BRIGHTON CROP PROTECTION CONFERENCE
Pests and Diseases – 1992

Volume 1

Proceedings of an international
conference organised by
The BRITISH CROP PROTECTION COUNCIL
held at Brighton Centre and
Brighton Metropole, Brighton, England
November 23–26, 1992

BCPC Registered Office
49 Downing Street
Farnham
Surrey GU9 7PH, UK

Contents

	Page
The British Crop Protection Council Members and Objectives	xix
Conference Organising Committee	xxi
Programme Committee	xxi
Abbreviations	xxii

VOLUME 1

SESSION 1

	Paper	Page
THE NINETEENTH BAWDEN LECTURE		1
Modern agriculture: the role and impact of technology, legislation and public opinion C. R. W. SPEDDING	1-1	3

SESSION 2

	Paper	Page
NEW COMPOUNDS, FORMULATIONS AND USES – INSECTICIDES		27
Research Reports		
Fipronil: a new soil and foliar broad spectrum insecticide F. COLLIOT, K A. KUKOROWSKI, D. HAWKINS and D. A. ROBERTS	2-1	29
MAT7484 – biological and chemical properties of a new soil insecticide J. HARTWIG, F. MAURER, B. MONKE, J. MAHLSTEDT and A. D. COHICK	2-2	35
CGA 215944 – a novel agent to control aphids and whiteflies C. R. FLÜCKIGER, H. KRISTINSSON, R. SENN *et al.*	2-3	43
Fenazaquin, a novel acaricide for the management of spider mites in a variety of crops C. LONGHURST, L. BACCI, J. BUENDIA *et al.*	2-4	51
Field evaluation of RH-5992 on lepidopterous pests in Europe J. J. HELLER, E. KLEIN, H. MATTIODA and A. SAGENMÜLLER	2-5	59
Activity of the natural plant product dihydroxymethyl dihydroxypyrrolidine (DMDP) – an anti-nematode agent A. N. E. BIRCH, W. M. ROBERTSON, L. E. FELLOWS *et al.*	2-6	67
Steinernema B-326 and B-319 (Nematoda); new biological soil insecticides in turf R. GEORGIS, C. T. REDMOND and W. R. MARTIN	2-7	73
Flufenprox – a new insecticide for rice R. F. S. GORDON, R. PASCOE and T. ENOYOSHI	2-8	81
NI-25, a new type of systemic and broad spectrum insecticide H. TAKAHASHI, J. MITSUI, N. TAKAKUSA *et al.*	2-9	89

SESSION 3A

***SCLEROTINIA:* ITS BIOLOGY AND IMPLICATIONS FOR DISEASE CONTROL** 97

Invited Papers

The effects of rotation and other cultural factors on *Sclerotinia* in oilseed rape, peas and potatoes
S. ARCHER, S. MITCHELL and B. WHEELER 3A-1 99

Release and dispersal of *Sclerotinia* ascospores in relation to infection
H. A. McCARTNEY and M. LACEY 3A-2 109

Resistance to *Sclerotinia sclerotiorum* in oilseed rape, linseed and sunflower cultivars and its role in integrated control
J. B. SWEET, S. J. POPE and J. E. THOMAS 3A-3 117

Biological control of *Sclerotinia sclerotiorum* in glasshouse crops
J. M. WHIPPS and S. P. BUDGE 3A-4 127

SESSION 3B

TOXICOLOGY: MODERN METHODS FOR RISK ASSESSMENT 133

Invited Papers

Mechanisms of chemical carcinogenesis; application to safety assessment of pesticides
G. M. WILLIAMS, L. VERNA and J. WHYSNER 3B-1 135

Progress in the international harmonisation of methods to investigate the neurotoxicity of chemicals
R. J. FIELDER 3B-2 143

Hazard estimation for pesticide applicators
N. G. CARMICHAEL 3B-3 149

The harmonisation of operator exposure risk assessment
W. L. CHEN 3B-4 157

SESSION 3C

PEST AND DISEASE RESISTANCE TO AGROCHEMICALS 163

Posters

FUNGICIDES

Fungicide sensitivity in yellow rust of wheat *(Puccinia striiformis)*
R. A. BAYLES, E. G. BARNARD and P. L. STIGWOOD 3C-1 165

