

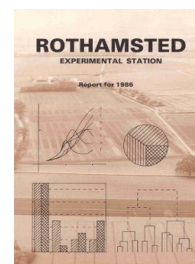
Thank you for using eradoc, a platform to publish electronic copies of the Rothamsted Documents. Your requested document has been scanned from original documents. If you find this document is not readable, or you suspect there are some problems, please let us know and we will correct that.



ROTHAMSTED
RESEARCH

Rothamsted Experimental Station Report for 1986

[Full Table of Content](#)



Publications

Rothamsted Research

Rothamsted Research (1987) *Publications* ; Rothamsted Experimental Station Report For 1986, pp 167 - 191 - DOI: <https://doi.org/10.23637/ERADOC-1-27>

PUBLICATIONS

Publications are listed under Divisions and not under their constituent Departments. Inter-Divisional papers appear under all contributing Divisions.

MULTIDISCIPLINARY AGRONOMY

- PREW, R. D., BEANE, J., CARTER, N., CHURCH, B. M., DEWAR, A. M., LACEY, J., PENNY, A., PLUMB, R. T., THORNE, G. N. & TODD, A. D. (1986) Some factors affecting the growth and yield of winter wheat grown as a third cereal with much or negligible take-all. *Journal of Agricultural Science, Cambridge* **107**, 639–671.
- WIDDOWSON, F. V., DARBY, R. J., DEWAR, A. M., JENKYN, J. F., KERRY, B. R., LAWLOR, D. W., PLUMB, R. T., ROSS, G. J. S., SCOTT, G. C., TODD, A. D. & WOOD, D. W. (1986) The effects of sowing date and other factors on growth, yield and nitrogen uptake, and on the incidence of pests and diseases, of winter barley at Rothamsted from 1981 to 1983. *Journal of Agricultural Science, Cambridge* **106**, 551–574.

AGRONOMY AND CROP PHYSIOLOGY DIVISION

Book

- LAWLOR, D. W. (1986) *Photosynthesis: metabolism, control and physiology*. Harlow: Longman.

Theses

- BROWN, K. F. (1986) *Water use and fibrous root growth of sugar beet*. Ph.D. Thesis, University of Nottingham.
- SMITH, H. G. (1986) *Comparative epidemiology and host:virus interactions of beet yellows virus and beet mild yellowing virus in sugar beet*. Ph.D. Thesis, University of East Anglia.

Research Papers

- ARMSTRONG, J. M., MILFORD, G. F. J., POCOCK, T. O., LAST P. J. & DAY, W. (1986) The dynamics of nitrogen uptake and its remobilization during the growth of sugar beet. *Journal of Agricultural Science, Cambridge* **107**, 145–154.
- CHALABI, Z. S. & DAY, W. (1986) Application of dynamic jump process analysis to modelling tiller production in winter wheat. *IMA Journal of Mathematics Applied in Medicine and Biology* **3**, 23–40.
- CHALABI, Z. S., MILFORD, G. F. J. & DAY, W. (1986) Stochastic model of the leaf area expansion of the sugar-beet plant in a field crop. *Agricultural and Forest Meteorology* **38**, 319–336.
- DAY, W. (1986) A simple model to describe variation between years in the early growth of sugar beet. *Field Crops Research* **14**, 213–220.
- DURRANT, M. J. & LOADS, A. H. (1986) The effect of pellet structure on the germination and emergence of sugar-beet seed. *Seed Science and Technology* **14**, 343–354.
- FITT, B. D. L., CREIGHTON, N. F., LACEY, M. E. & MCCARTNEY, H. A. (1986) Effects of rainfall intensity and duration on dispersal of *Rhynchosporium secalis* conidia from infected barley leaves. *Transactions of the British Mycological Society* **86**, 611–618.
- FITT, B. D. L., WALKLATE, P. J., MCCARTNEY, H. A., BAINBRIDGE, A., CREIGHTON, N. F., HIRST, J. M., LACEY, M. E. & LEGG, B. J. (1986) A rain tower and wind tunnel for studying the dispersal of plant pathogens by rain and wind. *Annals of Applied Biology* **109**, 661–671.
- GUMMERSON, R. J. (1986) The effect of constant temperatures and osmotic potentials on the germination of sugar beet. *Journal of Experimental Botany* **37**, 729–741.
- MCCARTNEY, H. A., LACEY, M. E. & RAWLINSON, C. J. (1986) Dispersal of *Pyrenopeziza brassicae* spores from an oil-seed rape crop. *Journal of Agricultural Science, Cambridge* **107**, 299–305.

ROTHAMSTED REPORT FOR 1986, PART 1

- PREW, R. D., BEANE, J., CARTER, N., CHURCH, B. M., DEWAR, A. M., LACEY, J., PENNY, A., PLUMB, R. T., THORNE, G. N. & TODD, A. D. (1986) Some factors affecting the growth and yield of winter wheat grown as a third cereal with much or negligible take-all. *Journal of Agricultural Science, Cambridge* **107**, 639–671.
- (STEVEN, M. D.), BISCOE, P. V., JAGGARD, K. W. & (PARUNTU, J.) (1986) Foliage cover and radiation interception. *Field Crops Research* **13**, 75–87.
- WALKLATE, P. J. (1986) Markov-chain particle dispersion model based on air flow data : extension to large water droplets. *Boundary Layer Meteorology* **37**, 313–318.
- WINDER, G. H. & DUNNING, R. A. (1986) Effects of row application of insecticides at sowing on leaf miner (*Pegomya betae*) injury to sugar beet. *Crop Protection* **5**, 109–113.

Paper in Rothamsted Report for 1985, Part 2

- HEATHCOTE, G. D. (1986) Yellow cylindrical sticky aphid traps at Rothamsted and Broom's Barn with particular reference to the study of yellowing viruses affecting sugar beet. *Rothamsted Experimental Station. Report for 1985*, 237–244.

General Papers

- ARMSTRONG, M. J., SQUIRE, A. J. & MILFORD, G. F. J. (1986) The nitrogen nutrition of sugar beet—an approach to better forecasting of nitrogen fertiliser requirement. *British Sugar Beet Review* **54**, (1), 84–87.
- ASHER, M. J. C. (1986) The occurrence and control of sugar-beet powdery mildew. In: *Crop protection of sugar beet and crop protection and quality of potatoes: Part 1. Aspects of Applied Biology* **13**, 131–137.
- (BREAY, T., MAY, M.) & BRAY, W. E. (1986) Trifluralin and chlorsulfuron residues—how to recognise the symptoms; and where to look for clues. *British Sugar Beet Review* **54** (4), 21–24.
- BROWN, K. F. & DUNHAM, R. J. (1986) The fibrous root system: The forgotten roots of the sugar beet crop. *British Sugar Beet Review* **54** (3), 22–24.
- CHURCH, B., ARMSTRONG, M. J. & (TURNER, R.) (1986) Fertiliser use—experiments and surveys. *British Sugar Beet Review* **54**, (1), 75–76.
- COOKE, D. A. (1986) Beet cyst nematode infestations—changing for the worse. *British Sugar Beet Review* **54** (2), 16–18.
- COOKE, D. A. (1986) Controlling Docking disorder. *British Sugar Beet Review* **54** (1), 62–64.
- COOKE, D. A. (1986) Controlling Docking disorder. *Revue de Nématologie* **9**, 293.
- COOKE, D. A. (1986) Sugar beet research at Broom's Barn Experimental Station. *Farming in East Anglia* **1** (3), 4; **1** (4), 5.
- DEWAR, A. M. (1986) Forecasting and control of virus yellows and aphids in sugar beet. *British Sugar Beet Review* **54** (2), 49–52.
- DEWAR, A. M. & COOKE, D. A. (1986) Recent developments in the control of nematode and soil-arthropod pests of sugar beet. In: *Crop protection of sugar beet and crop protection and quality of potatoes: Part 1. Aspects of Applied Biology* **13**, 89–99.
- DUNHAM, R. J. & (CARR, M.) (1986) Irrigating sugar beet—a UKIA Winter Conference. *British Sugar Beet Review* **54** (2), 9–12.
- DURRANT, M. J., DUNNING, R. A. & BYFORD, W. J. (1986) Treatment of sugar-beet seeds. In: *Seed treatment*. 2nd ed. Ed. K. A. Jeffs. Thornton Heath: BCPC, pp. 217–238.
- DURRANT, M. J. & LOADS, A. H. (1986) Pellet structure and the sensitivity of sugar-beet seed to soil moisture. *Proceedings 49th Winter Congress International Institute for Sugar Beet Research*. Brussels: IIRB, pp. 61–76.
- FITT, B. D. L. & MCCARTNEY, H. A. (1986) Spore dispersal in relation to epidemic models. In: *Plant disease epidemiology*. Vol. 1. Eds K. J. Leonard & W. E. Fry. New York: Macmillan, pp. 311–345.
- FITT, B. D. L. & MCCARTNEY, H. A. (1986) Spore dispersal in splash droplets. In: *Water, fungi and plants*. Eds P. G. Ayres & L. Boddy. Cambridge: Cambridge University Press, pp. 87–104.

PUBLICATIONS

- GUMMERSON, R. J. (1986) The role of soil measurements in understanding the effects of seedbed cultivation on seedling emergence. *British Sugar Beet Review* **54** (4), 25–26, 31–32.
- HEATHCOTE, G. D. (1986) Virus yellows of sugar beet. In: *Plant virus epidemics*. Eds G. D. McLean, R. G. Garrett & W. G. Ruesink. Sydney: Academic, pp. 399–417.
- LONGDEN, P. C. (1986) Influence of the seed crop environment on the quality of sugar-beet seed. *Proceedings 49th Winter Congress International Institute for Sugar Beet Research*. Brussels: IIRB, pp. 1–16.
- LONGDEN, P. C. (1986) The development of weed beet as a problem in England. *British Sugar Beet Review* **54** (2), 45–47.
- LONGDEN, P. C. (1986) Weed beet through the rotation. *Farmers Guide, Sugar Beet Supplement*, January 1986.
- MCCARTNEY, H. A. & FITT, B. D. L. (1986) Construction of dispersal models. In: *Mathematical modelling of crop disease. Advances in Plant Pathology* **3**. Ed. C. A. Gilligan. London: Academic, pp. 107–143.
- PAYNE, P. A. (1986) *Rhizoctonia solani* and the Barney patch disorder. In: *Crop protection of sugar beet and crop protection and quality of potatoes: Part 1. Aspects of Applied Biology* **13**, 127–129.
- PAYNE, P. A. (1986) Thiram steep treatments for the control of *Phoma betae*. In: *Crop protection of sugar beet and crop protection and quality of potatoes: Part 1. Aspects of Applied Biology* **13**, 159–163.
- SCOTT, R. K. & COOKE, D. A. (1986) A forward look from Broom's Barn Experimental Station. *The Agronomist* No. 2, 6–8.
- SMITH, H. G. (1986) Comparative studies of the sugar beet yellowing viruses: field incidence and effect on yield. In: *Crop protection of sugar beet and crop protection and quality of potatoes. Aspects of Applied Biology* **13**, 107–113.
- SMITH, H. G. (1986) Fodder beet clamps as a source of virus yellows. *British Sugar Beet Review* **54** (1), 38–39.
- SNELGROVE, R. C., STRIBLEY, D. P., TINKER, P. B. & LAWLOR, D. W. (1986) The effect of vesicular-arbuscular mycorrhizal infection on photosynthesis and carbon distribution in leek plants. In: *Physiological and genetical aspects of mycorrhizae*. Proceedings 1st European Symposium on Mycorrhizae, Dijon, 1985. Eds V. Gianinazzi-Pearson & S. Gianinazzi. Paris: INRA, pp. 420–424.
- THORNE, G. N. (1986) Multifactorial studies of causes of variation in growth and yield of winter wheat over six years. *Journal of the Science of Food and Agriculture* **37**, 673–674.
- THORNHILL, W. A. (1986) Green aphids: their importance and how to identify them. *British Sugar Beet Review* **54** (1), 40–42.
- WINDER, G. H. (1986) Developments in use of insecticide treatments of sugar-beet seed. In: *Crop protection of sugar beet and crop protection and quality of potatoes: Part 1. Aspects of Applied Biology* **13**, 165–176.
- WINDER, G. H. & COOPER, J. M. (1986) Insecticides and nematicides for sugar beet. *Farm Contractor*, March, 38–39.

ROTHAMSTED REPORT FOR 1986, PART 1

BIOMATHEMATICS DIVISION

Programs and System Guides

RESCU/095/86	Scientex Work Processor, Advanced User Guide
RESCU/096/86	Managing the SSEW Laboratory Automation System
RESCU/097/86	SSEW Automation User Guide
RESCU/098/86	R\$SIGLIB User Guide
RESCU/099/86	Maintaining and Repairing Idris File System
RESCU/100/86	HX20 programs DISEASE and CROPDATA
RESCU/102/86	Scientex Address Extraction
RESCU/103/86	dBASE III+ Complement Database
RESCU/104/86	Plant Pathology Potato Data Capture
RESCU/105/86	Entomology Potato Data Capture
RESCU/106/86	Daisy Wheel Printing on the Scientex

Book

- DIGBY, P. G. N. & (KEMPTON, R. A.) (1986) *Multivariate analysis of ecological communities*. London: Chapman and Hall.

