GLOBAL INITIATIVE ON LATE BLIGHT

Newsletter December, 2003 - No. 21

New Genomics and Biodiversity Project for Smallholder Potato Farmers

The International Potato Center (CIP) in Peru, Max Planck Institute for Plant Breeding Research (MPIZ), Germany and previous INCO-PAPA partners (See GILB Newsletters No. 7, 11, 12, 20) including the University of Tübingen in Germany, PROINPA (Foundation for the Promotion and Research of Andean Products) in Bolivia, Universidad Nacional de Colombia, Colombia, and Instituto Nacional de Investigaciones Agropecuarias (INIAP), Ecuador, along with the Instituto de Biotecnología, Universidad Nacional Agraria La Molina, Peru, will collaborate in a three year project entitled *Genomics and Biodiversity: Providing New Opportunities for Smallholder Potato Farmers*. Funding is provided by the German Federal Ministry for Economic Cooperation and Development (BMZ).

The project aims to significantly improve income, food security, human health, and environmental well being by providing resource-poor farmers with diverse, marketable potato varieties with a broad genetic background and resistance to potato late blight and Potato Virus Y. In the Andes, the potato is one of the few commodities that farmers can use to generate cash income, albeit at a high price to the environment and human health. While traditional producers often grow hundreds of varieties for home consumption or barter, only a handful of cultivars are available that meet the standards of emerging markets and commercial processors. Of these few, all require repeated applications of pesticides. The availability of diverse, marketable varieties with a broad genetic background, is expected to buffer farmers against the threats posed by new disease variants, help stabilize prices, reduce chemical use, encourage trade, and contribute to genetic conservation in farmers' fields.

The project will build upon the INCO-PAPA project's and CIP's efforts to exploit the biodiversity of potato genetic resources to improve late blight resistance and will also respond to the request by national program scientists for assistance in using molecular tools that permit further exploitation of enhanced germplasm. Project scientists will utilize measures ranging from genomics to participatory research and economic impact assessment, to incorporate needed biodiversity into resilient varieties and production systems. Activities will include the generation and evaluation of interspecific hybrids, assessment of diversity with neutral and gene-based markers, genetic and association mapping using manual and automatic high-throughput genotyping, analysis of gene expression, focus group research in markets, and participatory selection of new varieties in farmer-led field trials.

The project partners will stimulate the exchange and evaluation of pre-bred hybrids and place them in a coherent utilization scheme that identifies complementary sources of genetic resistance. Participatory evaluation, focus groups and market studies will convene the early collaboration of researchers, farmers, processors, merchants, and consumers to assess improved germplasm and foster learning about each others' expectations for and perceptions of new varieties. The project will provide national programs with advanced tools to utilize the diversity held in genebanks and reduce the time required to develop robust, farmer-ready varieties from native genetic resources. The evaluation and sustainable utilization of genetic resources to develop such varieties will

GILB Steering Committee Chairman to speak at WPC 2004

GILB Steering Committee Chairman, H W (Bud) Platt, will give a presentation on Global Initiatives in Late Blight at the World Potato Congress and Trade and Technology Show to be held 20–25 April 2004 in Kunming, Yunnan Province, China. For information about WPC 2004 see Potato Meetings (page 7).

New Award for Latin American Plant Pathologists

The APS Foundation, in furthering the goals of the French-Monar Latin American Fund, is accepting applications for five group membership awards for plant pathologists working in Latin American countries. The awards consist of free group membership and free access to the electronic versions of the APS journals. The guidelines and very simple criteria for the awards are available at www.apsnet.org/foundation/FrenchMonar.asp. Questions should be directed to George Agrios, Email: gna@ifas.ufl.edu.

also assist partner countries fulfill their commitments under the international Convention on Biological Diversity.

Merideth Bonierbale and Marc Ghislain, International Potato Center, Lima, Peru
Email: m.bonierbale@cgiar.org; m.ghislain@cgiar.org

The Netherlands Initiative on Late Blight (NILB)

Problem

Production of potatoes is of prime agricultural importance in the Netherlands. Late blight, caused by the oomycete *Phytophthora infestans* is the most important threat to this crop. Control of the disease is only possible by abundant use of fungicides, which use amounts to more than 50% of all fungicides used in The Netherlands. For more than a century the *Phytophthora* population was rather uniform and control was possible by integrated crop protection in combination with more or less resistant potato cultivars. However, due to the importation of infected potato material, the *Phytophtora* population has changed during the last 20 years, becoming more aggressive, producing persistent oospores, and showing more genetic variability, thus enabling adaptation to the present resistant cultivars. The increased aggressiveness, the decrease of resistance and, consequently, the large input of fungicides form a threat to sustainable potato culture in The Netherlands. This threat has led to the Netherlands Initiative on Late Blight (NILB), 2003–2012.

