NBR projektnr 2008-424

Betning mot jordburna svampsjukdomar i sockerbetor 2008

Seed treatments against soil borne fungi in sugar beets 2008

DuPont
GEP report 2008

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SWEDAC ACKREDITERING
5607
GEP

Betning mot jordburna svampsjukdomar i sockerbetor 2008

Sammanfattning

Denna försöksserie utförs på uppdrag av DuPont Sverige AB och har som mål att prova tre olika doser av hymexazol (0, 14, 18 och 30 g aktiv substans/enhet) som är den verksamma substansen i Tachigaren. Försöken har legat på tre olika fält (Tullingagården i Mörarp, Videröra i Vallåkra och Åkerslätt i Trelleborg). I Sverige används för närvarande 14 g hymexazol på allt frö som säljs till lantbrukare. Odlingsåret 2008 började med en relativt sen sådd, inte förrän i slutet av april kunde sockerbetorna sås. Efter sådd följde en mycket torr och nederbördsfattig period, vilket gjorde att angreppsgraden av rotbrand blev generellt låg.

I försöken gjordes plantäkningar vid fyra tillfällen (20, 50, 100 % samt slutlig uppkomst) och sundhet samt rotbrandsbedömningar vid två tillfällen. Samtliga försök skördades och betorna bedömdes också för kroniska rotbrandsskador.

Resultaten från årets försök visar, i likhet med tidigare år, att svampbetning med hymexazol har stor effekt på antalet plantor som ökar med 7 000–8 000 per hektar. Svampbetning är alltså ett bra sätt att försäkra sig om ett tillräckligt högt plantantal. Sett över alla 15 försök som legat sedan 2004 är ökningen av antalet plantor/ha 9 000–10 000.

Trots den torra våren blev det en signifikant sänkning av rotbrandsangreppen på försöksplatsen utanför Vellinge (Åkerslätt). Samtliga doser reducerade där angreppen med 33 %.

I genomsnitt över 15 försök ger svampbetning med hymexazol 3–4 % ökning av sockerskörden. Även andra skördeparametrar påverkas positivt av svampbetning. Sockerhalten ökar signifikant med ca 0,1 % och kalium+natrium-värdet sjunker signifikant med ca 0,1 mM/100 g beta.

Summary

In 2008, the sugar beets were drilled very late, in the end of April. After drilling very little rain fell and the root rot infections were generally low in the growing area. The average final plant number (three trials) was despite the dry spring, higher in the treatments with fungicides than in the control ($p = 0,0536$, $LSD = 5,4$). The plant number in the treatment with 14 g hymexazol was 87.2 per hectare, with 18 g hymexazol 87.9 and with 30 g hymexazol 90.8 per hectare.

On the trial location (Åkerslätt) where *Aphanomyces cochlioides* was isolated from the plants, yield was increased with 6 and 7 % for 18 and 30 g, respectively (not significant).

There was also a tendency that the plant weight (g/pl) was slightly lower in the control and in the treatment with 30 g hymexazol (average over three trials and also at the trial location Åkerslätt). This may suggest that 30 g hymexazol has a slight impact on the early growth of the seedlings. Root rot infections occurred at Åkerslätt and this is the reason why the plants also had lower weight in the control.

The green house experiment 2008 showed that there was a significant difference in DSI between the 14 and 18 g dose of hymexazol. *Aphanomyces cochlioides, F. culmorum* and *F. redolens* was isolated from the roots of the four week old seedlings.

Yield parameters have been investigated in a total of 15 field trials during 2004–2008. The average over all 15 trials shows that seed treatment with hymexazol (14, 18 and 30 g) has a significant positive effect on plant number, sugar content, sugar yield and K+Na. The sugar yield is increased by three to four percent. There is also a tendency for higher root weight. The amino-N value is not affected.

Introduction

A number of soil borne fungi may cause substantial damage in sugar beet fields. One of the most important fungi in Sweden is *Aphanomyces cochlioides*. Particularly in warm and wet soils, *A. cochlioides* infect young seedlings two to three weeks after emergence. The hypocotyl (region between root and cotyledons) rots and the seedling dies. Early seedling infections of *A. cochlioides* can result in low plant numbers in the field. The disease also exists in a chronic form that appear later in the growing season, often following periods with heavy rains. The symptoms of this stage of the disease are a general reduction of the growth and often a severely and a typically deformed tap root.

It is important to protect the seedlings during emergence by treating the seed with hymexazol, the active ingredient of Tachigaren. The standard dose used on all seed in Sweden is 14 g. The seed treatment remains effective for four to six weeks. On highly infested fields it is important to use a tolerant variety in combination with hymexazol.

Hymexazol is the only registered product that is effective against *A. cochlioides*. In this trial series, Tachigaren is combined with 6 g fludioxonil, the active ingredient in Maxim tech. Fludioxonil is a broad spectrum, non systemic fungicide with effect against several soil borne fungi such as some *Fusarium* spp., *Rhizoctonia* and *Sclerotinia* (Olaya and Barnard, 1994; Mueller et al., 1999; Munkvold and O'Mara 2002; Dorrance et al., 2003; Broders et al., 2007).

Materials and methods

In late autumn 2007, soil samples were taken from a number of different locations in the south of Sweden. The soil samples were analyzed for infestation level of soil borne fungi. The soil tests were carried out by Syngenta Crop Protection (Maria Nihlgård). Sugar beet seeds were sown in pots with test soil and then put in greenhouse under conditions favourable for infection. Occurrence of *A. cochlioides* was detected with specific primers. The evaluation of the risk of damping-off (soil index 0–100) is shown in table 1. Three trial locations were chosen on the basis of the result from the soil tests. The results of the analyses of soil type on each locality are shown in appendix 3.

Table 1. The risk of infection in soils analyzed for disease severity index (M. Nihlgård, Syngenta)

Index	Risk	Evaluation
0 – 20	No risk	-
20 – 40	Low	Normally no problems
40 – 70	Medium	Growing sugar beets could be hazardous
70 – 100	High	Under favourable conditions, damping-off is highly likely

This trial series included five seed treatments that were compared in three field trials and one experiment in controlled green house conditions.

The field trials were drilled on three locations (Tullingagården in Mörarp and Videröra in Vallåkra in the north west of Skåne and Åkerslätt in Vellinge in the south of Skåne). The trial design was a randomized complete block design with four replications. To be able to remove plants for analyses, an extra sample area was sown adjacent to the original plot. A practical trial was also sown in Skurup in the south of Skåne.

Plant number

The number of plants in each plot was counted three times during emergence (20 %, 50 %, maximum and finally after inter-row cultivation (full emergence)). The results are shown in appendix 4.

Plant vigour and row coverage

Plant vigour was evaluated once in each trial using a scale from 0 to 100 where values below 50 indicate plants in severely reduced growth (50 % yield reduction), 50–79 indicates somewhat reduced growth that probably will affect yield. Values between 80 and 90 indicates that the plants only show minor damage that seldom has any effect on yield and values above 90 are nearly healthy plants. The results on plant vigour are shown in appendix 4.