Research Papers

- BAILEY, R. A. (1985) Balance, orthogonality and efficiency factors in factorial design. *Journal of the Royal Statistical Society* **B47**, 453–458.
- BAILEY, R. A. & (SPEED, T. P.) (1986) Rectangular lattice designs: efficiency factors and analysis. *Annals of Statistics* **14**, 874–895.
- (BARTLETT, P. W.) & MURRAY, A. W. A. (1986) Modelling adult survival in the laboratory of diapause and non-diapause Colorado beetle *Leptinotarsa decemlineata* (Coleoptera: Chrysomelidae) from Normandy, France. *Annals of Applied Biology* **108**, 487–501.
- BENZIAN, B. & LANE, P. W. (1986) Protein concentration of grain in relation to some weather and soil factors during 17 years of English winter-wheat experiments. *Journal of the Science of Food and Agriculture* **37**, 435–444.
- CHURCH, B. M. & SKINNER, R. J. (1986) The pH and nutrient status of agricultural soils in England and Wales 1969–83. *Journal of Agricultural Science, Cambridge* **107**, 21–28.
- GOWER, J. C. (1986) Euclidean distance matrices. In: *Multidimensional data analysis*. Eds J. deLeeuw, W. Heiser, J. Meulman & F. Critchley. Leiden: TSWO Press, pp. 11–22, 61–63.
- GOWER, J. C. (1986) Numerical methods of classification. In: *Colloques CNRS/INSERM, Institut Méditerranée Epidemiologie, Montpellier*, pp. 207–214.
- GOWER, J. C. & (LEGENDRE, P.) (1986) Metric and Euclidean properties of dissimilarity coefficients. *Journal of Classification* **3**, 5–48.
- HIGGINS, S., FITT, B. D. L. & WHITE, R. P. (1986) The development of eyespot (*Pseudocercospora herpotrichoides*) lesions in winter wheat crops. *Journal of Plant Diseases and Protection* **93**, 210–220.
- JOHNSTON, A. E., LANE, P. W., MATTINGLY, G. E. G., POULTON, P. R. & HEWITT, M. V. (1986) Effects of soil and fertilizer P on yields of potatoes, sugar beet, barley and winter wheat on a sandy clay loam soil at Saxmundham, Suffolk. *Journal of Agricultural Science, Cambridge* **106**, 155–167.
- (MEAD, R.), RILEY, J., DEAR, K. B. D. & (DABEK, A. J.) (1986) Stability analysis of intercropping and monocropping systems. *Biometrics* **42**, 253–266.
- (PAIN, B. F., SMITH, K. A.) & DYER, C. A. (1986) Factors affecting the response of cut grass to the nitrogen content of dairy cow slurry. *Agricultural Wastes* **17**, 189–202.
- PERRY, J. N. (1986) Multiple-comparison procedures: a dissenting view. *Journal of Economic Entomology* **79**, 1149–1155.
- PERRY, J. N. & TAYLOR, L. R. (1986) Stability of real interacting populations in space and time: implications, alternatives and the negative binomial k_c . *Journal of Animal Ecology* **55**, 1053–1068.
- POWELL, W., WILDING, N., BROBYN, P. J. & CLARK, S. J. (1986) Interference between parasitoids

PUBLICATIONS

- (Hym.: Aphididae) and fungi (Entomophthorales) attacking cereal aphids. *Entomophaga* **31**, 293–302.
- PREW, R. D., BEANE, J., CARTER, N., CHURCH, B. M., DEWAR, A. M., LACEY, J., PENNY, A., PLUMB, R. T., THORNE, G. N. & TODD, A. D. (1986) Some factors affecting the growth and yield of winter wheat grown as a third cereal with much or negligible take-all. *Journal of Agricultural Science, Cambridge* **107**, 639–671.
- SHERLOCK, P. L., BOWDEN, J. & DIGBY, P. G. N. (1986) Studies of elemental composition as a biological marker in insects. V. The elemental composition of *Rhopalosiphum padi* (L.) (Hemiptera: Aphididae) from *Prunus padus* at different localities. *Bulletin of Entomological Research* **76**, 621–632.
- WALL, C. & PERRY, J. N. (1985) The role of a simulation model in understanding the behaviour of male pea moths attracted to pheromone traps. *IMA Journal of Mathematics Applied in Medicine and Biology* **2**, 299–309.
- WIDDOWSON, F. V., DARBY, R. J., DEWAR, A. M., JENKYN, J. F., KERRY, B. R., LAWLOR, D. W., PLUMB, R. T., ROSS, G. J. S., SCOTT, G. C., TODD, A. D. & WOOD, D. W. (1986) The effects of sowing date and other factors on growth, yield and nitrogen uptake, and on the incidence of pests and diseases of winter barley at Rothamsted from 1981 to 1983. *Journal of Agricultural Science, Cambridge* **106**, 551–574.
- WILLIAMS, I. H., MARTIN, A. P. & WHITE, R. P. (1986) The pollination requirements of oil-seed rape (*Brassica napus* L.). *Journal of Agricultural Science, Cambridge* **106**, 27–30.

Papers in Rothamsted Report, Part 2

- ELSMERE, J. I. (1987) Use of fertilizers in England and Wales. *Rothamsted Experimental Station. Report for 1986*, 281–288.
- KERSHAW, C. D. & CHURCH, B. M. (1987) Survey work in the Statistics Department. *Rothamsted Experimental Station. Report for 1986*, 227–235.

General Papers

- BAILEY, R. A. (1986) Randomization, constrained. In: *Encyclopedia of statistical sciences*, Vol. 7. Eds S. Kotz, N. L. Johnson & C. B. Read. New York: Wiley, pp. 524–530.
- (BERZUINI, C.), ROSS, G. J. S. & (LARIZZA, C.) (1986) Developing intelligent software for non-linear model fitting as an expert system. In: *Compstat 86, Proceedings in Computational Statistics*. Eds F. de Antoni, N. Lauro & A. Rizzi. Heidelberg: Physica Verlag, pp. 259–264.
- CHALMERS, A. G., & LEECH, P. K. (1986) Fertilizer use on farm crops in England and Wales 1985. Harpenden: Rothamsted Experimental Station.
- CHURCH, B., ARMSTRONG, M. J. & (TURNER, R.) (1986) Fertilizer use—experiments and surveys. *British Sugar Beet Review* **54** (1), 75–76.
- (DEAR, K. B. G., MEAD, R.) & RILEY, J. (1986) Bivariate analysis for intercropping experiments. In: *Source materials and guidelines for research methodology for the exploration and assessment of multipurpose trees*. Ed. P. A. Huxley. Nairobi: ICRAF, Part 4H.
- DIGBY, P. G. N. (1986) Graphical displays for classification. In: *To pattern the past!* Eds A. Voorrips & S. H. Loving. Strasbourg: PACT, pp. 75–90.
- DIGBY, P. G. N. & HARDING, S. A. (1986) Developing robust multivariate methods using Genstat. In: *Compstat 86. Short communications and posters*. Dipartimento di Statistica Probabilità e Statistiche Applicate Università “La Sapienza”, Roma, pp. 71–72.
- GOWER, J. C. & PAYNE, R. W. (1986) On identifying yeats and related problems. In: *The statistical consultant in action*. Eds D. J. Hand & B. S. Everitt. Cambridge: Cambridge University Press, pp. 108–120.
- PAYNE, R. W. & LANE, P. W. (1986) Design criteria for a flexible statistical language. In: *Compstat 86, Proceedings in Computational Statistics*. Eds F. de Antoni, N. Lauro & A. Rizzi. Heidelberg: Physica Verlag, pp. 345–350.
- PERRY, J. N. (1986) Adès: new families of frequency distributions that describe repeated animal samples. *Proceedings 13th International Biometric Conference, Seattle, 1986*, p. C-7.1.

ROTHAMSTED REPORT FOR 1986, PART 1

- PERRY, J. N. & WALL, C. (1986) The effect of habitat on the flight of moths orienting to pheromone sources. In: *Mechanisms in insect olfaction signals*. Eds T. L. Payne, M. C. Birch & C. E. J. Kennedy. Oxford: Oxford University Press, pp. 91–96.
- PREECE, D. A. (1986) Some general principles of crop rotation experiments. *Experimental Agriculture* **22**, 187–198.
- RYDER, K. (1986) Numerical tables: guidelines for presentation. *Journal of Applied Statistics* **13**, 77–88.
- SAWICKI, R. M., DENHOLM, I., FARNHAM, A. W. & MURRAY, A. W. A. (1986) Structure activity relationship to pyrethroid insecticides in house flies (*Musca domestica* L.) with *kdr* and *super-kdr*. *Abstracts 6th International Congress Pesticide Chemistry, IUPAC, Ottawa, 1986*, 3E–25.

PUBLICATIONS

CROP PROTECTION DIVISION

Thesis

- ROBINSON, M. P. (1986) *Factors influencing the infectivity of the potato cyst nematodes Globodera rostochiensis and G. pallida*. Ph.D. Thesis, University of Leeds.

Research Papers

- ADAMS, M. J., SWABY, A. G. & MACFARLANE, I. (1986) The susceptibility of barley cultivars to barley yellow mosaic virus (BaYMV) and its fungal vector, *Polymyxa graminis*. *Annals of Applied Biology* **109**, 561–572.
- AIREY, W. (1984) The distribution of slug damage in a potato crop. *Journal of Molluscan Studies* **50**, 239–240.
- AIREY, W. J. (1986) The influence of an alternative food on the effectiveness of proprietary molluscicidal pellets against two species of slugs. *Journal of Molluscan Studies* **52**, 206–213.
- ALLEN, M. F., BALL, B. V., WHITE, R. F. & ANTONIW, J. F. (1986) The detection of acute paralysis virus in *Varroa jacobsoni* by the use of a simple indirect ELISA. *Journal of Apicultural Research* **25**, 100–105.
- (ALPHEY, T. J. W.), BROMILOW, R. H. & (ABDALLA, A. M.) (1985) Phloem translocation of foliar-applied oxamyl and its role in plant protection. *Nematologica* **31**, 468–477.
- ANTONIW, J. F., (LINTHORST, H. J. M.), WHITE, R. F. & (BOL, J. F.) (1986) Molecular cloning of the double-stranded RNA of beet cryptic viruses. *Journal of General Virology* **67**, 2047–2051.
- BATEMAN, G. (1986) Effects of triadimenol-containing seed treatment on winter wheat infected with take-all. *Journal of Plant Diseases and Protection* **93**, 404–414.
- BLIGHT, M. M. & WADHAMS, L. J. (1986) A male produced aggregation pheromone in the pea and bean weevil, *Sitona lineatus* (L.) *Journal of Chemical Ecology* **13**, 733–739.
- BOWEN, S. A., (STOREY, G. W.) & EVANS, K. (1985) Preliminary screening of oilseed rape for beet cyst nematode resistance. *Tests of Agrochemicals and Cultivars No. 6 (Annals of Applied Biology* **106**, Supplement), pp.152–153.
- (BRENNAN, R. M.), FITT, B. D. L., (COLHOUN, J., & TAYLOR, G. S.) (1986) Factors affecting the germination of *Septoria nodorum* pycnidiospores. *Journal of Phytopathology* **117**, 49–53.
- BRIGGS, G. G., CAYLEY, G. R., DAWSON, G. W., GRIFFITHS, D. C., MACAULAY, E. D. M., PICKETT, J. A., (PILE, M. M.), WADHAMS, L. J. & WOODCOCK, C. M. (1986) Some fluorine-containing pheromone analogues. *Pesticide Science* **17**, 441–448.
- BROMILOW, R. H., BRIGGS, G. G., WILLIAMS, M. R., (SMELT, J. H., TUINSTRAL, L. G. M. TH. & TRAAG, W. A.) (1986) The role of ferrous ions in the rapid degradation of oxamyl, methomyl and aldicarb in anaerobic soils. *Pesticide Science* **17**, 535–547.
- BURROWS, P. R. & (BOFFEY, S. A.) (1986) A technique for the extraction and restriction endonuclease digestion of total DNA from *Globodera rostochiensis* and *Globodera pallida* second stage juveniles. *Revue de Nématologie* **9**, 199–200.
- CAYLEY, G. R. & SIMPSON, B. W. (1986) Separation of pyrethroid enantiomers by chiral high performance liquid chromatography. *Journal of Chromatography* **356**, 123–134.
- CHAMBERLAIN, K., BUTCHER, D. N. & WHITE, J. C. (1986) Relationships between chemical structure and phloem mobility in *Ricinus communis* var. Gibsonii with reference to a series of (ω -naphthoxy)alkanoic acids. *Pesticide Science* **17**, 48–52.
- CLARKE, A. J. & PERRY, R. N. (1985) The role of egg-shell calcium in the hatching of *Heterodera schachtii*. *Nematologica* **31**, 151–158.
- COCKBAIN, A. J. (1986) Detection of broad bean stain virus in faba beans (*Vicia faba*) in China. *Acta Phytopathologica Sinica* **16**, 117–120.
- COCKBAIN, A. J., JONES, P. & WOODS, R. D. (1986) Transmission and some other properties of bean yellow vein-banding virus, and its association with pea enation mosaic virus. *Annals of Applied Biology* **108**, 59–69.
- (CUERO, R. G., SMITH, J. E.) & LACEY, J. (1986) The influence of gamma irradiation and sodium hypochlorite sterilization on maize seed microflora and germination. *Food Microbiology* **3**, 107–114.
- (DABEK, A. J.), JONES, P. & (MARTIN, P. J.) (1986) Mycoplasma-like organisms in clove trees