Aim

The aim of NILB is to reduce the use of fungicides to control *P. infestans* in potato by 75% in 2012 by three strategies. Firstly, to integrate all present and new research in the Netherlands and to focus all projects on this 2012 aim. Secondly, to hand over the steering of all research to a board of representatives from the potato sector to ensure commitment to and application of the results of all short term and long term research. Thirdly, to combine the three parties — research (Wageningen UR), policy (Ministry of Agriculture) and potato sector — in NILB to ensure that each party takes its responsibility for reaching the 2012 aim.

Integrated Research

All research is brought together in six themes that form a highly integrated program (see Fig.1).

Theme 1: *Phytophthora* Toolbox

Within the Toolbox results from the other five themes will be translated into practical solutions resulting in an integrated control strategy for *P. infestans* with a minimal input of fungicides. The strategy will have to be adapted to the specific Dutch conditions regarding crop intensity, varieties, pathogen population, pathogen epidemiology, available fungicides, effectiveness of fungicides during the growth cycle, and weather conditions. Integrated practical knowledge will be generated by experimental applied research, on-farm research using different farming systems and by evaluation of farmers' results after applying the new knowledge.

Theme 2: Population Biology

High levels of genetic variation mark *P. infestans* populations in the Netherlands, which may be associated with the presence of sexual reproduction by means of oospores in diseased crops. This theme is aimed at generating knowledge on functional variation in *P. infestans* that can be used to improve late blight management strategies and risk assessments. Research topics are monitoring the various sources of early infections and of specific virulence and genetic diversity, risk assessment of future introduction of new *Phytophthora* pathogens in Europe from the Andean highlands, evaluation of epidemic fitness components, and studies on mutation rates in *P. infestans* that lead to fungicide resistance.

Theme 3: Epidemiology

This theme aims to contribute to improved, reliable, year round control strategies through additional (quantitative) insight in the potato late blight disease cycle and epidemic build up. Projects focus on reduction of tuber-born primary inoculum, improved estimates for disease pressure as related to timing and input of chemical control measures, improving yield and yield quality of organic potato by advancing yield formation and increasing the partial resistance level through agronomic measures and physiological optimization of seed tubers. Prototype control measures are evaluated in a practical context in the theme 'toolbox'.

Theme 4: New sources for resistance

Development of durable disease resistant potato varieties is the most effective way to control late blight. The major resistance genes in the current potato varieties are no longer effective against *Phytophthora*. In this theme an elaborate and systematic search for new genes is performed in some hundred wild species, related to potato. Whenever new major resistance genes are found, they will be characterized for variation in function and

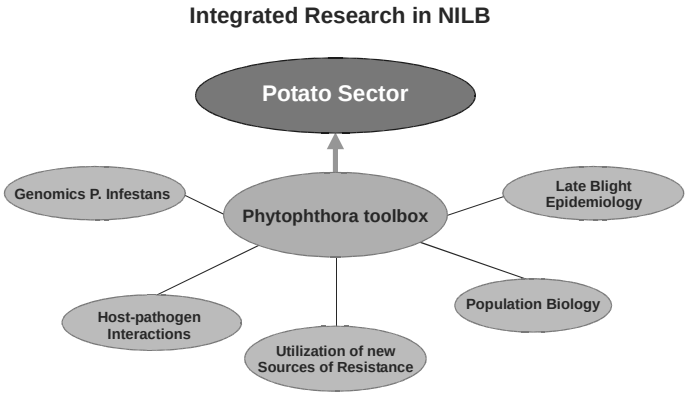

Fig. 1. The results from five themes of short- and long-term research are integrated in the *Phytophthora* toolbox (theme 6) and translated to be applicable by the potato sector.

combined by breeding. After testing for resistance, promising material will be handed over to the breeders for integration in their potato breeding programs.

Theme 5: Genomics potato-Phytophthora *interaction*
The ultimate goal of breeders is to combine resistance genes that confer broad-spectrum resistance to late blight through complementary mechanisms and through the recognition of pathogen factors that are essential for pathogen fitness. However, the fundamental understanding of resistance mechanisms is missing. The aim of this theme is to study the identification of specific genes of potato and *Phytophthora*, which in the initial stages of an infection determine the outcome of the interaction. Furthermore, the generation and analysis of defense-related mutants, and the identification and characterization of genes involved in non-host resistance to *P. infestans* in *Arabidopsis* are studied to unravel the role of key regulators of defense in late blight resistance.

Theme 6: Genomics Phytophthora infestans
In this theme current genomic and EST sequence data of *P. infestans* will be screened as efficiently as possible to identify candidate genes that possibly encode for pathogenicity and (a)virulence factors and to identify variable regions in the genome that can be used for the efficient development of molecular markers. These markers can subsequently be used to study the variation and dynamics of natural *P. infestans* populations. The final goal is to identify factors that are essential for the overall fitness of the pathogen. The targeting of such factors for chemical control will lead to the development of innovative control strategies.

