Blackcurrants

Sustainable control of *Botrytis cinerea*

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Blackcurrants - Background

- Around 2,300 ha of blackcurrants in UK with yield of about 14,000 t per year
- Most of crop grown under contract for processing for Ribena blackcurrant juice
- Main disease problems are leaf spot (*Drepanopezziza ribis*), powdery mildew and *Botrytis cinerea*
- Most new cultivars have good resistance to powdery mildew
- Botrytis is considered the most important disease problem

Blackcurrants – Botrytis

- Most important disease affecting fruit quality at harvest
- Concern over degeneration of ripening fruit due to botrytis
- Crop often harvested prematurely before sugar and colour are optimum
- Losses post-harvest are minimal as fruit is stored frozen if not processed immediately

Blackcurrants – Botrytis epidemiology

- Botrytis overwinters on mummified fruit on ground or bush or as sclerotia on fruit stalks and twigs
- These sporulate in damp conditions in spring
- Spores infect flowers which can result in flower abscission and significant yield loss
- Botrytis can also remain latent in the flowers and developing fruit and result in fruit rot once fruit matures

Blackcurrants – Botrytis control

- Botrytis control in flowering is most important
- Current control is based on fungicides which are applied routinely during flowering and fruit development
- Such reliance on fungicidal control is unsustainable
  - Residues in the fruit
  - Consumer acceptability
  - Loss of key products due to regulatory authorities
- Biocontrol agents (BCAs) are an alternative to fungicides and offer a more sustainable approach to control

Blackcurrants – Project details

- The work described was part of Horticulture LINK project HL01105

- Overall objective of the project was to develop new management methods for key pests and diseases of blackcurrants with the emphasis on non-chemical methods of control

- Specific objectives for this part of the project were

  - To evaluate BCAs and alternative chemicals (elicitors) for control of botrytis compared to a conventional fungicide programme

  - To evaluate programmes based on fungicides and / or BCAs and elicitors for botrytis control

Blackcurrants – Project details

- Trials conducted over 3 seasons
  - 2011 – Comparison of BCAs and fungicides
  - 2012 – Comparison BCAs / fungicide programmes
  - 2013 and 2014 – Evaluation of elicitors

Blackcurrants – Experiment details

- Blackcurrant plantation located at EMR planted in 2004
- 3 separate blocks of each cv. Ben Hope (early flowering) and Ben Tirran (late flowering)
- Each plot consisted of 6 bushes
- Treatments applied using Stihl motorised air-assisted knapsack sprayer at 500-1000 L/ha

Blackcurrants – Assessments

- Latent botrytis in fruit assessed once on green fruit
  - Random sample of 30 green fruit per plot collected
  - Fruit surface sterilised, plated on paraquat agar, incubated under UV light
  - Botrytis assessed after 4 weeks
- Plots assessed at flowering and harvest for visible botrytis on flowers and fruit
- At harvest random sample of 300 fruit collected per plot, incubated post-harvest in high humidity at ambient temperature and rots recorded after 7 days

Blackcurrants – Experiment details 2011

- Ten treatments evaluated
- 3 replicates per block of each cv. Ben Hope (early flowering) and Ben Tirran (late flowering) giving 9 replicates in total
- Treatments applied using Stihl motorised air-assisted knapsack sprayer at 1000 L/ha

Blackcurrants – Treatments 2011

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Product	Active ingredient	Product rate per ha
Bravo 500	chlorothalonil	5 kg
Teldor	fenhexamid	1.5 kg
Switch	cyprodonil + fludioxonil	1.0 kg
Signum	boscalid + pyraclostrobin	1.5 kg
Serenade	*Bacillus subtilis*	10 L
Prestop	*Gliocladium catenlanum*	0.5%
Trianum P	*Trichoderma harzianum*	10 g/L
Boniprotect Forte	*Aureobasidium pullulans*	0.6 g/L

