Success Stories

in the use of ICTs for agricultural research and innovation in Latin America and the Caribbean

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Success stories in the use of information and communication technologies for
agricultural research and innovation in Latin America and the Caribbean

Introduction

One of the fields that has undergone some of the fastest and most substantial changes in recent years is that of information. The information milieu – which comprises individuals, organizations, information and communication technologies (ICTs), and information itself – is of crucial importance to the efforts aimed at scientific and technological research and innovation in the agricultural sector. Information is the basic ingredient of any technological innovation and a key element in any research.

ICTs, as basic tools for knowledge management, play – or can play – a significant role in procuring, organizing, sharing and disseminating technical information related to agriculture. In Latin America and the Caribbean, there are many experiences in this regard, and it is necessary to share them in order to start identifying best practices in this relatively novel field of institutional management.

Documenting successful experiences is basic for the purposes of *learning* and *awareness-raising* among decision makers. For learning, given the possibility of sharing experiences about how information and communications are managed so they can contribute to the success of research or innovation initiatives; for *awareness-raising*, by *positioning the subject* so that decision makers can examine concrete instances of how a positive impact was achieved through the use of these technologies.

Within this framework, the FORAGRO Technical Secretariat[1] at IICA arranged for this compilation of success stories in the use of ICTs for technological research and innovation aimed at agricultural development. This effort was part of

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[1] *FORAGRO is the Forum for the Americas on Agricultural Research and Technology Development.*

an INFOTEC[2] project co-sponsored by the Global Forum on Agricultural Research (GFAR) as part of its program for promoting information and communications management for agricultural research and development.

An invitation was issued through INFOTEC, FORAGRO's Executive Committee and several mailing lists to those interested in submitting successful instances they might know about to fill out an INFOTEC form designed to collect contact information regarding the person submitting the case as well as basic information about the project or program in which ICTs had been used successfully and how they were used. Within a month, 28 proposals were received (Annex 1).

An international jury was convened made up of three distinguished professionals with extensive experience in agricultural information and technological innovation management. They were called upon to select six cases for publication. The jury consisted of the following experts:

Frank Hartwich Research Fellow at the International Food Policy Research Institute (IFPRI), San José, Costa Rica	**Franz Joseph Martin** Regional Officer for Information Management, Sub-Directorate for Capacity Building and Services Outreach, Regional Office for LAC of the World Center for Agricultural Information (WAICENT-FAO)	**Lornel Rivas Mago** Research Fellow, Information and Knowledge Management Processes, INIA, Venezuela

The cases that were chosen for this publication were the following:

- REDesastres: A contribution to the management of health disasters involving plants and animals

- An early warning system on Asian soybean rust, Paraná State, Brazil

- Agricultural Information System for Cauca Valley, Colombia (SISAV)

- The National Voice Network as a pillar for technological innovation and research at Venezuela's National Agricultural Research Institute (INIA)

- The Electronic Potato Network (REDEPAPA)

- The Virtual Network on Rural Agro-Industry (PRODARNET)

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[2] *Scientific and Technological Information System for the Agricultural Sector in the Americas. INFOTEC constitutes FORAGRO's information sharing system.*

Those who submitted the stories that were finally chosen were asked to write their respective chapter. We thank everyone who submitted cases, whether they were chosen or not, for their willingness to share their success stories. We also thank the members of the Jury for their selfless dedication and assistance.

It is our hope that this compilation of successful cases and lessons learned will encourage all stakeholders to take better advantage of the opportunities provided by ICTs for energizing technological innovation in the agricultural field.