ROTHAMSTED REPORT FOR 1986, PART 1

- affected by sudden death disease in Zanzibar and Pemba. *Phytopathologische Zeitschrift* **114**, 180–184.
- DENHOLM, I., SAWICKI, R. M., FARNHAM, A. W. & WHITE, J. C. (1986) Evaluation of a method for maintaining age-structured populations of house-flies, *Musca domestica* L. (Diptera: Muscidae), to study the evolution of insecticide resistance. *Bulletin of Entomological Research* **76**, 297–302.
- DEVONSHIRE, A. L., SEARLE, L. M. & MOORES, G. D. (1986) Quantitative and qualitative variation in the mRNA for carboxylesterases in insecticide-susceptible and resistant *Myzus persicae* (Sulz). *Insect Biochemistry* **16**, 659–665.
- ELLIOTT, M., (ELLIOTT, R. L.), JANES, N. F. & KHAMBAY, B. P. S. (1986) The pyrethrins and related compounds. Part XXIX: Haloallylbenzyl esters. *Pesticide Science* **17**, 701–707.
- ELLIOTT, M., (ELLIOTT, R. L.), JANES, N. F., KHAMBAY, B. P. S. & PULMAN, D. A. (1986) The pyrethrins and related compounds. Part XXVIII: Alkenyl- and alkynyl-substituted benzyl esters. *Pesticide Science* **17**, 691–700.
- ELLIOTT, M., FARNHAM, A. W., JANES, N. F., JOHNSON, D. M., PULMAN, D. A. & SAWICKI, R. M. (1986) Insecticidal amides with selective potency against a resistant (*Super-kdr*) strain of houseflies (*Musca domestica* L.) *Agricultural and Biological Chemistry* **50**, 1347–1349.
- ELLIOTT, M., JANES, N. F. & KHAMBAY, B. P. S. (1986) The pyrethrins and related compounds. Part XXX: Esters from acids with mono-halovinyl side chains. *Pesticide Science* **17**, 708–714.
- EVANS, K. & SPAULL, A. M. (1985) Comparison of autumn and spring applications of oxamyl to winter oilseed rape cv. Bienvenu infected by brassica cyst nematode. *Tests of Agrochemicals and Cultivars No.6 (Annals of Applied Biology* **106**, Supplement), pp.16–17.
- FATEMY, F. & EVANS, K. (1986) Effects of *Globodera rostochiensis* and water stress on shoot and root growth and nutrient uptake of potatoes. *Revue de Nématologie* **9**, 181–184.
- FATEMY, F. & EVANS, K. (1986) Growth, water uptake and calcium content of potato cultivars in relation to tolerance of cyst nematodes. *Revue de Nématologie* **9**, 171–179.
- FITT, B. D. L., CREIGHTON, N. F., LACEY, M. E. & MCCARTNEY, H. A. (1986) Effects of rainfall intensity and duration on dispersal of *Rhynchosporium secalis* conidia from infected barley leaves. *Transactions of the British Mycological Society* **86**, 611–618.
- FITT, B. D. L., WALKLATE, P. J., MCCARTNEY, H. A., BAINBRIDGE, A., CREIGHTON, N. F., HIRST, J. M., LACEY, M. E. & LEGG, B. J. (1986) A rain tower and a wind tunnel for studying the dispersal of plant pathogens by rain and wind. *Annals of Applied Biology* **109**, 661–671.
- FREE, J. B., FERGUSON, A. W. & SIMPKINS, J. R. (1985) Influence of virgin queen honeybees (*Apis mellifera*) on queen rearing and foraging. *Physiological Entomology* **10**, 271–274.
- GIBSON, R. W. & RICE, A. D. (1986) The combined use of mineral oils and pyrethroids to control plant viruses transmitted non- and semipersistently by *Myzus persicae*. *Annals of Applied Biology* **109**, 465–472.
- GREEN, C. D. & (VERDEJO, S.) (1985) Colonisation of *Pisum sativum* and *Phaseolus vulgaris* by *Pratylenchus penetrans* in sterile media. *Nematologica* **31**, 452–457.
- GUTTERIDGE, S., PARRY, M. A. J., BURTON, S., KEYS, A. J., MUDD, A., (FEENEY, J., SERVATES, J. & PIERCE, J.) (1986) A nocturnal inhibitor of carboxylation in leaves. *Nature* **324**, 274–276.
- HARRINGTON, R., KATIS, N. & GIBSON, R. W. (1986) Field assessment of the relative importance of different species in the transmission of potato virus Y. *Potato Research* **29**, 67–76.
- HIDE, G. A. (1986) *Phoma* and *Fusarium* rots on imported 'new' potatoes. *Plant Pathology* **35**, 126–127.
- HIDE, G. A. & CAYLEY, G. R. (1986) Effects of delaying fungicide treatment of wounded potatoes on the incidence of *Fusarium* dry rot in store. *Annals of Applied Biology* **107**, 429–438.
- HIGGINS, S., FITT, B. D. L. & WHITE, R. P. (1986) The development of eyespot (*Pseudocercospora herpotrichoides*) lesions in winter wheat crops. *Journal of Plant Diseases and Protection* **93**, 210–220.
- HORNBY, D. & HENDEN, D. R. (1986) Epidemics of take-all during 16 years of continuous spring barley. *Annals of Applied Biology* **108**, 251–264.
- (ILOTT, T. W., INGRAM, D. S.) & RAWLINSON, C. J. (1986) Evidence of a chemical factor involved in the control of sexual development in the light leaf spot fungus, *Pyrenopeziza brassicae* (Ascomycotina). *Transactions of the British Mycological Society* **87**, 303–308.

PUBLICATIONS

- JONES, P., (ANGOOD, S. B.) & CARPENTER, J. M. (1986) Melon rugose mosaic virus, the cause of a disease of watermelon and sweet melon. *Annals of Applied Biology* **108**, 303–307.
- KATIS, N., CARPENTER, J. M. & GIBSON, R. W. (1986) Interference between potyviruses during aphid transmission. *Plant Pathology* **35**, 152–157.
- (KIGATHIRA, I. K., BEAMENT, J. W. L.), FREE, J. B. & PICKETT, J. A. (1986) Using synthetic pheromone lures to attract honeybee colonies in Kenya. *Journal of Apicultural Research* **25**, 85–86.
- (KOSHY, P. K.) & EVANS, K. (1986) Hatching from cysts and egg sacs of *Heterodera cruciferae* and effects of temperature on hatching and development of oilseed rape. *Annals of Applied Biology* **109**, 163–171.
- LACEY, J. (1986) *Microascus cinereus* (Emile-Weil & Gaudin) Curzi—a human pathogen? *Mycopathologia* **96**, 137–142.
- LAPWOOD, D. H. & READ, P. J. (1986) A comparison of methods of seed tuber inoculation for assessing the susceptibility of potato cultivars to blackleg (*Erwinia carotovora* subsp. *atroseptica*) in the field. *Annals of Applied Biology* **109**, 287–297.
- LAPWOOD, D. H. & READ, P. J. (1986) The susceptibility of stems of different potato cultivars to blackleg caused by *Erwinia carotovora* susp. *atroseptica*. *Annals of Applied Biology* **109**, 555–560.
- MCCARTNEY, H. A., LACEY, M. E. & RAWLINSON, C. J. (1986) Dispersal of *Pyrenopeziza brassicae* spores from an oil-seed rape crop. *Journal of Agricultural Science, Cambridge* **107**, 299–305.
- MCINTOSH, A. H., CHAMBERLAIN, K. & DAWSON, G. W. (1986) Foliar sprays against potato common scab: compounds related to 3,5-dichlorophen oxyacetic acid. *Crop Protection* **4**, 473–480.
- MAGAN, N. & LACEY, J. (1986) The effects of two ammonium propionate formulations on growth in vitro of *Aspergillus* species isolated from hay. *Journal of Applied Bacteriology* **60**, 221–225.
- MAGAN, N. & LACEY, J. (1986) The phylloplane microflora of ripening wheat and effect of late fungicide applications. *Annals of Applied Biology* **109**, 117–128.
- MAGAN, N. & LACEY, J. (1986) Water relations and metabolism of propionate in two years from hay. *Journal of Applied Bacteriology* **60**, 169–173.
- PERRY, J. N. & TAYLOR, L. R. (1986) Stability of real interacting populations in space and time: implications, alternatives and the negative binomial k_c . *Journal of Animal Ecology* **55**, 1053–1068.
- PERRY, R. N. & (FEIL, J. J.) (1986) Observations on a novel hatching bioassay for *Globodera rostochiensis* using fluorescence microscopy. *Revue de Nématologie* **9**, 280–282.
- PERRY, R. N. & TRETT, M. W. (1986) Ultrastructure of the eggshell of *Heterodera schachtii* and *H. glycines* (Nematoda: Tylenchida). *Revue de Nématologie* **9**, 399–403.
- PLUMB, R. T., LENNON, E. A. & GUTTERIDGE, R. A. (1986) The effects of infection by barley yellow mosaic virus on the yield and components of yield of barley. *Plant Pathology* **35**, 314–318.
- POWELL, W., DEAN, G. J., & WILDING, N. (1986) The influence of weeds on aphid-specific natural enemies in winter wheat. *Crop Protection* **5**, 182–189.
- POWELL, W., WILDING, N., BROBYN, P. J. & CLARK, S. J. (1986) Interference between parasitoids (Hym.: Aphididae) and fungi (Entomophthorales) attacking cereal aphids. *Entomophaga* **31**, 293–302.
- PREW, R. D., BEANE, J., CARTER, N., CHURCH, B. M., DEWAR, A. M., LACEY, J., PENNY, A., PLUMB, R. T., THORNE, G. N. & TODD, A. D. (1986) Some factors affecting the growth and yield of winter wheat grown as a third cereal with much or negligible take-all. *Journal of Agricultural Science, Cambridge* **107**, 639–671.
- ROBINSON, M. P., (ATKINSON, H. J.) & PERRY, R. N. (1985) The effect of delayed emergence on infectivity of juveniles of the potato cyst nematode *Globodera rostochiensis*. *Nematologica* **31**, 171–178.
- ROWLAND, M. W. & (LINDSAY, S. W.) (1986) The circadian flight activity of *Aedes aegypti* parasitized with the filarial nematode *Brugia pahangi*. *Physiological Entomology* **11**, 325–334.

ROTHAMSTED REPORT FOR 1986, PART 1

- SAWICKI, R. M., FARNHAM, A. W., DENHOLM, I. & CHURCH, V. J. (1986) Potentiation of *super-kdr* resistance to deltamethrin and other pyrethroids by an intensifier (factor 161) on autosome 2 in the housefly (*Musca domestica* L.). *Pesticide Science* **17**, 483–488.
- SHERLOCK, P. L., BOWDEN, J. & DIGBY, P. G. N. (1986) Studies of elemental composition as a biological marker in insects. V. The elemental compositions of *Rhopalosiphum padi* (L.) (Hemiptera: Aphididae) from *Prunus padus* at different localities. *Bulletin of Entomological Research* **76**, 621–632.
- STAFFORD, E. A. & MCGRATH, S. P. (1986) The use of acid insoluble residue to correct for the presence of soil-derived metals in the gut of earthworms used as bio-indicator organisms. *Environmental Pollution* **A42**, 233–246.
- STONE, A. R., (HOLLIDAY, J. M., MATHIAS, P. L.) & PARROTT, D. M. (1986) A selective survey of potato cyst-nematode in Great Britain. *Plant Pathology* **35**, 18–24.
- (STOREY, G. W., BOWEN, S. A.) & EVANS, K. (1985) Preliminary screening of oilseed rape for brassica cyst nematode resistance. *Tests of Agrochemicals and Cultivars No.6 (Annals of Applied Biology* **106**, Supplement), pp. 160–161.
- TRETT, M. W. & PERRY, R. N. (1985) Effects of the carbamoyloxime, aldicarb, on the ultrastructure of the root-lesion nematode, *Pratylenchus penetrans* (Nematoda: Pratylenchidae) *Nematologica* **31**, 321–334.
- TRETT, M. W. & PERRY, R. N. (1985) Functional and evolutionary implications of the anterior sensory anatomy of species of root-lesion nematode (genus *Pratylenchus*). *Revue de Nématologie* **8**, 341–355.
- WALL, C. & PERRY, J. N. (1985) The role of a simulation model in understanding the behaviour of male pea moths attracted to pheromone traps. *IMA Journal of Mathematics Applied in Medicine and Biology* **2**, 299–309.
- WHITE, R. F. (DUMAS, E.), SHAW, P. & ANTONIW, J. F. (1986) The chemical induction of PR(6) proteins and resistance to TMV infection in tobacco. *Antiviral Research* **6**, 177–185.
- WIDDOWSON, F. V., DARBY, R. J., DEWAR, A. M., JENYKN, J. F., KERRY, B. R., LAWLOR, D. W., PLUMB, R. T., ROSS, G. J. S., SCOTT, G. C., TODD, A. D. & WOOD, D. W. (1986) The effects of sowing date and other factors on growth, yield and nitrogen uptake, and on the incidence of pests and diseases, of winter barley at Rothamsted from 1981 to 1983. *Journal of Agricultural Science, Cambridge* **106**, 551–574.
- WILDING, N., MARDELL, S. K. & BROBYN, P. J. (1986) Introducing *Erynia neoaphidis* into a field population of *Aphis fabae*: form of the inoculum and effect of irrigation. *Annals of Applied Biology* **108**, 373–385.
- WILLIAMS, I. H. & MARTIN, A. P. (1986) Evidence for a female sex pheromone in the brassica pod midge *Dasineura brassicae*. *Physiological Entomology* **11**, 353–356.
- WILLIAMS, I. H., MARTIN, A. P. & WHITE, R. P. (1986) The pollination requirements of oil-seed rape (*Brassica napus* L.). *Journal of Agricultural Science, Cambridge* **106**, 27–30.

Papers in Rothamsted Report, Part 2

- WOIWOD, I. P. & DANCY, K. J. (1987) Synoptic monitoring for migrant insect pests in Great Britain and Western Europe. VII. Annual population fluctuations of macrolepidoptera over Great Britain for 17 years. *Rothamsted Experimental Station. Report for 1986*, 237–263.
- WOIWOD, I. P., TATCHELL, G. M., DUPUCH, M. J., MACAULAY, E. D. M., PARKER, S. J. & TAYLOR, M. S. (1987) Rothamsted Insect Survey. Eighteenth annual summary. *Rothamsted Experimental Station. Report for 1986*, 289–321.