Disease severity index

Evaluation of disease severity index was performed twice in early spring. The first evaluation took place when the plants had just developed cotyledons and the second evaluation two weeks later. In the sample area 20 randomly chosen plants were dug up and each plant was evaluated for symptoms of damping-off and classified into one of six groups: 0 (healthy), 10, 25, 50, 75 and 100 % (roots totally rotten, plant dead). A disease index (DSI) was calculated using the following equation developed by Larsson and Gerhardson (1990):

$$DSI = ((n_0 * 0 + n_{20} * 20 + n_{50} * 50 + n_{75} * 75 + n_{100} * 100)/\text{plant number})$$

where n = number of beets in each class.

The plants were also weighed and average plant weight calculated. The results are shown in appendix 6. Pieces of roots were put on agar plates and fungi were determined to genera and species based on morphology. A summary over 12 trials is shown in appendix 6 (DSI1 and 2, plant weight).

Harvest

After harvest, the beets in each plot were evaluated for symptoms of chronic root rot using a scale from 1–7 (appendix 6). The evaluation of chronic root rot was carried out at the central tare house in Örtofta (Agri Provtvätt, Örtofta Sockerbruk, Danisco Sugar).

Table 1. Evaluation of chronic symptoms of root rot

1 = Weak symptoms on max. 25% of the beets
2 = Weak symptoms on max. 50% of the beets
3 = Weak symptoms on max. 75% of the beets
4 = Strong symptoms on 25% of the beets
5 = Strong symptoms on 50% of the beets
6 = Strong symptoms on 75% of the beets
7 = Severe symptoms on all beets

Green house experiment

Soil was collected from a field naturally infested with soil borne fungi. The soil was divided between six pots per treatment and replication and put in a green house in a randomized complete block design. Ten seeds of the variety Sapporo were sown in each pot. The pots were checked daily for any dying sugar beet plants. After four weeks all remaining plants were washed from soil and inspected for symptoms of root rot. A DSI was calculated according to Larsson and Gerhardson (1990). The results are shown in appendix 5.

Statistical analyses

All variables were analyzed using Proc GLM in SAS, SAS Institute Inc. All shown treatment means are adjusted means (LSmeans) unless otherwise stated. In case of no missing values in the data set, LSmeans are equal to the aritmethic means.

Results and discussion

The analyses of DSI with the purpose of choosing trial locations showed that the DSI was above 90 on all locations: Videröra 97, Tullingagården 93 and Åkerslätt 99.

The average final plant number (three trials) was higher in the treatments with fungicides than in the control ($p = 0{,}0536$, LSD = 5,4). The plant number in the treatment with 14 g hymexazol was 87.2 pl/ha, for 18 g hymexazol 87.9 and for 30 g hymexazol 90.8 pl/ha.

The number of small plants (plants appearing late in a second generation) was also counted at the same time as the final counting. There was no significant difference in number of small plants at any of the trial locations suggesting that the higher doses of hymexazol (18 or 30 g) have not had an impact of emergence in these trials.

In 2008, the sugar beets were drilled very late, in the end of April. After drilling very little rain fell and the root rot infections were generally low in the growing area. At two of the trial locations, Videröra and Tullingagården, there were no significant differences between the treatments in DSI 1 and DSI 2. At the third trial location, Åkerslätt, there was a significant difference in DSI 1 between the treatments (figure 1). The cropping system on this farm does not include ploughing the soil. This has resulted in a high amount of straw in the top soil which may be favourable for *Fusarium* spp. Soil borne fungi was isolated from plants collected in the field trial and *F. redolens* was confirmed (table 2). On Videröra, *A. cochlioides* was confirmed.

Table 2. Soil borne fungi isolated from plants collected in the three field trials

Location	Fungi
Åkerslätt	*Fusarium redolens*
Tullingagården	-
Videröra	*Aphanomyces cochlioides*

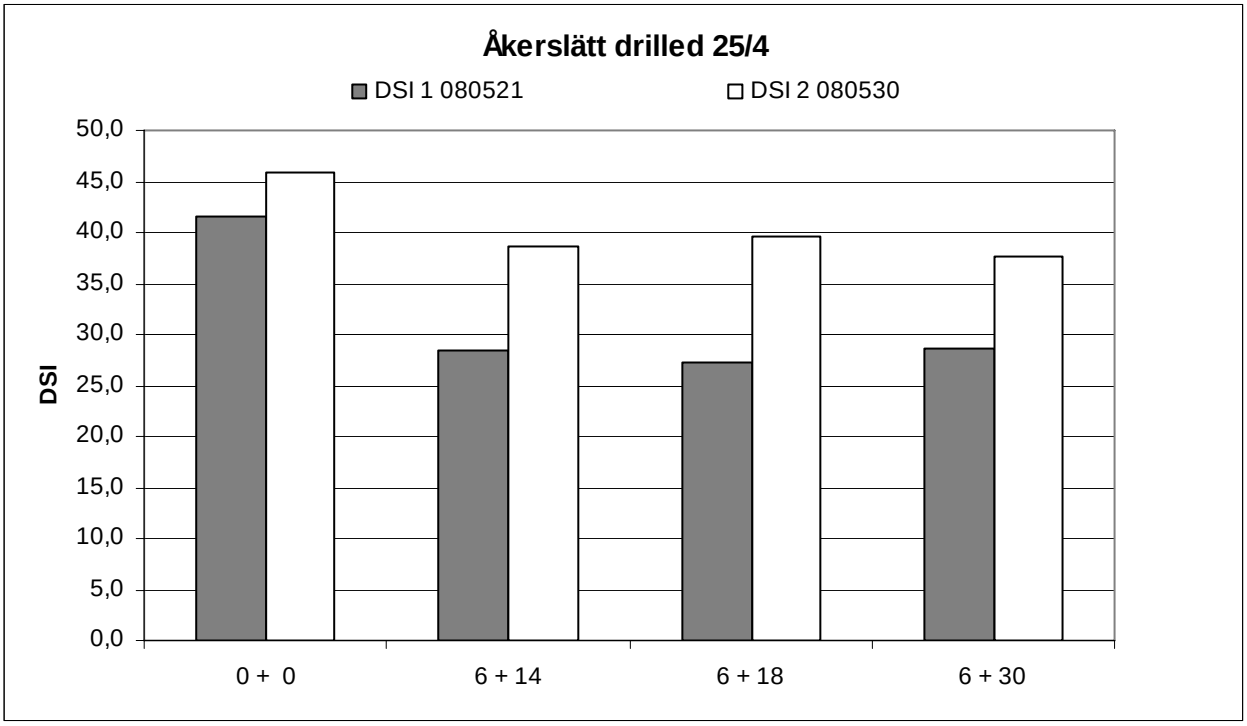

Figure 1. Disease severity index in the four treatments at the trial location Åkerslätt. For DSI 1, p = 0,001 and LSD = 5,8. For DSI 2 p = 0,1113 (ns) and LSD = 7,3.