Organization of NILB
The organization of NILB is outlined in Fig. 2. Central is the Steering Committee with representatives from the stakeholders. Although the Dutch Ministry of Agriculture is financing the major part of the research at Wageningen UR, their role in the Steering Committee is modest. The potato sector (breeders, growers and trade) has the most prominent role in the Steering Committee, as this sector is able to keep research on the applied track and to communicate and implement the results into practice. As shown in Fig. 2 "steering" occurs in two annual loops: one is steering the Wageningen UR research to fill the *Phytophthora* 'Toolbox', another is implementing the toolbox in practice. The implementation is monitored in different farming systems with respect to environmental effects, and problems will be reported to Wageningen UR for feed-back. Whenever a tool is found to be useful and robust, the Steering Committee can make the application of it mandatory for all farmers.

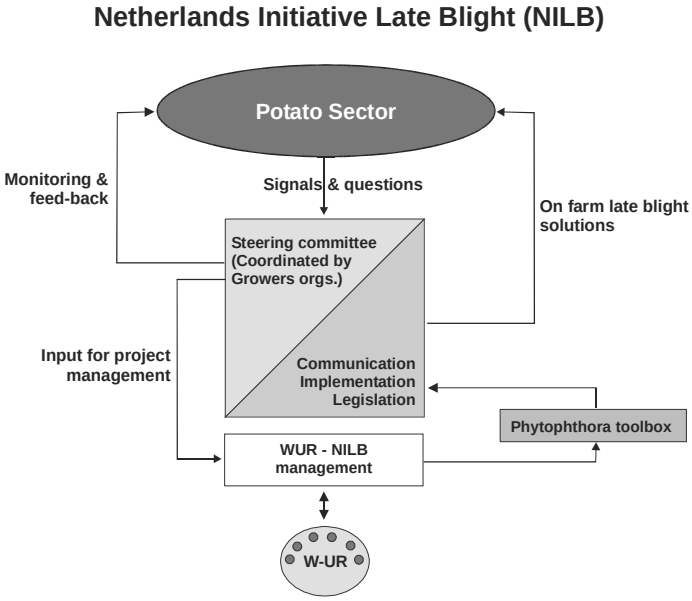

Fig. 2. Organization-scheme of NILB. The Steering Committee is steering Wageningen UR research as well as communication and implementation of the results.

NILB will stimulate international cooperation with other *Phytophthora*-research groups in the world.

For further information please contact Piet M. Boonekamp, Plant Research International, Wageningen UR, P.O. Box 16, 6700 AA Wageningen, The Netherlands, Email: piet.boonekamp@wur.nl.

PNAS gives free online access to developing countries

PNAS (Proceedings of the National Academy of Sciences) gives 81 developing countries free and immediate online access to help build scientific capacity in low-income areas of the world. Like the National Academy of Sciences, PNAS is committed to providing broad access to current scientific research across many fields and to fostering globalization of research tools and advances. At present countries in Latin America are not included, but PNAS plans to extend the list of recipients as the impact of this new initiative is assessed. For more information see: www.pnas.org/cgi/content/full/99/9/5751.

The ECOPAPA Project

The ECOPAPA (Enrichment of Potato Breeding Programs in Latin America and Europe with resistance to late blight, *Phytophthora infestans*) Project (supported by the European Union Program for International Cooperation with Developing Countries [INCO-DC] Contract ERBIC18 CT98 0318), November 1998 to February 2003, has been successful in meeting its objectives of broadening the genetic base of late blight resistance in the breeding programs in the participating countries in Latin America and Europe, as well as the transfer of knowledge and technology for marker-assisted breeding. The partners are INIA (Instituto Nacional de Investigación Agropecuaria) Uruguay; INRA (Institut National de la Recherche Agronomique) France; INTA (Instituto Nacional de Technología Agropecuaria) Argentina; PRI (Plant Research International) the Netherlands, which also has a coordinating role; PROINPA (Foundation for the Promotion and

Research of Andean Products) Bolivia; and SCRI (Scottish Crop Research Institute) United Kingdom.

Parental genotypes, 2x and 4x, with potentially useful late blight resistance genes, six from each institution, were sent to SCRI (United Kingdom) and quarantined. Thirty-four of them were subsequently distributed as an "exchanged set" by SCRI to each partner. The performance in field-testing of this exchanged set across all participating countries was evaluated for two cropping seasons, including the reaction towards the local late blight isolates. Some clones were identified as particularly suited for resistance breeding for specific regions, or (in a few cases) anywhere. The results of this multi-site foliage resistance study of these thirty-four genotypes will be published. PRI (the Netherlands), who was responsible for collating and analyzing the data, will prepare the draft manuscript.

To produce potential new parental lines with no specific local adaptation for exchange between the partners, INTA (Argentina) produced 91 families from tetraploid crosses between local varieties and the CIP (International Potato Center) "population B", both with partial resistance. Tubers of these families were obtained during the third year and testing was in progress at the end of the project.

