

Plant Breeding

Group members located in the major horticultural regions of New Zealand breed new or improved fruit crops and rootstocks using both traditional methods and newer technologies such as gene mapping. The primary focus of the breeding group is to provide a continuing supply of novel and improved cultivars to enhance the performance of New Zealand's fruit industries, and to provide consumers with a variety of flavoursome, healthy fruit products. Better quality, yield, climatic adaptation and resistance to pests and diseases are being achieved through the kiwifruit, pipfruit, summerfruit, berryfruit, citrus and hops breeding programmes.

The group is using improved techniques to screen for disease resistance as well as breeding disease-resistant and size-controlling rootstocks. It is also developing methods to fingerprint apple cultivars using isoenzymes and DNA markers and is involved in genetic studies in *Actinidia*. Maintaining and updating germplasm collections is a key component of the plant breeding activity.

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Science Capability Leader	
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Alspach, P; Bus, V (1997): Incidence of woolly apple aphid in a genetically diverse apple planting. *Conference book / Biodiversity now*, 1997:15

Beatson, RA; Inglis, TE (1999): Development of aroma hop cultivars in New Zealand. *Journal of the Institute of Brewing*, 105:382-385

Brewer, L; Alspach, P; White, A (2000): Variation on the susceptibility of pear seedlings to damage by the larvae of the sawfly (*Caliroa cerasi*). *Abstracts / International symposium on pear*, VIII:180-181

Broom, FD; Mowat, AD; Poole, PR; Miller, SA (2000): The influence of canopy management on visible-near infrared spectral properties of kiwifruit berries. *Acta horticultrae*, 515:227-229

Bus, V (1999a): Disease resistant cultivars: progress and sustainability. *Nelson Research Centre pipfruit field day*, 1999:13-14

Bus, V (1999b): Trial for resistance in apples. *The Orchardist*, 72(6):27

Bus, V; Bradley, S; Hofstee, M; Alspach, P; Brewer, L; Luby, J (2000): Increasing genetic diversity in apple breeding to improve the durability of pest and disease resistance. *Acta horticultrae*, 538:185-190

Bus, V; Plummer, K; Rikkerink, E; Luby, J (2000): Evaluation of the pathogenicity of two scab isolates derived from the Vf-resistant apple cultivar 'Baujade'. *IOBC WPRS bulletin*, 23(12):231-237

Bus, V; Ranatunga, C; Gardiner, S; Bassett, H; Rikkerink, E (2000): Marker assisted selection for pest and disease resistance in the New Zealand apple breeding programme. *Acta horticultrae*, 538:541-547

Cashmore, W; Ferguson, R; Glucina, P; MacKenzie, A; McNeilage, M; Muggleston, S; Martin, P; Patterson, K; Richardson, A; Snelgar, B; Stowell, B; McKenna, C; Manning, M; Pak, H; Burdon, J; Lallu, N; Stowell, BE; Percy, HE. (2001). Coltivazione della varietà di Actinidia 'Hort16A' in Nuova Zelanda. Palmerston North : Horticulture and Food Research Institute of New Zealand



Brown rot research in Italy

Experience gained on an Italian project may help us develop brown rot tolerant peaches and nectarines in New Zealand. For 10 weeks a member of our plant breeding team managed a project looking at brown rot susceptibility/resistance in a 'Contender x Elegant Lady' seedling population near Bologna.

Previous work had shown it was possible to discriminate between highly and less susceptible genotypes using tolerance segregation, following the artificial inoculation of *Monilia laxa* on to unwounded ripe fruit from progeny of a tolerant/susceptible cross. Over a period of six weeks, 53 seedlings and eight commercial cultivars were inoculated and assessed. This work incorporated taking skin thickness measurements looking for morphological markers to resistance.

The tests were run as part of an Italian project aimed at breeding nectarines and peaches more tolerant to brown rot.