Long-term monitoring results of wheat powdery mildew sensitivity towards fenpropimorph and strategies to avoid the development of resistance
G. LORENZ, R. SAUR, B. FORSTER, R. KÜNG *et al.* 3C-2 171

Practical aspects of resistance to DMI fungicides in barley powdery mildew (*Erysiphe graminis*)
W. S. CLARK 3C-3 177

Effects of crop history on sensitivity to prochloraz of *Pseudocercosporella herpotrichoides* isolates from cereals in Western Europe
R. J. BIRCHMORE, P. I. ASHMAN, S. STANLEY, P. E. RUSSELL and H. BUSCHHAUS 3C-4 183

Resistance of the cereal eyespot fungus (*Pseudocercosporella herpotrichoides*) to DMI fungicides
N. CAVELIER, F. LORÉE and M. PRUNIER... ... ... 3C-5 189

Sensitivity of apple powdery mildew (*Podosphaera leucotricha*) to triadimefon
U. SCHULZ 3C-6 195

Phenylamide resistance in *Phytophthora infestans* in Northern Ireland – a changing situation
L. R. COOKE and R. E. PENNEY 3C-7 201

Use of the polymerase chain reaction for the diagnosis of MBC resistance in *Botrytis cinerea*
L. A. MARTIN, R. T. V. FOX, B. C. BALDWIN and I. F. CONNERTON ... 3C-8 207

Effect of morpholine-like fungicides on growth and sterol composition of a wild-type strain and a sterol mutant of *Ustilago maydis* defective in sterol $\Delta 8 > \Delta 7$ isomerase activity
C. S. JAMES, J. A. HARGREAVES, R. S. T. LOEFFLER & R. S. BURDEN ... 3C-9 215

Molecular genetic analysis of carboxin resistance in *Ustilago maydis*
J. P. R. KEON, P. L. E. BROOMFIELD, J. A. HARGREAVES & G. A. WHITE 3C-10 221

INSECTICIDES

Identification of mechanisms of resistance in larvae of the tobacco budworm (*Heliothis virescens*) from cotton field populations
A. R. McCAFFERY and J. W. HOLLOWAY 3C-11 227

Evidence of nerve insensitivity to cypermethrin from Indian strains of *Helicoverpa armigera*
A. J. WEST and A. R. McCAFFERY 3C-12 233

Pyrethroid resistance in the pod borer *Helicoverpa armigera* in Southern India
N. J. ARMES, D. R. JADHAV and A. B. S. KING 3C-13 239

Problems with estimating the toxicity of amitraz to susceptible and resistant spider mites
T. J. DENNEHY, A. W. FARNHAM AND I. DENHOLM 3C-14 245

Insecticidal activity and expression of pyrethroid resistance in adult *Bemisia tabaci* using a glass vial bioassay
M. R. CAHILL and B. HACKETT 3C-15 251

The microimmersion assay: a novel method for measuring acaricidal activity and for characterising pesticide resistance in spider mites
A. W. FARNHAM, T. J. DENNEHY, I. DENHOLM and J. C. WHITE 3C-16 257

Testing insecticide use strategies: a model grain store ecosystem for the saw-toothed grain beetle *Oryzaephilus surinamensis*
P. L. MASON 3C-17 263

SESSION 4A

POST HARVEST LOSSES 269

Invited Papers

Recent surveys of post-harvest pest problems in farm and commercial grain stores in the UK
A. J. PRICKETT 4A-1 271

Current trends in the protection of stored cereals in the tropics by insecticides and fumigants
R. W. D. TAYLOR, P. GOLOB and R. J. HODGES 4A-2 281

Research Reports

The influence of stored food on the effectiveness of farm rat control
R. J. QUY, D. P. COWAN, P. HAYNES, I. R. INGLIS and T. SWINNEY ... 4A-3 291

