

Diseases of field vegetable crops

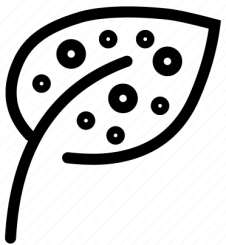
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Sceptre+ Disease trials

SCEPTREPLUS



34 disease trials



30 plant pathogens

22 crop types



Target Crops in Sceptre+ disease trials

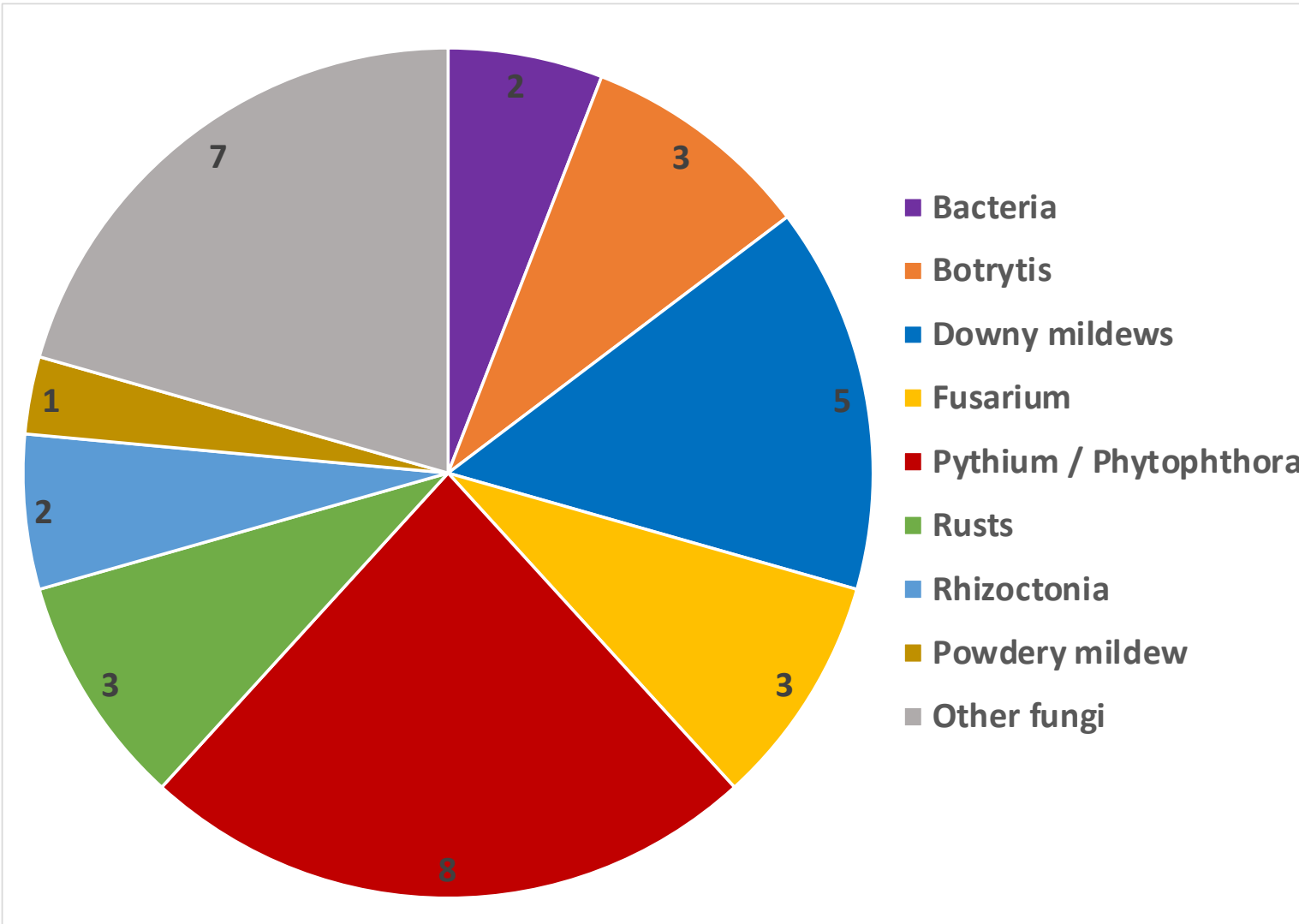
Target crops for disease trials in Sceptre+			
FV	PE	Fruit	HNS / POBOF
Brassica	Babyleaf spinach	Apple	Heuchera
Cabbage	Cucumber	Blackberry	Honeysuckle
Carrot	Lettuce	Blackcurrant	Narcissus
Cauliflower	Tomato	Plum	
Celery		Strawberry	
Leek			
Lettuce			
Onion			
Spinach			
Squash			