General Papers

- ALLEN, M. F. & BALL, B. V. (1986) Assay of acute paralysis virus in populations of *Apis mellifera* and *Varroa jacobsoni* by ELISA. In: *Fundamental and applied aspects of invertebrate pathology*. Eds R. A. Samson, J. M. Vlak & D. Peters. Wageningen: Foundation of the 4th International Colloquium of Invertebrate Pathology, p. 153.
- ANTONIW, J. F., (LINTHORST, M. J. M.), WHITE, R. F. & (BOL, J. F.) (1986) Molecular cloning of the double-stranded RNA of beet cryptic viruses. In: *EMBO Workshop on Molecular Plant Virology, Wageningen, 1986*, p. 48.

PUBLICATIONS

- BALL, B. V. & ALLEN, M. F. (1986) The incidence of acute paralysis virus in honey bee colonies infested with the parasitic mite *Varroa jacobsoni*. In: *Fundamental and applied aspects of invertebrate pathology*. Eds R. A. Samson, J. M. Vlak & D. Peters. Wageningen: Foundation of the 4th International Colloquium of Invertebrate Pathology, p.151.
- BATEMAN, G. L., (EHLE, H. & WALLACE, H. A. H.) (1986) Fungicidal treatment of cereal seeds. In: *Seed treatment*. 2nd ed. Ed. K. A. Jeffs. Thornton Heath: BCPC, pp. 83–111.
- BATEMAN, G. L., FITT, B. D. L., CREIGHTON, N. F. & HOLLOMAN, D. W. (1986) Seasonal changes in populations of *Pseudocercosporella herpotrichoides* (eyespot) in wheat crops. *Proceedings British Crop Protection Conference—Pests and Diseases, Brighton, 1986*, pp. 441–446.
- BATEMAN, G. L., FITT, B. D. L., KILBY, K. & HOLLOMAN, D. W. (1986) Variation in eyespot populations. In: *Genetics and plant pathogenesis*. Eds P. R. Day & G. J. Jellis. Oxford: Blackwells, pp. 320–322.
- BATEMAN, G. L., NICHOLLS, P. H. & CHAMBERLAIN, K. (1986) Physico-chemical properties of fungicides in relation to effects on take-all. *Proceedings British Crop Protection Conference—Pests and Diseases, Brighton, 1986*, pp. 1169–1175.
- (BOWEN, S. A., STOREY, G. W.) & EVANS, K. (1986) The contribution of egg sacs to the population dynamics of *Heterodera cruciferae* and *H. schachtii*. *Revue de Nématologie* **9**, 290.
- BROMILOW, R. H., CHAMBERLAIN, K. & BRIGGS, G. G. (1986) Techniques for studying the uptake and translocation of pesticides in plants. In: *Biochemical and physiological techniques in herbicide research. Aspects of Applied Biology* **11**, pp. 29–44.
- CARTER, N. (1986) Simulation modelling. In: *Plant virus epidemics*. Eds G. D. McLean, R. G. Garrett & W. G. Ruesink. Sydney: Academic, pp. 193–215.
- CAYLEY, G. R., GRIFFITHS, D. C. & PYE, B. J. (1986) Exploiting new concepts in sprayer technology. In: *Science, sprays and sprayers*. London: AFRC, pp. 10–11.
- DAWSON, G. W., GRIFFITHS, D. C., (HASSANALI, A.), PICKETT, J. A., PLUMB, R. T., PYE, B. J., SMART, L. E. & WOODCOCK, C. M. (1986) Antifeedants: A new concept for control of barley yellow dwarf virus in winter cereals. *Proceedings British Crop Protection Conference—Pests and Diseases, Brighton, 1986*, pp. 1001–1007.
- DAWSON, G. W., GRIFFITHS, D. C., PICKETT, J. A., WADHAMS, L. J. WOODCOCK, C. M. (1986) Plant compounds that synergise activity of the aphid alarm pheromone. *Proceedings British Crop Protection Conference—Pests and Diseases, Brighton, 1986*, pp. 829–834.
- DENHOLM, I. (1986) Operational counter-measures for resistance: theory and practice. In: *Proceedings IVe Congres sur la Protection de la Sante Humaine et des Cultures en Milieu Tropical, Marseilles, 1986*, pp. 206–214.
- FARNHAM, A. W., SAWICKI, R. M. & WHITE, J. C. (1986) The response of resistant houseflies to an unsynergised and synergised *N*-alkylamide. *Proceedings British Crop Protection Conference—Pests and Diseases, Brighton, 1986*, pp. 645–649.
- (FELTON, J. C., OOMEN, P. A.) & STEVENSON, J. H. (1986) Toxicity and hazard of pesticides to honeybees: Harmonization of test methods. *Bee World* **67**, 114–124.
- FFRENCH-CONSTANT, R. H. & DEVONSHIRE, A. L. (1986) Effect of different insecticides on the selection and control of highly resistant *Myzus persicae*. *Proceedings British Crop Protection Conference—Pests and Diseases, Brighton, 1986*, pp. 631–637.
- FFRENCH-CONSTANT, R. H. & DEVONSHIRE, A. L. (1986) Monitoring the development of insecticide resistance in peach potato aphid populations by immunoassay. In: *Abstracts 6th International Congress Pesticide Chemistry, IUPAC, Ottawa, 1986*, 3E–15.
- FFRENCH-CONSTANT, R. H. & DEVONSHIRE, A. L. (1986) The effect of aphid immigration on the rate of selection of insecticide resistance in *Myzus persicae* by different classes of insecticides. In: *Crop protection of sugar beet and crop protection and quality of potatoes: Part I. Aspects of Applied Biology* **13**, 115–125.
- FITT, B. D. L. & MCCARTNEY, H. A. (1986) Spore dispersal in relation to epidemic models. In: *Plant disease epidemiology*. Vol. 1. Eds K. J. Leonard & W. E. Fry. New York: Macmillan, pp. 311–345.
- GARTHWAITE, D. G., WALL, C. & (WARDLOW, L. R.) (1986) Further evidence for a female sex pheromone in the blackcurrant leaf midge, *Dasineura tetensi*. *Proceedings British Crop Protection Conference—Pests and Diseases, Brighton, 1986*, pp. 355–357.
- GIBSON, R. W. & CAMPBELL, C. C. (1986) Investigations into how cypermethrin controls the

ROTHAMSTED REPORT FOR 1986, PART 1

- spread of potato virus Y by aphids. *Proceedings British Crop Protection Conference—Pests and Diseases, Brighton, 1986*, pp. 997–1000.
- GIBSON, R. W., CAYLEY, G. R. & (PERRIN, R. M.) (1986) The use of pyrethroids to protect planting material against aphid-borne viruses. In: *Healthy planting material: strategies and technologies. British Crop Protection Council Monograph 33*, 155–160.
- (GREENSLADE, P.) & FLETCHER, K. E. (1986) Collembola from earthworm rearing beds at Rothamsted, including three new records for Britain. *Entomologist's Monthly Magazine 122*, 143–144.
- GRIFFITHS, D. C. (1986) Insecticidal treatment of cereal seeds. In: *Seed treatment*. 2nd ed. Ed. K. A. Jeffs. Thornton Heath: BCPC, pp. 113–137.
- GRIFFITHS, D. C., BARDNER, R. & BATER, J. (1986) Control of damage by *Sitona lineatus* in autumn sown faba beans. *Fabis 14*, 30–33.
- GRIFFITHS, D. C. & PICKETT, J. A. (1986) Electrostatic sprayers for behaviour-controlling chemicals. In: *Science, sprays and sprayers*. London: AFRC, pp. 18–19.
- HARRINGTON, R., GOVIER, D. A. & GIBSON, R. W. (1986) Assessing the risk from potato virus Y in seed saved from potato crops grown in England. In: *Crop protection of sugar beet and crop protection and quality of potatoes: Part II. Aspects of Applied Biology 13*, pp. 319–324.
- HENDERSON, I. F. & PARKER, K. A. (1986) Problems in developing chemical control of slugs. In: *Crop protection of sugar beet and crop protection and quality of potatoes: Part II. Aspects of Applied Biology 13*, pp. 341–348.
- (HEWETT, P. D.) & GRIFFITHS, D. C. (1986) Biology of seed treatment. In: *Seed treatment*. 2nd ed. Ed. K. A. Jeffs. Thornton Heath: BCPC, pp. 7–15.
- HIDE, G. A. (1986) Potato diseases and their control. *Potato quality*. London: Potato Marketing Board, pp. 90–95.
- HIDE, G. A. (1986) Potatoes—the importance of producing disease-free planting material. In: *Healthy planting material: strategies and technologies. British Crop Protection Council Monograph 33*, pp. 99–105.
- HIDE, G. A. (1986) Some problems in the chemical control of potato tuber diseases. In: *Crop protection of sugar beet and crop protection and quality of potatoes. Part II. Aspects of Applied Biology 13*, pp. 263–272.
- HIDE, G. A. (1986) Treatment of potatoes used for seed. In: *Seed treatment*. 2nd ed. Ed. K. A. Jeffs. Thornton Heath: BCPC, pp. 263–289.
- HOOPER, D. J. (1986) The use of the scanning electron microscope in the taxonomy of *Aphelenchoides* species. *Revue de Nématologie 9*, 299.
- LACEY, J. (1986) Collection, detection, and identification of agents in farm dust implicated in respiratory disease. *American Journal of Industrial Medicine 10*, 311–313.
- LACEY, J. (1986) Factors affecting mycotoxin production. In: *Mycotoxins and phycotoxins*. 6th International IUPAC Symposium on Mycotoxins and Phycotoxins, Pretoria, 1986. Eds P. Steyn & R. Vleggar. Amsterdam: Elsevier, pp. 65–76.
- LACEY, J. (1986) Genus *Micropolyspora* Lechevalier, Solotorovsky and McDurmont 1961, 11al. In: *Bergey's Manual of systematic bacteriology*. Vol. 2. Eds P. H. A. Sneath, N. S. Mair, M. E. Sharpe & J. G. Holt. Baltimore: Williams & Wilkins, pp. 1496–1501.
- LACEY, J. (1986) Genus *Saccharopolyspora* Lacey and Goodfellow 1975, 77al. In: *Bergey's Manual of systematic bacteriology*, Vol. 2. Eds P. H. A. Sneath, N. S. Mair, M. E. Sharpe & J. G. Holt. Baltimore: Williams & Wilkins, pp. 1492–1496.
- LACEY, J. (1986) Microorganisms in cereals and other stored products. In: *Spoilage and mycotoxins of cereals and other stored products*. Ed. B. Flannigan. *International Biodeterioration 22* (Suppl.), 29–34.
- LACEY, J. (1986) Philip Herries Gregory (1907–1986). *Grana 25*, 159–160.
- LOXDALE, H. D. (1986) Further records of fleas (Siphonaptera) from birds' nests of Bardsey Island. *Entomologist's Gazette 37*, 57–59.
- MACAULAY, E. D. M. (1986) Report of tests of propheromones as mating disruptants against two bollworm pests of cotton in Pakistan 1985. In: *Use of pheromones for the control of cotton pests in Pakistan. Progress Report 1985/86, Project A1304*. London: TDRI/ODA, pp. 36–39.
- MACAULAY, E. D. M., DAWSON, G. W., (LI XUN) & PICKETT, J. A. (1986) Field performance of

