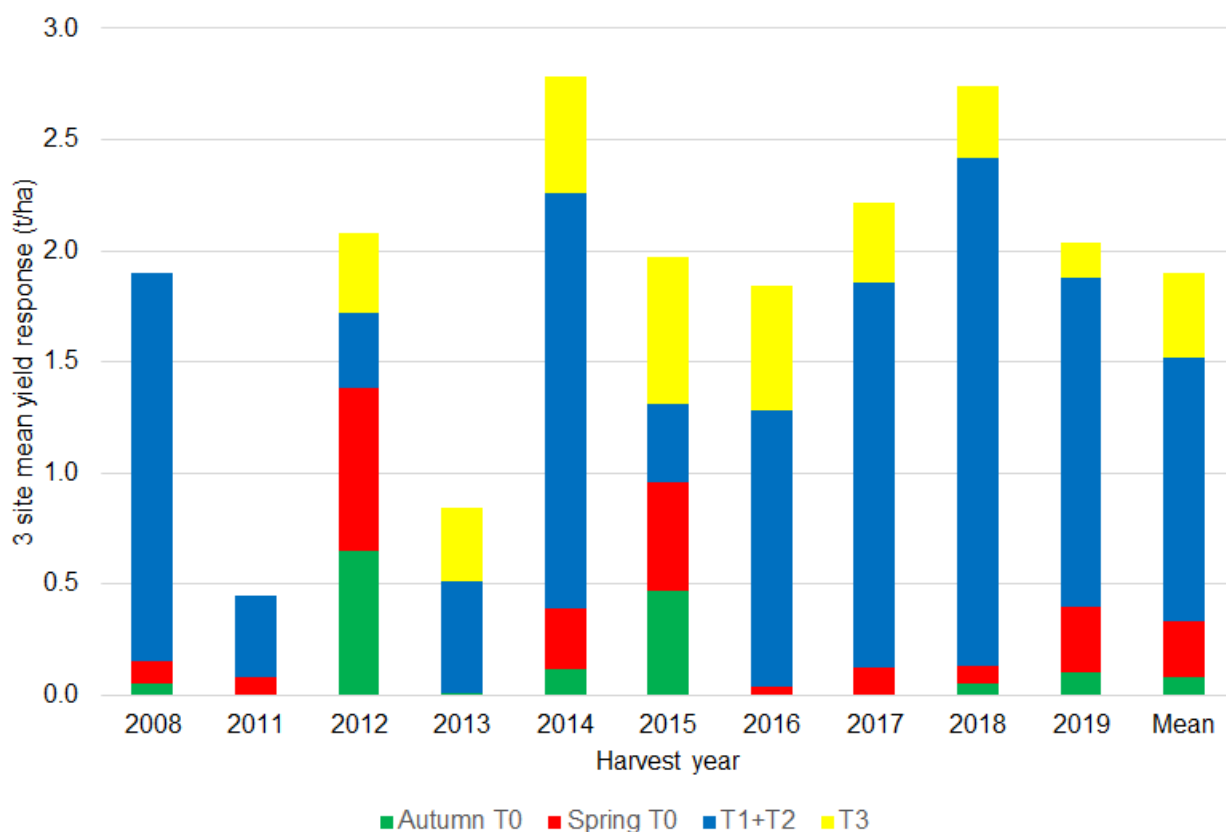


Figure 3 shows the typical "cigarette" column graph for the 3 site mean each year back to 2008. 2019 appears to have also been a typical year with more usual fungicide responses from each treatment with little from the autumn T0 but more from the spring T0 and T3 and the largest effect from the T1+T2. The T3 response was slightly lower than average but the data continues to show significant T3 responses every year back to 2012.