Project leader: Nicola Hall, Hawke's Bay

Capability leader: Dr Pauline Mooney, Kerikeri

Funded by: Heinz Wattie; Summerfruit NZ; Hawke's Bay Fruit Growers

Currie, AJ; Ganesanandam, S; Noiton, DA; Garrick, D; Shelbourne, CJA; Oraguzie, N (2000): Quantitative evaluation of apple (*Malus x domestica* Borkh.) fruit shape by principal component analysis of Fourier descriptors. *Euphytica*, 111:219-227

Dawson, T; Mooney, P (2000a): CTV preimmunization of citrus trees. *Annual conference / New Zealand Citrus Growers Incorporated*, 2000:5 pp

Dawson, TE; Mooney, PA (2000b): Evidence for trifoliolate resistance breaking isolates of citrus tristeza virus in New Zealand. *Proceedings of the conference / International Organization of Citrus Virologists*, 14th:69-76

Drazeta, L; Lang, S; Hall, A; Volz, R; Jameson, PE (2000): Seed set and the development of fruit shape in apple. *Special publication / Agronomy Society of New Zealand*, 12:99-101

Drazeta, L; Lang, S; Jameson, P; Volz, R (1999): Seed effects on xylem development in apple. *Proceedings / New Zealand Institute of Agricultural*