PUBLICATIONS

- synthetic diamondback moth sex pheromones. In: *Crop protection in vegetables. Aspects of Applied Biology* **12**, 105–116.
- MCCARTNEY, H. A. & FITT, B. D. L. (1986) Construction of dispersal models. In: *Mathematical modelling of crop disease. Advances in Plant Pathology* **3**. Ed. C. A. Gilligan. London: Academic, pp. 107–143.
- MAGAN, N. & LACEY, J. (1986) Interaction of temperature and water activity on growth of yeasts and metabolism of propionate: Implications for preservation of moist hay. In: *Biodeterioration VI*. Eds S. Barry, D. R. Houghton, G. C. Llewellyn & C. O. Rear. Farnham Royal: CAB International, pp. 306–311.
- MARDELL, S. K. (1986) Liquid nitrogen storage of Entomophthorales. In: *Fundamental and applied aspects of invertebrate pathology*. Eds R. A. Samson, J. M. Vlak & D. Peters. Wageningen: Foundation of the 4th International Colloquium of Invertebrate Pathology, p. 223.
- (PERRIN, R. M.) & GIBSON, R. W. (1985) Control of some insect-borne plant viruses with the pyrethroid PP321 (Karate). *International Pest Control* **27**, 142–145.
- PERRY, R. N. (1986) A novel hatching bioassay for cyst nematodes using fluorescence microscopy. *Revue de Nématologie* **9**, 304.
- PERRY, J. N. & WALL, C. (1986) The effect of habitat on the flight of moths orienting to pheromone sources. In: *Mechanisms in insect olfaction signals*. Eds T. L. Payne, M. C. Birch & C. E. J. Kennedy. Oxford: Oxford University Press, pp. 91–96.
- PICKETT, J. A. (1986) Biotechnology in the service of pest control. In: *Biotechnology's potential for increasing crop production efficiency*. National Agricultural Conference, Stoneleigh, 1986.
- PICKETT, J. A. (1986) Honey bee pheromones: some recent developments in controlling honey bee behaviour. The Gooding Memorial Lecture. Ilford: Central Association of Bee-Keepers, 12 pp.
- PICKETT, J. A., CAYLEY, G. R., DAWSON, G. W., GRIFFITHS, D. C., (HOCKLAND, S. H., MARPLES, B.), PLUMB, R. T. & WOODCOCK, C. M. (1986) Use of alarm pheromone and derivatives against aphid-mediated damage. *Abstracts 6th International Congress Pesticide Chemistry, IUPAC, Ottawa, 1986*, 2C–08.
- PICKETT, J. A., DAWSON, G. W., GRIFFITHS, D. C., (HASSANALI, A.), MERRITT, L. A., MUDD, A., SMITH, M. C., WADHAMS, L. J., WOODCOCK, C. M. & ZHANG, Z. N. (1986) Development of plant-derived antifeedants for crop protection. *Abstracts 6th International Congress Pesticide Chemistry, IUPAC, Ottawa, 1986*, 2D/E–11.
- PLUMB, R. T. (1986) A rational approach to the control of barley yellow dwarf virus. *Journal of the Royal Agricultural Society of England* **147**, 162–171.
- PLUMB, R. T., LENNON, E. A. & GUTTERIDGE, R. A. (1986) Forecasting barley yellow dwarf virus by monitoring vector populations and infectivity. In: *Plant virus epidemics*. Eds G. D. McLean, R. G. Garrett & W. G. Ruesink. Sydney: Academic, pp. 387–398.
- POWELL, W. (1986) Enhancing parasitoid activity in crops. In: *Insect parasitoids*. 13th Symposium of the Royal Entomological Society of London. Eds D. J. Greathead & J. K. Waage. London: Academic, pp. 319–340.
- RAWLINSON, C. J. & (DOVER, P. A.) (1986) Pests and diseases of some new and potential alternative arable crops for the United Kingdom. *Proceedings British Crop Protection Conference—Pests and Diseases, Brighton, 1986*, pp. 721–732.
- RILEY, A. M. (1986) review of the status of *Eupithecia goossensiata* Mab. (Ling Pug) and *E. absinthiata* (Wormwood Pug) (Lep: Geometridae). *Entomologist's Record* **98**, 85–90.
- RILEY, A. M. (1986) *Costaconvexa polygrammata* Bork. (Lep: Geometridae) on Jersey. *Entomologist's Gazette* **37**, 68.
- RILEY, A. M. (1985) *Deileptenia ribeata* (Satin Beauty) at Blairgowrie, Perthshire. *Entomologist's Record* **97**, 202.
- RILEY, A. M. (1986) *Eupithecia tenuiata* Hb. (Slender Pug) in Inverness-shire. *Entomologist's Record* **98**, 125.
- RILEY, A. M. (1985) Late capture of *Chloroclystis chloerata* Mab. (Sloe pug). *Entomologist's Record* **97**, 228.

ROTHAMSTED REPORT FOR 1986, PART 1

- RILEY, A. M. (1985) *Paracystola acroxantha* Meyrick (Lep: Oecophoridae) at Camborne, Cornwall. *Entomologist's Record* **97**, 229.
- RILEY, A. M. (1986) *Thaumtopoea processionea* L. (Oak Processionary) and *Lymantria dispar* L. (Gypsy) on Jersey, 1984. *Entomologist's Record* **98**, 146.
- ROBINSON, M. P. & (JEPSON, S. B.) (1986) Isoelectric focusing studies on root-knot nematodes. *Association of Applied Biologists Nematology Group Meeting, Imperial College, December 1986*. Abstract.
- ROBINSON, M. P. & (JEPSON, S. B.) (1986) Routine biochemical identification of *Meloidogyne* species using isoelectric focusing. *Revue de Nématologie* **9**, 307.
- ROBINSON, M. P., PERRY, R. N. & (ATKINSON, H. J.) (1986) The association and characterization of a fluorescent hypersensitive response of potato roots to *Globodera* spp. In: *Abstracts. British Society for Parasitology Spring Meeting*, pp. 58–59.
- SAWICKI, R. M. (1986) Rapport general sur 'Les insectes et la résistance aux insecticides. Solutions actuelles et perspectives'. In: *Proceedings IVe Congres sur la Protection de la Santé Humaine et des Cultures en Milieu Tropical, Marseilles, 1986*, pp. 206–214.
- SAWICKI, R. M. (1986) Resistance to synthetic pyrethroids can be countered successfully. *Agribusiness Worldwide* **8**, (5), 20–25.
- SAWICKI, R. M. & DENHOLM, I. (1986) Evaluation of existing resistance—management strategies against arthropod pests of cotton. *Proceedings British Crop Protection Conference—Pests and Diseases, Brighton, 1986*, pp. 933–941.
- SAWICKI, R. M., DENHOLM, I., FARNHAM, A. W. & MURRAY, A. W. A. (1986) Structure activity relationship to pyrethroid insecticides in house flies (*Musca domestica* L.) with *kdr* and *super-kdr*. *Abstracts 6th International Congress Pesticide Chemistry, IUPAC, Ottawa, 1986*, 3E–25.
- (STOREY, G. W.) & EVANS, K. (1986) Interactions between *Globodera pallida* and *Verticillium dahliae* and their effect on the tolerance of three potato cultivars. *Revue de Nématologie* **9**, 310.
- TATCHELL, G. M. (1986) The Rothamsted Insect Survey: forecasting aphids and the diseases they transmit. *Proceedings of the Seminar on Agrometeorology and Pest Forecasting, Fulmer Grange, 1985*. Ed. T. J. Perfect. Wageningen: CTA, pp. 81–88.
- TAYLOR, L. R. (1985) An international standard for the synoptic monitoring and dynamic mapping of migrant pest aphid populations. In: *The movement and dispersal of agriculturally important biotic agents*. Ed. D. R. MacKenzie et al. Baton Rouge, Louisiana: Claitor's Publishing Division, pp. 337–418.
- TAYLOR, L. R. (1986) Synoptic dynamics, migration and the Rothamsted Insect Survey. Presidential address to the British Ecological Society, 1984. *Journal of Animal Ecology* **55**, 1–38.
- TAYLOR, L. R. (1986) The distribution of virus disease and the migrant vector aphid. In: *Plant virus epidemics*. Eds G. D. McLean, R. G. Garrett & W. G. Ruesink. Sydney: Academic, pp. 35–57.
- TAYLOR, L. R. (1986) The four kinds of migration. In: *Insect flight: dispersal and migration*. Ed. W. Danthanarayana. Berlin: Springer, pp. 265–280.
- (TORRANCE, L.), PLUMB, R. T. LENNON, E. A. & GUTTERIDGE, R. A. (1986) A comparison of ELISA with transmission tests to detect barley yellow dwarf virus-carrying aphids. In: *Developments and applications in virus testing*. Eds R. A. C. Jones & L. Torrance. Wellesbourne: Association of Applied Biologists, pp. 165–176.
- WALL, C., GARTHWAITE, D. G., GREENWAY, A. R. & (BIDDLE, A. J.) (1986) Prospects for pheromone monitoring of the pea moth, *Cydia nigricana* (F.), in vining peas. In: *Crop protection in vegetables. Aspects of Applied Biology* **12**, 117–125.
- WHITE, R. F. & ANTONIW, J. F. (1986) Molecular cloning of beet cryptic virus dsRNA. *Meeting on Applied Biology—Pathways Forward, University of Warwick, 1986*, 49.
- WHITEHEAD, A. G. (1986) Problems in integrated control of cyst and stem nematodes. *Revue de Nématologie* **9**, 312.
- WHITEHEAD, A. G. (1986) Problems in the integrated control of potato cyst-nematodes, *Globodera rostochiensis* and *G. pallida*, and their solution. In: *Crop protection of sugar beet and crop protection and quality of potatoes: Part II. Aspects of Applied Biology* **13**, pp. 363–372.

PUBLICATIONS

- WHITEHEAD, A. G. (1986) Techniques of applying nematicides to soil. *Bulletin OEPP/EPPO* **16**, 335–341.
- WILDING, N. (1986) The pathogens of diamondback moth and their potential for its control—a review. In: *Proceedings International Workshop on Diamondback Moth Management, Shanhua, Taiwan, 1985*. Shanhua: Asian Vegetable Research Development Centre, pp. 219–232.
- WILDING, N., (LATTEUR, G. & DEDRYVER, C. A.) (1986) Evaluation of Entomophthorales for aphid control: laboratory and field data. In: *Fundamental and applied aspects of invertebrate pathology*. Eds R. A. Samson, J. M. Vlak & D. Peters. Wageningen: Foundation of the 4th International Colloquium of Invertebrate Pathology, pp. 159–162.
- WOIWOD, I. P. (1986) Computer mapping in the Rothamsted Insect Survey. *Proceedings of the Seminar on Agrometeorology and Pest Forecasting, Fulmer Grange, 1985*. Ed. T. J. Perfect. Wageningen: CTA, pp. 89–98.

ROTHAMSTED REPORT FOR 1986, PART 1

MOLECULAR SCIENCES DIVISION

Book

(JONES, R. N.) & KARP, A. (1986) *Introducing genetics*. London: John Murray.

Theses

- BURGESS, S. R. (1986) *Characterization and comparative studies of the seed storage proteins of oats*. Ph.D. Thesis, CNAA.
- FOULGER, D. (1986) *Protoplast regeneration and somatic hybridization of potato*. (*Solanum tuberosum* L.). Ph.D. Thesis, CNAA.
- HOLBROOK, G. (1985) *Limitations to photosynthesis associated with photorespiration in wheat leaves*. D.Phil. Thesis, University of York.

Research Papers

- ALLEN, M. F., BALL, B. V., WHITE, R. F. & ANTONIW, J. F. (1986) The detection of acute paralysis virus in *Varroa jacobsoni* by the use of a simple indirect ELISA. *Journal of Apicultural Research* **25**, 100–105.
- ANTONIOW, J. F., (LINTHORST, H. J. M.), WHITE, R. F. & (BOL, J. F.) (1986) Molecular cloning of the double-stranded RNA of beet cryptic viruses. *Journal of General Virology* **67**, 2047–2051.
- BUNCE, N. A. C., FORDE, B. G., KREIS, M. & SHEWRY, P. R. (1986) DNA restriction fragment length polymorphism at hordein loci: application to identifying and fingerprinting barley cultivars. *Seed Science and Technology* **14**, 419–429.
- BURGESS, S. R. & SHEWRY, P. R. (1986) Identification of homologous globulins from embryos of wheat, barley, rye and oats. *Journal of Experimental Botany* **37**, 1863–1871.
- (DVORAK, J., KASARDA, D. D., DIETLER, M. D., LEW, E. J.-L., ANDERSON, O., LITTS, J. C.) & SHEWRY, P. R. (1986) Chromosomal location of seed storage protein genes in the genome of *Elytrigia elongata*. *Canadian Journal of Genetic Cytology* **28**, 818–830.
- EVANS, N. E., FOULGER, D., (FARRER, L.) & BRIGHT, S. W. J. (1986) Somaclonal variation in explant-derived potato clones over three tuber generations. *Euphytica* **35**, 353–361.
- (FIELD, J. M.), TATHAM, A. S., BAKER, A. M. & SHEWRY, P. R. (1986) The structure of C hordein. *FEBS Letters* **200**, 76–80.
- FISH, N. & KARP, A. (1986) Improvements in regeneration from protoplasts of potato and studies on chromosome stability. I. The effect of initial culture media. *Theoretical and Applied Genetics* **72**, 405–412.
- FOULGER, D. & JONES, M. G. K. (1986) Improved efficiency of genotype-dependent regeneration from protoplasts of important potato cultivars. *Plant Cell Reports* **5**, 72–76.
- GEHARDT, C., OLIVER, J. E., FORDE, B. G., SAARELAINEN, R. & MIFLIN, B. J. (1986) Primary structure and differential expression of glutamine synthetase genes in nodules, roots and leaves of *Phaseolus vulgaris*. *EMBO Journal* **5**, 1429–1435.
- GUTTERIDGE, S., PARRY, M. A. J., BURTON, S., KEYS, A. J., MUDD, A., (FEENEY, J.), SERVAITES, J. & (PIERCE, J.) (1986) A nocturnal inhibitor of carboxylase in leaves. *Nature* **324**, 274–276.
- KENDALL, A. C., WALLSGROVE, R. M., HALL, N. P., TURNER, J. C. & LEA, P. J. (1986) Carbon and nitrogen metabolism in barley (*Hordeum vulgare* L.) mutants lacking ferredoxin-dependent glutamate synthase. *Planta* **168**, 316–323.
- LEA, P. J., HALL, N. P., KENDALL, A. C., KEYS, A. J., MIFLIN, B. J., TURNER, J. C. & WALLSGROVE, R. M. (1985) The isolation and characterisation of photorespiratory mutants of barley *Hordeum vulgare* L. cv. Maris pink. *Barley Genetics Newsletter* **15**, 7–10.
- MADDOCK, S. E. & SEMPLE, J. T. (1986) Field assessment of somaclonal variation in wheat. *Journal of Experimental Botany* **37**, 1065–1078.
- MORRIS, P., MADDOCK, S. E., JONES, M. G. K., & (BOWLES, D. J.) (1986) Lectin levels in tissues of cultured immature wheat embryos. *Plant Cell Reports* **5**, 460–463.
- OOMS, G., ATKINSON, J., BOSSEN, M. E. & LEIGH, R. A. (1986) Ti-DNA from *Agrobacterium rhizogenes* plasmid pRi1855 reduces the osmotic pressure in transformed plants grown *in vitro*. *Planta* **168**, 106–112.