INRA (France) crossed 33 of the exchanged genotypes with five modern cultivars that were chosen for favorable traits like tuber aspect, yielding ability and cooking quality. Fifty-seven of the crosses yielded 200 or more seeds for each partner and 38 of them yielded 100–200 seeds each. At INIA (Uruguay) crosses were made among exchanged and other identified resistant genotypes. Many of these crosses combine blight resistance, a high level of virus resistance and commercial attributes. The selection of potential new cultivars by the partners is yet to be achieved. At SCRI breeders are evaluating materials generated by the program and have expressed interest in crosses with the Bolivian (PROINPA) clones.

To gain insight on the population structure of *Phytophthora infestans* in the different testing locations, one isolate of *P. infestans* was collected from each of the 34 exchanged clones after natural infection by four of the partners. In order to obtain pure isolates, sampling took place at a time when individual lesions were still small, from leaflets with only one lesion. These isolates were sent to SCRI and then re-distributed for analysis by SCRI, PRI and INRA. Isolates were not collected in Uruguay or Argentina. However, the Argentinean isolate used for artificial inoculation of the field tests was included. All isolates were characterized by SCRI for AFLP (Amplified Fragment Length Polymorphisms) fingerprints, metalaxyl resistance and mating type. A selection of the isolates was characterized by PRI for aggressiveness and by INRA for virulence. Furthermore, INRA evaluated oospore production of specific isolate combinations on different clones. SCRI will be responsible for drafting an article describing these characterizations. It should be published during 2004.

Scientists from INTA, PRI and SCRI used two diploid potato populations (a *Solanum chacoense* F1 mapping population from INTA and a *S. tuberosum* x *S. phureja* backcross mapping population from SCRI) with quantitative resistance to develop new molecular markers for foliage and tuber resistance. The *S. chacoense* population is being studied at INTA and PRI. At INTA a linkage map based largely on AFLP markers has been developed and markers for one QTL have been identified. PRI work has focused on the development of RGA (Resistance Gene Analogs) for this population. This is a relatively new kind of marker that targets sequences that are conserved in resistance genes and this work is ongoing. At SCRI, AFLP mapping of the *S. tuberosum x S. phureja* population is in progress. As an integral part of this endeavor, scientists from INIA, INRA, INTA and PROINPA were trained in molecular marker techniques.

Besides the two scientific papers mentioned in this article, it is expected that the QTL mapping of both the *Solanum chacoense* F1 mapping population and the *S. tuberosum* x *S.phureja* backcross mapping population will be published.

ECOPAPA held its initiation meeting at the GILB'99 Conference in Ecuador [GILB Newsletter No. 7, April 1999] and updates on the ECOPAPA project appeared in the GILB Newsletters No. 11, August 2000 and No. 17, October 2002.

Submitted by Roeland Voorrips, Coordinator ECOPAPA, Email:roeland.voorrips@wur.nl

INTERNATIONAL POTATO CENTER (CIP)

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Late Blight Abstracts

Gene *RB* cloned from *Solanum bulbocastanum* confers broad spectrum resistance to potato late blight

Song J, Bradeen J M, Naess S K, Raasch J A, Wielgus S M, Haberlach G T, Liu, J, Kuang H, Austin-Phillips S, Buell C R, Helgeson J P and Jiang J. 2003. PNAS:100: 9128-9133. © 2003 National Academy of Sciences, U.S.A.

Late blight, caused by the oomycete pathogen *Phytophthora infestans*, is the most devastating potato disease in the world. Control of late blight in the United States and other developed countries relies extensively on fungicide application. We previously demonstrated that the wild diploid potato species *Solanum bulbocastanum* is highly resistant to all known races of *P. infestans*. Potato germplasm derived from *S. bulbocastanum* has shown durable and effective resistance in the field. Here we report the cloning of the major resistance gene *RB* in *S. bulbocastanum* by using a map-based approach in combination with a long-range (LR)-PCR strategy. A cluster of four resistance genes of the CC-NBS-LRR

(coiled coil–nucleotide binding site–Leu-rich repeat) class was found within the genetically mapped *RB* region. Transgenic plants containing a LR-PCR product of one of these four genes displayed broad spectrum late blight resistance. The cloned *RB* gene provides a new resource for developing late blight-resistant potato varieties. Our results also demonstrate that LR-PCR is a valuable approach to isolate genes that cannot be maintained in the bacterial artificial chromosome system.

Corresponding authors: John P. Helgeson or Jiming Jiang
Email: jphelges@wisc.edu or jjiang1@wisc.edu.

Resistance to *Phytophthora infestans* in somatic hybrids of *Solanum nigrum* L. and diploid potato

Zimnoch-Guzowska E, Lebecka R, Kryszczuk A, Maciejewska U, Szczerbakowa A, and Wielgat B. 2003. Theoretical and Applied Genetics 107:43-48. © Springer-Verlag 2003.