Alternative strategies for the control of post-harvest rots in apples and pears
A. M. BERRIE 4A-4 301

SESSION 4B

ADVANCES IN THE SAFER FORMULATION, PACKAGING AND APPLICATION TECHNOLOGY OF PESTICIDES 311

Invited Papers

Future formulation trends – the likely impact of regulatory and legislative pressures
W. T. C. HOLDEN 4B-1 313

Novel formulations and packaging concepts – customer need or marketing tool?
B. FREI and P. NIXON 4B-2 321

Polymeric formulations of pesticides
P. CHAMBERLAIN... ... ... 4B-3 327

Research Report

New developments in controlled droplet application (CDA) techniques for small farmers in developing countries – opportunities for formulation and packaging
J. CLAYTON... ... ... 4B-4 333

SESSION 4C

DEVELOPMENT OF PATHOGENS FOR BIOCONTROL 343

Posters

Technical improvements to biopesticides
S. G. LISANSKY and J. COOMBS 4C-1 345

Quantifying the ecological and pathological properties of entomopathogenic fungi
D. J. RHODES, J. D. SMITH and J. L. FAULL 4C-2 351

Control of the migratory locust, *Locusta migratoria capito* in Madagascar: the potential for the use of a myco-pesticide
R. SCHERER, R. P. BATEMAN, D. MOORE and G. V. McCLATCHIE 4C-3 357

BIO 1020: granular *Metarhizium* – a new product for biocontrol of soil pests
K. STENZEL, J. HÖLTERS, W. ANDERSCH and T. A. M. SMIT 4C-4 363

Synergism between entomopathogenic fungi *Metarhizium* spp. and the insecticide, teflubenzuron, against the desert locust
L. JOSHI, R. BATEMAN, G. ARNOLD, P. BRAIN and A. K. CHARNLEY ... 4C-5 369

Opportunities for a new *Bacillus thuringiensis* bioinsecticide in grapes
R. SENN, K. BERNHARD, J. BRASSEL, H. BUHOLZER, T. COTTI and C. R. FLÜCKIGER ... 4C-6 375

NovoBtt – A novel *Bacillus thuringiensis ssp tenebrionis* for superior control of Colorado potato beetle and other leaf-eating Chrysomelidae
N. C. J. SCHMIDT and G. W. Kirfman ... 4C-7 381

Improvement of a baculovirus pesticide by deletion of the *EGT* gene
D. R. O'REILLY ... 4C-8 387

SESSION 5

NEW COMPOUNDS, FORMULATIONS AND USES – FUNGICIDES 393

Research Reports

Pyrimethanil: a new fungicide
G. L. NEUMANN, E. H. WINTER and J. E. PITTIS ... 5-1 395

BAS 490F – A broad-spectrum fungicide with a new mode of action
E. AMMERMANN, G. LORENZ, B. WENDEROTH, H. SAUTER *et al* ... 5-2 403

Fluquinconazole, a novel broad-spectrum fungicide for foliar application
P. E. RUSSELL, A. PERCIVAL, P. M. COLTMAN and D. E. GREEN ... 5-3 411

Metconazole, an advance in disease control in cereals and other crops
A. J. SAMPSON, A. CAZENAVE, J-P. LAFFRANQUE, R. GLYN JONES, S. KUMAZAWA and T. CHIDA ... 5-4 419

MON 24000: A novel fungicide with broad-spectrum disease control
P.O. O'REILLY, S. KOBAYASHI, S. YAMANE, W. G. PHILLIPS *et al* ... 5-5 427

ICI A5504: A novel broad-spectrum systemic β-methoxyacrylate fungicide
J. R. GODWIN, V. M. ANTHONY, J. M. CLOUGH and C. R. A. GODFREY ... 5-6 435

XRD-563 – A novel foliar applied fungicide for the control of powdery mildew in cereals
W. ARNOLD, D. JOHNSON, P. DANIAU and C. LONGHURST ... 5-7 443

A new concept in crop protection: an active adjuvant in fungicides – the case of copper tallate
J-L. SOYEZ ... 5-8 451