- Science and the New Zealand Society for Horticultural Science annual convention, 1999:42
- Drazeta, L; Lang, S; Volz, R; Jameson, PE (2000): Seasonal changes in the functionality of the xylem vasculature of 'Granny Smith' and 'Braeburn' apples. *Proceedings / New Zealand Institute of Agricultural Science and the New Zealand Society for Horticultural Science annual convention*, 2000:67-68
- Elgar, HJ; Burmeister, DM; Volz, RK; Marsh, KB; Watkins, CB; Brookfield, PL; Rose, KJ (1996): Preharvest and postharvest effects on a browning disorder in 'Braeburn' apple. *Conference handbook / PH'96 International postharvest science conference*, 1996:157
- Ferguson, AR (2000): Joseph Pierre Buc'hoz. *New Zealand garden journal*, 3(2):12-14
- Ferguson, AR; McNeilage, MA. (1999). Germplasm for *Actinidia* breeding in Andrews, S; Leslie, AC; Alexander, C (eds.), Taxonomy of cultivated plants: third international symposium. p. 481. Kew : Royal Botanic Gardens
- Ferguson, R (2001): The legacy of Hayward Wright. *The Orchardist*, 74(4):34-35
- Ferguson, R; Lowe, R; McNeilage, M; Marsh, H (1999): "Hort16A": un nuovo kiwi a polpa gialla dalla Nuova Zelanda. *Rivista di frutticoltura*, 61(12):24-29
- Gardiner, S; Bassett, H; Murdoch, J; Meech, S; Cook, M; Bus, V; Ranatunga, C; De Silva, N; Rikkerink, E (2001): Major pest and disease resistance loci in apple available to breeders. *Abstracts / Plant & animal genome IX*, 2001:194
- Gardiner, SE; Bus, VB; Bassett, HCM; Rikkerink, EHA; Forster, RLS (1999): Molecular markers linked to 8 major gene resistances to black spot, powdery mildew, and woolly apple aphid in apple. *Programme / Symposium of the Federation of Asian and Oceanic Biochemists and Molecular Biologists in conjunction with the annual meeting of the New Zealand Society for Biochemistry and Molecular Biology*, 14th:15
- Hall, HK; Daubeny, HA (1999): Introduced germplasm in the New Zealand raspberry industry and breeding programme. *Acta horticulturae*, 505:59-63
- Hall, HK; Stephens, MJ (1999a): Fruit firmness in raspberries. *Acta horticulturae*, 505:93-99
- Hall, HK; Stephens, MJ (1999b): Hybridberries and blackberries in New Zealand - breeding for spinelessness. *Acta horticulturae*, 505:65-71
- Hofstee, ME; Malone, M; Howard, C (1999): Apricot breeding in New Zealand. *Acta horticulturae*, 488:171-172
- Huang, H; Ferguson, AR (2001): Review : Kiwifruit in China. *New Zealand journal of crop and horticultural science*, 29:1-14
- Khanizadeh, S; Prasher, SO; Hall, HK (1999): PGRIS: PEDIGREE[®], a genetic resource inventory system. *Acta horticulturae*, 505:283-287
- Langford, G. (1994). Berryfruit variety descriptions. Christchurch : New Zealand Berryfruit Propagators Ltd
- Langford, G; Snelling, C (2001a): Berry notes : 30 years of service. *The Grower*, 56(2):62
- Langford, G; Snelling, C (2001b): Berry notes : growing for taste. *The Grower*, 56(5):44
- Langford, G; Snelling, C (2001c): Berry notes : strawberry varieties. *The Grower*, 56(3):49
- Langford, G; Snelling, C (2001d): Berry notes : the down side of tightening biosecurity. *The Grower*, 56(4):42
- Langford, G; Snelling, C (2001e): Berry notes : western flower thrips. *The Grower*, 56(1):44
- Langford, G; Snelling, C (2000a): Berry notes. *Commercial grower*, 55(2):50
- Langford, G; Snelling, C (2000b): Berry notes. *Commercial grower*, 55(10):51
- Langford, G; Snelling, C (2000c): Berry notes : growing better strawberries. *Commercial grower*, 55(11):55-56
- Langford, G; Snelling, C (2000d): Berry notes : millennium bugs. *Commercial grower*, 55(1):41
- Langford, G; Snelling, C (2000e): Berry notes : new varieties : hybridberries/blackberries. *Commercial grower*, 55(3):44
- Langford, G; Snelling, C (2000f): Berry notes : strawberry diseases. *Commercial grower*, 55(9):51-52
- Langford, G; Snelling, C (2000g): Berry notes : sustainable production systems. *Commercial grower*, 55(5):45
- Langford, G; Snelling, C (2000h): Berry notes : the knowledge economy. *Commercial grower*, 55(4):53
- Langford, G; Snelling, C (2000i): Berry notes : winter chilling (or the lack of it). *Commercial grower*, 55(7):56,58
- Langford, G; Snelling, C (1999a): Berry notes : 10th Australian berryfruit conference. *Commercial grower*, 54(6):41-42
- Langford, G; Snelling, C (1999b): Berry notes : constant incremental improvement. *Commercial grower*, 54(10):44
- Langford, G; Snelling, C (1999c): Berry notes : growing berries in 2010. *Commercial grower*, 54(7):42
- Langford, G; Snelling, C (1999d): Berry notes : soil monitoring. *Commercial grower*, 54(8):39
- Langford, G; Snelling, C (1999e): Berry notes : water quality. *Commercial grower*, 54(9):45
- Luby, J; Forsline, P; Aldwinckle, H; Bus, V; Geibel, M (2001): Silk Road apples - collection, evaluation, and utilization of *Malus sieversii* from Central Asia. *HortScience*, 36:225-231
- Machin, T; Sutton, P; Anderson, P; Hackett, B; Mooney, P (1999): Satsuma mandarin rootstock trial - an update. *The Orchardist*, 72(11):64-66
- Marsh, H; McNeilage, M; Gordon, I (1999): Breeding value of parents in kiwifruit (*Actinidia deliciosa*). *Acta horticulturae*, 498:85-92
- McGregor, GR; Hall, HK; Langford, GI (eds.). (1999). Proceedings of the Seventh International Rubus-Ribes Symposium. Leuven : ISHS Fruit Section International Working Group on Rubus and Ribes. (Acta horticulturae, Vol. 505)
- Miller, S; Broom, F; Meekings, J (1999): Canopy management in Hort 16A. *Kiwifruit technical updating seminar*, 1999:41-45
- Miller, SA; Broom, FD; Mowat, AD (1999): Canopy effects on flesh colour in *Actinidia chinensis*. *Proceedings / New Zealand Institute of Agricultural Science and the New Zealand Society for Horticultural Science annual convention*, 1999:39
- Miller, SA; Henzell, RF (2000): Seed germination of weeds from New Zealand native plant communities. *Special publication / Agronomy Society of New Zealand*, 12:115-116
- Miller, S; Minchin, P (2000): Kiwifruit canopy management : have you seen the light? *Kiwifruit: NZ kiwifruit journal*, 137:18-20
- Mooney, PA; Dawson, TE; Niblett, CL (2000): Comparison of the coat protein gene sequences of citrus tristeza virus isolates in New Zealand. *Proceedings of the conference / International Organization of Citrus Virologists*, 14th:28-33
- Mooney, P; Richardson, AC; Marsh, KB (2000): Applications of biotechnology to cultivar improvement in New Zealand. *Acta horticulturae*, 535:207-212
- Mowat, A; Miller, S; Broom, F; Edwards, C (1999): Spatial patterns in the visible-near infrared spectral properties of *Actinidia chinensis* Planch. fruit. *Proceedings / New Zealand Institute of Agricultural Science and the New Zealand Society for Horticultural Science annual convention*, 1999:39
- Nandini, AV; Murray, BG; O'Brien, IEW; Hammett, KRW (1997): Intra- and interspecific variation in genome size in *Lathyrus* (Leguminosae). *Botanical journal of the Linnean Society*, 125:359-366
- Oraguzie, N (2000): Recent advances in pipfruit breeding and genetics. *The Orchardist*, 73(5):24-25
- Oraguzie, NC; Currie, A (2000): Assessment of genotype x environment interaction in an apple breeding population. *Proceedings / New Zealand Institute of Agricultural Science and the New Zealand Society for Horticultural Science annual convention*, 2000:79
- Oraguzie, NC; Gardiner, SE; Basset, HCM; Stefanati, M; Ball, RD; Bus, VGM; White, AG (2001): Genetic diversity and relationships in *Malus sp.* germplasm collections as determined by randomly amplified polymorphic DNA. *Journal of the American Society for Horticultural Science*, 126:318-328
- Oraguzie, NC; Hofstee, ME; Alspach, PA; Brewer, LR; Howard, C (2000): Quantitative genetic studies in a recurrent selection program in apple. *Acta horticulturae*, 538:191-195
- Oraguzie, NC; Hofstee, ME; Brewer, LR; Howard, C (2001): Estimation of genetic parameters in a recurrent selection program in apple. *Euphytica*, 118:29-37