FORAGRO Technical Secretariat
Area of Technology and Innovation
Technical Leadership and Knowledge Management Directorate
Inter-American Institute for Cooperation on Agriculture (IICA)

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REDesastres, a Cuban contribution to the management of health disasters in animals and plants

*Dr. María Irian Percedo Abreu, Dr. Mayra
G. Rodríguez Hernández, Dr. Pastor Alfonso
Zamora, Dr. María Teresa Frías Lepoureau,
Isel Gonzalez Hernández, Dr. Lydia M. Tablada
Romero and Dr. Adela Encinosa Liñero[3]*

[3] *Dr. María Irian Percedo Abreu, DrC, Animal Health and Production Directorate, National Center for
Agricultural Health (CENSA), Coordinator of REDesastres. percedo@censa.edu.cu; Dr. Mayra G. Rodríguez
Hernández, DrC, Plant Protection Directorate, CENSA, Coordinator of REDesastres. mrguez@censa.edu.cu; Dr.
Pastor Alfonso Zamora, DrC, Animal Health and Production Directorate, CENSA, alfonso@censa.edu.cu; Dr.
María Teresa Frías Lepoureau, DrC, Microbiology Directorate, CENSA, mariat.frias@infomed.sld.cu; Lic. Isel
Gonzalez Hernández, Dept. of Computing and Applied Mathematics, CENSA, isel@censa.edu.cu; Dr. Lydia M.
Tablada Romero, DrC, Director General of CENSA. lydia@censa.edu.cu; Dr. Adela Encinosa Liñero, Director-
ate of Research and Development, Institute of Veterinary Medicine (IMV), encinosa@infomed.sld.cu*

SUMMARY

Nowadays there is an ever-increasing global risk of creating emergencies through the introduction of exotic and quarantine diseases and pests in animals and crops, including zoonoses. Such health disasters could have serious economic, social and even political consequences, in addition to an alarming potential to spread across boundaries. Strengthening intersectoral and multidisciplinary cooperation is key to successfully tackling disasters of this nature, and is a fundamental pillar of Cuba's national strategy in this area. In response to this threat, REDesastres was established as the national agricultural sector's first network in this field (http://www.censa.edu.cu/cedesap, REDesastres-L@censa.edu.cu). Sponsored by the National Agricultural Health Center (CENSA), under the auspices of the Ministry of Higher Education (MES) and Cuba's Civil Defense (DC), REDesastres has nationwide coverage and some 393 members, including researchers, teachers, specialists and officials of different levels in the ministries of Higher Education, Agriculture, Public Health, and Science, Technology and Environment, among others. The network has facilitated the real-time interconnection between professionals from different disciplines and institutions: all the universities and the agricultural research centers, the technical-administrative departments and diagnostic laboratories of the official animal and plant health services, as well as the productive sectors. The network distributes timely and up to date information and analysis from health organizations and international news agencies, scientific publications and other sources, relative to the prevention, diagnosis and control of transboundary diseases. Currently, emphasis is given to the discussion forum on avian influenza (AI), given the threat of a pandemic. The work carried out to date has also contributed to the teaching-learning process of the future graduates of the country's Veterinary Medicine and Agronomy colleges.

BACKGROUND

Nowadays there is an ever-increasing global risk of creating emergencies through the introduction of exotic and quarantine diseases and pests in animals and crops, including zoonoses, due to increased international passenger travel and global trade, bioterrorism and the inevitable consequences of climate change. Such health disasters could have very serious economic, social and even political consequences, in addition to an alarming potential to spread across boundaries.

According to FAO (2004), outbreaks of different animal diseases have caused losses equivalent to nearly one-third of world meat exports, or 6 million metric tons (US$ 10,000 million), without taking into account *"the cost of public measures required to combat diseases, the losses suffered by producers and consumers due to the destabilization of the markets and the fluctuation of prices, and the general costs that industry must assume"*. The diseases responsible for such losses include classic swine fever (CSW), bovine spongiform encephalopathy

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(BSE), foot and mouth and highly pathogenic avian influenza (HPAI). The latter is the subject of alarming forecasts of a pandemic given the mutagenic and recombinogenic potential of its causal agent.

The rapid increase in emerging diseases, many of them zoonoses, has also revealed the vulnerability of the entire world in the face of this threat (King, 2004; OMS, 1994 and 1996).

FAO, WHO and the OIE have pooled efforts and made appeals to the international community to reduce its vulnerability to transboundary diseases by adopting specific strategies on a global, regional and national scale. These organizations agree that effective disease control should be considered an International Public Good, and that it should be included among the Millennium Development Goals (Lubroth, 2005).