VOLUME 2

SESSION 6A

EFFECTS AND FATE OF PESTICIDES IN WATER AND THE ATMOSPHERE 457

Invited Papers

Loss of pesticides from plants and soil by volatilisation
W. PESTEMER and G. KRASEL ... 6A-1 459

Photochemical processes affecting the fate of pesticides in the atmosphere
R. ATKINSON, E. S. C. KWOK and J. AREY 6A-2 469

Pesticide application and deposition – their importance for leaching to surface waters
G. HARRIS, A. B. TURNBULL, A. J. GILBERT, D. G. CHRISTIAN and D. J. MASON 6A-3 477

Laboratory methods for evaluating the impact of pesticides on water/sediment organisms
M. J. HAMER, S. J. MAUND and I. R. HILL 6A-4 487

SESSION 6B

ADVANCES IN IPM IN FRUIT AND VITICULTURE 497

Invited Papers

The role of integrated pest management in integrated crop management of viticulture in Europe
E. F. BOLLER 6B-1 499

Apple pest management in North America: challenge and response
J. M. HARDMAN 6B-2 507

Research Reports

Implementation of IRAC anti-resistance guidelines with IPM programmes for Belgian apple and pear orchards
G. STERK and D. P. HIGHWOOD 6B-3 517

Plant breeding strategies for integrated pest management in soft fruit crops
R. M. BRENNAN, R. J. McNICOL, A. N. E. BIRCH and S. C. GORDON ... 6B-4 527

SESSION 6C

CROP PROTECTION IN ARABLE CROPS 537

Posters

Recent studies on chemical and cultural control of wheat bulb fly
J. E. B. YOUNG 6C-1 539

Incidence of pollen beetles in winter oilseed rape and evaluation of thresholds for control
K. F. A. WALTERS and A. LANE 6C-2 545

Aphid control in potatoes from imidacloprid, a new systemic insecticide for application to seed tubers or in furrow at planting
R. H. MEREDITH and P. J. HEATHERINGTON 6C-3 551

Systemic effects of imidacloprid on aphid feeding behaviour and virus transmission on potatoes
J. A. T. WOODFORD and J. A. MANN 6C-4 557

Effect of imidacloprid on transmission of viruses by aphids in sugar beet
A. M. DEWAR, L. A. READ, P. B. HALLSWORTH and H. G. SMITH 6C-5 563

Corn rootworms and soil insecticides: management lessons from on-farm studies in Illinois
M. E. GRAY and K. L. STEFFEY 6C-6 569

Efficacy of reduced-rate insecticide use against cereal aphids
D. TURNER 6C-7 575

Spreadsheets as research tools and decision aids for cereal aphid control
M. WALLER 6C-8 581

Surface versus admixed applications of slug pellets to winter wheat
D. B. GREEN, S. J. CORBETT, A. W. JACKSON and K. J. NOWAK 6C-9 587

The action of oilseed rape metabolites on olfactory nerve activity and behaviour of *Deroceras reticulatum*
R. GARRAWAY, L. D. L. LEAKE, I. F. HENDERSON, A. J. HICK *et al.* ... 6C-10 593

Trials of zeta-cypermethrin for pest control in agricultural crops in Poland
M. MRÓWCZYŃSKI and S. PRUSZYŃSKI 6C-11 597

An evaluation of the potential of reduced dose fungicide programmes in winter wheat
S. J. WALE and S. OXLEY 6C-12 603

Reduced dosages of fungicides for controlling wheat diseases in Denmark
L. N. JØRGENSEN and B. J. NIELSEN 6C-13 609

Disease epidemiology and fungicide activity in winter wheat
M. J. HIMS and R. J. COOK 6C-14 615

Reduction in the wheat ear disease complex with tebuconazole sprays
A. WAINWRIGHT, J. JEITNER and P. CAZIN-BOURGUIGNON 6C-15 621

Control of seed borne diseases of wheat and barley with myclobutanil
M. C. E. GREEN and N. GOOCH 6C-16 627