In breeding for resistance to late blight, (*Phytophthora infestans*) Mont. De Bary), an economically important disease affecting potatoes, the search for new sources of durable resistance includes the non-host wild *Solanum* species, The aim of this work was to evaluate the resistance to *P. infestans* in the somatic hybrids between *S. nigrum* L. and diploid potato clone ZEL-1136. Sixteen somatic hybrids, their fusion parents, and three standard potato cultivars were screened for resistance to *P. infestans* in two types of tests—on whole plants and detached leaves—with two highly aggressive and virulent isolates of *P. infestans*, US8 and MP322. In the whole plant assay, the foliage of the somatic hybrids showed no symptoms of infection, while the foliage of the potato fusion parent and the standard cultivars was infected with *P. infestans*, In the detached leaflet assay, the breaking-down of resistance of the *S.nigrum* L. parent and the variable response of individual hybrid clones were noted. Nine *S. nigrum* L. (+) ZEL-1136 hybrids showed a resistance that was significantly higher than that of *S. nigrum*, while six clones expressed a resistance to *P. infestans* similar to that of *S. nigrum*. The results confirm the effective transfer of late blight resistance of *S. nigrum* into its somatic hybrids with potato.

Corresponding author: Ewa Zimnoch-Guzowska
Email: mlochow@ihar.edu.pl

Stability of partial resistance in potato cultivars exposed to aggressive strains of *Phytophthora infestans*.

Flier W G, van den Bosch G B M and Turkensteen L J. 2003. Plant Pathology 52:326–337.

Potato cultivars were evaluated for their resistance responses to aggressive strains of *Phytophthora infestans* in field and laboratory experiments. Analysis of variance revealed differential cultivar-by-isolate interactions for both foliar and tuber blight resistance. Differential responses occur as revealed by specific susceptibilities of cultivars to certain pathogen genotypes and changing rank order. In general, severity of late blight epidemics as observed in the haulms did not correlate well with foliar blight resistance ratings as presented in the National List of Recommended Potato Varieties. No significant correlation was found between tuber blight incidence under field conditions and the tuber blight rating in the National List. Also, there was no relation between the field and laboratory tuber blight resistance assessments. A significant association was demonstrated between late blight infection in the foliage and tuber blight incidence under field conditions. The presence of differential interaction, independent of R-gene-based resistance, indicates some adaptation of *P. infestans* to partial resistance and consequently adverse effects on the stability and durability of partial resistance to potato late blight.

Corresponding author: Wilbert Flier
Email: Wilbert.flier@wur.nl

The effect of the presence of R-genes for resistance to late blight (*Phytophthora infestans*) of potato (*Solanum tuberosum*) on the underlying level of field resistance

Stewart H E, Bradshaw J E, Pande B. 2003. Plant Pathology 52:193–198.

The differential genotypes R_1, R_{10} and R_{11}, as originally defined by Black, were crossed with R-gene-free cultivars and the progenies divided into two subpopulations comprising those which had inherited the R-gene and those which had not. The underlying level of field resistance of the two groups was compared in a field trial in which they were inoculated with an isolate that could overcome the relevant R-genes. The R-gene-bearing group was significantly (P<0·001) more resistant than the R-gene-free group, with mean scores over four dates in 2000 of 4·86 and 4·09, respectively, on a 1–9 scale of increasing resistance, and of 4·10 and 2·35 on one date in 2001. However, the magnitude of the effect depended on the R-gene and the year of the trial. Data from a progeny of cv. Stirling (with an R-gene and a high level of field resistance) were examined and the same effect of an R-gene found. Fewer of the R-gene-bearing group of clones were highly susceptible, and more were resistant. The most resistant clones always bore the R-gene. It is concluded that increased resistance is conferred by the defeated R-gene or linked genes for field resistance.

Corresponding author: John E. Bradshaw
Email: jbrads@scri.sari.ac.uk

Characterization of isolates of *Phytophthora infestans* from southern and southeastern Brazil from 1998 to 2000

Reis A, Smart C D, Fry W E, Maffia L A and Mizubuti E S G. 2003. Plant Disease 87:896–900.

The population of *Phytophthora infestans* in Brazil was first characterized 12 years ago. In this research, isolates of *P. infestans* from potato (n = 184) and tomato (n = 267) collected in southern and southeastern Brazil were characterized to provide more detailed analysis of the current structure of the population. All 451 isolates were analyzed for mating type, and subsets of the isolates were analyzed for allozymes, restriction fragment length polymorphism fingerprint, mtDNA haplotypes, and metalaxyl resistance. Tomato isolates were all of A1 mating type, mtDNA Ib, and US-1 genotype or some variant within this clonal lineage. Of the potato isolates, 82% were A2 mating type, mtDNA IIa, BR-1 genotype, which is a new lineage of *P. infestans*. All A2 isolates were found on potato, whereas 91% of the A1 isolates were from tomato. A1 and A2 isolates were never found in the same field. The frequency of resistance to metalaxyl was higher in isolates from tomato (55%) than in isolates from potato (38%). After more than a decade of coexistence of isolates of the A1 and A2 mating

types, the population was highly clonal, dominated by the BR-1 and US-1 clonal lineages.