PUBLICATIONS

- OOMS, G., BOSSEN, M. E., BURRELL, M. M. & KARP, A. (1986) Genetic manipulation in potato with *Agrobacterium rhizogenes*. *Potato Research* **29**, 367–379.
- OOMS, G., KARP, A., BURRELL, M. M., TWELL, D. & ROBERTS, J. (1985) Genetic modification of potato development using Ri T-DNA. *Theoretical and Applied Genetics* **70**, 440–446.
- OOMS, G., TWELL, D., BOSSEN, M. E., (HODGE, J. H. C.) & BURRELL, M. M. (1986) Developmental regulation of Ri Tl-DNA gene expression in roots, shoots and tubers of transformed potato (*Solanum tuberosum* cv. Désirée). *Plant Molecular Biology* **6**, 321–330.
- (PAYNE, P. L., HOLT, L. M.), BURGESS, S. R. & SHEWRY, P. R. (1986) Characterisation by two-dimensional gel electrophoresis of the protein components of protein bodies, isolated from the developing endosperm of wheat (*Triticum aestivum*). *Journal of Cereal Science* **4**, 217–223.
- PIERPOINT, W. S. (1986) The pathogenesis-related proteins of tobacco leaves. *Phytochemistry* **25**, 1595–1601.
- RELTON, J. M., WALLSGROVE, R. M., (BOURGIN, J.-P.) & BRIGHT, S. W. J. (1986) Altered feedback sensitivity of acetohydroxyacid synthase from valine-resistant mutants of tobacco (*Nicotiana tabacum* L.). *Planta* **169**, 46–50.
- ROGNES, S. E., WALLSGROVE, R. M., KUEH, J. S. H. & BRIGHT, S. W. J. (1986) Effects of exogenous amino acids on growth and activity of four aspartate pathway enzymes in barley. *Plant Science* **43**, 45–50.
- SHEWRY, P. R., PARMAR, S. & FRANKLIN, J. (1985) The effects of mutant high lysine genes on the amount and composition of hordein. *Barley Genetics Newsletter* **15**, 48–51.
- SHEWRY, P. R., PARMAR, S., (FULRATH, N., KASARDA, D. D. & MILLER, T. E.) (1986) Chromosomal locations of the structural genes for secalins in wild perennial rye (*Secale montanum* Guss.) and cultivated rye (*S. cereale* L.) determined by two-dimensional electrophoresis. *Canadian Journal of Genetics and Cytology* **28**, 76–83.
- SHEWRY, P. R., SMITH, S. J., (LEW, E. J-L & KASARDA, D. D.) (1986) Characterization of prolamins from meadow grasses: homology with those of wheat, barley and rye. *Journal of Experimental Botany* **37**, 633–639.
- WALLSGROVE, R. M., KENDALL, A. C., HALL, N. P., TURNER, J. C. & LEA, P. J. (1986) Carbon and nitrogen metabolism in a barley (*Hordeum vulgare* L.) mutant with impaired chloroplast dicarboxylate transport. *Planta* **168**, 324–329.
- WALLSGROVE, R. M., RISIOTT, R., (KING, J.) & BRIGHT, S. W. J. (1986) Biochemical characterisation of an auxotroph of *Datura innoxia* requiring isoleucine and valine. *Plant Science* **43**, 109–114.
- WALLSGROVE, R. M., RISIOTT, R., (NEGRUTIU, I.) & BRIGHT, S. W. J. (1986) Biochemical characterisation of *Nicotiana plumbaginifolia* auxotrophs that require branched-chained amino acids. *Plant Cell Reports* **3**, 233–226.
- WHITE, R. F., (DUMAS, E.), SHAW, P. & ANTONIW, J. F. (1986) The chemical induction of PR(6) proteins and resistance to TMV infection in tobacco. *Antiviral Research* **6**, 177–185.

General Papers

- ANTONIOW, J. F., (LINTHORST, H. J. M.), WHITE, R. F. & (BOL, J. F.) (1986) Molecular cloning of the double-stranded RNA of beet cryptic viruses. In: *EMBO Workshop on Molecular Plant Virology, Wageningen, 1986*, p. 48.
- BRIGHT, S. W. J., JONES, M. G. K., OOMS, G., MADDOCK, S., KARP, A., FOULGER, D. & MIFLIN, B. J. (1986) Biotechnology's potential for crop improvement. In: *Biotechnology's potential for increasing crop production efficiency*. National Agricultural Conference, Stoneleigh, 1986.
- CARR, G. R., HINKLEY, M. A., LE TACON, F., HEPPER, C. M., JONES, M. G. K. & THOMAS, E. (1986) Growth responses of *Glomus caledonium* in the presence of suspension cultured lucerne cells. In: *Physiological and genetical aspects of mycorrhizae*. Proceedings 1st European Symposium on Mycorrhizae, Dijon, 1985. Eds V. Gianinazzi-Pearson & S. Gianinazzi. Paris: INRA, pp. 521–525.
- DE BOTH, M. T. J. & JONES, M. G. K. (1986) Direct gene transfer in *Nicotiana* protoplasts by electroporation of the neomycin phosphotransferase gene. In: *Proceedings 6th International*

ROTHAMSTED REPORT FOR 1986, PART 1

- Congress Plant Tissue and Cell Culture, Minneapolis, 1986*. Eds D. A. Somers *et al.* Minneapolis: University of Minnesota/International Association for Plant Tissue Culture, p. 209.
- (FAMAEER, I.), KARP, A., (SIDOROV, V., NEGRUTIU, I., CAMMAERTS, D. & JACOBS, M.) (1986) Cellular engineering by means of gamma fusion: genetic variation in fusion products. In: *Somaclonal variation and crop improvement*. Ed. J. Semal. Dordrecht: Nijhoff, pp. 260–263.
- (FAMAEER, I., CAMMAERTS, D.), KARP, A., (SIDOROV, V., DE BROUWER, D., NEGRUTIU, I. & JACOBS, M.) (1986) Cellular engineering by gamma fusion and egg transformation: recent experimental data and applications in plant breeding. In: *Nuclear techniques and in vitro culture for plant improvement*. Vienna: IAEA, pp. 453–461.
- FOULGER, D., FISH, N., KARP, A., BAINS, A., COOPER-BLAND, S., BRIGHT, S. W. J. & JONES, M. G. K. (1986) Protoplast fusion of *Solanum* species. In: *Proceedings 6th International Congress Plant Tissue and Cell Culture, Minneapolis, 1986*. Eds D. A. Somers *et al.* Minneapolis: University of Minnesota/International Association for Plant Tissue Culture, p. 420.
- GUTTERIDGE, S., PHILLIPS, A. L., KETTLEBOROUGH, C. A., PARRY, M. A. J. & KEYS, A. J. (1986) Expression of bacterial Rubisco genes in *Escherichia coli*. *Philosophical Transactions of the Royal Society of London* **B313**, 433–445.
- HALL, N. P., KENDALL, A. C., TURNER, J. C. & WALLSGROVE, R. M. (1986) Isozymes of phosphoglycolate phosphatase missing in a photorespiratory mutant of barley. In: *Meeting on Photosynthesis, 3rd, Aberystwyth, 1986*. London: AFRC, 44.
- HALL, N. P., KENDALL, A. C., TURNER, J. C., WALLSGROVE, R. M. & KEYS, A. J. (1986) A barley mutant deficient in RuBP carboxylase. *Plant Physiology* **80S**, 281.
- JONES, M. G. K. (1986) Developments in the culture of plant protoplasts and cells and their regeneration to plants. In: *Biotechnology and crop improvement and protection*. *British Crop Protection Council Monograph* **34**, 3–11.
- JONES, M. G. K. & BRIGHT, S. W. J. (1986) The transfer of genetic information in crop plants by somatic fusion of protoplasts. In: *Biomolecular engineering in the European Community (1982–86)—Final Report*. Ed. E. Magnien. Dordrecht: Nijhoff, pp. 906–913.
- JONES, M. G. K., DE BOTH, M. T. J., WU, Q. S., SPARKS, C. A., MADDOCK, S. E. & (GLEDDIE, S.) (1986) Transient expression of CAT in wheat protoplasts. In: *Proceedings 6th International Congress Plant Tissue and Cell Culture, Minneapolis, 1986*. Eds D. A. Somers *et al.* Minneapolis: University of Minnesota/International Association for Plant Tissue Culture, p. 19.
- KARP, A. (1986) Chromosome variation in plants regenerated from protoplasts and cultured plant tissues. In: *Somaclonal variation and crop improvement*. Ed. J. Semal. Dordrecht: Nijhoff, pp. 28–35.
- KARP, A. (1986) Chromosome variation in regenerated plants. In: *Genetic manipulation in plant breeding*. Eds W. Horn, C. J. Jensen, W. Odenbach & O. Schieder. Berlin: Walter de Gruyter, pp. 547–554.
- KENDALL, A. C., HALL, N. P., KEYS, A. J., LEA, P. J., TURNER, J. C. & WALLSGROVE, R. M. (1986) Photorespiratory mutants of barley (*Hordeum vulgare*). In: *Meeting on Photosynthesis, 3rd, Aberystwyth, 1986*. London: AFRC, 409.
- KEYS, A. J. (1986) Rubisco: its role in photorespiration. *Philosophical Transactions of the Royal Society of London* **B313**, 325–336.
- KREIS, M., WILLIAMSON, M. S., FORDE, J., SCHMUTZ, D., CLARK, J., BUXTON, B., PYWELL, J., MARRIS, C., HENDERSON, J., (HARRIS, N.), SHEWRY, P. J., FORDE, B. G. & MIFLIN, B. J. (1986) Differential gene expression in the developing barley endosperm. *Philosophical Transactions of the Royal Society of London* **B314**, 355–365.
- KRUGER, N. J. & BURRELL, M. M. (1986) Characterization of pyrophosphate: fructose 6-phosphate phosphotransferase from potato tubers. *Plant Physiology* **80S**, 42.
- KRUGER, N. J., HAMMOND, J. B. W. & BURRELL, M. M. (1986) Properties of purified potato phosphofructokinase from potato (*Solanum tuberosum* cv. Record). *Plant Physiology* **80S**, 41.
- MADDOCK, S. E. (1986) Somaclonal variation in wheat. In: *Somaclonal variation and crop improvement*. Ed. J. Semal. Dordrecht: Nijhoff, pp. 127–135.
- OOMS, G., BURRELL, M. M., KARP, A., TWELL, D. & ROBERTS, J. (1986) Genetic manipulation in potato. In: *Genetic manipulation in plant breeding*. Eds W. H. Horn, C. J. Jensen, W. Odenbach & O. Schieder. Berlin: Walter de Gruyter, pp. 823–825.

PUBLICATIONS

- PARRY, M. A. J., BURTON, S., GUTTERIDGE, S., KEYS, A. J. & SERVAITES, J. C. (1986) Diurnal regulation of Rubisco by a phosphorylated inhibitor. In: *Meeting on Photosynthesis, 3rd, Aberystwyth, 1986*. London: AFRC, 58.
- PARRY, M. A. J., MILLARD, B. N., GUTTERIDGE, S. & KEYS, A. J. (1986) Limited proteolysis of Rubisco and loss of catalytic activity. In: *Meeting on Photosynthesis, 3rd, Aberystwyth, 1986*. London: AFRC, 57.
- PHILLIPS, A. L., KETTLEBOROUGH, C. A., PARRY, M. A. J., GUTTERIDGE, S. & KEYS, A. J. (1986) Expression of genes of ribulose 1,5-bisphosphate carboxylase in bacteria. In: *Meeting on Photosynthesis, 3rd, Aberystwyth, 1986*. London: AFRC, 49.
- PHILLIPS, A. L., PARRY, M. A. J. & GUTTERIDGE, S. (1986) Alteration of the activity of ribulose-1, 5-bisphosphate carboxylase through manipulation of its structure and regulation. In: *Biotechnology and crop improvement and protection. British Crop Protection Council Monograph 34*, 61–68.
- PIERPOINT, W. S. (1986) Flavonoids in the human diet. In: *Plant flavonoids in biology and medicine*. Eds V. Cody, E. Middleton & J. B. Harborne. New York: Alan Liss, pp. 125–140.
- RINTAMAKI, E., KEYS, A. J. & PARRY, M. A. J. (1986) Specific activity of Rubisco from wheat and maize leaves. In: *Meeting on Photosynthesis, 3rd, Aberystwyth, 1986*. London: AFRC, 56.
- SHEWRY, P. R. & (MILLER, T.E.) (1986) The genetics of rye seed proteins In: *Proceedings, Part II. Eucarpia Meeting of the Cereal Section on Rye, Svalov, Sweden, 1985*, pp. 617–627.
- SHEWRY, P. R. & TATHAM, A. S. (1986) Wheat gluten structure. The key to improving breadmaking quality. *Milling* **169**, 32–34.
- SHEWRY, P. R., TATHAM, A. S., FORDE, J., KREIS, M. & MIFLIN, B. J. (1986) The classification and nomenclature of wheat gluten proteins: a reassessment. *Journal of Cereal Science* **4**, 97–106.
- TURNER, J. C., HALL, N. P., KENDALL, A. C., WALLSGROVE, R. M. & BRIGHT, S. W. J. (1986) Genetic analysis of photorespiratory mutants in barley. In: *Meeting on Photosynthesis, 3rd, Aberystwyth, 1986*. London: AFRC, 41.
- TURNER, J. C., PARKER, M. L., TEMPLE, S. J. & LEA, P. J. (1986) Characterization of two chlorophyll b-deficient, azide-derived mutants of barley. In: *Meeting on Photosynthesis, 3rd, Aberystwyth, 1986*. London: AFRC, 9.
- WALLSGROVE, R. M., KENDALL, A. C., TURNER, J. C. & HALL, N. P. (1986) Glutamine synthetase-deficient mutants of barley (*Hordeum vulgare*). *Plant Physiology* **80S**, 283.
- WALLSGROVE, R. M., TURNER, J. C., HALL, N. P. & KENDALL, A. C. (1986) Barley mutants deficient in chloroplast glutamine synthetase. In: *Meeting on Photosynthesis, 3rd, Aberystwyth, 1986*. London: AFRC, 46.
- WHITE, R. F. & ANTONIW, J. F. (1986) Molecular cloning of beet cryptic virus dsRNA. *Meeting on Applied Biology—Pathways Forward, University of Warwick, 1986*, 49.