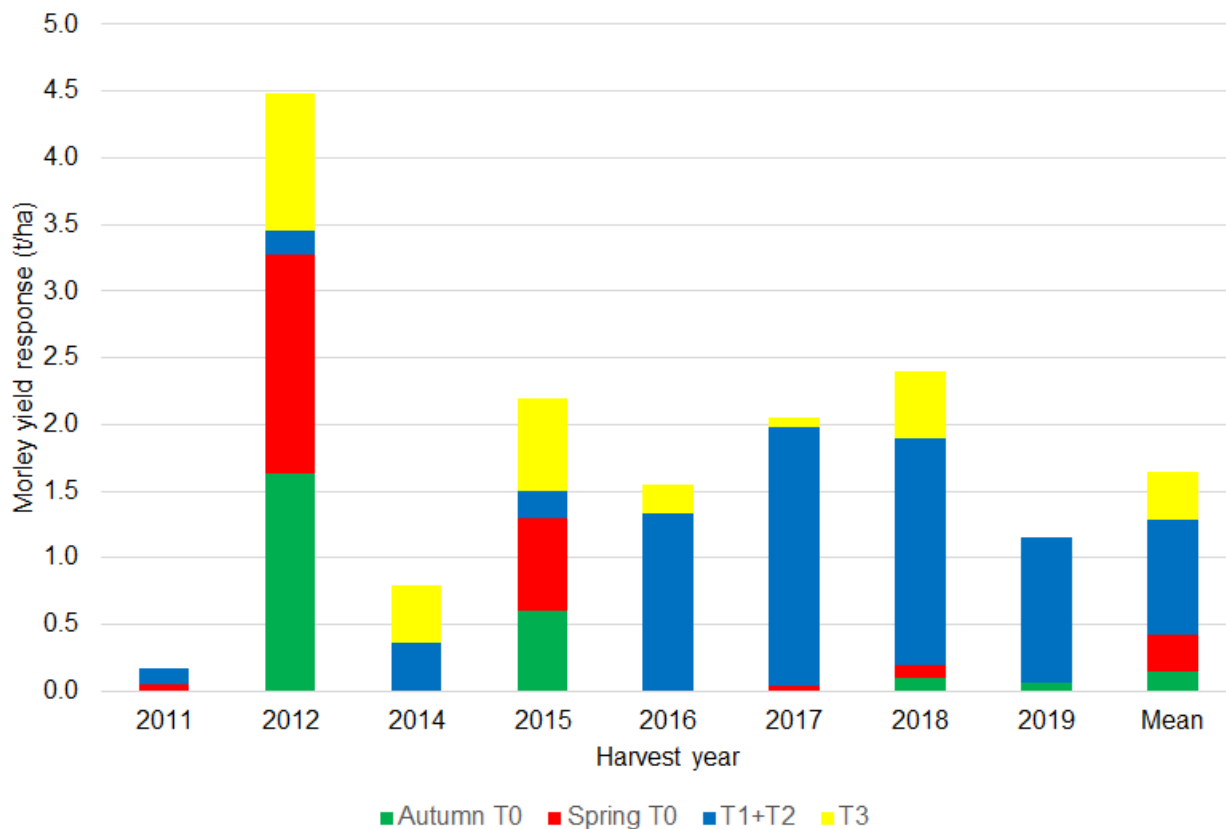
Table 6: Yield response by site 2011-2018

	Morley T0 Aut	Morley T0 Spr	Morley T1+T2	Morley T3	Morley 3 Spray v 2 Spray	Cay T0 Aut	Cay T0 Spr	Cay T1+T2	Cay T3	Cay 3 Spray v 2 Spray	SS/EMR T0 Aut	SS/EMR T0 Spr	SS/EMR T1+T2	SS/EMR T3	EMR 3 Spray v 2 Spray
2011	-0.27	0.05	0.12	-0.05		no data	no data	no data	no data		0.10	0.11	0.61	0.02	
2012	1.63	1.64	0.19	1.02		0.46	0.49	0.25	0.12		-0.13	0.06	0.59	-0.05	
2013	no data	no data	no data	no data		0.03	-0.24	0.59	0.54		0.00	0.12	0.42	0.12	
2014	-0.11	-0.01	0.36	0.43		0.40	0.20	3.56	0.95		0.08	0.62	1.70	0.20	
2015	0.60	0.70	0.20	0.70		0.44	0.22	0.38	0.62		0.36	0.55	0.47	0.68	
2016	-0.73	-0.27	1.33	0.22		-0.43	0.26	0.99	0.95		-0.26	0.12	1.41	0.51	
2017	-0.12	0.04	1.94	0.07		-0.70	-0.01	1.56	0.42		0.16	0.35	1.70	0.60	
2018	0.10	0.10	1.70	0.50	-0.10	0.06	0.00	3.26	0.07	0.42	0.00	0.20	1.90	0.40	0.60
2019	0.07	-0.06	1.09	-0.08	-0.49	0.41	0.46	1.76	0.53	0.19	-0.19	0.48	1.60	0.01	0.12
Mean	0.15	0.27	0.87	0.35	-0.30	0.08	0.17	1.54	0.53	0.31	0.01	0.29	1.16	0.28	0.36

The site at Sutton Scotney was moved to East Malling in 2018. The data for 2011 and 2013 covers only two sites as the trial did not run in Caythorpe in 2011 and Morley in 2013. In addition, data for 2008 is only available as multi-site means (Table 5 and Figure 3) and no individual site data is shown in Table 6 above or figures 4 to 6 below. There was also no T3 comparison in 2008.