Corresponding author: Eduardo Mizubuti
Email: mizubuti@ufv.br

Phenotypic and genotypic diversity of *Phytophthora infestans* populations in Scotland (1995-97)

Cooke D E L, Young V, Birch P R J, Toth R, Gourlay F, Day J P, Carnegie S F and Duncan J M. 2003. Plant Pathology 52:181–192.

In a survey of Scottish potato late blight (*Phytophthora infestans*) populations from 1995 to 1997, nearly 500 isolates were collected from over 80 disease outbreaks in commercial potato crops and gardens/allotments. The isolates were characterized by mating type, resistance to the fungicide metalaxyl and almost 300 were examined by DNA-based AFLP fingerprinting. These data were examined alongside cropping details to determine the population structure in the context of existing disease management strategies. A1 and A2 mating type isolates were present in both commercial potato crops and gardens or allotments although they coexisted more frequently in the latter sites. One-fifth of the isolates collected were of the A2 mating type and the frequency was similar over the 3 years and amongst sites. In 1995 the proportions of isolates that were sensitive and resistant to metalaxyl were equal (~40%) but, over the following 2 years, the frequency of resistant isolates decreased and that of intermediate isolates increased. The mating type response to metalaxyl differed markedly, with 52% of A1 and only 5% of A2 isolates being resistant. Considerable molecular diversity was observed, with over half of the isolates having unique AFLP patterns. Analysis of the molecular and phenotypic data revealed a broad clustering of the population into three groups. Many factors point to an A2 population restricted by its sensitivity to phenylamides. The majority of the A2 isolates were found in a single AFLP group, but the presence of mixed mating type samples, an increasing frequency of isolates of intermediate metalaxyl resistance and the extent of the AFLP diversity suggest occasional sexual recombination, and thus gene flow, between groups.

Corresponding author: Dave Cooke
Email: dcooke@scri.sari.ac.uk

Characteristics of *Phytophthora infestans* Isolates from Uruguay

Deahl K L, Pagani MC, Vilaro F L, Perez F M, Morovec B and Cooke LR. 2003. European Journal of Plant Pathology 109:277–281.

Isolates of *Phytophthora infestans* were obtained from late blighted plants from several potato-growing regions of Uruguay in 1998 and 1999. Of these, 25 representative isolates (4 from 1998, 21 from 1999) from the main potato-growing areas of the country, were characterised in terms of mating type, metalaxyl resistance, allozyme genotype, mitochondrial haplotype, RG57 fingerprint (1999 isolates only) and pathotype. All isolates proved to be A2 mating type, monomorphic and homozygous at the loci coding for glucose-6-phosphate isomerase and peptidase (*Gpi 100/100*, *Pep 100/100*) and to possess mitochondrial haplotype IIa. Metalaxyl-resistant isolates constituted 92% of the total. All the 1999 isolates possessed the same RG57 fingerprint, which was that previously reported as associated with the clonal lineage BR-1 from Brazil and Bolivia, which is also A2, *Gpi 100/100*, *Pep 100/100*. Most of the isolates displayed broad-spectrum virulence and five carried virulence to 10 of the 11 R genes tested despite the absence of R genes in commercially grown potato cultivars. It was concluded that the Uruguayan *P. infestans* isolates resembled isolates from neighbouring South American countries, notably Brazil, and belong to the new populations of the pathogen now predominant in many countries.

Corresponding author: Ken Deahl
Email: deahlk@ba.ars.usda.gov

Genetic variation among asexual progeny of *Phytophthora infestans* detected with RAPD and AFLP markers

Abu-El Samen F M, Secor G A and Gudmestad N C. 2003. Plant Pathology 52:314–325.

Genotypic variation among 32 single-zoospore isolates (SZI) of *Phytophthora infestans*, derived asexually from two hyphal-tip parental isolates (PI-105 and PI-1) of the US-8 genotype, was assessed with 80 random amplified polymorphic DNA (RAPD) primers and 18 amplified fragment length polymorphic DNA (AFLP) primer pairs. In previous investigations, the SZIs from parental isolate PI-105 showed high levels of virulence variability and were differentiated into 14 races, whereas the SZIs from PI-1 showed identical virulence to the parent. The purpose of this investigation was to determine if phenotypic variation observed among SZIs of *P. infestans* could be detected at the DNA level in these isolates. Polymorphism was detected with 51 RAPD primers and with all 18 AFLP primer pairs in PI-105 SZIs. In SZIs from PI-1, polymorphism was also detected with 25 RAPD primers and 17 AFLP primer pairs. Cluster analysis using the unweighted pair-group method with arithmetic averages (UPGMA) separated the SZIs from parent PI-105 into six virulence groups, 11 RAPD groups and three AFLP groups. Cluster analysis of PI-1 SZIs, which all belong to the same virulence group, differentiated them into four RAPD groups and six AFLP groups. No close correlation among RAPD, AFLP and virulence groups could be established within the two progenies of SZIs. Results of this study suggest that there is a considerable level of inherent genetic variability among SZIs derived asexually from the same parental isolate. The possible mechanisms and implications of this genetic variation are discussed.

