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RESEARCH

## Iacr Report for 1998

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## Research Projects in Progress

### Rothamsted Research

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# Research Projects in Progress

## **Innovative crops and husbandry strategies for competitive, sustainable and environmentally benign agriculture** **Barraclough P.B.**

Improved genotypes and agronomy of lupins for UK agriculture  
*Shield I.F.*

Adapting new crops for the UK climate: genotype and environment interactions on development, structure and yield of lupins  
*Shield I.F.*

Internal nitrogen resources and the regulation of pod growth, crop ripening and grain quality in lupins  
*Shield I.F.*

Reed Canary Grass (*Phalaris arundinacea*): development of a new crop for the production of chemical pulp and biofuel  
*Christian D.G.*

Application of gene technology and chromosome visualisation for improved UK adaptability of white lupins  
*Millford G.F.J.*

Dynamics of nutrient pools in plants and their relationship to crop growth, yield and quality  
*Barraclough P.B.*

Optimising a straw fuel supply  
*Christian D.G.*

Monitoring growth and yield of crops grown as biofuels and measuring nutrient content of various components of the aerial biomass  
*Christian D.G.*

Creation of varieties and technologies for increasing production and utilisation of high quality protein from the white lupin in Europe  
*Millford G.F.J.*

European *Miscanthus* improvement: breeding and selection of new genotypes of *Miscanthus* to improve yield and product quality  
*Christian D.G.*

Diagnosing crop N status with a chlorophyll meter  
*Barraclough P.B.*

Plant and soil testing to assess the adequacy of P supply to oilseed rape crops  
*Barraclough P.B.*

Switchgrass (*Panicum virgatum*) as an alternative energy crop in Europe  
*Christian D.G.*

The physiology of late season and post-harvest changes in the quality of sugar beet storage roots  
*Leigh R.A.*

## **Biology, ecology, genetics and control of weeds in arable agriculture, including herbicide-resistant biotypes** **Lutman P.J.W.**

Developing strategies for reducing the risk from herbicide-resistant wild-oats  
*Moss S.R.*

Ecology and genetics of arable weeds  
*Lutman P.J.W.*

Developing strategies for reducing the risk from herbicide-resistant wild-oats  
*Moss S.R.*

Herbicide resistance in black-grass and wild-oats  
*Moss S.R.*

Biology and control of weeds and volunteer oilseed rape in broad-leaved crops  
*Lutman P.J.W.*

Molecular genetics of herbicide resistance  
*Cavan G.P.*

Ecological and genetic correlates of long-term population trends in plants  
*Miller A.C.E.*

The vulnerability of new xenobiotics to the evolution of resistance  
*Moss S.R.*

Weed competition and crop canopy manipulation in winter wheat  
*Cussans J.W.*

Biology and population dynamics of weeds in cereals and other arable crops  
*Lutman P.J.W.*

Botanical and rotational implications of genetically modified herbicide tolerance - baseline monitoring  
*Lutman P.J.W., May M.J.*

Development of simulation and risk analysis for weed competition in winter wheat  
*Semenov M.A.*

Exploiting weed patch dynamics - development of spatially selective weed control techniques  
*Lutman P.J.W.*

Weed competition and crop canopy manipulation in winter wheat  
*Seavers G.P.*

Development of simulation and risk analysis for weed competition in winter wheat  
*Cussans J.W.*

**Interactions between plant pathogens (prokaryotes, viruses and fungi), their hosts and vectors and the development of control strategies Adams M.J.**

Characterisation and diagnosis of fungally-transmitted viruses of cereals and their vectors  
*Adams M.J.*

Characterisation and diagnosis of viruses affecting tropical crops  
*Jones P.*

Molecular biology of interactions between plant hosts and fungal and viral pathogens and their vectors  
*Antoniw J.F.*

Characterisation and diagnosis of viruses infecting novel crops and the interactions between the host, virus and vector  
*Jones P.*

Molecular biology software requirements for sequence handling  
*Verrier P.J.*

Spring barley and barley yellow dwarf virus  
*Plumb R.T.*

Assessment of genome variation amongst bymovirus isolates from China and Europe and the design of transgenic resistance strategies  
*Adams M.J.*

Characterisation of the *Polymyxa* spp. transmitting rice stripe necrosis virus in South America and West Africa  
*Adams M.J.*

Lethal coconut diseases in Ghana caused by phytoplasmas  
*Jones P.*

Response of winter barley cultivars to barley mild mosaic and barley yellow mosaic virus  
*Adams M.J.*

**The epidemiology, population dynamics and control of fungal diseases in arable crops and rotations Jenkyn J.F.**

Population biology and molecular ecology of soil-borne plant pathogens  
*Bateman G.L.*

Forecasting light leaf spot on winter oilseed rape  
*Fitt B.D.L.*

Diagnosis, forecasting, risk assessment and control of stem base diseases of wheat using new molecular technologies  
*Bateman G.L.*

Integrated strategies for the management of stem canker of oilseed rape in Europe (IMASCOPE)  
*Fitt B.D.L.*

Modelling to develop effective strategies for control of diseases on winter oilseed rape  
*Fitt B.D.L.*

Fundamental studies of crop-disease-environment interactions  
*McCartney H.A.*

Control of ergot in cereal crops  
*Jenkyn J.F.*

Exploitation of biotechnology in developing strategies for integrated control of *Sclerotinia* stem rot in rapeseed  
*McCartney H.A.*