Fungicide timing and performance for Fusarium control in wheat
J. A. HUTCHEON and V. W. L. JORDAN 6C-17 633

Biological properties of flusilazole contributing to its field performance
C. M. SMITH, M. C. KLAPPROTH, D. W. SAUNDERS *et al.* 6C-18 639

Control of fungal diseases of arable crops using inhibitors of polyamine biosynthesis
D. R. WALTERS, N. D. HAVIS, S. A. FOSTER and D. J. ROBINS 6C-19 645

Difenoconazole: a new fungicide against *Cercospora beticola* on sugar beet
G. KNAUF-BEITER, C. FLEISCHHACKER, L. MITTERMEIER and R. LIGUORI 6C-20 651

Control of tuber-borne diseases of potatoes with fenpiclonil
A. J. LEADBEATER and W. W. KIRK 6C-21 657

Fluazinam: a novel fungicide for use against *Phytophthora infestans* in potatoes
B. P. ANEMA, J. J. BOUWMAN, T. KOMYOJI and K. SUZUKI 6C-22 663

Epidemiology in relation to control of grey mould (*Botrytis cinerea*) on sunflower
V. J. CHURCH 6C-23 669

The use of tebuconazole for disease control and subsequent effects on lodging in oilseed rape
B. J. G. BOLTON and N. M. ADAM 6C-24 675

Epidemiology in relation to control of white leaf spot (*Mycosphaerella capsellae*) on oilseed rape
A. J. INMAN, B. D. L. FITT and R. L. EVANS 6C-25 681

SESSION 7A

DISEASE FORECASTING AND DIAGNOSTICS IN ARABLE CROPS 687

Research Reports

Research and development of ELISA diagnostics for the detection of the wheat pathogens *Septoria nodorum* and *Septoria tritici*
M. C. JOEGER, L. T. HIRATA, M. A. BAXTER, J. L. GENET and L. MAY ... 7A-1 689

Field evaluation of an immunodiagnostic assay for cereal eyespot
M. COLLETT, J. S. C. CLARK, S. J. KENDALL & D. W. HOLLOMON ... 7A-2 697

Future prospects for the introduction of diagnostic tools in agriculture
B. LABIT 7A-3 705

Experience with EPIPRE in Switzerland and the prospects for the use of diagnostics to monitor the disease state
H. R. FORRER 7A-4 711

A practitioner's view of diagnostics as an aid to disease forecasting
M. J. HIMS 7A-5 721

SESSION 7B

TRANSGENIC PLANTS FOR RESISTANCE TO PESTS AND DISEASES 729

Invited Papers

Genes for protecting transgenic crops from chewing and sap-sucking insect pests
V. A. HILDER, C. BROUGH, A. M. R. GATEHOUSE, Y. SHI,
W. D. O. HAMILTON *et al.* 7B-1 731

Engineering resistance to codling moth in apple and walnut
A. DANDEKAR, G. H. McGRANAHAN, P. V. VAIL, J. DRIVER,
D. J. JAMES *et al.* 7B-2 741

Field performance of insect resistant transgenic crop plants: cotton, potato and corn
D. FISCHHOFF (NO WRITTEN SUBMISSION) 7B-3 749

The field release of transgenic plants
P. DALE, H. C. McPARTLAN, R. PARKINSON and J. A. SCHEFFLER ... 7B-4 751

Foreign phytoalexin expression in plants results in increased disease resistance
R. HAIN, H. KINDL, H. REIF, E. SCHMELZER *et al.* 7B-5 757

SESSION 7C

EFFECTS AND FATE OF PESTICIDES IN THE ENVIRONMENT 767

Posters

A proposed test method for the assessment of pesticide formulation impact on the sediment dwelling larvae of the midge, *Chironomus riparius*
K. L. BARRETT and G. P. DOHMEN 7C-1 769

Inhibition of Daphnia β-galactosidase enzyme activity as a predictive assay for 21-day chronic toxicity
I. BARBER and P. CORDELL 7C-2 775