Corresponding author: Ned Gudmestad
Email: Neil.Gudmestad@ndsu.nodak.edu

Identification and characterization of isolates of *Phytophthora infestans* using fatty acid methyl ester (FAME) profiles

Larkin R P and Groves C L. 2003. Plant Disease 87:1233–1243.

The utility of fatty acid profiles for characterization and differentiation of isolates of *P. infestans* was investigated. Two libraries of fatty acid methyl ester (FAME) profiles (one representing average genotype characteristics and one representing individual isolate characteristics) were established from at least eight replicate samples of each of 25 different isolates of *P. infestans,* including representative isolates of US-1, US-6, US-7, US-8, US-11, US-14, and US-17 genotypes. These libraries then were used to identify and characterize additional unknown isolates. Fatty acid profile

characteristics also were compared with cultural and genetic characteristics of the isolates. FAME profiles for isolates of *P. infestans* were consistent over multiple extractions and distinctly different from profiles for isolates of other *Phytophthora* species, such as *P. capsici* and *P. erythroseptica*, as well as isolates of *Pythium* spp. and various other fungal groups. Overall, profiles from different isolates within the same genotype shared similar characteristics, although there was overlap among some genotypes. Incubation temperature, growth medium, and prolonged storage on agar media all significantly affected fatty acid profiles; however, when these conditions were kept constant, profiles were distinct, consistent, and reproducible over time. Isolate profiles were sufficiently specific that individual isolates could be distinctly identified by FAME profiles. In general, individual isolate characteristics were more determinant than genotype group characteristics, although genotype could be determined for most isolates tested. Results indicated that FAME profiles can be an additional tool useful for characterizing isolates and populations of *P. infestans.*

Corresponding author: Bob Larkin
Email: bob.larkin@ars.usda.gov

Joint Section Meeting of EAPR and EUCARPIA

The joint meeting of the EAPR Breeding and Varietal Assessment Section and EUCARPIA Potato Section was held in Oulu, Finland, 26–30 July 2003 and was hosted by Dr. Jari Valkonen (University of Helsinki) and friends. The meetings provided a presentation, discussion and tour format that highlighted the following aspects of potato breeding:

- Breeding and assessing potatoes for diverse environments and uses
- Yield stability, adaptation and GxE
- Molecular introgression and breeding
- Molecular biology and genetics of resistance and quality traits
- Applying genomics to potato breeding.

More than 55 presentations were made and tours of agricultural research, farms, potato seed operations, and local cultural attractions provided the more than 90 delegates from about 30 countries with much information and excellent contacts. Discussion sessions also provided excellent opportunities for participants to acquire new ideas and to develop new scientific collaborations. Of special interest to GILB members, were several presentations regarding genetic advances on resistance to late blight. These can be viewed at www.spk.fi/eapr/

Reported by Bud Platt, Agriculture and Agri-Food Canada. Email: PlattH@agr.gc.ca

Potato Meetings

The XXI Congress of the Latin American Potato Association (ALAP, Asociación Latinoamericana de la Papa), V Latin American Seminar on Potato: Use and Commercialization (V Seminario Latinoamericano de la Papa: Uso y Comercialización), X Meeting of the Chilean Potato Association (Asociación Chilena de la Papa, ACHIPA) and II Spanish American Congress on Research and Development of the Potato (II Congreso Iberoamericano sobre Investigación y Desarrollo en Patata) will be held 7–12 March 2004 in Valdivia, Chile. More information can be found at http://uach.cl/alap2004 or contact Andrés Contreras, ALAP President, email acontrer@uach.cl

The 5th World Potato Congress and Trade & Technology Show will be held 24–30 March 2004 in Kunming, China. Online registration is available. Further information will be placed on the website at www.potatocongress.org, or individuals may e-mail the Congress Office in Charlottetown, Canada at info@potatocongress.org for more information.

The Sixth Triennial Congress of the African Potato Association *Research Development Innovation for Income Generation and Food Security* will be held 5–10 April 2004 in Agadir, Morocco. More information can be found at www.iavcha.ac.ma/APA/congress.html or contact A. Hanafi, APA President, email: hanafi@iavcha.ac.ma

Special Announcement from IAPPS

For scientists in Developing Countries, membership in IAAPS (International Association for the Plant Protection Sciences) is $35.00 with web access and $85.00 for a subscription to the print edition of Crop Protection, the IAPPS Official Journal. IAPPS members can publish in Crop Protection without page charges. For more information please visit the IAPPS website at www.plantprotecion.org.