Epidemiology of light leaf spot on winter oilseed rape  
*Fitt B.D.L.*

Novel methods for identifying and enumerating airborne microorganisms using molecular techniques  
*McCartney H.A.*

Effects of fungicides on take-all in wheat  
*Jenkyn J.F.*

Importance of diseases on winter linseed  
*Fitt B.D.L.*

Optimising control of stem canker in winter oilseed rape  
*Fitt B.D.L.*

Factors affecting the pathogenicity of *Verticillium dahliae* to linseed  
*Fitt B.D.L.*

Indo - UK collaboration on oilseed crops  
*Nashaat N.I.*

Indo - UK collaboration on oilseed crops (visiting scientists)  
*Nashaat N.I.*

**Biometrical analysis, computation and consultation Payne R.W.**

Statistical Training Advisory and Research Services  
*Thompson R.*

Statistical analysis of complex biological experiments and surveys  
*Todd A.D.*

Development of statistical algorithms and software, in particular Genstat Releases 3 and 4  
*Payne R.W.*

**Research in statistics relevant to biological processes Thompson R.**

Analysis of generalised linear multivariate mixed models  
*Thompson R.*

Unification of indicator quality for assessment of impact of multidisciplinary systems (UNIQUAIMS)  
*Riley J.*

Database creation and analysis of Ugandan long term rotational trial  
*Riley J.*

Collaborative statistical investigations into biological processes  
*Thompson R.*

Statistical and stochastic modelling of complex biological processes with emphasis on spatial and temporal processes  
*Thompson R.*

Statistics for development (in overseas countries)  
*Riley J.*

Monte Carlo methods for detecting and using interacting quantitative trait genes  
*Thompson R.*

Prediction of sugar-beet variety production using spatial and temporal information  
*Thompson R.*

**Biomangement of pest and beneficial insects in farmland Powell W.**

Manipulation of natural enemies of pests in arable crops  
*Powell W.*

Integrated management of pest and beneficial insects on oilseeds  
*Williams I.H.*

Movement and population dynamics of insect pests and beneficial organisms in farmland  
*Powell W.*

Insect pest and pollinator ecology  
*Williams I.H.*

Identification of a synergistic complex of natural enemies for biocontrol of aphids on cereals  
*Powell W.*

The environmental impact of insect resistance in genetically modified annual and perennial crop plants  
*Kerry B.R.*

Impact of transgenic potatoes expressing lectins against aphids and their parasitoids  
*Poppy G.M.*

Use of buffer zones to protect non-target arthropods  
*Powell W.*

Foraging strategies of generalist and specialist aphid parasitoids: a comparative approach  
*Poppy G.M.*

Farmland ecology of invertebrates and plants  
*Marshall E.J.P.*

Elucidating the changes in plant chemistry induced by aphid feeding and which are involved in plant signalling and attraction of parasitoids  
*Poppy G.M., Dewar A.M.*

Quantification of the effects of pesticides on the population dynamics of beneficial arthropods  
*Powell W.*

#### **Sustainable management of nematodes *Evans K.***

Potential of plant defence mechanisms and disrupting nematode behaviour for nematode control  
*Perry R.N.*

Engineering resistance to potato cyst nematodes  
*Burrows P.R.*

The effect of natural plant compounds on the life cycle of the potato cyst nematode  
*Perry R.N.*

Basis and development of molecular approaches to nematode resistance  
*Burrows P.R.*

Improved estimation of between and within field distribution of potato cyst nematodes and the implications for sampling and management  
*Evans K.*

Cyst and root-knot nematodes in potato land  
*Evans K.*

#### **Invertebrate pathology *Kerry B.R.***

Microbial pathogens in the management of invertebrates  
*Kerry B.R.*

The development of improved control strategies for *Varroa jacobsoni* by integrating research on mite populations and virus epidemiology  
*Ball B.V.*

Mode of action of a microbial nematocide  
*Kerry B.R.*

The integration of biological control in management studies for potato cyst nematodes  
*Crump D.H.*

Biomangement of root-knot nematodes in peri-urban agricultural systems  
*Kerry B.R.*

Immunodiagnosics for monitoring the release of *Phasmarhabditis hermaphrodita*, the slug biological control agent, in the environment  
*Davies K.G.*

Screening pathogens for biocontrol of *Varroa jacobsoni*  
*Ball B.V., Pell J.K.*

Development of an environmentally-benign nematocide based on the exploitation of interactions between rhizosphere bacteria and nematode pests  
*Kerry B.R.*

Sustainable strategy for the management of root-knot nematodes in vegetable crops in Southern Europe  
*Kerry B.R.*

#### **Populations, biodiversity and environmental interactions *Woiod I.P.***

Biodiversity, spatial and temporal population dynamics and long-term fluctuations in insect populations in relation to environmental change, agricultural practice and land use  
*Woiod I.P.*

The dynamics of migrant insects in the agricultural environment  
*Harrington R.*

Gene flow and dispersal in insect populations  
*Harrington R.*

Monitoring and forecasting aphids and virus incidence in sugar beet  
*Harrington R.*

Develop biomathematical methods to measure spatial pattern and non-linear spatio-temporal dynamics of long-term insect and plant data  
*Perry J.N.*