Blackcurrants – Treatments 2011

NIAB EMR

Treatment	Pre-Flower	First flower BBCH 60	+ 7-10 days	+ 7-10 days	+ 7-10 days	+ 7-10 days
1		-	-	-	-	
2		Bravo 500	Teldor	Switch	Signum	
3		Serenade	Serenade	Serenade	Serenade	
4	Serenade	Serenade	Serenade	Serenade	Serenade	
5		Prestop	Prestop	Prestop	Prestop	
6	Ben Tirran only	Trianum P	Trianum P	Trianum P	Trianum P	
7		Bravo 500	Teldor	Switch	Serenade	Serenade
8		Boniprotect Forte	Boniprotect Forte	Boniprotect Forte	Boniprotect Forte	
9		Bravo 500	Teldor	Switch		
10		Bravo 500	Teldor	Switch	Serenade	

% Botrytis rot in post harvest tests on cvs. Ben Hope and Ben Tirran 2011

NIAB EMR

Treatment	Products	Ben Hope % Botrytis rot	Ben Tirran % Botrytis rot
1	Untreated	8.3	12.0
2	Bravo 500 Teldor Switch Signum	2.9	3.8
3	Serenade x4	13.1	8.1
4	Serenade x 5	9.0	7.2
5	Prestop x 4	9.1	6.6
6	Trianum P x4	13.5	8.1
7	Fungicide x 3 + Serenade x2	4.4	4.3
8	Boniprotect x 4	7.5	6.7
9	Fungicide x 3	5.6	6.7
10	Fungicide x 3 + Serenade x1	5.3	5.3

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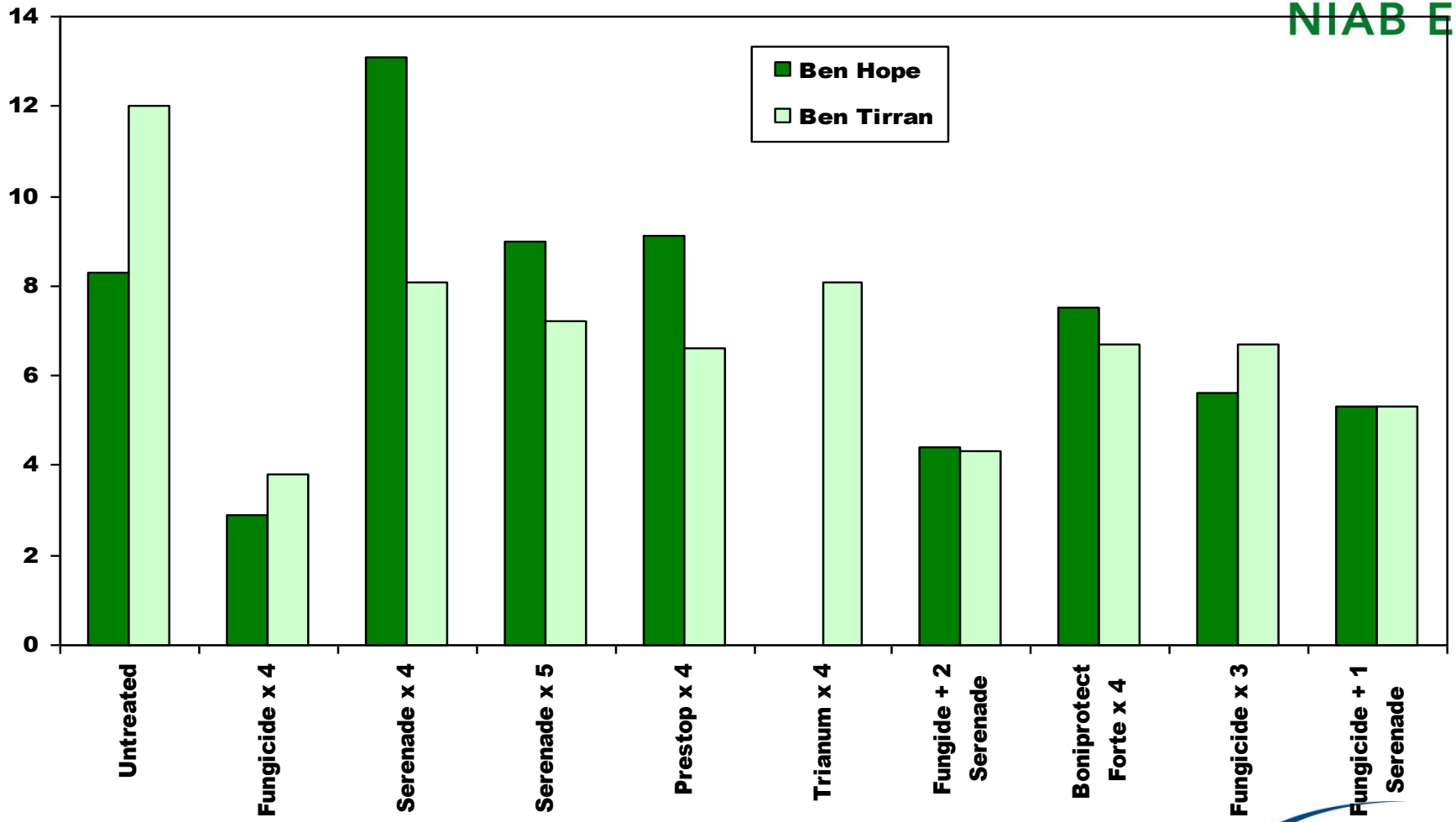
% Botrytis rot in post harvest tests on cvs Ben Hope and Ben Tirran in 2011