Sector	No. relevant trials
FV	17
PE	8
Fruit	6
HNS	4
POBOF	5



Pathogens in Sceptre+

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- Major groups include oomycetes, downy mildews, rusts
- Model crop approach allows actives to be identified which are potentially effective across commodities

SP 62 / 63 Identification of seed treatments to replace Thiram and Metalaxyl-M

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All pathogens introduced into growing media and damping off assessed with exception of *Stemphylium* (seed inoculated, treated and plated)

- **SP62a *Rhizoctonia solani* on cauliflower:** 5 fungicides, 1 biological. 3 fungicides AHDB9847, AHDB9849 and Maxim 480FS (fludioxonil) reduced disease incidence by more than 85%
- **SP62b *Fusarium culmorum* on leek:** 4 fungicides, 3 biologicals. 2 fungicides (AHDB9850, AHDB9848) reduced disease incidence by more than 70%.
- **SP63a *Pythium ultimum* on leek:** 3 fungicides, 3 biologicals. No clear effects, some phytotoxicity confounded results
- **SP63b *Stemphylium botryosum* on spinach:** 3 chemical biocides, 2 fungicides, 2 biologicals. Fungicide AHDB9848 and biological AHDB9815 were most effective.
- **Outcomes:** Some products effective across several pathogens. EAMU previously gained for use of Maxim 480FS on cauliflower and application now submitted for use on leek. EAMU for Integral Pro (*Bacillus amyloquefaciens*) for use on leafy salads and herbs but applications planned for other crops.



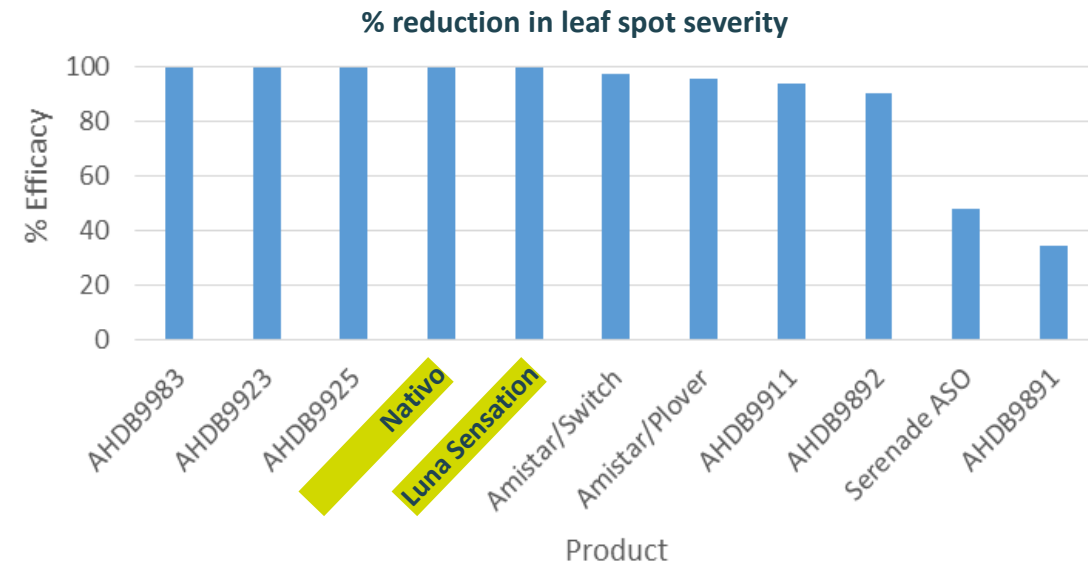
SP 26 Control of Septoria on celery (seed treatments)

- **Tested:** 7 seed treatments compared with Thiram
- Seed inoculated with *S. apiicola* and treatments applied one week later
- Seed assessed for germination; washings taken and used to inoculate celery plants to assess *Septoria* load
- AHDB9849, AHDB9848, AHDB9847 and acetic acid severely affected seed germination or seedling development
- Hydrogen peroxide (3% solution) and Maxim 480FS (fludioxonil) resulted in good control
- **Outcome:** EAMU being pursued for Maxim on celery



SP 26 Control of Septoria on celery (foliar treatments)

