NEONICOTINOID SEED TREATMENTS TO CONTROL APHIDS AND VIRUS YELLOWS IN SUGAR BEET

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ABSTRACT

Imidacloprid (Gaucho, Bayer) applied as a seed treatment to pelleted sugar beet seed was used on 73% of crops in the UK in 2002 to control soil and foliar pests of sugar beet, of which the aphid vectors of virus yellows were the most important target. Two new neonicotinoid insecticides, thiamethoxam (Cruiser, Syngenta) and clothianidin (Ti435, Bayer) have been developed as alternatives, and were compared with imidacloprid in 3 field trials conducted over three years. Trials were inoculated with virus-infective aphids, which were placed on six plants per plot in mid-June. This represented approximately 2% primary infection - similar to that which would occur naturally in a moderate-high virus year. Both thiamethoxam and clothianidin, applied at 60 g a.i./unit, a 33% lower rate than imidacloprid, gave excellent control of the green aphids *Myzus persicae* and *Macrosiphum euphorbiae*, resulting in significant reductions in virus yellows incidence (range 29% to 78 %), and sometimes in significant increases (range 9 % to 57 %) in sugar yield compared to untreated plots.

ABRÉGÉ - TRAITEMENT NEONICOTINIQUE DES SEMENCES AFIN DE LIMITER LA PRESENCE D'APHIDES VECTEURS DE LA JAUNISSE VIRALE DANS LA BETTERAVE SUCRIERE.

L'emploi d'Imidaclopride (Gaucho, Bayer) en tant que traitement sur des semences de betterave sucrière pelliculées a été conduit sur 73% des cultures du Royaume Uni en 2002; ceci afin de limiter les ravages causés par les nuisibles du sol et des feuilles dans les cultures de betterave a sucre. Les pucerons responsables de la transmission de la jaunisse virale furent les vecteurs les plus ciblés. Deux nouvelles variétés d'insecticides nicotiniques; le Thiamethoxame (Cruiser, Syngenta) et la Clothianidine (Ti435, Bayer) ont étés développés comme traitements alternatifs et ont été comparés à l'Imidaclopride durant des essais dans 3 champs expérimentaux conduits pendant trois ans. Les parcelles furent inoculées avec des pucerons virulifères placés sur six plans par parcelle a la mi-juin. Ceci représente une infection primaire de 2%; ce qui est tout à fait comparable au taux d'infection lors d'une année modérément haute en termes d'infection virale. Des doses identiques en Thiamethoxame et en Clothianidine furent administrées à raison de 60g s.a./ha, ce qui représente un taux inférieur de 33% a la dose d'Imidaclopride généralement employée. Ces doses donnèrent d'excellents résultats sur le contrôle des aphides verts *Myzus persicae* et *Macrosiphum euphorbiae*, ceci menant à une diminution significative de l'incidence de la jaunisse virale (de l'ordre de 29 a 78%) et quelquefois, une

hausse également assez significative (de l'ordre de 9 a 57%) du rendement en sucre en comparaison avec les parcelles non traitées.

KURZFASSUNG - NEONICOTINOID-SAMENBEHANDLUNGEN ZUR KONTROLLE VON APHIDEN UND Y-VIRUS BEI ZUCKERRÜBEN

Imidacloprid (Gaucho, Bayer) behandeltes Zuckerrübensaatgut wurde in 2002 für 73% des Zuckerrübenanbaus in Grossbritannien zur Bekämpfung von Boden- und Blattschädlingen, besponders fuer Y-Virus-übertragende Blattläuse, verwendet. Zwei neue Neonicotinoid-Insektizide, Thiamethoxam (Cruiser, Syngenta) und Clothianidin (Ti435, Bayer), entwickelt als Alternativen für Imidacloprid, wurden in drei Feldversuchen ueber drei Jahren hinweg mit Imidacloprid verglichen. Die Versuche wurden mit virusinfizierten Blattläusen inokuliert, die Mitte Juni auf sechs Pflanzen pro Parzelle plaziert wurden. Dies entsprach ungefähr einer 2%igen Primärinfektion, was einer in einem Jahr mit mäßigem bis hohem Virusbefall natürlich vorkommenden Infektion ähnelt. Sowohl Thiamethoxam als auch Clothianidin (60 g a. i./Einheit – einer um 33 % niedrigeren Rate als Imidacloprid) erzielten eine ausgezeichnete Bekämpfunge der grünenBlattläuse *Myzus persicae* und *Macrosiphum euphorbiae*, was zu signifikanten Reduktionen von Y-Virus (von 29 % bis 78 %) und manchmal im Vergleich zu unbehandelten Parzellen zu signifikanten Steigerungen des Zuckerertrags (von 9 % bis 57 %) führte.

1.- INTRODUCTION

Pest control in sugar beet is now dominated by the pelleted seed treatment, imidacloprid (Gaucho, Bayer), which has been applied to over 70% of crops in the UK since 1999. In this paper we report the results from field trials to assess the efficacy of two other neonicotinoids, clothianidin (Poncho, Bayer) and thiamethoxam (Cruiser, Syngenta) compared to the standard imidacloprid, against aphids and two of the yellowing viruses they transmit in inoculated field trials.