Toxicity of second generation rodenticides to barn owls
C. V. EADSFORTH, A. GRAY, A. J. DUTTON and J. A. VAUGHAN 7C-3 781

Acceptance studies to assess the hazard of pesticides, formulated as dressing, bait and granules, to birds
R. GRAU, W. PFLÜGER and R. SCHMUCK 7C-4 787

Post-registration surveillance to detect wildlife problems arising from approved pesticides
M. R. FLETCHER and R. C. GRAVE 7C-5 793

The use of data on effects in the environment to validate risk assessment procedures for pesticides
A. D. M. HART and P. W. GREIG-SMITH 7C-6 799

The long-term environmental fate and effects of flufenoxuron in orchards
J. M. GILBERT, J. P. GILL and E. G. HARRISON 7C-7 805

The effects of a pyrethroid, lambda-cyhalothrin, on natural pest control in Brazilian soybeans
J. WHITE, R. A. BROWN, A. BETTENCOURT and C. SOARES 7C-8 811

Pesticide exposure of birds breeding in vegetable crops
M. D. KOSTER, P. NG and D. V. WESELOH 7C-9 817

Evaporation of 1,3-dichloropropene from soil in laboratory and field studies
A. P. WOODBRIDGE and A. J. SHERREN 7C-10 823

The determination of the volatilization of pesticides in plant containers under field conditions
R. FRITZ, E. KERSTING and K. H. KUCK 7C-11 829

A simple procedure to measure the volatility of agrochemicals from soil and leaf surfaces
J. HEATH, A. AHMAD and J. P. LEAHEY 7C-12 835

Volatility testing of pesticides in a wind tunnel
H. RUEDEL and B. WAYMANN 7C-13 841

A laboratory-scale apparatus for the study of pesticide volatility from soil and plant surfaces
A. H. P. DEAS, M. J. PHILLIPS, G. N. JACKSON & D. MOORE-VALE ... 7C-14 847

A field study to meet US environmental protection regulatory requirements for measurement of vertical and lateral movement of pesticides to ground water
P. M. FICHTER and P. W. HOLDEN 7C-15 853

The role of earthworm burrows in transport of pesticides into groundwater under conservation tillage
C. A. EDWARDS, W. M. EWARDS and M. J. SHIPITALO 7C-16 859

Source-sediment control on the riverine transport of pesticides
W. A. HOUSE, J. E. RAE and R. KIBLIN 7C-17 865

The role of outdoor lysimeters to evaluate long term soil degradation and leaching potential of pesticides
K. FIGGE, M. L. HULLEBROECK and S. SHIRES 7C-18 871

Uptake and elimination of fenazaquin by rainbow trout in relation to predicted environmental concentrations
J. M. PERKINS, W. L. CHEN and R. E. BRIANT 7C-19 877

Degradation of imidacloprid in soil with groundcover
K. SCHOLZ and M. SPITELLER 7C-20 883

A photographic fluorescent tracer technique for assisting sprayer operator exposure to pesticides
W. J. KING and H. M. DOBSON 7C-21 889

The application of gas chromatography – selected ion monitoring to the determination of residues of the novel acaricide fenzaquin in environmental and crop samples
A. R. GAMBIE and J. M. PERKINS 7C-22 889

Comparative metabolism of [pyridinyl $-^{14}C$-methyl] imidacloprid in plant cell suspension cultures
J. KOESTER 7C-23 901

The environmental distribution of hexaflumuron
D. YON, K. OSBOURNE, A. McGIBBON, R. BALOCH & R. LACEY 7C-24 907

The metabolism of CGA 173506 in the rat
P. THANEI, H. P. KRIEMLER, *et al.* 7C-25 913

VOLUME 3

SESSION 8A

DISEASES AND PESTS OF NON-BRASSICA OILSEED CROPS

Invited Paper

Linseed diseases in the UK and their control
P. C. MERCER, A. RUDDOCK, B. D. L. FITT and J. HAROLD 8A-1 921

Research Reports

Control of *Sclerotinia sclerotiorum* on sunflower
A. PERES, L. M. ALLARD, A. PENAUD and Y. REGNAULT 8A-2 931