- Oraguzie, NC; Hofstee, M; Rako, A (1999): Morphological patterns of diversity and relationships in exotic germplasm of apple. *Proceedings / New Zealand Institute of Agricultural Science and the New Zealand Society for Horticultural Science annual convention*, 1999:61-62
- Pearson, MN; Aftab, M; Mooney, P (1998): Properties and incidence of a previously unreported seedborne filamentous virus infecting citrus in New Zealand. *Offered papers abstracts / International congress of plant pathology*, 7th:3.7.8
- Richardson, K; Wu, J; White, D; Morris, B (1998): Transformation of perennial ryegrass (*Lolium perenne* L.) via microprojectile bombardment of immature inflorescences. *Proceedings / Asia Pacific conference on agricultural biotechnology*, 4th:129-131
- Richardson, K; Wu, J; White, D; Morris, B (1997): Developments toward establishing a transformation system for perennial ryegrass (*Lolium perenne* L.). *Abstracts / Biennial conference of the New Zealand branch of the International Association for Plant Tissue Culture*, 12th:52
- Rikkerink, E; Plummer, K; Bus, V; Gardiner, S (2000): Apple: applying lessons learned from deploying resistance genes in annuals to a deciduous perennial crop. *Book of abstracts / Durable resistance symposium*, 2000:98
- Ryan, SN; Ross, GS; Volz, RK; Ferguson, IB (1996): Genetic control of calcium levels in apple. *Conference handbook / PH'96 International postharvest science conference*, 1996:154
- Seal, A (2000): Using gene technology in kiwifruit breeding. *Kiwifruit: NZ kiwifruit journal*, 139:17
- Seal, A (1999a): Kiwifruit in the new millennium. *New Zealand kiwifruit journal*, 135:14-15
- Seal, A (1999b): The use of gene technology in developing new kiwifruit varieties. *Kiwifruit technical updating seminar*, 1999:30-31
- Seleznayova, A; Broom, F; Miller, S; Thorp, G; Greaves, T (1999): Quantifying kiwifruit architecture with AMAPmod. *Proceedings / New Zealand Institute of Agricultural Science and the New Zealand Society for Horticultural Science annual convention*, 1999:29
- Stanley, CJ; Harris-Virgin, PM; Morgan, CGT; Snowball, AM (1999): Boysenberry primocane management for improved productivity. *Acta horticultrae*, 505:79-86
- Stanley, J; Alspach, P (1999): New Zealand olives: turning flowers into fruit. *Proceedings / New Zealand Institute of Agricultural Science and the New Zealand Society for Horticultural Science annual convention*, 1999:33
- Stanley, J; Buxton, R; Alspach, P; Morgan, C; Martindale, D; Sarosa, W (2000a): Developing optimum strategies for rehabilitating overburden stockpiles at the Grasberg mine, Irian Jaya, Indonesia. *Proceedings / International peat congress*, 11th:806-814
- Stanley, J; Buxton, R; Alspach, P; Morgan, C; Martindale, D; Sarosa, W (2000b): A different approach to high altitude revegetation: establishing mosses on the Grasberg overburden, Irian Jaya. *Proceedings / High altitude revegetation workshop*, 14th:238-242
- Stanley, J; Buxton, R; Alspach, P; Morgan, C; Martindale, D; Sarosa, W (2000c): A different approach to high altitude revegetation: establishing mosses on the Grasberg overburden, Irian Jaya. *Proceedings / New Zealand Institute of Agricultural Science and the New Zealand Society for Horticultural Science annual convention*, 2000:77-78
- Stanley, J; Morgan, C; Alspach, P; Stokes, J-A (1997): Climatic effects on *Sphagnum* wetland dynamics. *Conference book / Biodiversity now*, 1997:77
- Stowell, B (1999): Hort 16A - a review of the 1998/99 season. *Kiwifruit technical updating seminar*, 1999:46-47
- Stowell, B; Martin, P; Patterson, K (1999): Influence of Kaimai rootstocks on Hort 16A. *Kiwifruit technical updating seminar*, 1999:52-54
- Sutton, P; Hackett, B; Dawson, T; Mooney, P (1999): Kerikeri report: New Zealand citrus budwood scheme: the 1999 update. *The Orchardist*, 72(10):64-65
- Thomas, W; Snelling, C (1999): New boysenberry pest: raspberry sawfly. *Commercial grower*, 54(6):42
- Thorp, G; Barnett, A; Miller, S (1999): Kiwifruit pruning systems. *Kiwifruit technical updating seminar*, 1999:9-12
- Volz, RK; Ferguson, IB (1999): Flower thinning method affects mineral composition of 'Braeburn' and 'Fiesta' apple fruit. *Journal of horticultural science & biotechnology*, 74:452-457
- Volz, RK; Ferguson, IB (1996): Cropping and storage disorders in apple. *Conference handbook / PH'96 International postharvest science conference*, 1996:59
- Walter, M; Boyd-Wilson, KSH; Harris-Virgin, T; Morgan, C; Stanley, J (2000): Garden floor management for control of *Botrytis cinerea* in boysenberry. *International botrytis symposium*, XIIth:L22
- Weskett, R (2000): Selections for the new variety display and tasting. *Pipfruit technical updating seminar / HortResearch*, 2000:41
- White, AG; Alspach, PA; Weskett, RH; Brewer, LR (2000): Heritability of fruit shape in pears. *Euphytica*, 112:1-7
- White, AG; Brewer, L (2000): The pear breeding project in New Zealand. *Abstracts / International symposium on pear*, VIII:62
- White, A; Brewer, L (1999): Prospective new pipfruit varieties. *Nelson Research Centre pipfruit field day*, 1999:12
- White, A; Brewer, L (1998): New varieties of apples and pears. *Nelson Research Centre pipfruit field day*, 1998:7
- White, AG; Brewer, LR; Alspach, PA (2000): Heritability of fruit characteristics in pears. *Acta horticultrae*, 538:331-337