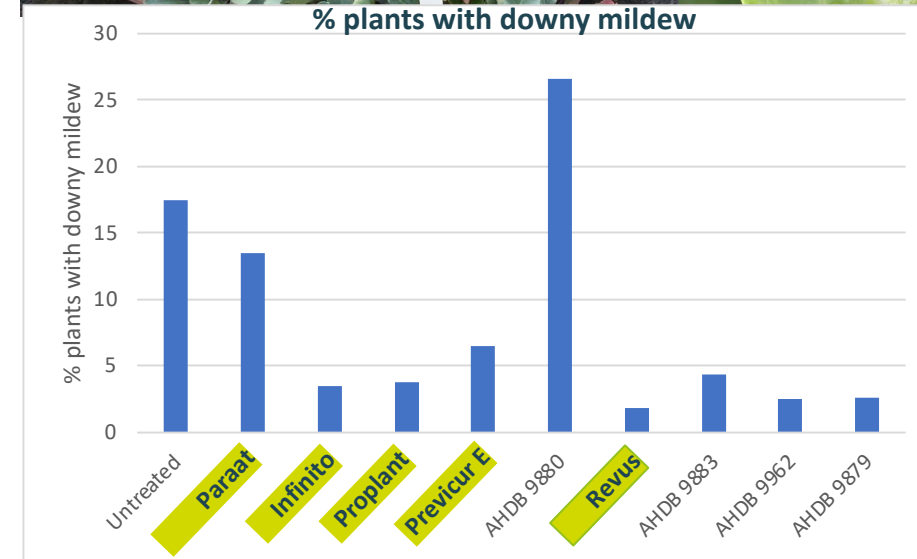
- **Tested:** 7 conventional fungicides and 2 biopesticides tested and compared with Amistar (azoxystrobin) / Switch (cyprodinil and fludioxonil) and Amistar / Plover (difenoconazole)
- Celery plants inoculated with spore suspension of *S. apiicola* 2 days after first treatment application
- Majority of products reduced disease development
- **Outcome:** Nativo (trifloxystrobin + difenconazole) very effective and now has EAMU
- **Outcome:** Luna Sensation (fluopyram + trifloxystrobin) also effective – potential for new EAMU



SP 37 New products for control of downy mildew on outdoor and protected crops

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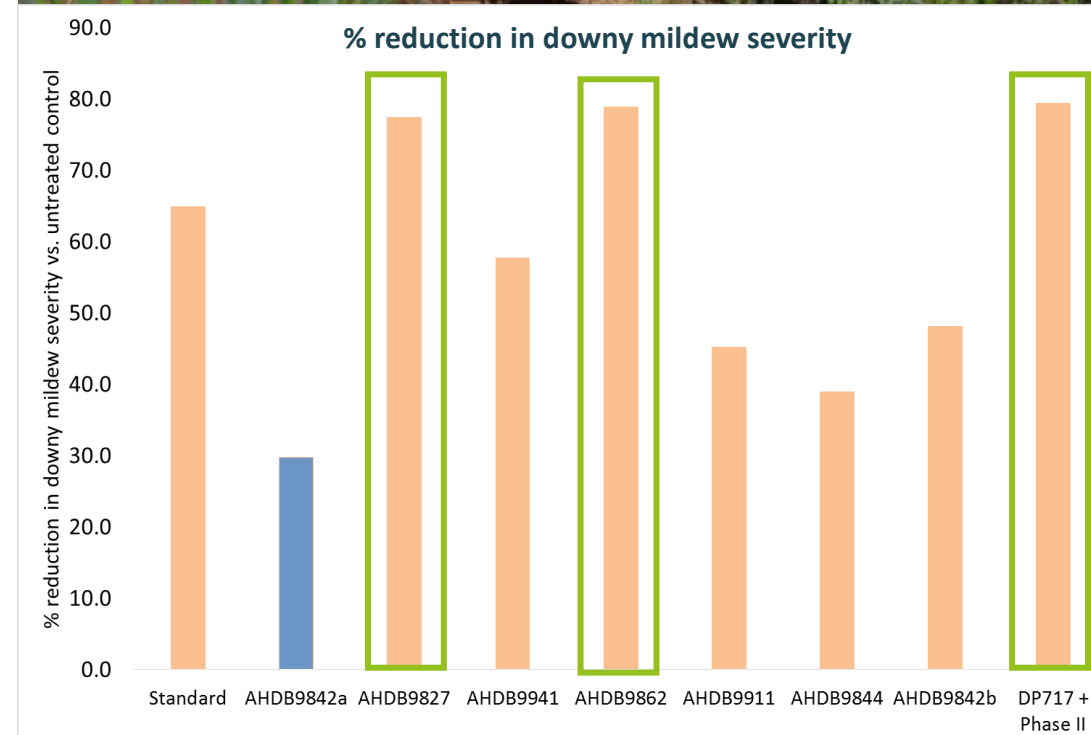
- To address pathogen resistance and dependence on common fungicide active (propamocarb)
- **Tested:** 8 conventional fungicides compared with Paraat (dimethomorph) on cauliflower seedlings
- First treatments applied 2 days before inoculation with *Hyaloperonospora brassicae*
- Standard product Paraat did not result in good control (but resistance is known) Other approved products Infinito (fluopicolide + propamocarb), Proplant (propamocarb;) and Previcur Energy (propamocarb) all significantly reduced disease BUT have common active
- Other coded fungicides effective as well as Revus (mandipropamid, originally coded)
- **Outcome:** Revus has now gained an EAMU for brassica transplants