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Blackcurrants – Results 2011

- No botrytis seen on Ben Hope or Ben Tirran bushes at harvest
- Ben Tirran
  - All treatments including BCAs significantly reduced botrytis rot in post-harvest tests
  - Best control achieved by 4 fungicide programme and 3 fungicide + 2 Serenade programme
- Ben Hope
  - Botrytis but data more variable probably because of lower botrytis risk
  - Best control achieved by 4 fungicide programme

Blackcurrants – Experiment details 2012

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- Further evaluation of BCAs in combination with fungicides compared to effective fungicide applied early

- Eleven treatments evaluated

- 2 replicates per block of each cv. Ben Hope (early flowering) and Ben Tirran (late flowering) giving 6 replicates in total

Product	Active ingredient	Product rate per ha
Signum	boscalid + pyraclostrobin 33.4WG	1.5 kg
UKA386a	fluopyram + trifloxystrobin 500SC	0.8 L
Serenade	*Bacillus subtilis*	10 L
Prestop	*Gliocladium catenlanum*	5 g/L

Blackcurrants – Treatments 2012

NIAB EMR

Treatment	First flower BBCH 60	+ 7-10 days	+ 7-10 days	+ 7-10 days	+ 7-10 days	+ 7-10 days
1	-	-	-	-	-	
2	Signum	Signum	Signum	Signum		
3	UKA386a	UKA386a	UKA386a	UKA386a		
4	Serenade	Serenade	Serenade	Serenade	Serenade	Serenade
5	Prestop	Prestop	Prestop	Prestop	Prestop	Prestop
6	Signum	Signum	Signum			
7	Signum	Signum	Signum	Serenade		
8	Signum	Signum	Signum	Serenade	Serenade	
9	UKA386a	UKA386a	UKA386a			
10	UKA386a	UKA386a	UKA386a	Serenade		
11	UKA386a	UKA386a	UKA386a	Serenade	Serenade	