There was also a tendency that the plant weight (g/pl) is slightly lower in the control and in the treatment with 30 g hymexazol (average over three trials and also at the trial location Åkerslätt). This may suggest that 30 g hymexazol has a slight impact on the early growth of the seedlings. Root rot infections occurred at Åkerslätt and this is the reason why the plants also had lower weight in the control.

Yield 2008

At Videröra, *Aphanomyces* was isolated from the plants in the field. The sugar yield in the 18 and 30 g doses of hymexazol was increased from 10,59 ton/ha for 14 g hymexazol to 11,04 and 11,17 ton/ha respectively (not significant).

Yield 2004–2008

Yield parameters have been investigated in a total of 15 field trials during 2004–2008. The average over all 15 trials show that seed treatment with hymexazol has a significant positive effect on plant number, sugar content and yield and K+Na (appendix 9). The sugar yield is increased by three to four percent. Plant number is increased with around 9 000–10 000

plants/ha. Sodium and potassium is lowered by 0,1 mM/100 g beet. There is also a tendency for higher root weight. The amino-N value is not affected.

Practical trial at Svenstorp, Skurup

The practical trial was drilled by the farmer at a field where very severe *Aphanomyces* infections occurred in a previous beet crop. All seed treatment reduced the DSI in the evaluation that was done on 25 May.

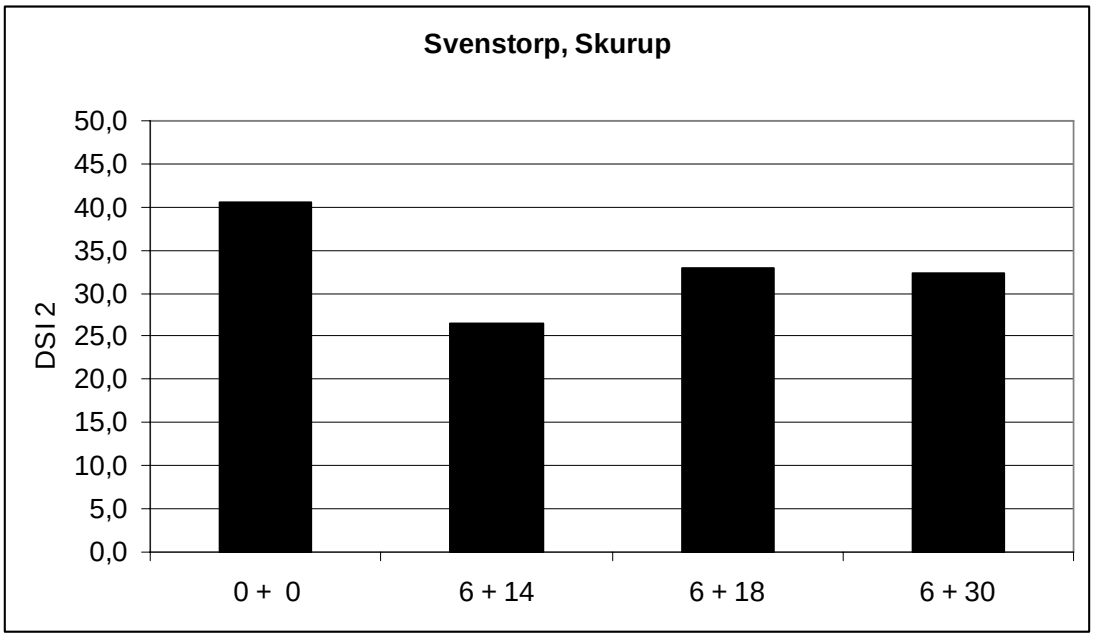

Figure 2. Disease severity index in the four treatments at the practical trial location Svenstorp. For DSI 2, p = 0,0708 and LSD = 10,0.

Green house experiment

Since 2005 a total of five experiments under controlled conditions have been carried out. Four of the five experiments have shown a significant reduction in DSI for seed treatment with hymexazol. Two experiments have shown a significant difference between 14 and 18 g hymexazol (experiments one and five). In the experiment 2008 (experiment five) soil from Skiberöd in the central parts of Skåne was used (average DSI = 60). *Aphanomyces cochlioides* was confirmed on the majority of all plants grown in the green house test. Also *F. redolens* and *F. culmorum* was isolated from the four week old seedlings. The result from experiment 5 2008 is shown in figure 3.

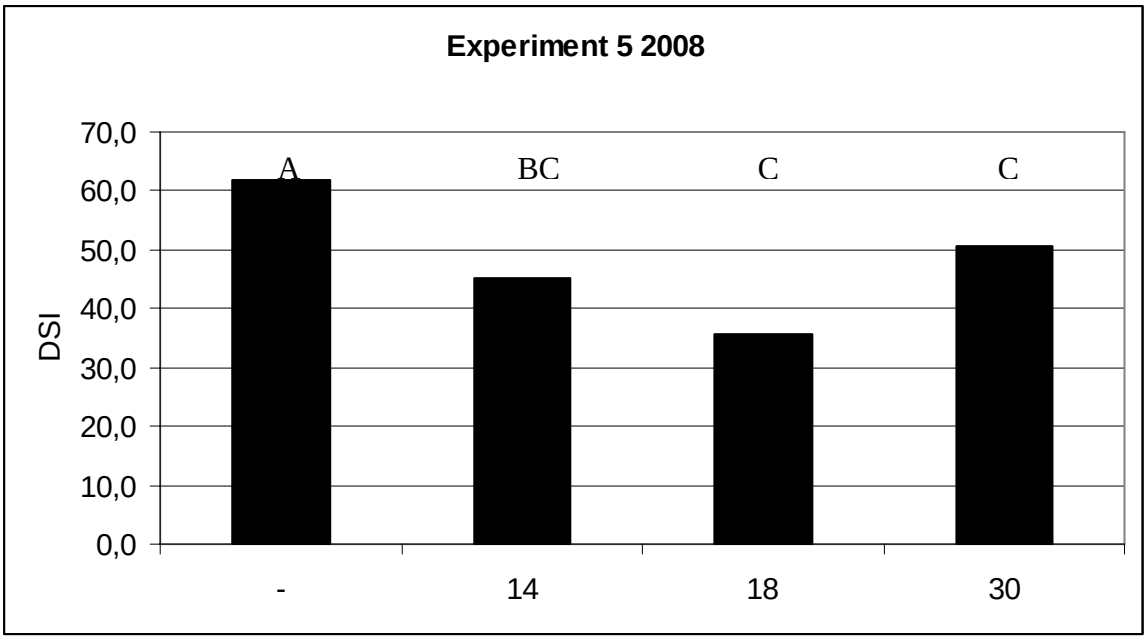

Figure 3. Disease severity index in the four treatments in green house experiment 5, p = 0,00005 and LSD = 6,3. Treatments with the same letter are not significantly different.

Picture 1. The four treatments in the green house experiment 2008. Lower left: control, lower right: 14 g hymexazol, upper left: 18 g and upper right: 30 g hymexazol.

Picture 2. Seedlings without seed treatment.

Picture 3. Seedlings with 14 g hymexazol as seed treatment.

Picture 4. Seedlings with 18 g hymexazol as seed treatment.

Picture 5. Seedlings with 30 g hymexazol as seed treatment.