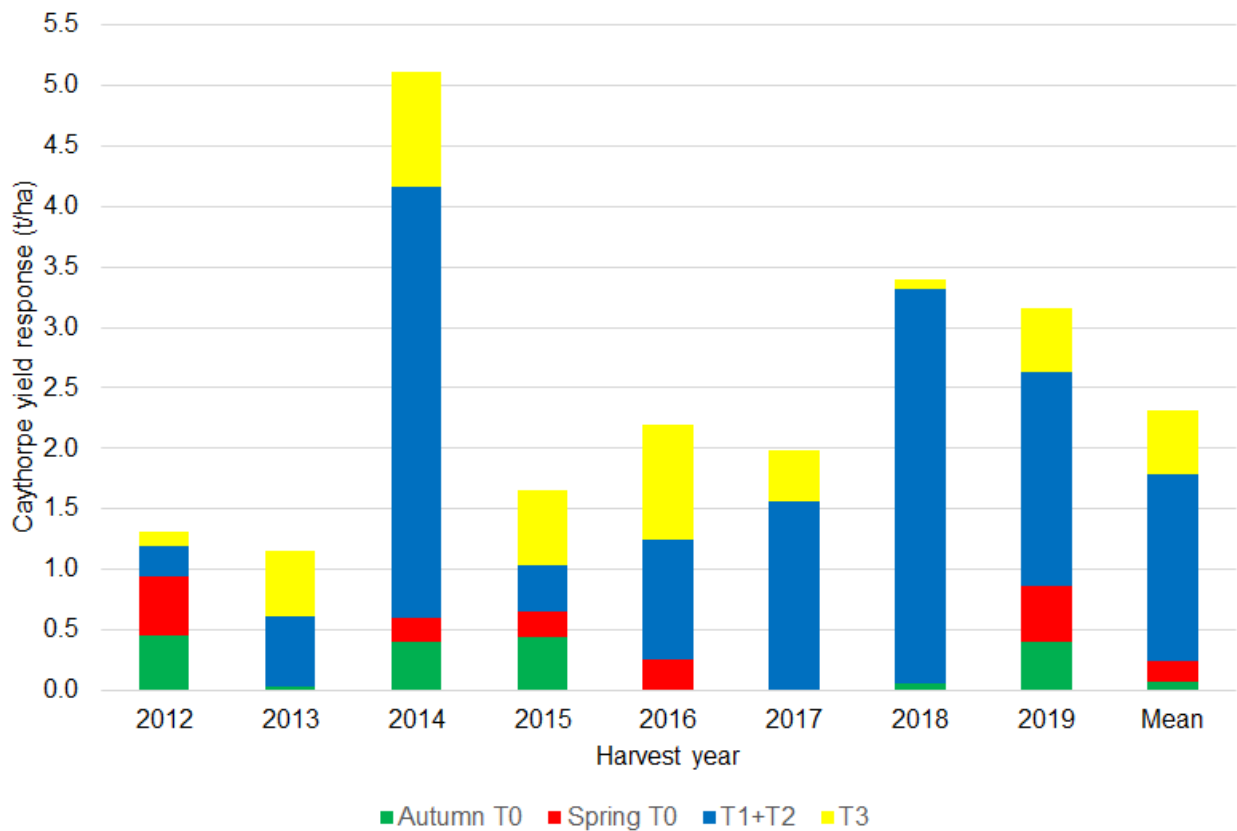
Table 6 also details the response to the 3 spray fungicide programme in 2018 and 2019 at each site (compared with the 2-spray standard).

Figure 4: Winter barley fungicide response at Morley over 8 years - 8 year mean: Aut T0 = 0.15 t/ha, Spr T0 = 0.27 t/ha, T1+T2 = 0.87 t/ha, T3 = 0.35 t/ha, Total =1.64 t/ha.