% Botrytis rot in post harvest tests on cvs. Ben Hope and Ben Tirran 2012

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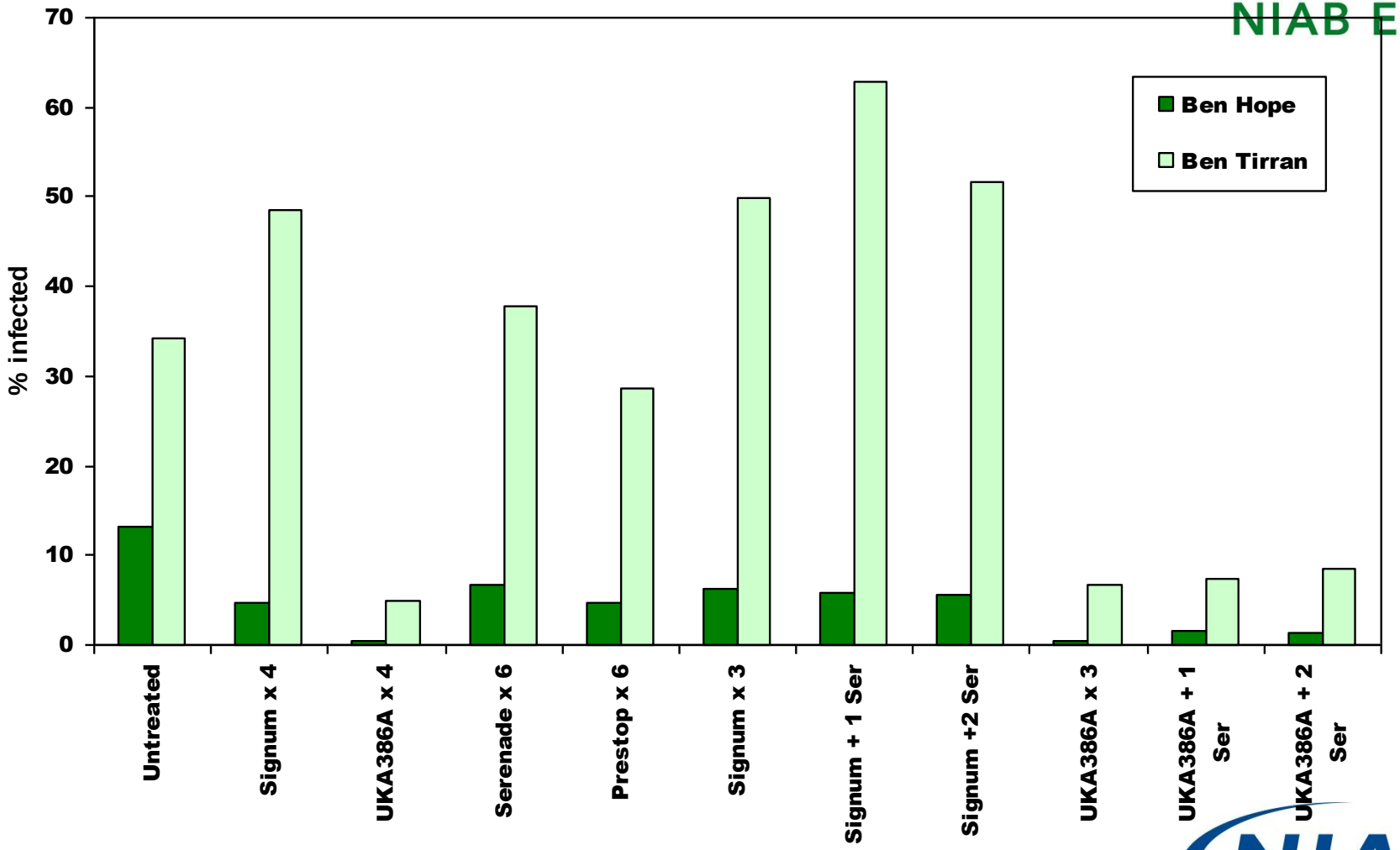
Treatment	Product	Timing	Mean % Botrytis rot in post-harvest tests	
			Ben Hope	Ben Tirran
1	Untreated control	-	13.2	34.3
2	Signum	4 sprays	4.8	48.6
3	UKA386a	4 sprays	0.5	5.0
4	Serenade	6 sprays	6.7	37.7
5	Prestop	6 sprays	4.8	28.6
6	Signum	3 sprays	6.2	49.9
7	Signum	3 sprays	5.9	62.9
	Serenade	1 spray		
8	Signum	3 sprays	5.7	51.7
	Serenade	2 sprays		
9	UKA386a	3 sprays	0.5	6.6
10	UKA386a	3 sprays	1.5	7.4
	Serenade	1 spray		
11	UKA386a	3 sprays	1.4	8.6
	Serenade	2 sprays		

% Botrytis rot in post harvest tests on cvs. Ben Hope and Ben Tirran 2012



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Blackcurrants – Results 2012