SP 54 Control of downy mildew in onions

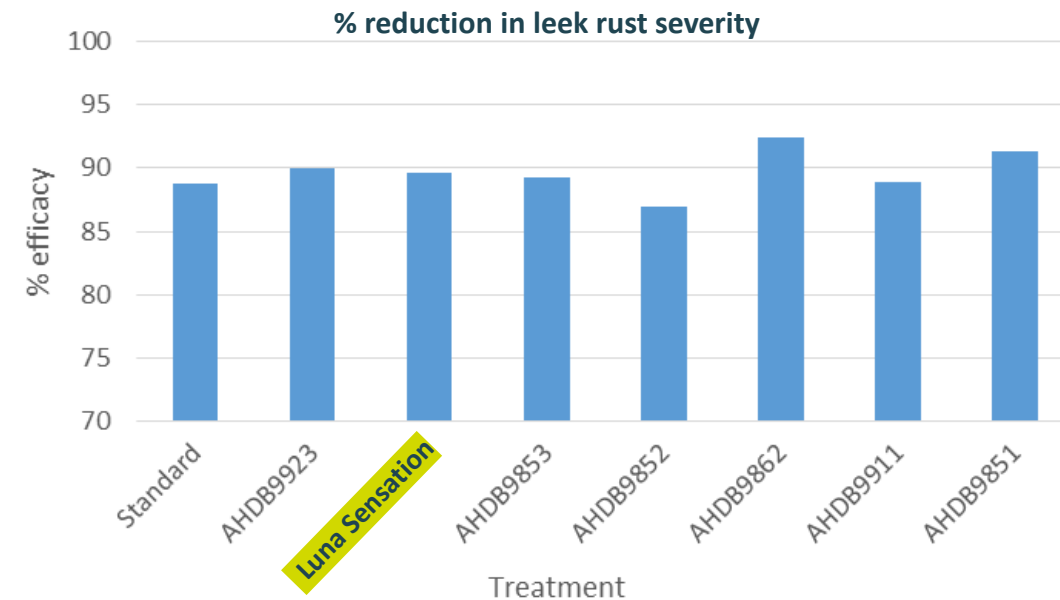
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- To address dependence on limited no. / withdrawal of actives (e.g. mancozeb)
- Salad onion field experiment with naturally occurring disease
- **Tested:** 8 conventional fungicides compared with a commercial DM programme (multiple products)
- Most products reduced DM severity; AHDB9827, AHDB9862 and DP717 (oxathiapiprolin) performed best (>76% control)
- Residues trials are planned for oxathiapiprolin on salad onion to support an EAMU application for a relevant product



SP 43 Evaluation of new products for control of leek rust

- To address dependence on approved products containing azole and strobilurin actives
- **Tested:** 6 conventional fungicides and 1 biopesticide compared with programme of Amistar Top (azoxystrobin + difenoconazole), Rudis (prothioconazole) and Nativo (trifloxystrobin + difenconazole)
- Treatments applied 5 true leaf stage as infected 'spreader' plants introduced
- **Outcome:** All products very effective including Luna Sensation (fluopyram + trifloxystrobin) so potential for further EAMUs.



SP 65 Novel approaches for bacterial disease control in outdoor field vegetables

- To address withdrawal of products containing copper
- Autumn squash inoculated with *Pseudomonas syringae* pv. *lachrymans* and products applied 48 later (in field). Similar approach in glasshouse experiment.
- **Tested:** 4 biologicals, 1 botanical and sulphur
- Serenade (*Bacillus subtilis* strain QST 713), orange oil + 1 coded biological reduced disease in both trials
- **Outcome:** EAMU already approved for Serenade.