Database aids flavour genetics work

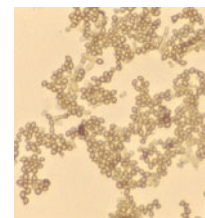
A Compounds Database has been established to hold all the data gathered by our scientists working on the *Actinidia* germplasm collection. It is used for molecular investigations into genes, markers, pathways and regulatory systems, and to direct breeding protocols, genetics experiments and germplasm acquisitions. It is most useful for our studies into how preharvest and postharvest conditions affect the development of positive and negative flavour components in kiwifruit.

Scientists at Mt Albert, Ruakura, Te Puke, Palmerston North and Nelson Research Centres are systematically evaluating the *Actinidia* germplasm collection and particular breeding lines and experimental populations using three sets of procedures. Objective sensory analyses provide linear scale measurements of intensities of flavour components against reference standards and descriptive comments, which build a standard lexicon of descriptors. Subjective sensory analyses rate samples for acceptability and liking. Chemical analyses identify and quantify individual sugars, acids and volatile compounds and determine which of the large numbers of compounds measured have positive, negative or neutral impact on flavour.

Project leader: Dr Mark McNeilage, Mt Albert

Capability leader: Dr Pauline Mooney, Kerikeri

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Wood, GA; Andersen, MT; Forster, RLS; Braithwaite, M; Hall, HK (1999): History of Boysenberry and Youngberry in New Zealand in relation to their problems with Boysenberry decline, the association of a fungal pathogen, and possibly a phytoplasma, with this disease. *New Zealand journal of crop and horticultural science*, 27:281-295

Yao, J-L; Wu, J-H; Morris, B (1995): Transgenic citrus produced following particle bombardment of embryogenic cell lines. *Abstracts / Biennial conference of the New Zealand branch of the International Association for Plant Tissue Culture*, 1995:[1p.]