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- No botrytis seen on Ben Hope or Ben Tirran bushes at harvest
- Ben Tirran
  - High incidence of botrytis rot in post-harvest tests
  - Only UKA386a significantly reduced botrytis rot in post-harvest tests
  - Similar control achieved by 3 fungicide programme as 4 fungicide
  - No additional benefit from pre-harvest BCAs
- Ben Hope
  - Low incidence of botrytis in post-harvest tests
  - BCAs reduced botrytis but not significant
  - Best control achieved by UKA386a
  - 3 sprays of UKA386a as good as 4
  - No additional benefit from pre-harvest BCAs

Blackcurrants – Discussion 2011 and 2012

- Best control of botrytis achieved by fungicide programme and 3 sprays of effective product (such UKA386a) as good as 4
- Full programme of BCAs reduced botrytis in 2011 but was not as effective as fungicides
- Substituting last fungicide treatment with 2 sprays of BCA Serenade resulted in similar control of botrytis indicating that the late treatments with Serenade had some benefit and could reduce risk of residues
- BCAs not effective in 2012
- BCAs frequently do not give consistent disease control when applied as foliar sprays in the field
- More research is needed to explore how best to use BCAs to give more consistent control

Blackcurrants – Experiment details 2013

- Evaluate possible use of alternative chemicals such as elicitors or plant strengtheners
- Ten treatments evaluated
- 2 replicates per block of each cv. Ben Hope (early flowering) and Ben Tirran (late flowering) giving 6 replicates in total

Product	Active ingredient	Product rate / ha
Signum	boscalid + pyraclostrobin 33.4WG	1.5 kg
Switch	cyprodonil + fludioxonil	1.0 kg
Teldor	fenhexamid	1.5 kg
UKA386a	fluopyram + trifloxystrobin 500SC	0.8 L
Serenade	*Bacillus subtilis*	10 L
PreTect	Harpin protein	2 kg
CropBiolife	flavonoids	350 ml
Farmfos	Potassium phosphite	10 L

Blackcurrants – Treatments 2013

NIAB EMR

Treatment	First flower BBCH 60	+ 7-10 days		+ 7-10 days	+ 7-10 days		Green fruit BBCH 79
1	-	-	-	-	-		
2	Signum	Switch		Teldor			
3	UKA386a	UKA386a		UKA386a			
4	Serenade	Serenade		Serenade	Serenade		
5	Pretect				Pretect		Pretect
6	CropBiolife				CropBiolife		CropBiolife
7	Farmfos				Farmfos		Farmfos
8	Pretect		Pretect		Pretect	Pretect	Pretect
9	CropBiolife		CropBiolife		CropBiolife	CropBiolife	CropBiolife
10	Farmfos		Farmfos		Farmfos	Farmfos	Farmfos

% Botrytis rot in post harvest tests on cvs. Ben Hope and Ben Tirran 2013

NIAB EMR

Treatment	Products	Ben Hope % Botrytis rot	Ben Tirran % Botrytis rot
1	Untreated	1.5	36.2
2	Signum Switch Teldor	0.7	22.4
3	UKA386a x 3	1.2	10.4
4	Serenade x 4	1.6	32.8
5	PreTect x 3	2.8	31.8
6	CropBiolife x 3	1.3	25.2
7	Farmfos x 3	0.9	35.3
8	PreTect x 5	1.9	34.5
9	CropBiolife x5	2.1	23.8
10	Farmfos x 5	1.4	31.2