References

Broders, K. D., Lipps, P. E., Paul, P. A. and Dorrance, A. E. 2007. Evaluation of *Fusarium graminearum* associated with corn and soybean seed and seedling disease in Ohio. Plant disease 91(9): 1155-1160.

Dorrance, A. E., Kleinhenz, M. D., McClure, S. A. and Tuttle, N. T. 2003. Temperature and seed treatment effects on *Rhizoctonia solani* root rot of soybean. Plant disease 87(5): 533-538.

Larsson, M. and Gerhardson, B. 1990. Isolates of *Phytophthora cryptogea* pathogenic to wheat and some other crop plants. Journal of Phytopathology 129: 303-315.

Mueller, D. S., Hartman, G. L. and Pedersen, W. L. Development of Sclerotia and apothecia of *Sclerotinia sclerotiorum* from infected soybean seed and its control by fungicide seed treatment. Plant disease 83(12): 1113-1115.

Munkvold, G. P. and O'Mara, J. K. 2002. Laboratory and growth chamber evaluation of fungicidal seed treatments for maize seedling blight caused by *Fusarium* species. Plant disease 86 (2): 143-150.

Olaya, G., Abawi, G. and Barnard, J. 1994. Response of *Rhizoctonia solani* and binucleate *Rhizoctonia* to five fungicides and control of pocket rot of table beets with foliar sprays. Plant disease 78(11): 1033-1037.
Persson, L. and Olsson, Å. 2006. Åtgärder mot jordburna svampar i sockerbetor under odling och lagring 2003-2005. Project report SBU. http\:rapporter.sockerbetor.nu.

GEP information

No of series and title	2008-424 Fungicide treatments against soil borne fungi in sugar beet
Objective	To evaluate the effect of hymexazol on soil borne fungi and yield parameters in sugar beet.
Claimant	DuPont Sverige AB Jan-Åke Svensson Box 839 201 80 Malmö
Testing unit	Nordic Beet Research Foundation Borgeby slottsväg 11 237 91 Bjärred Sweden Phone: +46 709 53 72 62 Fax: +46 46 71 36 62 www.nordicbeet.nu
Trial manager	Åsa Olsson, NBR
Technical manager/organisation	Jörgen Mårtensson, HS Malmöhus
Trial seed	Trial seed was ordered by NBR. Variety: Opta
Methodology	Description of methods and evaluations: see appendix 1 (field plan) for references to PM in NBR quality handbook (Sweden).

Trial locations

Trial no	Location
58	Göran Svensson, Videröra gård, 260 30 Vallåkra
59	Göran Brynell, Maglarp, Åkerslätt, 321 93 Trelleborg
60	Mats Janström, Tullingagården 44, 260 34 Mörarp

Tested materials All seed treated with Gaucho 60 g a.i.

Product	Active ingredient	Dose	Treatments
Tachigaren	Hymexazol	14,18, 30 g /unit	2, 3, 4
Maxim tech	Fludioxonil	6 g /unit	1, 2, 3, 4

Identification of reference Entry no. 1 untreated with fungicides

Nonconformances

424 Videröra	Körspår inne i parceller vid ogrässprutning. Då alla parceller i block I drabbats lika gjordes ingen förkortning av parcellerna. / Tractor wheels inside plots. No shortening of rows, all plots in block I damaged equally.

Styrelsen för ackreditering och teknisk kontroll (SWEDAC) - SE

Test facilities are accredited by the Swedish Board for Accreditation and conformity Assessment (SWEDAC) under the terms of Swedish legislation. The accredited test facilities meet the relevant requirements for GEP accreditation in SS-EN ISO/IEC 17 025 (2000).

Försöksstationer ackrediteras av Styrelsen för ackreditering och teknisk kontroll (SWEDAC) enligt svensk lag. Den ackrediterade verksamheten vid försöksstationerna uppfyller för GEP-ackreditering relevanta delar av kraven i SS-EN ISO/IEC 17025 (2000).

Borgeby in January 2009

…….
Åsa Olsson
Project manager

Betning mot jordburna svampar i sockerbetor 2008

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Syfte/aim:
Att prova Tachigaren i tre olika doser mot *Aphanomyces cochlioides* . Fält och växthusförsök.

Trial plan

Led	Produkt	Fungicid	g a.i/unit	Insecticid		g a.i/unit	Land
1	-	-					SE
2	Maxim tech Tachigaren	fludioxonil hymexazol	6 14	Gaucho	imidacloprid	60	SE
3	Maxim tech Tachigaren	fludioxonil hymexazol	6 18	Gaucho	imidacloprid	60	SE
4	Maxim tech Tachigaren	fludioxonil hymexazol	6 30	Gaucho	imidacloprid	60	SE

Land	Serie	Försöksvärd (namn och telefon):	
SE	424	Mats Janström, Tullingagården 44, 260 34 Mörarp	070-327 90 90
SE	424	Göran Brynell, Åkerslätt, Maglarp, 231 93 Trelleborg	0708-74 93 19
SE	424	Göran Svensson, Videröra gård, 260 30 Vallåkra	0703 27 90 90

Videröra

IV	4	1	3	2
	provtagningsyta			
	provtagningsyta			
III	3	4	2	1
II	1	2	4	3
	provtagningsyta			
	provtagningsyta			
I	2	3	1	4

Åkerslätt

	3	1	4	2
	2	4	3	1
	4	2	1	3
	1	3	2	4

Tullingagården

	4	3	1	2
	3	2	4	1
	1	4	3	2
	2	1	4	3

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Land	Serie	Plats	Försöksvärd (namn och telefon):	
SE	424	Skurup	Claes Mårtensson, Svenstorp 101, 274 93 Skurup.	0705-14 14 94 0411-455 35

Fältplan Strimförsök

		Opta	Opta		Opta	Opta	Opta	Opta		Opta	Opta	
Led	Odl	1	1	Odl	3	3	2	2	Odl	4	4	Odl
Såhus	1	2	3	4	5	6	7	8	9	10	11	12

Fröet bör räcka till knappt 3 ha. Kör gärna flera drag över fältet så långt det räcker.

Sort: Opta Odlarens sort:
Frö: finns ca 0,5 enheter/led
Fröet till varje led fördelas på två såhus enligt fältplanen dvs 0,25 enh/såhus.