Supervised control of aphids on horticultural brassicas  
*Perry J.N.*

Effects of elevated CO<sub>2</sub> levels on the tritrophic interaction between aphids, their host plants and natural enemies  
*Harrington R.*

Epidemiology of barley yellow dwarf virus in Greece  
*Harrington R.*

Investigation of genetic variation of aphids and parasitoids using genetic markers  
*Loxdale H.D.*

Measurement and simulation of spatio-temporal dynamics in cereal aphids to reduce pesticide inputs  
*Perry J.N.*

Automatic monitoring of the migratory flight of insects over the UK, using a novel radar technique  
*Woiod I.P.*

#### **The molecular and cellular basis of nutrient acquisition and use by plants *Leigh R.A.***

Structure/function relationships of the plant vacuolar H<sup>+</sup>-pumps  
*Gordon-Weeks R.*

Genetic manipulation of nitrogen-use efficiency in wheat  
*Leigh R.A.*

Nutrient ion homeostasis in plant cells: studies with ion-selective microelectrodes  
*Miller A.J.*

Cellular ion homeostasis in plants subjected to salinity stress  
*Laurie S.A.*

Structure/function studies of plant sugar transporters heterologously expressed in *Xenopus* oocytes  
*Miller A.J.*

Molecular genetics of nitrate signalling in *Arabidopsis*  
*Forde B.G.*

Crops self reporting for their nutrient status: a feasibility study  
*Forde B.G.*

Nitrogen allocation in *Arabidopsis* plants overexpressing nitrate transporters  
*Miller A.J.*

Ion-selective microelectrode measurements of ammonium compartmentation in plant cells and functional characterisation of plant ammonium transporters in oocytes  
*Miller A.J.*

Molecular characterisation of genes and proteins involved in sulphate uptake and translocation  
*Hawkesford M.J.*

Diagnosis of sulphur deficiency in oilseed rape and wheat  
*Hawkesford M.J.*

Phosphate and crop productivity: experimental manipulation of mycorrhizal infection in transgenic potatoes  
*Clarkson D.T.*

Molecular markers for defining the response and genetic control of resource allocation of nutrient-stressed wheat roots  
*Clarkson D.T.*

Engineering high quality crops by optimising lysine, methionine and cystine content  
*Hawkesford M.J.*

Evaluation of critical phases of sulphur supply for optimum yield and quality of wheat  
*Hawkesford M.J.*

### **The development and application of plant transformation technology in crop improvement and in basic agricultural research** *Lazzeri P.A.*

Development of improved crop plant transformation methodology and analysis of gene transfer and integration processes  
*Lazzeri P.A.*

The isolation of tissue-specific and developmentally-regulated cereal promoters via marker gene tagging  
*Barcelo P.*

The development of robust and efficient direct gene transfer methods for genetic engineering of UK cereal varieties (Part I)  
*Lazzeri P.A.*

The development of robust and efficient direct gene transfer methods for genetic engineering of UK cereal varieties (Part II)  
*Lazzeri P.A.*

The study of transgene integration, stability and heritability in crop plants transformed by direct gene transfer (Part I)  
*Lazzeri P.A.*

The study of transgene integration, stability and heritability in crop plants transformed by direct gene transfer (Part II)  
*Lazzeri P.A.*

Cassava genetic engineering for virus resistance  
*Lazzeri P.A.*

Improving the quality of EU wheats for use in the food industry: EU EUROWHEAT project  
*Lazzeri P.A.*

Production of insect-resistant wheat by the expression of snowdrop lectin gene  
*Barcelo P.*

Transformation of wheat by *Agrobacterium* co-cultivation  
*Lazzeri P.A.*

Genetic manipulation of cereal (wheat, barley, tritordeum) grain quality  
*Barcelo P.*

Expression patterns of gluten genes in transgenic wheat and their effect on grain processing properties  
*Lazzeri P.A.*

Effect of agriculturally-relevant environmental factors on expressions of wheat lipid biosynthesis genes  
*Lazzeri P.A.*

Sugar-beet crop improvement through genetic manipulation  
*Mutasa E.S.*

### **Regulation of photosynthesis and resource allocation in plants** *Lawlor D.W.*

Recombinant DNA approaches to altering the photorespiratory characteristics of C3 plants  
*Mifflin B.J.*

Photosynthetic rate and metabolic regulation of sunflower, wheat and transgenic tobacco leaves in response to water stress  
*Lawlor D.W.*

Regulation of photosynthetic activity, capacity and mechanisms of winter wheat in response to environmental factors and consequences for source/sink relations  
*Lawlor D.W.*

Compartmentation of metabolic steps in the biosynthesis of 2-carboxyl-D-arabinitol-1 phosphate and consequences for regulation of photosynthetic metabolism  
*Parry M.A.J.*

The role of branched chain sugars in the regulation of photosynthesis  
*Parry M.A.J.*

Investigation of the role of fructose-2,6-bisphosphate in the regulation of carbohydrate partitioning in wheat  
*Parry M.A.J.*

Molecular physiology of photosynthesis and photorespiration and source/sink interactions  
*Paul M.J.*

Control of photorespiration in plant leaves by recombinant DNA technology: effects on plant physiology, agricultural productivity and water-use efficiency.  
*Mifflin B.J.*

Improving wheat model accuracy and suitability for regional impact assessment (IMPETUS)  
*Mitchell R.A.C.*