% Botrytis rot in post harvest tests on cvs. Ben Hope and Ben Tirran 2013

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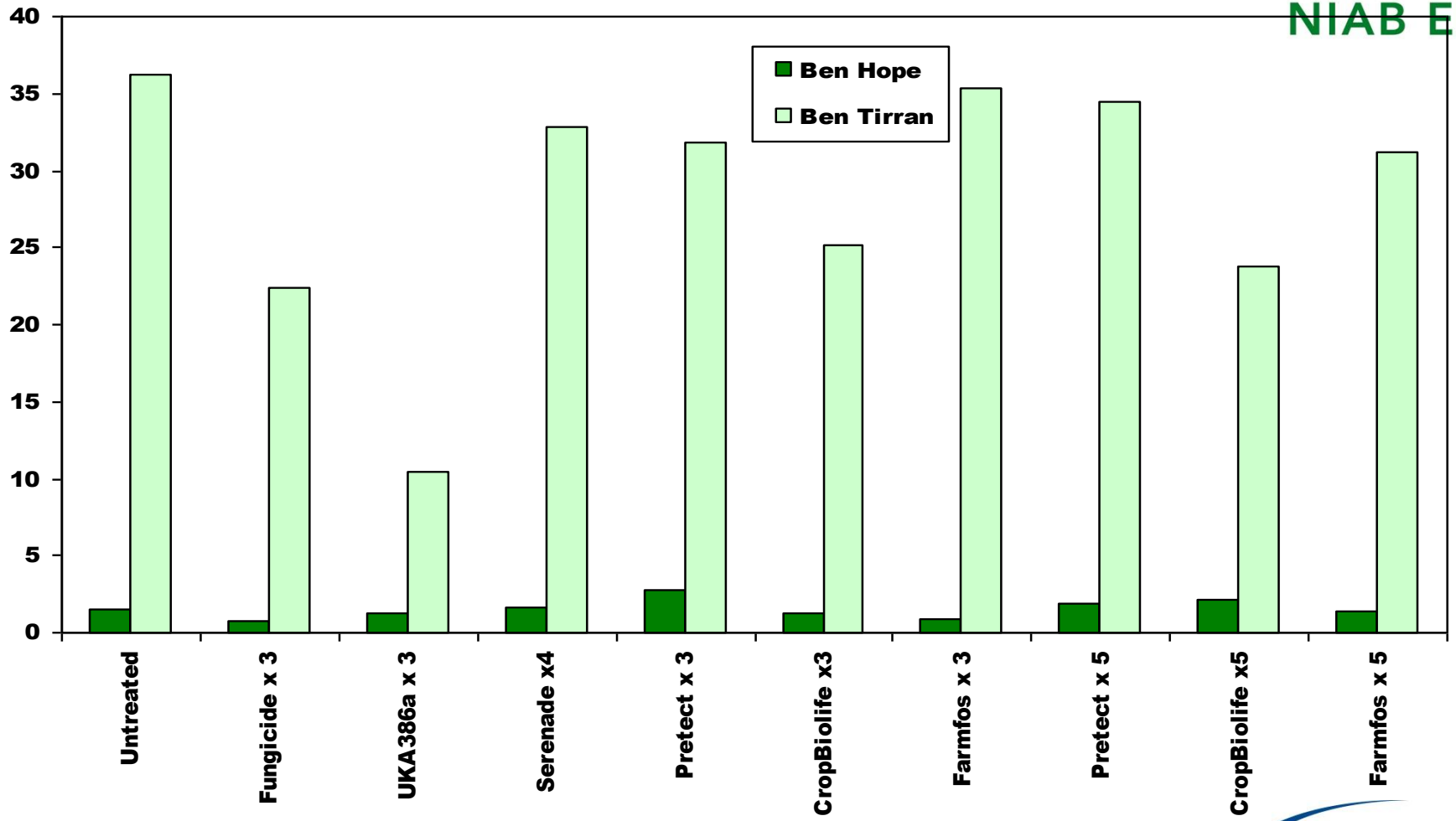

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Blackcurrants – Results 2013

NIAB EMR

- No botrytis seen on Ben Hope or Ben Tirran bushes at harvest

- Ben Tirran
  - High incidence of botrytis rot in post-harvest tests
  - UKA386a most effective in reducing botrytis rot
  - CropBiolife (3 or 5 sprays) and fungicide programme reduced botrytis rot
  - Serenade and other Elicitors were not effective

- Ben Hope
  - Low incidence of botrytis in post-harvest tests
  - None of the treatments were significant

Blackcurrants – Overall discussion

- Best control of botrytis achieved by fungicide programmes
- BCAs reduced botrytis in 2011but were not as effective as fungicides and did not work in 2012 and 2013
- CropBiolife was as effective in controlling botrytis in 2013 as the standard fungicide programme at a third of the cost
- Further trials on elicitors and fungicides were conducted in 2014 but the mild winter resulted in erratic flowering and poor yields especially in Ben Tirran
- Further trials will be conducted in 2017

Acknowledgements

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