Led	Produkt	Aktiv substans Fungicid		Insekticid	
		g a.i/enhet			g a.i/enhet
1	Kontroll	-			
2	Maxim tech	fludioxonil	6	Gaucho (imidacloprid)	60
	Tachigaren	hymexazol	14		
3	Maxim tech	fludioxonil	6	Gaucho (imidacloprid)	60
	Tachigaren	hymexazol	18		
4	Maxim tech	fludioxonil	6	Gaucho (imidacloprid)	60
	Tachigaren	hymexazol	30		

Betning mot jordburna svampar i sockerbetor 2008

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Videröra

Sweden

Analyser och bedömningar	**Tid**	**PM**	**Kommentarer**	**Utförare**	**Datum**	**Signatur**
Analysis and evaluations	Time	PM	Comments	Responsible	Date	Signature
Generalprov 6		2.6.1		HS	17-mar	JM
Svampprov	jan-febr	2.6.1	Soil index by M. Nihlgård, Syngenta	HS	28-feb	JE
Utstakning i fält		2.4.1		HS	17-mar	JE JM
Parcellvis sådd		2.4.2		HS	20-apr	JM JE UDK
Planträkning 20		2.5.4		HS	02-maj	JE UDK
Planträkning 50		2.5.4		HS	05-maj	JE
Planträkning max		2.5.4		HS	23-maj	JM
Planträkning slutl		2.5.4		HS		
Rotbrandsbed. 1	BBCH 10-11	2.5.8	In sampling area	HS	20-maj	JM JE ÅO
Rotbrandsbed. 2	BBCH 14-15	2.5.8	In sampling area. Two weeks after first evaluation	HS	03-jun	JM JE ÅO
Sundhet	BBCH 10-19	2.5.20		NBR		
Radtäckning	BBCH 10-19	2.5.6		NBR		
Besiktning inför skörd				NBR	26-sep	JE
Skörd		2.4.7		HS	26-sep	JM JE SH
Leverans till provtvätt		2.4.7		HS	26-sep	JM
Svampangrepp efter skörd		2.5.10		NBR		
Analys av skördevariabler		-		DS		

Betning mot jordburna svampar i sockerbetor 2008

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Åkersslätt

Sweden

Analyser och bedömningar Analysis and evaluations	**Tid** Time	**PM** PM	**Kommentarer** Comments	**Utförare** Responsible	**Datum** Date	**Signatur** Signature
Generalprov 6		2.6.1		HS	05-mar	JM
Svampprov	jan-febr	2.6.1	Soil index by M. Nihlgård, Syngenta	HS	22-jan	JE
Utstakning i fält		2.4.1		HS	05-mar	JM
Parcellvis sådd		2.4.2		HS	25-apr	JM JE UDK
Planträkning 20		2.5.4		HS	05-maj	JM
Planträkning 50		2.5.4		HS	07-maj	JE
Planträkning max		2.5.4		HS	04-jun	JE
Planträkning slutl		2.5.4		HS		
Rotbrandsbed. 1	BBCH 10-11	2.5.8	In sampling area	HS	21-maj	JM ÅO ME
Rotbrandsbed. 2	BBCH 14-15	2.5.8	In sampling area. Two weeks after first evaluation	HS	30-maj	JM ÅO
Sundhet	BBCH 10-19	2.5.20		NBR		
Radtäckning	BBCH 10-19	2.5.6		NBR		
Besiktning inför skörd				NBR		
Skörd		2.4.7		HS	29-sep	JM JE
Leverans till provtvätt		2.4.7		HS	01-okt	JE
Svampangrepp efter skörd		2.5.10		NBR		
Analys av skördevariabler		-		DS		

Betning mot jordburna svampar i sockerbetor 2008

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Tullingagården

Sweden

Analyser och bedömningar Analysis and evaluations	**Tid** Time	**PM** PM	**Kommentarer** Comments	**Utförare** Responsible	**Datum** Date	**Signatur** Signature
Generalprov 6		2.6.1		HS	17-mar	JM
Svampprov	jan-febr	2.6.1	Soil index by M. Nihlgård, Syngenta	HS	06-mar	JE
Utstakning i fält		2.4.1		HS	06-mar	JE
Parcellvis sådd		2.4.2		HS	21-apr	JM JE ME
Planträkning 20		2.5.4		HS	02-maj	UDK
Planträkning 50		2.5.4		HS	05-maj	JE
Planträkning max		2.5.4		HS	23-maj	JM
Planträkning slutl		2.5.4		HS		
Rotbrandsbed. 1	BBCH 10-11	2.5.8	In sampling area	HS	20-maj	JM JE ÅO
Rotbrandsbed. 2	BBCH 14-15	2.5.8	In sampling area. Two weeks after first evaluation	HS	03-jun	JM ÅO
Sundhet	BBCH 10-19	2.5.20		NBR		
Radtäckning	BBCH 10-19	2.5.6		NBR		
Besiktning inför skörd				NBR		
Skörd		2.4.7		HS	28-okt	FH UDK HOJ
Leverans till provtvätt		2.4.7		HS	30-okt	HOJ
Svampangrepp efter skörd		2.5.10		NBR		
Analys av skördevariabler		-		DS		

Appendix 3a

2008-424

Betning mot jordburna svampar i sockerbetor 2008

Analyser och bedömningar	**Field information**	**VIDERÖRA**				**ÅKERSSLÄTT**					**TULLINGAGÅRDEN, MÖRARP**				
Försöksnummer	**Trial no**	**NBR 58**				**NBR 59**					**NBR 60**				
Betsort	Variety	Opta				Opta					Opta				
Förfrukt	Previous crop	Höstvete, Höstraps				Höstvete, Höstraps, Vårkorn, Sockerbetor					Vårkorn, Höstvete				
Sådatum	Sowing date	20-apr				25-apr					21-apr				
Planträkningar	Plant count date	02-maj	05-maj	23-maj		05-maj	7-maj	04-jun			02-maj	05-maj	23-maj		
Ogräsräkning, datum	Weed count date														
Behandlingsdatum	Treatment date														
Tillväxt analyser, datum	Growth analysis date														
Blasthöjd, datum	Top hight date														
Radtäckning, datum	Leaf cover date														
Sundhet, datum	Plant healthiness date														
Blastfrodighet, datum	Top healthiness date														
Skördedatum	Harvest date	26-sep				29-sep					28-0kt				
Analysdatum	Analysis date	29-sep				01-okt					31-okt				
Radavstånd cm	Row distance	48 cm				48					48				
Nettoparcell m^2	Plot size m2	8,64				8,64					8,64				
Fröafstand cm	Seed distance	5,1				5,1					5,1				
Nematoder (Antal/g jord)	Nematodes (no/g soil)	0				0,2					0				
Isolerade svampar i fält	Isolated fungi (plants in the field)	*Aphanomyces cochlioides*				*Fusarium redolens*					-				
DSI Syngenta M. Nihlgård	DSI Syngenta M. Nihlgård	97				99					93				
pH-värde	pH	6,7				6,7					7,2				
P-AL (mg/100 g jord)	P-AL (mg/100 g soil)	33	V			8,1	IVA				6,7	III			
K-AL (mg/100 g jord)	K-AL (mg/100 g soil)	9,5	III			8,1	III				9,8	III			
Mg-AL (mg/10 g jord)	Mg-AL (mg/10 g soil)	9,7				4,5					7				
K/Mg-kvot	K/Mg-kvot	1				1,8					1,4				
Ca-AL (mg/kg jord)	Ca-AL (mg/kg soil)	210				170,0					160				
K-HCl (mg/100 g jord)	K-HCl (mg/100 g soil)	78	2			120	III				76	2			
Cu-HCl (mg/kg jord)	Cu-HCl (mg/kg soil)	5,9				7,6					5,1				
P-HCL mg/100 g	P-HCL mg/100 g soil	83	5			45	3				48	3			
Bor (mg/kg jord)	Boron	0,66				0,68					0,4				
Mullhalt (%)	Organic matter	3,5				2,2					2,9				
Lerhalt (%)	Clay content	15				11,0					12,0				
Sand + grovmo (%)	Sand + fine sand	48				61,0					48,0				
Jordart	Soil type	mmhmoLL				nmhlMo					nmhlMo				