2.- MATERIALS AND METHODS

Sugar beet seed was sown in plots 12 rows by 12 m. In mid-June each year six plants per plot, located in the centre and 3 m from each end of rows five and eight, were inoculated with aphids carrying beet mild yellowing virus (BMYV). The aphids came from glasshouse cultures maintained on Shepherd's purse (*Capsella bursa-pastoris*), which is a host for BMYV.

An untreated control was compared to treatments containing the insecticides, imidacloprid at 90 g a.i./unit, and clothianidin and thiamethoxam at 60 a.i./unit.

Natural colonisation by aphids was assessed on two to four occasions. Aphids were classed as green or black, winged or wingless. The green aphids were either *M. persicae* or *Macrosiphum euphorbiae*, and the black aphids were mostly *Aphis fabae*. Virus yellows incidence was assessed visually in late

August. Sugar beet was harvested by machine from the four central rows by 9.7 m per plot (19.8 m^2). Root weight, sugar concentration, and levels of impurities were determined in the tarehouse at Broom's Barn.

3.- RESULTS

EFFECTS OF TREATMENTS ON EMERGENCE AND ESTABLISHMENT

There were no effects of neonicotinoid treatments on rate of emergence in 2000 and 2001, but in 2002, imidacloprid and thiamethoxam adversely affected emergence (Table 1). This was due to a phytotoxic interaction between the insecticides and the herbicide, lenacil.

EFFECT OF TREATMENTS ON APHIDS

In 2000, on 15 June all insecticide treatments significnatly reduced green aphid numbers but there were no differences between treatments (Table 1). Two weeks later black aphids predominated, but there were no differences between treated and untreated plants, indicating that treatments had worn off.

In 2001 and 2002, green aphid numbers were never very high in June, and black aphids, which are usually common in late June /July, also did not reach high numbers, due to the activities of predators. Thus there were no differences between treatments in those years (Table 1).

EFFECT OF TREATMENTS ON VIRUS YELLOWS

All neonicotinoid insecticides reduced virus yellows incidence significantly, but clothianidin gave best control on two occasions, and thiamethoxam on one (Table 2).

EFFECT OF TREATMENTS ON YIELD

Sugar yields in 2001 were much lower than in the other two years due to the later sowing date. In 2000 and 2001 both clothianidin and thiamethoxam gave significant improvements in yield, but not imidacloprid (Table 2). In 2002, no treatment improved yield, but thiamethoxam reduced yield significantly, due to lower plant populations in that treatment, as a result of the herbicide interaction.

4.- CONCLUSION

Where aphid numbers were high enough, all neonicotinoid insecticides gave good control of green aphids at early stages of plant growth.

However, control of black aphids after 10 weeks was poor, probably due to degradation of the chemicals.

Virus yellows (BMYV) infection was significantly reduced by all three neonicotinoids, but only clothianidin and thiamethoxam gave significant yield

Table 1 Effect of neonicotinoid seed treatments on green wingless aphids per plant (log 10 (n+1)) on sugar beet

Treatment	Rate A. I. Per Unit	Year					
		2000		2001		2002	
		15 June: 83 DAS	27 June: 95 DAS	8 June: 37 DAS	12 July: 71 DAS	17 June: 68 DAS	27 June: 78 DAS
		Green W-	Black W-	Green W-	Black W-	Green W-	Black W-
Untreated		1.094 (11.4)	1.953 (88.7)	0.114 (0.3)	0.167 (0.5)	0.137 (0.4)	1.348 (21.3)
Imid	90	0.298 (1.0)*	1.723 (51.8)	0	0.850 (6.1)+	0*	1.344 (21.1)
Cloth	60	0.501 (2.2)*	1.757 (56.1)	0	0.644 (3.4)	0*	1.162 (13.5)
Thia	60	0.619 (3.2)*	1.732 (53.0)	0.010 (0)	0.470 (2.0)	0*	1.460 (27.9)
SED 27 d.f.	4	0.1740	0.1656	0.0414	0.2720	0.0327	0.1313
LSD (5%)		0.3571	NS	NS	0.5582	0.0670	NS

*DAS = days after sowing; W- = wingless; * = significantly less and + - significantly more than untreated at P<0.05*

NS = not significantTable 2 Effect of neonicotinoid seed treatments on virus yellows incidence and sugar yield of sugar beet

Table 2 Effect of neonicotinoid seed treatments on virus yellows incidence and sugar yield of sugar beet

T'ment	Rate A. I. Per Unit	Virus yellows infection (%)			Sugar yield (t/ha)		
		24/8 2000	24/8 2001	21/8 2002	2000	2001	2002
Untr		49.6	50.6	25.2	8.85	6.28	11.49
Imid	90	37.4*	35.8*	6.3*	8.88	7.44	11.53
Cloth	60	24.6*	35.3*	4.9*	10.49+	8.35+	12.30
Thia	60	34.3*	30.4*	18.3*	10.18+	8.76+	6.89*
SED 27d.f.	4	3.93	6.70	3.73	0.501	0.619	0.70
LSD (5%)		8.06	13.75	7.66	1.029	1.270	1.43

** = significantly less and + - significantly more than untreated at P<0.05; NS = not significant*

increases. These were only achieved in two years probably because virus infection was not high enough in untreated plots in the third to affect yield.

Imidacloprid and thiamethoxam interacted adversely with lenacil. These treatments should NOT be used pre-emergence with that herbicide.

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