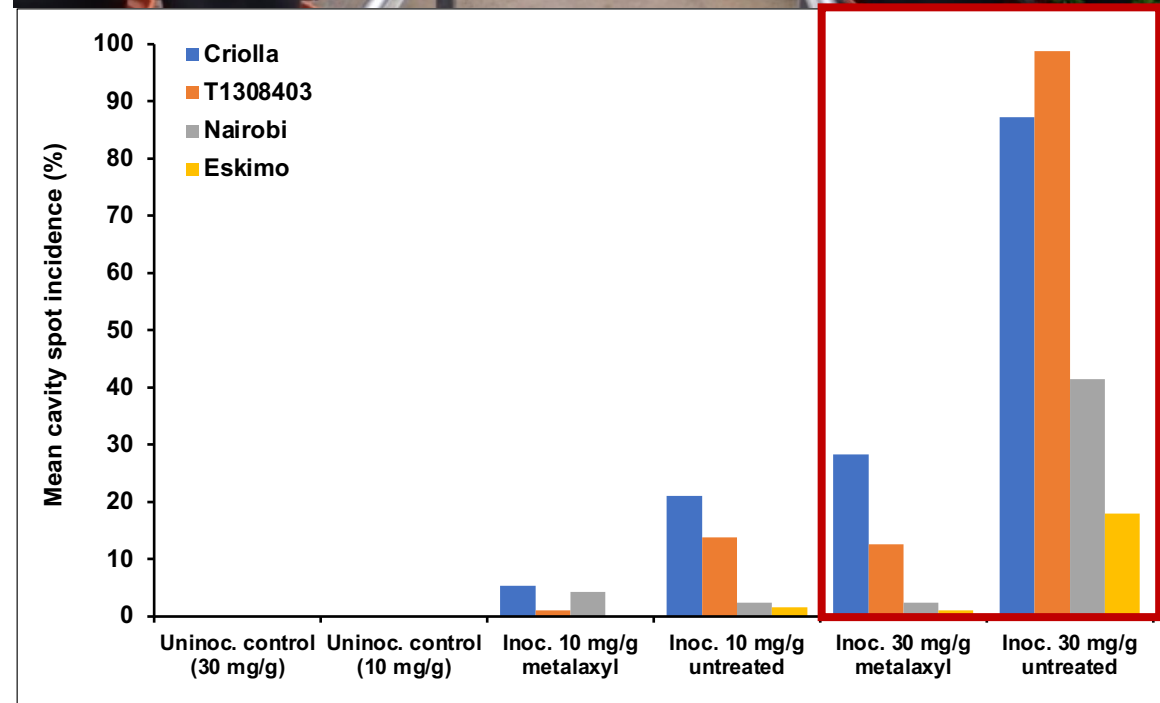
SP 16: Control of Botrytis on stored cabbage

- Replacement for Rovral (iprodione) required
- **Tested:** 5 conventional fungicides and 3 bio-pesticides
- Stored December / harvested June
- AHDB9925, AHDB9926, AHDB9923 and Serenade resulted in significant control of Botrytis and increased marketable yield
- **Outcome:** Serenade now has EAMU and another is being pursued for Filan (boscalid)



SP72 Development of artificial inoculation for cavity spot in pot-grown carrots

- To address the failure of field trials due to low disease and enable testing of products under controlled conditions
- *P. violae* millet grain inoculum used – previously shown to result in:
 - stubby carrots
 - reduction in root weight
 - cavity spot incidence of 50%
- Tested method to investigate if approach could be used to identify new crop protection approaches to cavity spot
- Treatments: 2 resistant / 2 susceptible carrot varieties +/- metalaxyl
- Inoculation method successful. Clear effect of metalaxyl and resistant variety



What have we learned?



Identifying and maintaining an arsenal of disease control products is a challenge as key actives are withdrawn



The number of biological products for disease control is still relatively small – we need more choice



Although some biological products are effective when applied in a similar way to chemistry, there needs to be more investment in understanding how best to formulate, test and use them



Much better integration is required to combine different approaches to disease control including cultural approaches and plant resistance.



The most successful trials used artificial inoculation – preliminary work and an understanding of the pathogen is required to determine the best type and amount of inoculum. Knowledge from previous AHDB projects.

Acknowledgments

- Many thanks to all the contractors in the disease trials.