New fungicide to control late blight

The state of New York has granted registration for a new fungicide for use on potatoes, tomatoes and cucurbits. Gavel 75DF (Dow Agrochemicals) fungicide has been accepted for use on potatoes, tomatoes and cucurbits in New York State. Gavel contains the active ingredients zoxamide and mancozeb. In potatoes, Gavel controls late blight and early blight. University studies show that Gavel also helps protect potatoes from late blight tuber rot. In tomatoes, Gavel controls late blight and some fungal diseases. More information at: www.spudman.com.

The ***GILB Newsletter*** is distributed in print and electronic formats to selected members in the scientific community, including GILB collaborators, researchers ad donors. Past and current issues of the Newsletter are also available on the GILB homepage of the International Potato Center (CIP) website at www.cipotato.org/gilb/

The objective of the newsletter is to facilitate and increase communication and cooperation among persons and organizations working to combat *Phytophthora infestans*, the causal agent of potato late blight disease.

Please consider sharing a brief write-up on your current work related to late blight with other GILB Newsletter readers. Short articles (250 words or less) are particularly welcome, as are news items, notices of coming events, and summaries of research underway.

Direct submissions or comments to GILB Editorial Committee members: Edward French, Charlotte Lizarraga or Greg Forbes through the general GILB newsletter E-mail address (GILB@cgiar.org).

Potato Web Links

Agriculture Network Information Center
www.agnic.org
Agronomic Links Across the Globe
www.agry.purdue.edu/links
American Phytopathological Society
www.apsnet.org
APSnet, Plant Pathology On-Line
www.apsnet.org/online/feature/lateblit/
CRP-Gabriel Lippmann CREBS, Luxembourg
www.crpgl.lu/fr/index.php3
Cornell-Eastern Europe Mexico Potato Late Blight Project (CEEM)
www.cals.cornell.edu/dept/plantbreed/CEEM
EUCABLIGHT (Potato Late Blight Network for Europe)
www.eucablight.org/EucaBlight.asp
European Association of Plant Breeders (EUCARPIA)
www.eurcarpia.org
European Association for Potato Research (EAPR)
www.agro.wau.nl/eapr
Global Potato Focus
www.potatofocus.com
Global Potato News
www.potatonews.com
Idaho Plant Disease Reporter/Late Blight
www.uidaho.edu/ag/plantdisease/lbhome.htm
Integrated Management of Late Blight on Potatoes
www.gov.mb.ca/agriculture/crops/diseases/lateblight/index.html
Integrated Management of Late Blight on Potatoes (PMRA, Canada)
www.hc-sc.gc.ca/pmrarlala/english/pdf/spm/spm_s9602-e.pdf
International Center for Genetic Engineering & Biotechnology (ICGEB)
www.icgeb.trieste.it/biosafety
International Potato Center (CIP)
www.cipotato.org
Maine Potato Board
www.mainepotatoes.com
Malheur Experiment Station. Potato Late Blight
www.cropinfo.net/Potatoblight.htm
Michigan State University
www.lateblight.org/
Minnesota Certified Seed Potato Growers Association
www.mnseedpotato.org/
Monsanto
www.monsanto.com
National Potato Council
www.npcspud.com
New Agriculturist
www.new-agri.co.uk
North American Potato Late Blight On-line Workshop
www.apsnet.org/online/lateblite/
North Dakota Pesticide Quarterly
www.ext.nodak.edu/extnews/pestqtrly
Oregon State University
http://plant-disease.oregonstate.edu/index.htm
PICTIPAPA
http://ppathw3.cals.cornell.edu/Fry/pictipap.htm
Plant Pathology Internet Guide Book
www.ifgb.uni-hannover.de/extern/ppigb/
Potato Association of America
www.ume.maine.edu/PAA
Potato Engine
www.potatoengine.com/thinkpotato.html
Potato Information Exchange
www.css.orst.edu/potatoes/main.htm
Potato Research Online
www.potatonews.com/potatoresearch.asp
Red Electrónica de la Papa Redepapa)
http://redepapa.org
Plant Research International
www.plant.wageningen-ur.nl
Resource Center, Cornell University
www.nysipm.cornell.edu/
Scottish Agricultural College (SAC)
www.sac.ac.uk
Scottish Crop Research Institute (SCRI)
www.scri.sari.ac.uk/trial/
Universidad Agraria La Molina, Peru
www.lamolina.edu.pe/investigacion/programa/papa
University of Idaho
www.uidaho.edu/ag/plantdisease/plbstem.htm
University of Florida. Late Blight On Potatoes And Tomatoes.
http://edis.ifas.ufl.edu/scripts/htmlgen.exe?DOCUMENT_VH008
University of Wisconsin
www.hort.wisc.edu/usdavcru/
Wageningen University
www.wau.nl
World Potato Congress
www.potatocongress.org/

-To receive a copy of the GILB newsletter by electronic mail please forward your request to GILB@cgiar.org-

GILB
GLOBAL INITIATIVE ON LATE BLIGHT

c/o International Potato Center
Apartado 1558
Lima 12, Peru