Appendix 3b

Betning mot jordburna svampar i sockerbetor 2008

2008-424

Analyser och bedömningar Försöksnummer	Field information Trial no	VIDERÖRA NBR 58	ÅKERSSLÄTT NBR 59	TULLINGAGÅRDEN, MÖRARP NBR 60
Gødning	**Fertilizer**	**700 kg/ha NPK 16-4-7 18-apr**	**700 kg/ha NPK 17-6-4 27-mar** Besal 200 kg/ha 12-maj	**450 kg /ha NPK 26-3-4 19-apr**
Ukrudts-bekæmpelse H = Herbasan; B=Betasana 2000 E = Ethosan; Et=Ethofol BO=Betanal Optima K=Kemifam Pro SC G = Goltix; ND=ND Metamitron SM= Swedane Metafol 700 SC S = Safari; Bc=Betanal Classic O = Olie; R=Renol M = Matrigon; Fm=Fusilade Max C=Contact (SweDane&DLG)	**Weed control** H = Herbasan; B=Betasana 2000 E = Ethosan; Et=Ethofol BO=Betanal Optima K=Kemifam Pro SC G = Goltix; ND=ND Metamitron SM= Swedane Metafol 700 SC S = Safari; Bc=Betanal Classic O = Olie; R=Renol M = Matrigon; Fm=Fusilade Max C=Contact (SweDane&DLG)	**G 1,0 + Bc 1,0 + E 0,05 + O 0,5** 4-maj **G 1,5 + Bc 1,75 + E 0,15 + O 0,5** 13-maj **G 1,25 + Bc 2,0 + E 0,2 + O 0,5** 26-maj	**Round-up 2,0 16-mar** 07-maj **G 1,0 + Bc 1,5 + E 0,05 + O 0,3** 07-maj **G 1,5 + Bc 2,0 + E 0,2 + O 0,3** 15-maj **G 1,25+Bc 1,5+E 0,2+Pyramin 0,4+O 0,3** 28-maj	**Glyphomax 1,5 11-apr** **G 0,7 + Bc 1,0 + E 0,1 + O 0,5** 6-maj **Pyramin 0,5 + G 0,5 + Bc 1,5 + E 0,1 + O 0,5** 16-maj **Safari 20g + G 0,8 + Bc 1,5 + E 0,15 + O 0,5** 27-maj
Insektsbekämpning	**Insect control**			Pirimor 0,3 15-jul
Mikronäring	**Micro nutrients**		Mantrac 0,5 l/ha 28-maj	Mangan 235 1,5 15-jul
Bekämpning av bladsvampar	**Leaf disease control**		Comet 0,5 06-aug	Comet 0,5 06-aug
Kommentarer	**Comments**			

Particle size

Sand	Sand = 2-0,2 mm
Grovmo	Fine sand = 0,02-0,06 mm
Finmo	Coarse silt = 0,06-0,02 mm
Mjäla	Silt = 0,02-0,002
Lera	Clay = <0,002 mm
Finler	Fine clay = <0,0006

Soil type

nmhlSa = medium humus rich light sand
mmhmoLL = humus rich loamy soil
mmhlSa = humus rich light sand
mmhlMo = humus rich fine sand soil

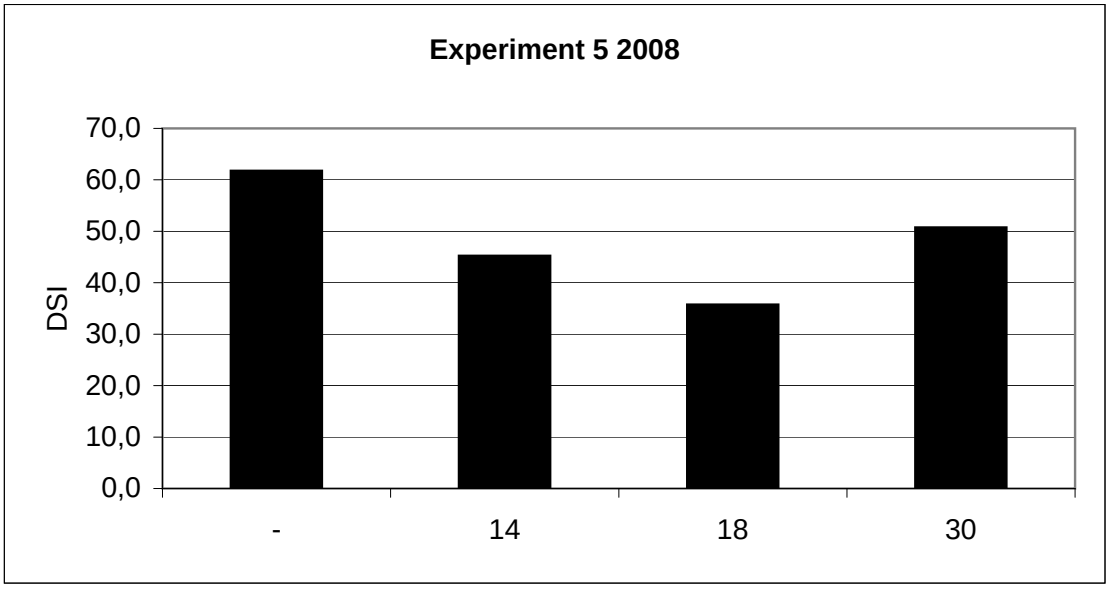
Betning mot jordburna svampar i sockerbetor 2008