ROTHAMSTED REPORT FOR 1986, PART 1

SOILS DIVISION

Book

Catt, J. A. (1986) *Soils and Quaternary geology*. Oxford: Clarendon Press.

Theses

AMJEE, F. (1986) *Colonization of root systems by vesicular-arbuscular mycorrhizal fungi*. Ph.D. Thesis, University of Leeds.

SHIPWAY, C. J. P. (1986) *The physics of water movement through clay soil to mole drains*. Ph.D. Thesis, Cranfield Institute of Technology.

Research Papers

ADDISCOTT, T. M., HEYS, P. J. & WHITMORE, A. P. (1986) Application of simple leaching models in heterogeneous soils. *Geoderma* **38**, 185–194.

BROOKES, P. C., HEIJNEN, C. E., MCGRATH, S. P. & VANCE, E. D. (1986) Soil microbial biomass estimates in soils contaminated with metals. *Soil Biology and Biochemistry* **18**, 383–388.

BROOKES, P. C., MCGRATH, S. P. & HEIJNEN, C. E. (1986) Metal residues in soils previously treated with sewage-sludge and their effects on growth and nitrogen fixation by blue-green algae. *Soil Biology and Biochemistry* **18**, 345–353.

BURGESS, T. M. & WEBSTER, R. (1986) A computer program for evaluating risks in constructing choropleth maps by point sampling along transects. *Computers and Geosciences* **12**, 107–127.

CANNELL, R. Q., CHRISTIAN, D. G. & HENDERSON, F. K. G. (1986) A Study of mole drainage with simplified cultivation for autumn-sown crops on a clay soil. 4. A comparison of direct drilling and mouldboard ploughing on drained and undrained land on root and shoot growth, nutrient uptake and yield. *Soil and Tillage Research* **7**, 251–272.

CATT, J. A. (1986) Petrography of deposits above and below the Hoxnian interglacial sediments. *Geological Magazine* **123**, 40–41.

CATT, J. A. & PRUDEN, G. (1985) Chemical analyses of rain and drain-water. In: *Soils in Humberside I, Sheet TA 14 (Brandesburton)*. Ed. R. R. Furness. *Soil Survey Record* **82**, 107–113.

CHRISTIAN, D. G. & MILLER, D. P. (1986) Straw incorporation by different tillage systems, the effect on growth and yield of winter oats. *Soil and Tillage Research* **8**, 239–252.

COPESTAKE, K. G., JOHNSTON, A. E., PAULSON, G. A. & RICHARDS, I. R. (1986) Phosphate fertilisers—is water solubility important? *Journal of the Science of Food and Agriculture* **37**, 18–19.

DANCY, K. J., WEBSTER, R. & (ABEL, N. O. J.) (1986) Estimating and mapping grass cover and biomass from low-level photographic sampling. *International Journal of Remote Sensing* **7**, 1679–1704.

DOUGLAS, J. T., JARVIS, M. G., HOWSE, K. R. & GOSS, M. J. (1986) Structure of a silty soil in relation to management. *Journal of Soil Science* **37**, 137–151.

(EHLERS, W.), GOSS, M. J. & (BOONE, F. R.) (1986) Einfluss der Bodenbearbeitung auf Bodenwasserhaushalt, Durchwurzelung und Wasserentzug. *KALI-BRIEFE (Buntehof)* **18**, 107–125.

GILLER, K. E. & WHEELER, B. D. (1986) Past peat cutting and present vegetation patterns in an undrained fen in the Norfolk broadland. *Journal of Ecology* **74**, 219–247.

GOULDING, K. W. T., POULTON, P. R., THOMAS, V. H. & WILLIAMS, R. J. B. (1986) Atmospheric deposition at Rothamsted, Saxmundham and Woburn Experimental Stations, England, 1969–1984. *Water, Air and Soil Pollution* **29**, 27–49.

GOULDING, K. W. T. & LOVELAND, P. J. (1986) The classification and mapping of potassium reserves in soils of England and Wales. *Journal of Soil Science* **37**, 555–565.

(GRAHAM, J. P., BLACKWELL, P. S.), ARMSTRONG, J. V., CHRISTIAN, D. G., HOWSE, K. R., (DAWSON, C. J. & BUTLER, A. R.) (1986) Compaction of a silt loam by wheeled agricultural vehicles. II. Effects on growth and yield of direct-drilled winter wheat. *Soil and Tillage Research* **7**, 189–203.

PUBLICATIONS

- HARPER, S. H. T., ELLIS, F. B. & LYNCH, J. M. (1986) Varietal and fertilizer effects on straw phytotoxins. *Biology and Fertility of Soils* **2**, 109–112.
- HART, P. B. S., RAYNER, J. H. & JENKINSON, D. S. (1986) Influence of pool substitution on the interpretation of fertilizer experiments with ^{15}N . *Journal of Soil Science* **37**, 389–403.
- HEPPER, C. M., SEN, R. & MASKALL, C. S. (1986) Identification of vesicular-arbuscular mycorrhizal fungi in roots of leek (*Allium porrum* L.) and maize (*Zea mays* L.) on the basis of enzyme mobility during polyacrylamide gel electrophoresis. *New Phytologist* **102**, 529–539.
- HIRSCH, P. R., WANG, C. L. & (WOODWARD, M. J.) (1986) Construction of a Tn5 derivative determining resistance to gentamicin and spectinomycin using a fragment cloned from R1033. *Gene* **48**, 203–209.
- JOHNSTON, A. E. (1986) Soil organic matter, effects on soils and crops. *Soil Use and Management* **2**, 97–105.
- JOHNSTON, A. E., GOULDING, K. W. T. & POULTON, P. R. (1986) Soil acidification during more than 100 years under permanent grassland and woodland at Rothamsted. *Soil Use and Management* **2**, 3–10.
- KARIM, Z. & NEWMAN, A. C. D. (1986) The possible effect of soluble silicon on the lepidocrocite content of gley soils from England and Bangladesh. *Journal of Soil Science* **37**, 259–266.
- (LEEDS-HARRISON, P. B.), SHIPWAY, C. J. P., (JARVIS, N. J.) & YOUNGS, E. G. (1986) The influence of soil macroporosity on water retention, transmission and drainage in a clay soil. *Soil Use and Management* **2**, 47–50.
- LEIGH, R. A. & JOHNSTON, A. E. (1986) An investigation of the usefulness of phosphorus concentrations in tissue water as indicators of the phosphorus status of field-grown spring barley. *Journal of Agricultural Science, Cambridge* **107**, 329–333.
- LEIGH, R. A., CHATER, M., STOREY, R. & JOHNSTON, A. E. (1986) Accumulation and subcellular distribution of cations in relation to the growth of potassium-deficient barley. *Plant, Cell and Environment* **9**, 595–604.
- MCBRATNEY, A. B. & WEBSTER, R. (1986) Choosing functions for semi-variograms of soil properties and fitting them to sampling estimates. *Journal of Soil Science* **37**, 617–639.
- MACDONALD, R. M. (1986) Extraction of microorganisms from soil. *Biological Agriculture and Horticulture* **3**, 361–365.
- MACDONALD, R. M. (1986) Sampling soil microfloras: dispersion of soil by ion exchange and extraction of specific microorganisms from suspension by elutriation. *Soil Biology and Biochemistry* **18**, 399–406.
- MACDONALD, R. M. (1986) Sampling soil microfloras: optimization of density gradient centrifugation in percoll to separate microorganisms from soil suspensions. *Soil Biology and Biochemistry* **18**, 407–410.
- MACDONALD, R. M. (1986) Sampling soil microfloras: problems in estimating concentration and activity of suspensions of mixed populations of soil microorganisms. *Soil Biology and Biochemistry* **18**, 411–416.
- MCGRATH, S. P., SANDERS, J. R., (LAURIE, S. H. & TANCOCK, N. P.) (1986) Experimental determinations and computer predictions of trace metal ion concentrations in dilute complex solutions. *Analyst* **111**, 459–465.
- MOFFAT, A. J. & CATT, J. A. (1986) A re-examination of the evidence for a Plio-Pleistocene marine transgression on the Chiltern Hills. II. Drainage patterns. *Earth Surface Processes and Landforms* **11**, 169–180.
- MOFFAT, A. J. & CATT, J. A. (1986) A re-examination of the evidence for a Plio-Pleistocene marine transgression on the Chiltern Hills. III. Deposits. *Earth Surface Processes and Landforms* **11**, 233–247.
- MOFFAT, A. J., CATT, J. A., WEBSTER, R. & (BROWN, E. H.) (1986) A re-examination of the evidence for a Plio-Pleistocene marine transgression on the Chiltern Hills. I. Structures and surfaces. *Earth Surface Processes and Landforms* **11**, 95–106.
- OLIVER, M. A. & WEBSTER, R. (1986) Combining nested and linear sampling for determining the scale and form of spatial variation of regionalized variables. *Geographical Analysis* **18**, 227–242.
- OLIVER, M. A. & WEBSTER, R. (1986) Semi-variograms for modelling the spatial pattern of landform and soil properties. *Earth Surface Processes and Landforms* **11**, 491–504.

ROTHAMSTED REPORT FOR 1986, PART 1

- PENNY, A., WIDDOWSON, F. V. & JENKYN, J. F. (1986) Results from experiments on winter barley measuring the effects of amount and timing of nitrogen and some other factors on the yield and nitrogen content of the grain. *Journal of Agricultural Science, Cambridge* **106**, 537–549.
- POWLSON, D. S., HART, P. B. S., PRUDEN, G. & JENKINSON, D. S. (1986) Recovery of ¹⁵N-labelled fertilizer applied in autumn to winter wheat at four sites in eastern England. *Journal of Agricultural Science, Cambridge* **107**, 611–620.
- POWLSON, D. S., PRUDEN, G., JOHNSTON, A. E. & JENKINSON, D. S. (1986) The nitrogen cycle in the Broadbalk Wheat Experiment: recovery and losses of ¹⁵N labelled fertilizer applied in spring and inputs of nitrogen from the atmosphere. *Journal of Agricultural Science, Cambridge* **107**, 591–609.
- RODGERS, G. A. (1986) Nitrification inhibitors in agriculture. *Journal of Environmental Science and Health* **A21**, 701–722.
- RODGERS, G. A. (1986) Potency of nitrification inhibitors following their repeated application to soil. *Biology and Fertility of Soils* **2**, 105–108.
- RODGERS, G. A., PENNY, A. & HEWITT, M. V. (1986) A comparison of the effects of prilled urea, used alone or with a nitrification or urease inhibitor, with those of 'Nitro-Chalk' on winter oil-seed rape. *Journal of Agricultural Science, Cambridge* **106**, 515–526.
- RODGERS, G. A., WICKRAMASINGHE, K. N. & JENKINSON, D. S. (1985) Mineralization of dicyan-diamide, labelled with ¹⁵N, in acid soils. *Soil Biology and Biochemistry* **17**, 253–254.
- SANDERS, J. R., ADAMS, T. McM. & (CHRISTENSEN, B. T.) (1986) Extractability and bioavailability of zinc, nickel, cadmium and copper in three Danish soils sampled 5 years after application of sewage sludge. *Journal of the Science of Food and Agriculture* **37**, 1155–1164.
- SANDERS, J. R., McGRATH, S. P. & ADAMS, T. McM. (1986) Zinc, copper and nickel concentrations in ryegrass grown on sewage sludge-contaminated soils of different pH. *Journal of the Science of Food and Agriculture* **37**, 961–968.
- SCHUBERT, A. & HAYMAN, D. S. (1986) Plant growth responses to vesicular-arbuscular mycorrhiza. XVI. Effectiveness of different endophytes at different levels of soil phosphate. *New Phytologist* **103**, 79–90.
- SCOTT, G. T. J., WEBSTER, R. & (NORTCLIFF, S.) (1986) An analysis of crack pattern in clay soil: its density and orientation. *Journal of Soil Science* **37**, 653–668.
- SEN, R. & HEPPEL, C. M. (1986) Identification of vesicular-arbuscular mycorrhizal fungi using selective enzyme polyacrylamide gel electrophoresis. *Journal of the Science of Food and Agriculture* **37**, 258–259.
- SKØT, L., HIRSCH, P. R. & WITTY, J. F. (1986) Genetic factors in *Rhizobium* affecting the symbiotic carbon costs of N₂ fixation and host plant biomass production. *Journal of Applied Bacteriology* **61**, 239–246.
- SNELGROVE, R. C. & STRIBLEY, D. P. (1986) Effects of pre-inoculation with a vesicular-arbuscular mycorrhizal fungus on growth of onions transplanted to the field as multi-seeded peat modules. *Plant and Soil* **92**, 387–397.
- STAFFORD, E. A. & McGRATH, S. P. (1986) The use of acid insoluble residue to correct for the presence of soil-derived metals in the gut of earthworms used as bio-indicator organisms. *Environmental Pollution* **A42**, 233–246.
- (THOM, M.), LEIGH, R. A. & (MARETZKI, A.) (1986) Evidence for the involvement of a UDP-glucose-dependent group translocator in sucrose uptake into vacuoles of storage roots of red beet. *Planta* **167**, 410–413.
- TINKER, P. B. (1986) Trace elements in arable agriculture. *Journal of Soil Science* **37**, 587–601.
- TOWNER, G. D. (1986) Anisotropic shrinkage of clay cores, and the interpretation of field observations of vertical soil movement. *Journal of Soil Science* **37**, 363–371.
- TOWNER, G. D. (1986) The influence of particle size distribution on soil physical properties. *Journal of Agricultural Science, Cambridge* **106**, 527–535.
- TOWNER, G. D. & YOUNGS, E. G. (1986) Application of drainage theory in the field. *Soil Use and Management* **2**, 44–47.
- (TRAPNELL, C. G.) & WEBSTER, R. (1986) Microaggregates in red earths and related soils in East and Central Africa, their classification and occurrence. *Journal of Soil Science* **37**, 109–123.
- WANG, C. L., BERINGER, J. E. & HIRSCH, P. R. (1986) Host plant effects on hybrids of *Rhizobium leguminosarum* Biovars *viciae* and *trifolii*. *Journal of General Microbiology* **132**, 2063–2070.