Improving wheat model accuracy and suitability for regional impact assessment (IMPETUS)  
*Semenov M.A.*

Developing wheat genotypes with reduced nitrogen requirement by manipulation to decrease Rubisco content  
*Mitchell R.A.C.*

### Plant defence metabolism - novel biochemical strategies for sustainable crop protection *Wallsgrave R.M.*

Metabolic detoxification of herbicides and other xenobiotics by plants: the role of transport  
*Coleman J.O.D.*

The function of ABC transporters in plants: an investigation into their physiological role and potential involvement in xenobiotic detoxification  
*Hallahan D.L.*

Biosynthesis of semiochemicals in plants  
*Hallahan D.L.*

Enabling technology for rapid metabolite profiling  
*Hallahan D.L.*

Optimised heterologous expression systems for plant cytochrome P450 enzymes  
*Hallahan D.L.*

Sulphur allocation and utilisation in brassicas  
*Wallsgrave R.M.*

Enzymology and metabolic regulation of glucosinolate biosynthesis in oilseed rape  
*Wallsgrave R.M.*

### Professional computing and electronic services *Harrison G.E.*

Management information systems for the coordination of the Institute research costs  
*Verrier P.J.*

Design and develop computer and electronic integrated systems for the control and monitoring of environments, research experiments and laboratory apparatus  
*LeFevre R.N.*

Systems installation, development and training for the support of Institute research programmes  
*Harrison G.E.*

### Sugar-beet crop protection *Asher M.J.C.*

The development of molecular markers for evaluating disease and stress tolerance in *Beta* germplasm  
*Asher M.J.C.*

Effect of changing crop husbandry on pests and diseases of sugar beet  
*Dewar A.M.*

Epidemiological studies of the interaction between sugar-beet yellowing viruses, their vectors and hosts  
*Smith H.G.*

Evaluating sugar-beet resistance to yellowing viruses  
*Smith H.G.*

Evaluation of rhizomania resistance in sugar beet  
*Asher M.J.C.*

Resistance to *Polymyxa betae* in *Beta* species  
*Asher M.J.C.*

Modelling/forecasting rhizomania disease in the UK  
*Asher M.J.C.*

Recombination risks associated with the use of genetically modified virus tolerant plants  
*Smith H.G.*

Evaluation and enhancement of *Beta* collections for extensification of agricultural production  
*Asher M.J.C.*

Integrated pest management system for sugar beet  
*Dewar A.M.*

Evaluation of *Beta* germplasm for resistance to fungal and virus diseases and tolerance of drought stress  
*Asher M.J.C.*

Biological and genetical control of seedling and late-season soil-borne diseases of sugar beet  
*Asher M.J.C.*

Environmental impact of disease resistance in genetically modified plants  
*Smith H.G.*

Exploitation of new chemistry to develop environmentally-sensitive pest control measures in sugar-beet crop  
*Dewar A.M.*

To assess the effect of chloronicotinyl insecticides against resistant aphids in sugar beet  
*Dewar A.M.*

To assess the effect of a novel insecticide against resistant aphids in sugar beet  
*Dewar A.M.*

### Agronomic and nutritional practices to improve profitability and quality of sugar-beet crops and decrease their environmental impact *Jaggard K.W.*

Precision farming in rotations containing sugar beet  
*Jaggard K.W.*

Drought tolerance in sugar beet  
*Jaggard K.W.*

Coordination of SBREF education programme  
*May M.J.*

Sugar-beet handling and storage losses  
*Jaggard K.W.*

Sugar-beet yield potential in northern and central Europe  
*Pidgeon J.D.*

SBREF attendance at agricultural events/liasion work  
*May M.J.*

Improving drought tolerance in sugar beet  
*Jaggard K.W.*

Control of volunteer potatoes with herbicide mixtures  
*May M.J.*

Tolerance of sugar-beet varieties to fungicides  
*May M.J.*

Control of weeds in sugar beet with new formulations of herbicides  
*May M.J.*

Tolerance of sugar beet to new herbicides  
*May M.J.*

Control of weeds in sugar beet grown with a cover crop  
*May M.J.*

Drought stress in *Beta* spp. (Novartis)  
*Pidgeon J.D.*

Drought stress in *Beta* spp. (KWS)  
*Pidgeon J.D.*

Drought tolerance in sugar beet  
*Jaggard K.W.*

### Soil protection and bioremediation *McGrath S.P.*

Pollution of soils and waters through acidification, eutrophication and the accumulation of organic and inorganic pollutants, and the associated mobilisation of pollutants  
*Goulding K.W.T.*

Effects of inorganic metal salt additions to agricultural soils on soil microbial activity and long-term soil fertility  
*McGrath S.P.*

Effects of sewage sludge applications to agricultural soils on soil microbial activity and the implications for agricultural productivity and long-term soil fertility  
*McGrath S.P.*

Effects of sewage sludge applications to calcareous agricultural soil on soil microbial activity and the implications for agricultural productivity and long-term soil fertility  
*McGrath S.P.*

Assessment of *in situ* bioavailability of heavy metals  
*McGrath S.P.*

Impacts of heavy metals on soil quality with respect to microbiological activity and production of crops  
*McGrath S.P.*

Heavy metal uptake by plants  
*McGrath S.P.*

Statistical and geostatistical study of the National Soil Inventory  
*McGrath S.P.*