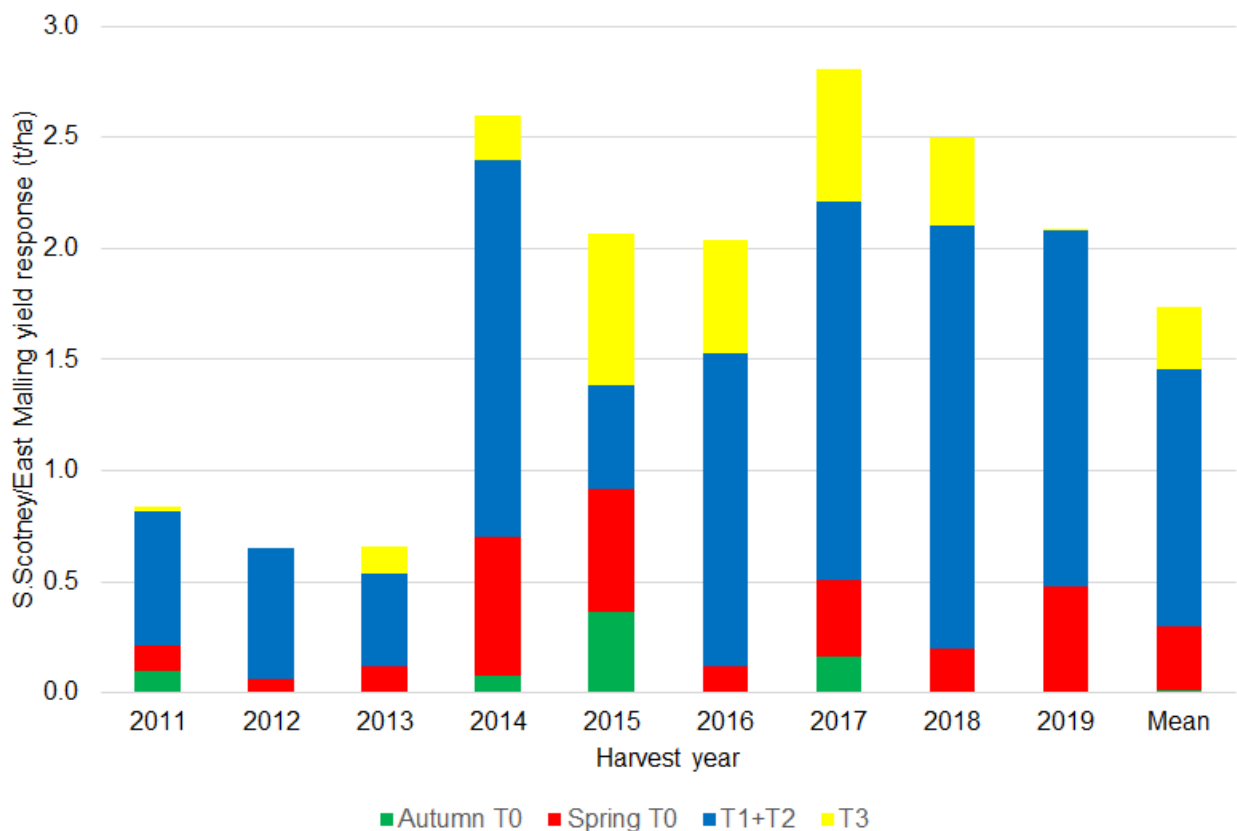
Morley had a low disease year and this shows in the overall fungicide response which was low and confined largely to T1+T2. There was no T3 response for the first time in 6 years.

Figure 5: Winter barley fungicide response at Caythorpe over 8 years - 8 year mean: Aut T0 = 0.08 t/ha, Spr T0 = 0.17 t/ha, T1+T2 = 1.54 t/ha, T3 = 0.53 t/ha, Total = 2.32 t/ha.



Caythorpe showed a relatively large fungicide response with positive benefits from all four timings including a small autumn T0 response.

Figure 6: Winter barley fungicide response at Sutton Scotney/East Malling over 9 years - 9 year mean: Aut T0 = 0.01 t/ha, Spr T0 = 0.29 t/ha, T1+T2 = 1.16 t/ha, T3 = 0.28 t/ha, Total = 1.74 t/ha.





At East Malling, the disease levels were the highest of any of the sites and this is reflected in the yield responses. There was no autumn T0 response and little T3 response. There was a relatively large spring T0 response in addition to the more standard T1+T2 uplift.

## Appendix

### Field details:

Trial Centre	NIAB EMR East Malling	Benniworth	Morley
Trial Location	Hope Farm	Caythorpe	Morley
Crop	Winter Barley	Winter Barley	Winter Barley
Previous Crop	Winter wheat	Spring barley	Spring Barley
Soil Texture	Sandy Clay Loam	Sandy loam	Clay loam
Soil Series	N/A	Elmton 1	N/A
Soil AnalysisN/A	pH 7.8, P 15 mg/l, K 326 mg/l, Mg 57 mg/l	pH 8.0, P 30 mg/l, K 211 mg/l, Mg 52 mg/l	N/A
Soil Mineral Nitrogen	0-30 cm 80 kgN/ha	0-30 cm 12 kgN/ha, 30-60 cm 14 kgN/ha	0-30 cm 7 kgN/ha, 30-60 cm 10 kgN/ha, 60-90 cm 22 kgN/ha
Total N/ha applied	179 kgN/ha	184 kgN/ha	142 kgN/ha
Drill Date	02/10/18	29/09/18	02/10/18
Seed Rate	300 seeds/m <sup>2</sup>	350 seeds/m <sup>2</sup>	300 seeds/m <sup>2</sup>
Drilled Plot Dimensions	2m x 12m	2m x 12m	2m x 12m
Replicates	3	3	3
Harvest Date	22/07/19	17/07/19	24/07/19

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