	Treatment	g a.i.	Plh, 1000/ha 20%	50%	Final	Small plants %	Vigour 0-100
Videröra			080502	080505	080523	080523	080603
1	Untreated	0 + 0	3,5	52,1	76,1	1,5	83
2	Fludioxonil + Hymexazol	6 + 14	3,5	53,2	81,6	2,5	85
3	Fludioxonil + Hymexazol	6 + 18	3,8	55,8	78,7	1,9	84
4	Fludioxonil + Hymexazol	6 + 30	3,5	59,6	85,6	2,6	90
	RSQ		26,6	24,6	38,6	43,9	23,6
	CV		78,5	17,4	11,8	80,3	8,5
	LSD		4,5	15,4	15,2	2,7	11,6
	Prob		0,9983	0,7037	0,5514	0,7839	0,5166
Tullingagården			080502	080505	080523	080523	080603
1	Untreated	0 + 0	16,2	49,2	84,8	6,9	82
2	Fludioxonil + Hymexazol	6 + 14	8,4	45,4	85,9	5,1	82
3	Fludioxonil + Hymexazol	6 + 18	12,4	41,7	91,1	7,5	80
4	Fludioxonil + Hymexazol	6 + 30	10,7	44,3	94,3	5,8	83
	RSQ		64,7	36,0	58,2	67,4	43,4
	CV		26,9	21,2	5,7	44,3	5,3
	LSD		5,1	15,3	8,1	4,5	6,9
	Prob		0,0403	0,7395	0,08058	0,6278	0,7604
Åkerslätt			080505	080507	080604	080604	080530
1	Untreated	0 + 0	28,6	70,6	88,5	2,9	85
2	Fludioxonil + Hymexazol	6 + 14	29,8	72,6	94,0	2,4	91
3	Fludioxonil + Hymexazol	6 + 18	29,8	74,1	93,8	1,5	90
4	Fludioxonil + Hymexazol	6 + 30	24,9	68,9	92,3	2,2	86
	RSQ		18,3	21,4	49,8	64,7	41,3
	CV		27,9	10,1	4,3	36,1	5,8
	LSD		12,6	11,6	6,3	1,3	8,1
	Prob		0,7907	0,7571	0,2499	0,1740	0,3109
Average							
1	Untreated	0 + 0	16,1	57,3	83,1	3,8	83
2	Fludioxonil + Hymexazol	6 + 14	13,9	57,1	87,2	3,3	86
3	Fludioxonil + Hymexazol	6 + 18	15,3	57,2	87,9	3,6	84
4	Fludioxonil + Hymexazol	6 + 30	13,0	57,6	90,8	3,5	86
	RSQ		84,1	65,5	45,8	39,5	26
	CV		33,0	14,7	7,5	72,1	6,4
	LSD		4,0	7,0	5,4	2,1	4,5
	Prob		0,4007	0,9991	0,0536	0,9762	0,4618

Betning mot jordburna svampar i sockerbetor 2008

Summary of disease severity index in green house experiments 2005-2008

			Rotbrand / Damping-off DSI 0-100						
		g a. i./unit	1	2	3	4	5	Average 5 tests	Average 4 tests (test 4 excl.)
1	Kontroll/untreated	-	68,1	65,8	47,8	65,0	61,8	61,7	59,8
2	Hymexazol	14	64,4	55,7	29,0	63,5	45,3	51,6	48,7
3	Hymexazol	18	54,2	54,4	36,9	67,3	35,8	50,0	46,5
4	Hymexazol	30	51,0	52,9	30,6	63,5	50,8	49,3	46,1
	RSQ %		82,2	36,1	81,2	35,5	91,8	64,2	64,6
	CV		8,2	12,0	13,3	7,5	8,1	12,4	12,6
	LSD 5%		7,8	3,9	9,7	7,8	6,3	3,3	3,5
	Prob.		0,0022	<0,0001	0,0015	0,6748	0,00005	<0,0001	<0,0001



Appendix 6

Betning mot jordburna svampar i sockerbetor 2008

2008-424

Entry	Treatment	g a.i.	Damping off I Weight	Damping off I DSI I	Damping off II Weight	Damping off II DSI II	RI 1-7
Videröra			*080520*		*080603*		
1	Untreated	0 + 0	1,2	33,0	17,2	27,0	1,0
2	Fludioxonil + Hymexazol	6 + 14	1,2	32,6	13,1	25,8	0,3
3	Fludioxonil + Hymexazol	6 + 18	1,5	29,8	14,7	26,8	1,0
4	Fludioxonil + Hymexazol	6 + 30	1,1	30,6	15,5	24,9	0,5
	RSQ		50,1	23,2	53,0	30,6	69,1
	CV		19,8	14,9	18,4	14,7	50,0
	LSD		0,4	7,5	4,6	6,1	0,5
	Prob		0,29274	0,7245	0,2813	0,8662	0,0296
Tullingagården			*080520*		*080603*		
1	Untreated	0 + 0	0,8	31,5	9,8	25,3	1,0
2	Fludioxonil + Hymexazol	6 + 14	0,8	30,4	10,5	26,7	0,8
3	Fludioxonil + Hymexazol	6 + 18	0,9	29,8	9,9	26,8	0,5
4	Fludioxonil + Hymexazol	6 + 30	0,9	32,9	9,7	27,0	0,5
	RSQ		32,4	80,5	53,9	28,5	40,0
	CV		15,2	11,8	13,1	10,4	69,6
	LSD		0,2	5,9	2,1	4,4	0,8
	Prob		0,96448	0,6562	0,7951	0,8023	0,4363
Åkerslätt			*080521*		*080530*		
1	Untreated	0 + 0	1,3	41,6	7,4	45,9	0,8
2	Fludioxonil + Hymexazol	6 + 14	1,5	28,4	6,5	38,7	0,8
3	Fludioxonil + Hymexazol	6 + 18	1,5	27,2	7,6	39,6	0,5
4	Fludioxonil + Hymexazol	6 + 30	1,3	28,6	6,7	37,7	0,5
	RSQ		60,7	82,8	67,3	50,2	66,7
	CV		9,8	11,6	10,9	11,3	59,6
	LSD		0,2	5,8	1,2	7,3	0,6
	Prob		0,08969	0,0010	0,2067	0,1113	0,6310176
Average							
1	Untreated	0 + 0	1,1	35,4	11,5	32,7	0,9
2	Fludioxonil + Hymexazol	6 + 14	1,2	30,5	10,0	30,4	0,6
3	Fludioxonil + Hymexazol	6 + 18	1,3	28,9	11,2	31,1	0,7
4	Fludioxonil + Hymexazol	6 + 30	1,1	30,7	10,6	29,9	0,5
	RSQ		65,5	17,8	76,8	78,5	11,3
	CV		16,1	17,8	19,0	12,2	71,2
	LSD		0,2	4,6	1,7	3,1	0,4
	Prob		0,0584	0,0406	0,3455	0,2933	0,1761