PUBLICATIONS

- (WANG, Y.), LEIGH, R. A., (KAESTNER, K. H. & SZE, H.) (1986) Electrogenic H⁺-pumping pyrophosphatase in tonoplast vesicles of oat roots. *Plant Physiology* **81**, 497–502.
- WEBSTER, C. P. & DOWDELL, R. J. (1986) Effect of drought and irrigation on the fate of nitrogen applied to cut permanent grass swards in lysimeters: Nitrogen balance sheet and the effect of sward destruction and ploughing on nitrogen mineralisation. *Journal of the Science of Food and Agriculture* **37**, 845–854.
- WEBSTER, C. P., (BELFORD, R. K. & CANNELL, R. Q.) (1986) Crop uptake and leaching losses of ¹⁵N labelled fertilizer nitrogen in relation to waterlogging of clay and sandy loam soils. *Plant and Soil* **92**, 89–101.
- WEIR, A. H. & BARRACLOUGH, P. B. (1986) The effect of drought on the root growth of winter wheat and on its water uptake from a deep loam. *Soil Use and Management* **2**, 91–96.
- WHITMORE, A. P. & ADDISCOTT, T. M. (1986) Computer simulation of winter leaching losses of nitrate from soils cropped with winter wheat. *Soil Use and Management* **2**, 26–30.
- WOOD, I. G., NICHOLLS, L. & BROWN, G. (1986) X-ray anomalous scattering difference patterns in qualitative and quantitative powder diffraction analysis. *Journal of Applied Crystallography* **19**, 364–371.
- WRIGHT, A. C. (1986) A physically-based model of the dispersion of splash droplets ejected from a water drop impact. *Earth Surface Processes and Landforms* **11**, 351–367.
- YOUNGS, E. G. (1986) Characterization of hydrograph recessions of land drains. *Journal of Hydrology* **82**, 17–25.
- YOUNGS, E. G. (1986) The analysis of groundwater flows in unconfined aquifers with nonuniform hydraulic conductivity. *Transport in Porous Media* **1**, 399–417.
- YOUNGS, E. G. (1986) Water-table heights and discharge rates with artesian flow to interceptor land drains. *Journal of Hydrology* **87**, 255–266.
- YOUNGS, E. G. (1986) Water-table heights in drained anisotropic homogeneous soils. *Agricultural Water Management* **11**, 1–11.

Paper in Rothamsted Report, Part 2

- JOHNSTON, A. E. (1987) Saxmundham Experimental Station 1899–1986. A review of the achievements during 1965–1986. *Rothamsted Experimental Station. Report for 1986*, 265–278.

General Papers

- ADDISCOTT, T. M. & WHITMORE, A. P. (1986) Putting nitrogen prediction on the screen. The soil and crop nitrogen viewdata service from Rothamsted and ADAS. *Soil and Water* **14**, 17–19.
- AMIJEE, F., STRIBLEY D. P. & TINKER, P. B. (1986) Relations between growth, colonization by a vesicular- arbuscular mycorrhizal fungus and soluble carbohydrates in roots of leek (*Allium porrum*.) as affected by soil phosphorus. In: *Transaction 13th Congress International Society of Soil Science. Vol. II, Hamburg, 1986*. Hamburg: ISSS, pp. 544–545.
- BROOKES, P. C. & JENKINSON, D. S. (1986) Adenylate energy charge measurements in soil. In: *Proceedings 4th International Symposium on Microbial Ecology, Ljubljana, 1986*, p. 78.
- BROOKES, P. C. & MCGRATH, S. P. (1986) Effects of metal residues from past applications of sewage sludge on soil microbial biomass and nitrogen-fixation. In: *Proceedings 4th International Symposium on Microbial Ecology, Ljubljana, 1986*, p. 140.
- CARR, G. R., HINKLEY, M. A., LE TACON, F., HEPPER, C. M., JONES, M. G. K. & THOMAS, E. (1986) Growth responses of *Glomus caledonium* in the presence of suspension cultured lucerne cells. In: *Physiological and genetical aspects of mycorrhizae*. Proceedings 1st European Symposium on Mycorrhizae, Dijon, 1985. Eds V. Gianinazzi-Pearson & S. Gianinazzi. Paris: INRA, pp. 521–525.
- CATT, J. A. (1986) Silt mineralogy of loess and 'till' on the Isles of Scilly. Appendix 2. In: *The Isles of Scilly: field guide*. Ed. J. D. Scourse. Coventry: Quaternary Research Association, pp. 134–136.
- CATT, J. A. (1986) The nature, origin and geomorphological significance of Clay-with-flints. In: *The scientific study of flint and chert. Proceedings 4th International Flint Symposium, Brighton Polytechnic, 1983*, Eds G. de G. Sieveking and M. B. Hart. pp. 151–159.
- COOKE, G. W. (1984) A mutragya-felhasznalas es -hatekonysag, valamint a talajtermekenysseg kutatasana k fejlodese. *Agromemia es Talajtan* **33**, 518–538.

ROTHAMSTED REPORT FOR 1986, PART 1

- COOKE, G. W. (1986) Nitrates in surface and underground waters. *Span* **29**, 10–11.
- COOKE, G. W. (1985) Pesquisas dos fatores que limitam os rendimentos e sua importancia no desenvolvimento de sistemas agricolas. In: *Reciclagem de nutrientes e Agricultura de Baixos Insumos nos Tropiclos*. Ed. Percy Cabala Rosand. XVI Reuniao Brasileira de Fertilidade do Solo, July 1984. Sociedade Brasileira de Ciencia do Solo: Centro de Pesquisas do Cacau, Ilheus, BA, pp. 1–43.
- COOKE, G. W. (1986) Phosphorus and potassium problems in plant production, and how to solve them. In: *Fight against hunger through improved plant nutrition*. Proceedings 9th CIEC World Fertilizer Congress, Budapest, 1984. Vol. 1. Eds E. Welte & I. Szabolcs, Belgrade: International Scientific Centre of Fertilizers (CIEC), pp. 197–220.
- DAY, J. (1986) Prospects for greater exploitation of symbiosis. In: *Biotechnology's potential for increasing crop production efficiency*. National Agricultural Conference, Stoneleigh, 1986.
- GOSS, M. J. (1986) How roots grow: a study in the field. *Span* **29**, 49–52.
- GOSS, M. J., HOWSE, K. R., COLBOURN, P. & HARRIS, G. L. (1986) Nitrate in water draining from arable land under autumn sown crops and the influence of cultivation. In: *Hydraulic design in water resources engineering: Land drainage*. Eds K. V. H. Smith & D. W. Rycroft. Berlin: Springer, pp. 457–464.
- GOULDING, K. W. T. (1986) Potassium–calcium exchange equilibria in aluminosilicate minerals and soils. In: *Geochemical processes at mineral surfaces*. American Chemical Society Symposium 323. Eds J. A. Davis & K. F. Hayes. Washington: American Chemical Society, pp. 327–340.
- (HARRIS, G. L.) & GOSS, M. J. (1986) The effect of soil physical changes introduced by mole drainage and cultivation on the removal of rainfall. In: *Hydraulic design in water resources engineering: land drainage*. Eds K. V. H. Smith & D. W. Rycroft, Berlin: Springer, pp. 423–432.
- HAYMAN, D. S., DAY, J. M. & DYE, M. (1986) Preliminary observation on dual inoculation of white clover. In: *Physiological and genetical aspects of mycorrhizae*. Proceedings 1st European Symposium on Mycorrhizae, Dijon, 1985. Eds V. Gianinazzi-Pearson & S. Gianinazzi. Paris: INRA, pp. 467–472.
- HEPPER, C. M. (1986) Growth of hyphae from *Glomus* spores in the presence of sulphur-containing compounds. In: *Physiological and genetical aspects of mycorrhizae*. Proceedings 1st European Symposium on Mycorrhizae, Dijon, 1985. Eds V. Gianinazzi-Pearson & S. Gianinazzi. Paris: INRA, pp. 527–530.
- HEPPER, C. M. (1986) *In vitro* behaviour, storage and deposit collections. An introduction. In: *Physiological and genetical aspects of mycorrhizae*. Proceedings 1st European Symposium on Mycorrhizae, Dijon, 1985. Eds V. Gianinazzi-Pearson & S. Gianinazzi. Paris: INRA, pp. 511–514.
- HEPPER, C. M. & SEN, R. (1986) Biochemical characterization of vesicular-arbuscular mycorrhizal fungi. In: *Physiological and genetical aspects of mycorrhizae*. Proceedings 1st European Symposium on Mycorrhizae, Dijon, 1985. Eds V. Gianinazzi-Pearson & S. Gianinazzi. Paris: INRA, pp. 611–614.
- HIRSCH, P. R. (1986) Gene cloning and its potential application to mycorrhizal fungi. In: *Physiological and genetical aspects of mycorrhizae*. Proceedings 1st European Symposium on Mycorrhizae, Dijon, 1985. Eds V. Gianinazzi-Pearson & S. Gianinazzi. Paris: INRA, pp. 147–155.
- JENKINSON, D. S. (1986) Nitrogen in UK arable agriculture. *Journal of the Royal Agricultural Society of England* **147**, 178–189.
- JENKINSON, D. S., POWLSON, D. S. & JOHNSTON, A. E. (1986) The nitrogen cycle under continuous wheat. In: *Transaction 13th Congress International Society of Soil Science, Vol. III, Hamburg, 1986*. Hamburg: ISSS, pp. 793–794.
- JOHNSTON, A. E. (1986) AFRC Research on straw disposal. In: *Proceedings 2nd Straw Incorporation Register Conference*. London: National Farmers Union, pp. 4–8.
- (LIOI, L.), GIOVANNETTI, M. & HEPPER, C. M. (1986) Host-endophyte specificity in mycorrhizal infection of *Hedysarum coronarium* L. Proceedings 1st European Symposium on Mycorrhizae, Dijon, 1985. Eds V. Gianinazzi-Pearson & S. Gianinazzi. Paris: INRA, pp. 551–554.
- MACDONALD, R. M. (1986) Nitrification in soil: an introductory history. In: *Nitrification*. Ed. J. I.

PUBLICATIONS

- Prosser. *Special Publication. Society of General Microbiology* 20. Eynsham: IRL Press, pp. 1–16.
- MCGRATH, S. P. & JOHNSTON, A. E. (1986) Sulphur—crop nutrient and fungicide. *Span* 29, 57–59.
- PIRIE, N. W. (1986) Appropriate technology of leaf protein. In: *International Symposium Proteins in Food, Health and Industry, Madras, 1986*. Unpaged.
- PIRIE, N. W. (1986) Leaf protein after forty years. *BioEssays* 5, 174–175.
- PIRIE, N. W. (1986) Leaf protein for overcoming hunger in the world. *International Leaf Protein Conference, Nagoya, Japan, 1985*, 1–2.
- PIRIE, N. W. (1986) Leaf protein in human diets. *International Leaf Protein Conference, Nagoya, Japan, 1985*, pp. 63–66.
- PIRIE, N. W. (1986) Production, preservation and use of leaf protein. *ASEAN Food Journal* 2, 47–49.
- PIRIE, N. W. (1986) Some physical properties on which successful leaf protein production depends. In: *3rd International Conference on Physical Properties of Agricultural Materials and their Influence on Design and Performance of Agricultural Machines and Technologies, Prague, 1985*, pp. 163–165.
- PIRIE, N. W. (1986) The next phase with leaf protein. In: *Proceedings 18th Annual Convention of the Indian Society of Agricultural Chemists, Kanpur, 1985*. Unpaged.
- PIRIE, N. W. (1986) The right to knowledge about food and the means for getting it. *Speculations in Science and Technology* 9, 75–82.
- SNELLGROVE, R. C., STRIBLEY, D. P., TINKER, P. B. & LAWLOR, D. W. (1986) The effect of vesicular-arbuscular mycorrhizal infection on photosynthesis and carbon distribution in leek plants. In: *Physiological and genetical aspects of mycorrhizae*. Proceedings 1st European Symposium on Mycorrhizae, Dijon, 1985. Eds V. Gianinazzi-Pearson & S. Gianinazzi. Paris: INRA, pp. 420–424.
- TINKER, P. B. (1985) Soil microbiology and the improvement of plant growth. North of Scotland College of Agriculture. 7th Tom Miller Memorial Lecture, 23 May, 1985.
- TINKER, P. B. (1986) Trace elements in arable agriculture. Hills Bequest Lecture of the Royal Agricultural Society of England. *Journal of Soil Science* 37, 587–601.
- WANG, C. L., SPOKES, J. R., (WOODWARD, M. J.) & HIRSCH, P. R. (1985) Transposon mutagenesis of *Rhizobium* using a derivative of Tn5 conferring gentamicin and spectinomycin resistance. In: *Nitrogen fixation research progress*. Eds H. J. Evans, P. J. Bottomley & W. E. Newton. The Hague: Nijhoff/Junk.
- WEBSTER, R. (1986) Statistical methods for analysing soil variation. In: *Transaction 13th Congress International Society of Soil Science, Vol. IV, Hamburg, 1986*. Hamburg: ISSS, pp. 1620–1621.