Control of soil-borne and foliar diseases of peanut
K. A. NOEGEL, J. W. BELL and R. D. RUDOLPH 8A-3 939

Effects of pests and agrochemical measures on olive oil quality
J. L. HARWOOD, A. J. RUTTER, M. de la VEGA, M. T. del CUVILLO and J. SANCHEZ 8A-4 945

SESSION 8B

MODELS IN THE CONTROL OF INVERTEBRATE PESTS 953

Invited Paper

The ecological basis of crop protection: theory and examples
A. P. GUTIERREZ 8B-1 955

Research Reports

The value of statistical models in aphid forecasting
R. HARRINGTON, G. HOWLING, A. M. DEWAR and J. S. BALE 8B-2 965

A prototype simulation model to explore options for the management of rice tungro virus disease
J. HOLT, T. C. B. CHANCELLOR and M. K. SATAPATHY 8B-3 973

The use of rule based models in crop protection
J. D. KNIGHT and J. D. MUMFORD 8B-4 981

SESSION 8C

ADVANCES IN THE INTEGRATED MANAGEMENT OF PESTS 989

Posters

Monitoring and biological control as the main components of IPM in vineyards
M. P. TESHLER 8C-1 991

Alternative crops as floral resources for beneficial hoverflies (Diptera: Syrphidae)
A. McLEOD 8C-2 997

Use of field simulators to investigate integrated chemical and biological control tactics against the cotton whitefly *Bemisia tabaci*
L. C. BIRNIE and I. DENHOLM... ... ... 8C-3 1003

Development of an integrated control strategy for summer aphids in winter wheat
J. N. OAKLEY 8C-4 1009

Supervised control of foliar pests in brassica crops
J. A. BLOOD SMYTH, B. J. EMMETT and A. MEAD 8C-5 1015

The development of practical and appropriate IPM methods for irrigated rice in Eastern India
G. C. GHOSH, M. H. ALI, S. V. FOWLER and N. R. MASLEN 8C-6 1021

Patterns of insecticide use and the attainment of pest status by *Icera pattersoni*, an indigenous insect on coffee in Kenya
M. T. K. KAIRO and S. T. MURPHY 8C-7 1027

The effect of managed field margins on hoverfly (Diptera: Syrphidae) distribution and within field abundance
R. W. J. HARWOOD, S. D. WRATTEN and M. NOWAKOWSKI... ... ... 8C-8 1033

Brent goose damage to oilseed rape and implications for integrated management
H. V. McKAY and J. D. BISHOP 8C-9 1039

Recent advances with the mating disruption technique in apples and grapes – factors influencing the success of pheromones
U. NEUMANN, V. HARRIS, A GASSER, W. WALDNER & W. K. KAST ... 8C-10 1045

Systems analysis as an aid in integrated pest management of the pear sucker
D. MORGAN and M. G. SOLOMON 8C-11 1051

Salicylic acid is an endogenous signal of resistance induction in plants
S. SCHNEIDER, F. KUROSAKI and A. NISHI 8C-12 1055

Activity of *Bacillus thuringiensis* var. *kurstaki* against *Helicoverpa zea* and *Heliothis virescens* (Lepidoptera: Noctuidae) on cotton
ABBAS ALI and S. Y. YOUNG 8C-13 1061

The sphinx project – a computer based IPM system for cotton
Y. OSMAN and W. F. NICHOLSON 8C-143 1067

Low rate multiple application of BT+ovicide for *Heliothis* control in cotton
A. M. PLATO and T. A. PLATO 8C-15 1073

SESSION 9A

ASSESSMENT OF THE NON-TARGET EFFECTS OF AGROCHEMICALS 1077

Invited Papers

Effects of home processing on residues of fungicides on citrus fruits: washing oranges
S. L. REYNOLDS and P. M. K. FRIAR ... 9A-1 1079

Effects of pesticides on beneficial arthropods
R. A. BROWN ... 9A-2 1087

Indirect effects of pesticides on birds
R. O'CONNOR ... 9A-3 1097

A link collaborative research programme on technologies for sustainable farming systems
C. WALL ... 9A-4 1107