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HORTICULTURE



Code	Title	Disease	Pathogen species	Host
SP 07	Identification of new products for control of downy mildew on protected / outdoor crops	Downy mildew	Bremia lactucae	Lettuce (hydroponic)
SP 14	Evaluation of biopesticides and conventional fungicides for control of Pythium	Pythium	Pythium aphanidermatum	Cucumber
SP 16	Control of Botrytis on stored cabbage	Botrytis	Botrytis cinerea	Cabbage
SP 19-Yr2	New treatment strategies to control bacterial canker on cherries	Bacteria	Pseudomonas syringae	Cherry
SP 21	Control of oomycete diseases in hydroponic lettuce	Phytophthora	Phytophthora cryptogea	Lettuce (hydroponic)
SP 25-Yr1	Development of treatments to control fusarium on lettuce	Fusarium	Fusarium oxysporum f.sp. lactucae	Lettuce
SP 26	Control of septoria on celery (seed treatments)	Septoria	Septoria apiicola	Celery
SP 26	Control of septoria on celery (foliar treatments)	Septoria	Septoria apiicola	Celery
SP 32	Control of Botrytis on hardy nursery stock and ornamentals	Botrytis	Botrytis cinerea	Heuchera
SP 33	Evaluation of the safety of promising downy mildew products on ornamentals	Downy mildew	Peronospera, Plasmopora & Hyaloperonospera	Various
SP 37	Identification of new products for control of downy mildew on outdoor and protected crops	Downy mildew	Hyaloperonospora brassicae	Brassica transplants
SP 40	Control of a new tomato blight strain	Phytophthora	Phytophthora infestans	Tomato
SP 41 Yr1	Development of treatments to control plum rust	Rust	Tranzschelia discolor	Plum
SP 42 Yr1	Control of smoulder & white mould on Narcissus	Smoulder & White mould	Ramularia vallisumbrosae / Botryotinia narcissicola	Narcissus
SP 42 Yr2	Control of smoulder & white mould on Narcissus	Smoulder & White mould	Ramularia vallisumbrosae / Botryotinia narcissicola	Narcissus
SP 43	Control of leek rust	Rust	Puccinia alii	Leek
SP 44	Rust control on ornamentals	Rust	Puccinia heucherae	Heuchera
SP 45	Control of Fusarium basal rot on narcissus	Fusarium	Fusarium oxysporum f.sp. narcissi	Narcissus
SP 46	Control of damping off diseases of baby leaf crops	Pythium	Pythium ultimum	Baby leaf spinach
SP 46	Control of damping off diseases of baby leaf crops	Rhizoctonia	Rhizoctonia solani	Baby leaf spinach
SP 47	Control of powdery mildew on protected crops	Powdery Mildew	Erysiphe lonicerae	Honeysuckle Lonicera
SP 54	Downy mildew control on Alliums	Downy mildew	Peronospora destructor	Onion
SP 62a	Identification of seed treatments strategies to replace Thiram and Metalaxyl-M: Rhizoctonia on brassica	Rhizoctonia	Rhizoctonia solani	Cauliflower
SP 62b	Identification of seed treatments strategies to replace Thiram and Metalaxyl-M: Fusarium on leek	Fusarium	Fusarium culmorum	Leek
SP 63a	Identification of seed treatments strategies to replace Thiram and Metalaxyl-M: Pythium on leek	Pythium	Pythium ultimum	Leek
SP 63b	Identification of seed treatments strategies to replace Thiram and Metalaxyl-M: Stemphylium on spinach	Stemphylium	Stemphylium botryosum	Spinach
SP 64	Seed Treatments for Onion Neck Rot	Botrytis	Botrytis aclada/allii	Onion
SP 65	Novel approaches for bacterial disease control in outdoor field vegetables	Bacteria	Pseudomonas syringae pv. lachrymans	Autumn squash
SP 66	Control of leaf spot in blackcurrant	Leaf spot	Drepanopeziza ribis	Blackcurrant
SP 67	Control of downy mildew in blackberry	Downy mildew	Peronospora sparsa	Blackberry
SP 68	New strategies to control apple canker	Apple canker	Neonectria ditissima	Apple
SP 69	Development of new strategies to control carrot cavity spot (macrocosm experiment)	Pythium	Pythium violae	Carrot
SP 70	New approaches to the control of Phytophthora crown rot in soft fruit	Phytophthora	Phytophthora cactorum	Strawberry
SP 72	Development of an artificial inoculation method for cavity spot in pot-grown carrots in the glasshouse (pot inoculation experiment)	Pythium	Pythium violae	Carrot