REDesastres was established in 2005 as a multi-institutional network of the newly created Training Center for the Reduction of Health Disasters in Animals and Plants (CEDESAP), attached to the National Agricultural Health Center (CENSA), and supported by the Ministry of Education and Cuba's Civil Defense. CEDESAP was established following the restructuring of its predecessor, the Veterinary Center for the Prevention in Cases of Disasters (CVPCD), created in 1990 in response to a call by the UN within the context of the International Decade for Natural Disaster Reduction (IDNDR).

The CVPCD carried out its work through the joint efforts of its branches at the country's four faculties of Veterinary Medicine, namely in the Agrarian University of Havana (UNAH), Universidad Central de las Villas (UCLV) and the universities of Camagüey (UC) and Granma (UDG).

Since 1991, the curriculum of the Veterinary Medicine program has included a training course to enable future graduates to protect animal populations and their production in the event of disasters. Programs and study materials were designed and professors were trained to impart these courses throughout the country, both at undergraduate and postgraduate levels. The participation of specialists from the country's official veterinary services (Veterinary Institute), Public Health and Civil Defense in the training of university staff has also systematically enriched the teaching-learning process, and is an example of multisectoral cooperation.

Each branch has carried out studies that focus on the most probable disasters in their respective territories. For example, UC and UDG have concentrated on natural disasters, droughts and earthquakes, respectively, while UCLV has focused on technological disasters (chemical-toxic substances). For its part, UNAH, in collaboration with the CVPCD, places emphasis on biological disasters caused by serious diseases in animals and, in the case of zoonoses, in people (Percedo, 1998; Suárez, 1999).

Efforts to train veterinarians throughout the country on disaster management issues have gradually been strengthened and improved, thanks to the joint efforts of the CVPCD and its branches, the Institute of Veterinary Medicine (IMV) and the Cuban Society of Veterinary

Medicine in Disasters, created in 1998 (EMNDC, 2006).

The experience of the Veterinary Medicine and Animal Husbandry programs in training students in disaster management has been the starting point for the gradual improvement of this specialized preparation in other related university courses, among them Agronomic Sciences.

Although a vast experience has been accumulated in dealing with disasters of all types, it is essential to ensure continued preparedness, particularly with respect to animal health disasters, given the frequency with which Cuba has suffered their impact: Newcastle Disease in 1961-1962 and 1969; African Swine Fever (ASF) in 1971 and 1980; Rabbit Viral Hemorrhagic Disease (RVHD) in 1993 and 1997; the re-emergence of Classic Swine Fever (CSF) since 1993; and the introduction of Transmissible Swine Gastroenteritis (TSG) and Bovine Winter Dysentery in 2003.

In the agricultural sphere there are several examples that demonstrate the need for continuous work to guarantee the country's response capability, such as the cases of sugarcane rust, tobacco blue mold, panicle rice mite, *Thrips palmi* and coffee bean borer.

The decision to restructure the CVPCD in order to establish CEDESAP and **REDesastres,** in response to agricultural health disasters, was prompted by the following considerations:

- Increased health risks due to exotic diseases and pests at the global level.

- The need for universities and society as a whole to continuously train human resources to deal with disasters.

- National recognition of CENSA for its role as a national reference center for the diagnosis of exotic diseases and technical training, endorsed in 2002 by the FAO which designated it as a Collaborating Center on Emergency Preparedness for Transboundary Animal Diseases in the Caribbean region.

- The opportunity to apply the experiences acquired in disaster management in the sphere of veterinary medicine to the agricultural sector.

- The potential of the new information and communication technologies (ICT) to promote and facilitate networking in order to strengthen intersectoral and multidisciplinary cooperation and continuously update technicians, producers and decision-makers.

THE PROJECT

The project's initial ideas were promoted in the National Agricultural Health Center (CENSA), attached to the Ministry of Higher Education (MES), by the researchers who had been linked to the CVPCD since its inception, together with other officials of the CENSA's Plant Protection Directorate.

The plan was to restructure the CVPCD and create a virtual center aimed at strengthening disaster preparedness in relation to sanitary disasters in animals and crops through partnerships with

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professionals and institutions from many different sectors of society throughout the country, taking advantage of the networking facilities provided by ICT.