Bioremediation in the rhizosphere  
*McGrath S.P.*

Remediation of metal contaminated soils by plants (PHYTOREM)  
*McGrath S.P.*

Effects of inorganic metal salts on soil microbial activity  
*McGrath S.P.*

### Agriculture and water quality *Catt J.A.*

Towards developing an index of phosphorus mobility in agricultural soils  
*Brookes P.C.*

Measure run-off and soil losses, and associated losses of phosphate, other nutrients and pollutants on land liable to erosion  
*Catt J.A.*

Brimstone phase IV: reducing phosphorus losses from arable soils  
*Addiscott T.M.*

Losses of nitrogen as dissolved organic N  
*Goulding K.W.T.*

### Dynamics of nutrients in the soil/crop system *Powelson D.S.*

A fundamental study of the cycling of sulphur in soil-crop systems  
*McGrath S.P.*

The efficiency of different forms of sulphur fertilisers under UK conditions  
*McGrath S.P.*

Changes in land-use and practice: modelling long-term soil organic matter dynamics using SOMNET, a global data network  
*Smith P.*

Diagnosis of sulphur deficiency in oilseed rape and wheat  
*McGrath S. P.*

Development and validation of a model on nitrogen dynamics in soil: short term effects due to straw incorporation  
*Brookes P.C.*

Modelling the turnover of organic carbon in soil, with special attention to arable soils  
*Coleman K.W.*

Soil fertility management for sustainable hillside farming systems in Nepal  
*Gaunt J.L.*

Modelling N mineralisation  
*Gaunt J.L.*

Measuring the contribution of below ground input to mineralisation  
*Gaunt J.L.*

Soil pollution, protection and remediation  
*McGrath S.P.*

Sulphur dynamics in the soil/crop/atmosphere system  
*Zhao F.J.*

Identifying key pools of soil organic matter using physical fractionation, NMR, MS, chromatography and related methods  
*Powelson D.S.*

Attempt to decrease fixation of fertiliser P and enhance biological cycling of P by increased inputs of organic fertiliser  
*Brookes P.C.*

Formation of soil micro-aggregates and their resistance to mechanical breakdown will be studied to discover the significance of drying to aggregate stabilisation  
*Brookes P.C.*

Indices of nitrate losses from arable soils  
*Goulding K.W.T.*

### Nutrient flows in farming systems *Goulding K.W.T.*

Measuring and modelling nitrogen flows and losses in a Cotswold mixed farming system - the Coates Farm Study  
*Goulding K.W.T.*

Nutrient and organic matter cycling as influenced by land management and anthropogenic inputs for sustainable farming systems  
*Poulton P.R.*

Modelling soil organic matter transformations and nitrogen availability in periodically flooded soils  
*Gaunt J.L.*

Investigation of soil fertility and sustainability of floodplain rice systems in Bangladesh  
*Gaunt J.L.*

Optimisation of phosphorus and potassium management within organic farming systems  
*Stockdale E.A.*

Strategies to further reduce N leaching loss from LIFE  
*Webster C.P.*

Nitrogen deposition from the atmosphere and its contribution to nitrate in groundwater in the Lichfield Nitrate Vulnerable Zone  
*Goulding K.W.T.*

Nutrient balancing for farm systems: technology transfer to the industry  
*Goulding K.W.T.*

#### **Decision support for crop nutrient management *Addiscott T.M.***

A system for improved fertiliser recommendations for arable and horticultural crops  
*Brenchley J.L.*

Novel approaches to environmental modelling and risk assessment using concepts derived from statistics, entropy, chaos and complexity theory  
*Addiscott T.M.*

Decision support system to design whole farm rotations that optimise the use of available nitrogen in mixed arable and horticultural systems: on-farm testing  
*Smith J.U.*

An integrated approach to modelling the rate of agricultural pollutants at national scale  
*Mirza N.A.*

Optimising efficiency of nitrogen use across whole farm rotations: mitigation for arable and ley-arable systems  
*Smith J.U.*

Follow-up to system for improved fertiliser recommendations for arable farmers and horticultural growers  
*Smith J.U.*

Scaling crop growth models to predict the environmental impact of agriculture at the landscape and regional level  
*Richter G.M.*

The influence of weather patterns on fertiliser recommendations and risk assessment  
*Smith J.U.*

#### **Soil microbial function and diversity *Hirsch P.R.***

The role of the soil microbial biomass in plant-nutrient cycling, soil organic matter dynamics and maintenance of soil fertility  
*Brookes P.C.*

Biodiversity of bacteria and fungi in soils subjected to different stress, pollution and agricultural inputs: developing improved PCR fingerprinting methods  
*Hirsch P.R.*

Investigating the genetic diversity of root-colonizing fungi and developing genetic transformation systems to facilitate improved monitoring of fungus-plant interactions  
*Hirsch P.R.*

Comparison of microbial gene presence and activity in soil: developing methods to study gene expression using RNA extracted directly from soil  
*Hirsch P.R.*

Genetic interactions between rhizobial inoculants (both genetically modified and non-genetically modified) and native populations of rhizobia in field soil  
*Hirsch P.R.*

#### **Climate and environmental change *Goulding K.W.T.***

Long-term measurement of biological populations and chemical and biological processes in the water, soil, vegetation and atmosphere for the Environmental Change Network  
*Goulding K.W.T.*