Betning mot jordburna svampar i sockerbetor 2008

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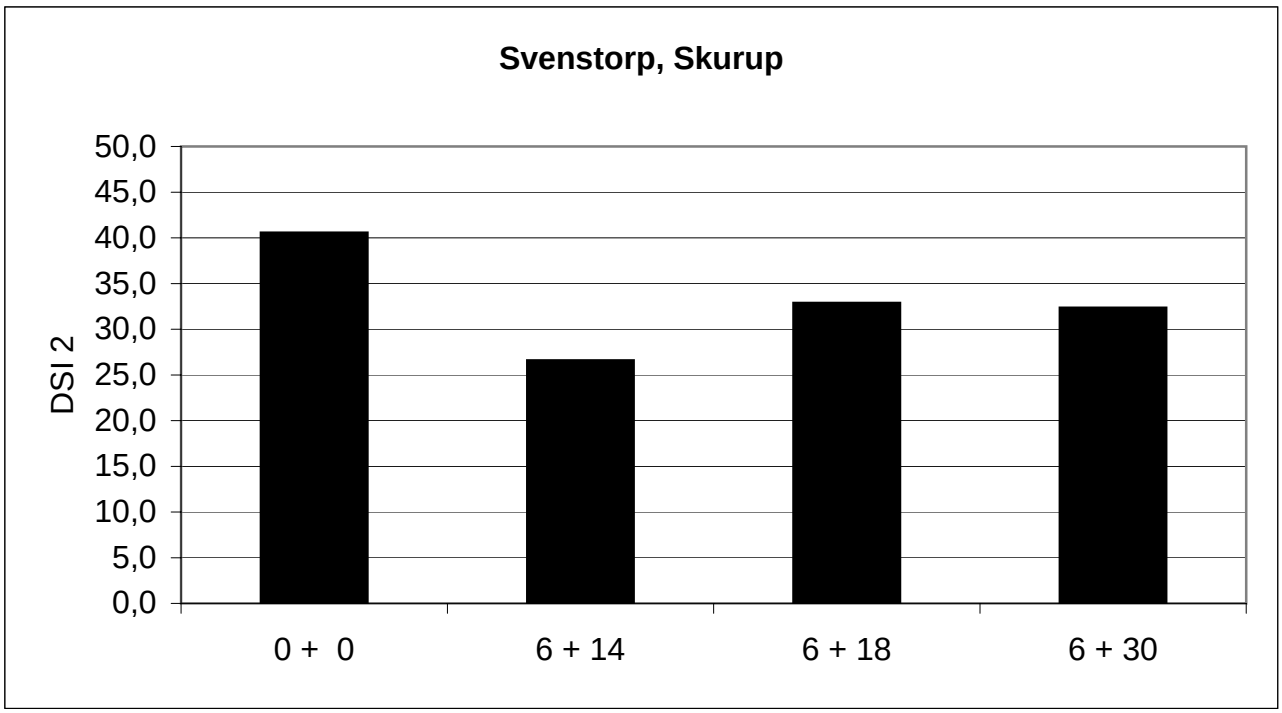
Practical trial at Svenstorp, Skurup **2008**

	Treatment	g a.i.	Damping off I DSI I	Damping off II DSI II
Svenstorp			080506	080525
1	Untreated	0 + 0	35,8	40,6
2	Fludioxonil + Hymexazol	6 + 14	29,7	26,6
3	Fludioxonil + Hymexazol	6 + 18	35,4	32,9
4	Fludioxonil + Hymexazol	6 + 30	38,7	32,3
	RSQ		35,1	56,5
	CV		15,6	16,1
	LSD		10,3	10,0
	Prob		0,3011	0,0708



Betning mot jordburna svampar i sockerbetor 2008

2008-424

	Treatment		Plh final	Roots		Sugar		Amino-N	K+Na	Clean-ness
		g a.i.	1000/ha	t/ha	%	t/ha	Rel	mg/100 g beet	mM/100 g beet	%
Videröra										
1	Untreated	0 + 0	76,1	59,5	17,5	10,44	100	12	4,3	93,2
2	Fludioxonil + Hymexazol	6 + 14	81,6	59,9	17,7	10,59	101	12	4,3	93,3
3	Fludioxonil + Hymexazol	6 + 18	78,7	63,5	17,4	11,04	106	12	4,2	93,6
4	Fludioxonil + Hymexazol	6 + 30	85,6	64,1	17,4	11,17	107	12	4,3	93,7
	RSQ		38,6	55,8	66,5	60,5	-	10,9	29,7	8,4
	CV		11,8	5,0	1,0	4,5	-	9,8	3,4	1,2
	LSD		15,2	4,9	0,3	0,8	-	1,9	0,2	1,7
	Prob		0,5514	0,1366	0,1965	0,1639	-	0,9790	0,5944	0,8955
Tullingagården										
1	Untreated	0 + 0	84,8	67,5	18,40	12,42	100	9	3,7	72,4
2	Fludioxonil + Hymexazol	6 + 14	85,9	68,8	18,46	12,70	102	10	3,7	73,3
3	Fludioxonil + Hymexazol	6 + 18	91,1	64,7	18,38	11,88	96	9	3,7	70,6
4	Fludioxonil + Hymexazol	6 + 30	94,3	68,4	18,27	12,49	101	9	3,8	73,3
	RSQ		58,2	76,3	74,4	71,0	-	73,2	13,5	59,0
	CV		5,7	4,5	0,7	4,8	-	18,4	4,2	6,9
	LSD		8,1	4,9	0,2	1,0	-	2,7	0,2	8,0
	Prob		0,08058	0,2845	0,3157	0,3184	-	0,6795	0,7536	0,8469
Åkerslätt										
1	Untreated	0 + 0	88,5	65,6	18,28	11,99	100	10	4,1	93,9
2	Fludioxonil + Hymexazol	6 + 14	94,0	66,9	18,35	12,28	102	11	4,0	93,6
3	Fludioxonil + Hymexazol	6 + 18	93,8	66,8	18,21	12,16	101	11	4,0	94,5
4	Fludioxonil + Hymexazol	6 + 30	92,3	67,7	18,09	12,23	102	11	4,1	94,3
	RSQ		49,8	31	35,4	33,1	-	17	38,2	62,4
	CV		4,3	7,3	2,0	6,9	-	16,9	3,3	0,5
	LSD		6,3	7,8	0,6	1,3	-	2,8	0,2	0,8
	Prob		0,2499	0,9430	0,7897	0,9623	-	0,8335	0,4026	0,1179
Average										
1	Untreated	0 + 0	83,1	64,2	18,067	11,615	100	10	4,0	86,5
2	Fludioxonil + Hymexazol	6 + 14	87,2	65,2	18,158	11,854	102	11	4,0	86,7
3	Fludioxonil + Hymexazol	6 + 18	87,9	65,0	17,99	11,694	100	10	3,9	86,2
4	Fludioxonil + Hymexazol	6 + 30	90,8	66,7	17,93	11,967	103	11	4,1	87,1
	RSQ		45,8	81,3	99,2	91,4	-	91,7	99,1	99,6
	CV		7,5	2,8	0,3	2,6	-	4,4	0,8	1,0
	LSD		5,4	3,6	0,1	0,6	-	0,9	0,1	1,7
	Prob		0,0536	0,4470	0,0056	0,5396	-	0,5127	0,0127	0,6366

Betning mot jordburna svampar i sockerbetor 2008

	Treatment		Plh final	Roots		Sugar		Amino-N	K+Na	Clean-ness
		g a.i.	1000/ha	t/ha	%	t/ha	Rel	mg/100 g beet	mM/100 g beet	%
15 trials 2004-2008										
1	Untreated	0 + 0	83,7	60,09	17,27	10,41	100	12	4,2	88,5
2	Fludioxonil + Hymexazol	6 + 14	92,2	61,89	17,40	10,79	104	12	4,1	88,9
3	Fludioxonil + Hymexazol	6 + 18	91,9	61,72	17,31	10,71	103	12	4,1	89,1
4	Fludioxonil + Hymexazol	6 + 30	93,4	61,68	17,33	10,72	103	12	4,1	89,4
	RSQ		80,6	94,2	99,4	96,5	-	97,0	98,3	97,0
	CV		5,4	3,2	0,6	3,3	-	5,0	1,8	1,2
	LSD		3,6	1,5	0,1	0,3	-	0,4	0,1	0,8
	Prob		0,0000	0,0587	0,0124	0,0223	-	0,2512	0,0073	0,1703