SESSION 9B

ALTERNATIVES TO MERCURY FOR DISEASE CONTROL 1115

Research Reports

The forgotten diseases: and why we should remember them
D. YARHAM and D. R. JONES ... 9B-1 1117

Alternatives to mercury for control of cereal seed-borne diseases
R. A. NOON and D. JACKSON ... 9B-2 1127

Phenylpyrroles-a new class of fungicides for seed treatment
E. KOCH and A. J. LEADBEATER ... 9B-3 1137

Control of clubroot using calcium cyanamide – a review
F. M. HUMPHERSON-JONES, G. R. DIXON, M. A. CRAIG and D. M. ANN ... 9B-4 1147

SESSION 9C

CROP PROTECTION IN HORTICULTURAL CROPS 1155

Posters

Post-harvest rots of avocado in New Zealand and their control
W. F. T. HARTILL ... 9C-1 1157

Cauliflower cultivar susceptibility and the effect of copper sprays on bacterial leaf spot
J. M. LL DAVIES and D. E. STEAD ... 9C-2 1163

Evaluation of fungicides for control of ringspot and light leaf spot in Brussels sprouts
P. GLADDERS, O. W. JONES and D. D. SLAWSON ... 9C-3 1169

Citrus trunk applications of fenamiphos to control *Tylenchus semipenetrans*
B. J. MONKE, W. M. ZECK and K. A. NOEGEL ... 9C-4 1175

Fenazaquin for the control of two-spotted spider mites on ornamentals
R. T. POLLACK, P. BLACKBURN and D. W. F. BUTLER ... 9C-5 1181

CGA 215'944 – opportunities for use in vegetables
C. R. FLÜCKIGER, R. SENN and H. BUHOLZER 9C-6 1187

Mating disruption utilizing lepidopterous sex pheromones: three years of testing in apple orchards in the Netherlands
P. VAN DEVENTER, A. K. MINKS, L. H. M. BLOMMERS, U. NEUMANN and K. JILDERDA 9C-7 1193

Field selection of the predatory mite *Typhlodromus pyri* for resistance to pyrethroids
J. D. FITZGERALD and M. G. SOLOMON 9C-8 1199

The role of olfactory system of the three crop pests; aphid, whitefly and thrips in the detection of semiochemicals
M. ANDERSON, P. EDMUNDS, H. E. MELLOR and M. H. WALBANK ... 9C-9 1205

Damson-hop aphid control in UK trials with imidacloprid, a nitroguanidine insecticide
T. J. MARTIN, P. A. BIRCH and D. J. BLUETT 9C-10 1211

Accelerated degradation of phorate: implications for pest control in the United Kingdom
D. L. SUETT and A. A. JUKES 9C-11 1217

Behaviour and efficacy of carbofuran and carbosulfan applied as seed treatments in previously-treated and previously-untreated soils
A. A. JUKES, D. L. SUETT and P. CHAMRASKUL 9C-12 1223

Control of vine weevil with controlled release chlorpyrifos granules in containerised nursery stock
J. H. BUXTON, J. V. CROSS, B. J. EMMETT and M. SAYNOR 9C-13 1229

Bemisia tabaci – biotype characterisation and the threat of this whitefly species to agriculture
I. D. BEDFORD, R. W. BRIDDON, P. G. MARKHAM, J. K. BROWN and R. C. ROSELL 9C-14 1235

SESSION 10

IMPLICATIONS OF MODERN REGULATORY REQUIREMENTS FOR CROP PROTECTION 1241

Invited Papers

EC Pesticide review procedures and decision making criteria as indicated in Directive 91/44/EEC
M. R. LYNCH 10-1 1243

The use of models in the regulatory decision making process
J. HUTSON 10-2 1253

Some lessons from the US re-registration program
S. D. JELLINEK and E. C. GRAY 10-3 1261

The implications of modern regulatory requirements for crop protection – a consumer view
P. BEAUMONT 10-4 1267