UK inventory of nitrous oxide emissions from agriculture  
*Willison T.W.*

The European soil organic matter network (EuroSOMNET)  
*Smith P.*

Modelling agroecosystems under global environmental change (MAGEC)  
*Smith P.*

Low input agriculture and soil sustainability in Eastern Europe (LASSEE)  
*Smith P.*

Assessing drought risks for UK crops under climate change  
*Mitchell R.A.C.*

#### **Biotechnological, chemical and ecological approaches to integrated control of slugs in sustainable arable production systems *Glen D.M.***

Slug population dynamics  
*Glen D.M.*

An applied study of the use of slug-parasitic nematodes for control of slug damage in organic vegetable crops  
*Glen D.M.*

Novel technologies for integrated control of slug damage in key horticultural crops  
*Glen D.M.*

Population biology of slug pests and their natural enemies  
*Glen D.M.*

Integrated control of slugs in organic vegetables  
*Glen D.M.*

#### **Fungicide action, selectivity and resistance *Hollomon D.W.***

Testing novel fungicides  
*Hollomon D.W.*

Novel DNA diagnostic technology in plant disease control  
*Hollomon D.W.*

Fungicide resistance in cereal pathogen populations  
*Hollomon D.W.*

Mode of action of a novel fungicide  
*Hollomon D.W.*

Strategies to maintain the effectiveness of DMI fungicides  
*Hollomon D.W.*



### Biology and control of tropical weeds *Terry P.J.*

Management of herbicide resistant weeds in rice

*Terry P.J.*

Management of *Cyperus* in smallholder farming systems on vertisols and vertic clay soils

*Terry P.J.*

*Striga* resistance in Tanzania

*Terry P.J.*

Provision of services as production system (semi-arid) leader for DFID crop protection programme

*Terry P.J.*

### Sustainable integrated arable farming systems in a changing environment *Jordan V.W.L.*

The integration of mechanical and chemical weed control in winter cereals

*Greaves M.P.*

Evaluation of combined food and energy systems for more efficient land use and environmentally benign sustainable production

*Jordan V.W.L.*

Processes and interactions underlying crop, weed and disease management in less intensive integrated production systems

*Jordan V.W.L.*

Agronomy and environmental implications of cultivation systems: effects on soil substrate, agrochemical and nutrient emissions and crop protection requirements

*Jordan V.W.L.*

Integrated and lower input crop management

*Jordan V.W.L.*

To test alternative wheat models, or their components, with common datasets, in order to determine optimal approach for different applications

*Mitchell R.A.C.*

Preparatory study - quantifying environmental and genetic components of disease escape

*Jordan V.W.L.*

The role of establishment techniques and minimum pass husbandry in reducing the cost per tonne of production

*Jordan V.W.L.*

### Short-rotation coppice for energy and other industrial uses *Royle D.J.*

Partnership willow breeding

*Royle D.J.*

Short-rotation coppice (SRC) willows and their diseases and pests: biodiversity and system studies

*Semenov M.A.*

Integrated crop protection in short-rotation coppice willow production

*Royle D.J.*

### Disease epidemiology and forecasting *Royle D.J.*

Analysing host and pathogen life strategies for understanding and predicting the effects of agricultural practices on disease risk

*Royle D.J.*

### Integrated management of terrestrial and aquatic semi-natural habitats in farming systems *Marshall E.J.P.*

Guidelines for hedge management to improve the conservation value of different types of hedge

*Marshall E.J.P.*

Management of emergent aquatic and riparian vegetation

*Greaves M.P.*

Novel methods of controlling submerged aquatic vegetation and algae

*Greaves M.P.*

Provision of best practice advice on aquatic and riparian vegetation management

*Greaves M.P.*

The potential use of willows and poplars as components of practical buffer zones

*Greaves M.P.*

Development of standard protocols for assessing the toxicity of crop protection products to aquatic macrophytes

*Newman J.R.*

Ecological interactions of field margin, weed and riparian flora and fauna and their spatial dynamics in agricultural landscapes

*Marshall E.J.P.*

Using population genetics to determine species dispersal for managing diversity in fragmented agricultural habitats

*Glen D.M.*

Methods to diversify field margin plant communities

*Marshall E.J.P.*

### Environmental behaviour and efficacy of crop protection compounds *Bromilow R.H.*

Brimstone farm project on the leaching of pesticides to drainage water from a structured clay soil

*Bromilow R.H.*

Measurement of physicochemical properties of organic compounds that influence their environmental behaviour

*Bromilow R.H.*

Principles underlying pesticide persistence and leaching in soils, and their use in expert systems and simulation models

*Bromilow R.H.*

### Chemistry of novel and established pesticides *Khambay B.P.S.*

To examine structure-activity relationships within plant derived pesticides with the aim of developing novel resistance defeating pesticides

*Khambay B.P.S.*

To assess pesticidal activity of extracts of natural flora and fauna and of synthetic analogues

*Denholm A.I.*

To explore the potential of peptidic natural products, and their synthetic analogues, for pest control

*Khambay B.P.S.*

To identify antipest agents for the development of pest control especially against resistant organisms

*Khambay B.P.S.*

Analysis of bioactive plant extracts

*Khambay B.P.S.*

### Evolutionary response of insects to environmental stress

**Devonshire A.L.**

Help overcome or avoid resistance by understanding its biochemistry and molecular genetics

*Devonshire A.L.*

Multidisciplinary study of acetylcholinesterase structure and function

*Devonshire A.L.*

Implications of pesticide resistance for pest management in horticultural crops

*Denholm A.I.*

Monitoring and management of insecticide resistance in *Myzus persicae*

*Denholm A.I.*

A systems approach to sustainable insect pest management in irrigated cotton in India

*Denholm A.I.*

Management of insect pests and viruses of tobacco using ecologically compatible technologies

*Devonshire A.L.*

Combating insecticide resistance in peach potato aphids in the UK

*Foster S. P.*

### The chemical ecology of pests and beneficial species **Pickett J.A.**

Insect behaviour control using semiochemicals

*Pickett J.A.*

Semiochemical-based control of pests and diseases of oilseed rape

*Pickett J.A.*

Identification, biosynthesis and associated molecular genetics of semiochemicals for a new basis of pest and disease regulation

*Pickett J.A.*

Understanding the chemical ecology of pests and beneficial organisms

*Wadhams L.J.*

Role of wild habitat in the invasion of cereal crops by stem-borers, *Chilo partellus*, *Busseola fusca*, in Africa

*Wadhams L.J.*

Improving biological control of thrips and aphids on protected ornamentals

*Wadhams L.J.*

The chemical ecology of pests and beneficial organisms in agricultural and semi-natural ecosystems

*Pye B.J.*

Integrated pest management of aphids on outdoor lettuce crops

*Wadhams L.J.*

Environmental impact of transgenic plants on beneficial insects

*Wadhams L.J.*

Outdoor lettuce: methodologies to develop plant volatiles to manipulate aphid numbers in the field

*Wadhams L.J.*

*Nepeta* species as a non-food, crop-derived feedstock for the production of semiochemicals for aphid control

*Wadhams L. J.*

Production of mosquito oviposition attractant pheromones from the plant *Kochia scoparia*

*Pickett J.A.*

### The molecular basis of interactions between plant pathogens and their hosts **Lucas J.A.**

Isolation and characterisation of pathogenicity genes from the downy mildew *Peronospora parasitica* using phage display and phage antibody approaches

*Bowyer P.*

Isolation and characterisation of pathogenicity genes from the wheat pathogen *Pseudocercospora herpotrichoides* using signature and tagged insertional mutagenesis

*Bowyer P.*

Molecular genetic tools for manipulating pathogenicity/avirulence genes in the cereal fungal pathogens, *Stagonospora nodorum* and *Mycosphaerella graminicola*

*Hargreaves J.A.*

To characterise the molecular nature of adhesion and differentiation of infection structures of fungal pathogens

*O'Connell R.J.*

Rational design of novel fungicides effective against plant pathogens

*Bowyer P.*

Molecular characterisation of appressorium morphogenesis on *Peronospora parasitica* using display antibodies

*Bowyer P.*

Antisense RNA technology for validating fungicide targets in plant pathogenic fungi

*Lucas J.A.*

Isolation and characterisation of fungal genes involved in biotrophy and plant-fungal recognition in the *Colletotrichum lindemuthianum*-bean interaction

*O'Connell R.J.*

Genetic variation in foliar and stem base cereal pathogens

*Lucas J.A.*

Determinants of pathogenicity and host range in plant pathogenic fungi

*Lucas J.A.*

Proteins and enzymes implicated in fungal pathogenicity to plants

*Lucas J.A.*

### Genome diversity **Karp A.**

Investigation of the molecular basis of somaclonal variation in oil palm tissue cultures and regenerants with a view to identifying markers for specific phenotypic abnormalities

*Karp A.*

Development, optimisation and validation of molecular techniques for the measurement, characterisation, evaluation and accessing of biodiversity

*Karp A.*

Molecular markers for genebanks: application of marker technology for the improvement of *ex situ* germplasm conservation methodology

*Karp A.*

Use of molecular genetics in understanding the population biology of key species in arable systems

*Karp A.*

### Decision systems technologies and development **Verrier P.J.**

Design and develop a software framework suitable for the construction of arable crop decision support systems

*Verrier P.J.*

Enabling technologies for decision support systems  
*Verrier P.J.*

Decision support systems shell with specific DSS for fungicide application to winter wheat  
*Verrier P.J.*

Animated simulation of wheat growth  
*Verrier P.J.*

ERA database of cereal pathology data  
*Verrier P.J.*

### **The development, structure and composition of seeds and other plant storage organs in relation to end use quality** *Shewry P.R.*

Wheat gluten proteins: their characterisation and role in determining the functional properties and end use quality of wheat  
*Tatham A.S.*

Mechanisms of protein synthesis, processing, targeting and deposition in plant cells  
*Napier J.A.*

Analysis and manipulation of the protein and oil compositions of oilseeds  
*Shewry P.R.*

Exploring and improving the functional properties of wheat gluten using protein engineering and transgenic wheat plants  
*Shewry P.R.*

The structure, targeting and molecular interactions of sunflower oleosins in relation to oil body structure and biogenesis  
*Shewry P.R.*

Structural and biochemical components of barley endosperm which influence malting quality  
*Shewry P.R.*

The rheology and structure of wheat gluten protein  
*Tatham A.S.*

Monoclonal antibody tests for wheat quality  
*Tatham A.S.*

Improving the quality of EU wheats for use in the food industry  
*Shewry P.R.*

Improving the functional properties of durum wheat by transformation  
*Shewry P.R.*

Structural and rheological determinants of gas cell expansion in baked product doughs  
*Tatham A.S.*

Isolation of DNAs for novel fatty acid desaturase enzymes and their use to manipulate fatty acid and triglycerol composition in transgenic plants  
*Napier J.A.*

Structural and biochemical components of barley endosperm which influence its raw quality for malting  
*Shewry P.R.*

### **Crop Genetics** *Edwards K.J.*

A generalised system for the rapid and inexpensive determination of the genetic function of ESTs: use in the analysis of maize embryogenesis  
*Edwards K.J.*

Development of brassica microsatellite markers for use in fingerprinting and mapping  
*Edwards K.J.*

Map based cloning of agronomically important genes directly from *Zea mays*  
*Edwards K.J.*

Analysing the function of existing and novel genetic promoters for tissue specific expression of transgenes in *Zea mays* (ZEROPA)  
*Edwards K.J.*

Development of the tools required to dissect large plant genomes and their application to a complex region of the maize genome linked to a disease resistant super locus  
*Edwards K.B.*

Determining the genetic function of conserved plant expressed sequence tags using a maize mutator grid  
*Holdsworth M.J.*

Development of a non-gel-based high throughput genotyping assay using previously characterised single locus microsatellite markers  
*Edwards K.J.*

Random sequencing of mutator tagged fragments  
*Edwards K.J.*

Enabling technologies for physical and functional genomics in crops of agricultural importance  
*Edwards K.J.*

### **Root development and responses to environmental stress** *Barlow P.W.*

Molecular analysis of *COW1*, a regulator of cell shape in plants and genetic analysis of root hair development in *Arabidopsis thaliana*  
*Grierson C.S.*

Experimental investigations into the controls of growth, development and morphogenesis of primary and secondary plant tissues, particularly as affected by the cytoskeleton  
*Barlow P.W.*

Molecular analysis of *TIP2*: a gene that controls cell shape in root hairs and pollen tubes of *Arabidopsis*  
*Grierson C.S.*

Rice for life: seeking a physiological and molecular basis for improving submergence in rainfed lowland rice  
*Jackson M.B.*

A study of anti-transpirant activity in xylem sap of flooded plants  
*Jackson M.B.*

Adaptive responses of plant root and shoot systems to environmental stress  
*Jackson M.B.*

Wood formation processes: the key to improvement of the raw material  
*Barlow P.W.*

### **Integration of cellular responses** *Hooley R.*

Biomolecular design and perception of plant signalling compounds  
*Hooley R.*

Dissection and manipulation of signal transduction pathways mediating metabolic regulation of gene expression in plant storage organs  
*Halford N.G.*



DNA-protein interactions in an alpha-amylase gene transcription complex  
*Huttly A.K.*

Intracellular signalling in aleurone cells  
*Hooley R.*

Hormones and Plant Development Initiative  
*Hooley R.*

Regulation of plant development through gibberellin signal transduction  
*Hooley R.*

Functional analysis of a higher plant G protein-coupled receptor  
*Hooley R.*

Genetic regulation of sink strength in wheat and potato - GRiSSt  
*Halford N.G.*

#### **Developmental events during seed maturation *Lenton J.R.***

How does ABI3 regulate the transition to embryo dormancy in *Arabidopsis thaliana*?  
*Holdsworth M.J.*

Molecular mechanisms regulating seed dormancy and embryogenesis  
*Holdsworth M.J.*

Fracture of oilseed rape pods  
*Child R.D.*

Characterisation of genes controlling pre-harvest sprouting in wheat and their manipulation in transgenic plants  
*Holdsworth M.J.*

Engineering shatter resistance into oilseed rape  
*Child R.D.*

Malting quality of barley  
*Lenton J.R.*

Genetic improvement of oilseed rape for increased resistance to pod shatter  
*Child R.D.*

Genetic improvement of oilseed rape pods to reduce susceptibility to shatter  
*Child R.D.*

Regulation and genetic manipulation of pre- and post-harvest sprouting in cereals  
*Lenton J.R.*

#### **Regulation of plant development through gibberellin biosynthesis *Hedden P.***

Structure and function of gibberellin-biosynthetic enzymes  
*Hedden P.*

Cloning and expression of genes involved in gibberellin biosynthesis  
*Phillips A.L.*

Regulation and genetic manipulation of gibberellin biosynthesis  
*Lenton J.R.*

Molecular dissection of the feedback mechanism in gibberellin biosynthesis  
*Hedden P.*

Elucidating and manipulating bolting and flowering mechanisms in sugar beet  
*Van Roggen P.M.*

#### **Chemical, biological and technological approaches to optimising agrochemical performance and weed control *Holloway P.J.***

Predicting the potential of adjuvants to affect pesticide residue levels in crops  
*Holloway P.J.*

Bioherbicides: strategies for their development and use  
*Greaves M.P.*

Rational usage of adjuvants for improving the safety and efficiency of pesticide spray delivery  
*Holloway P.J.*

Spraying characteristics for more efficient agrochemical performance  
*Holloway P.J.*

New applications for polymers in optimising the performance of foliage-applied formulations of agrochemicals  
*Holloway P.J.*

Herbicide studies  
*Glen D.M.*

Optimising biological control of a dominant weed in major crops  
*Greaves M.P.*