All sectors of Cuban society have had valuable experiences in disaster response, stemming from the organization and planning of actions contemplated in the national System of Civil Defense Measures (EMNDC, 2006; Macareño, 2006). In 2005, a new directive came into force for the Planning, Organization and Preparation of the Country for Disaster Situations. This directive is an expression of the political will that guarantees the legal framework for actions corresponding to the stages of prevention, preparation, response and recovery of the Disaster Reduction Cycle (CDN, 2005).

To promote the establishment of **REDesastres**, partnerships were developed with the Faculty of Veterinary Medicine of the Agrarian University of Havana and other former branches of CVPCD, and various workshops were held in CENSA and UDG in 2005.

These workshops were attended by representatives of the country's official animal and plant health services, representatives of all the main teaching and research institutions, and officials of MES and Cuba's Civil Defense.

In addition to providing a framework for the dissemination of work experiences related to disaster response in the sphere of agriculture, both workshops provided an opportunity to present the new project's objectives, strategy and plan of action, and to forge the necessary alliances to launch **REDesastres**, the multi-center network of CEDESAP.

CEDESAP's mission is to contribute to the reduction of health disasters through the training of human resources, research, and technology transfer aimed at improving the prevention and control of health emergencies caused by diseases and pests in animals and plants in agriculture, fisheries and forestry.

Among the activities executed by CEDESAP are efforts to promote **REDesastres** as a multi-center network to enhance multisectoral and interdisciplinary cooperation. The goal is to optimize the actions of the different social actors involved in preventing and responding to sanitary disasters that could affect the agricultural economy and, in the case of zoonoses, public health.

THE ROLE OF ICTs

The operation of **REDesastres** is based on an electronic mailing list REDesastres-L@censa.edu.cu and on the CEDESAP web site (http://www.censa.edu.cu/cedesap), which provides access to national and international information on this subject matter, as well as all messages circulated through the e-mail list, including attached documents (*.doc, *.pdf, *.htm, *.mht, etc.). Recent messages appear on the home page as News.

REDesastres is a virtual community that was launched in January 2006, with 95 users. It now has 393 members, among them 54 researchers, 84 professors, 73 production specialists, 69 officials and 60 managers, together

with 52 directorates of different institutions, mostly associated with agriculture.

The network facilitates the real time interconnection of officials and managers in the ministries of Higher Education, Agriculture, Public Health and Civil Defense, with professionals from all the country's research centers, agricultural training centers and universities, diagnostic laboratories on veterinary and plant health, national and provincial technical and administrative offices of both these sectors, and agricultural businesses.

The network has expanded thanks to the many professionals who have applied to register after finding out about it. Another growth factor has been the inclusion in the mailing list of the electronic addresses of individuals and institutions whose work and responsibilities suggest a possible interest in the topics discussed. The results have been surprising: only two individuals have asked to be taken off the list in the two years since the network was established.

Due to technological difficulties such as lack of broad band, many members of **REDesastres** do not have rapid access to the Internet. In this regard, the mailing list REDesastres-L@censa.edu.cu has played an important role in providing up to date scientific and technical information required by these subscribers.

In addition, the uploading of the CEDESAP and **REDesastres** pages, both on CENSA's web site (http://www.censa.edu.cu/cedesap) and on its Intranet (http://intranet.censa.edu.cu/cedesap) facilitates access to all users in the agricultural training centers and universities, since it operates with the platform provided by the university network of MES, linking together all the country's universities and higher education centers and scientific and technical units, such as CENSA. The uploading of the home page on the university network also provides access to the users of **INFOMED**, the Public Health Ministry's network with national coverage, even for users without Internet access.

The Web site of the Cuban Society of Veterinary Medicine in Disasters (http://www.mvd.sld.cu) also provides access to the CEDESAP and **REDesastres** pages through a hyperlink.

POSITIVE IMPACT

REDesastres disseminates information from both national sources, such as the Institute of Veterinary Medicine, the Ministry of Agriculture and the Ministry of Public Health, and international sources, mainly the web sites of organizations such as the OIE, WHO, PAHO, FAO, etc., as well as from scientific publications and news agencies. The network also offers information received through other international networks such as PROMed, FMD News and AvianFlu.

REDesastres has its own Information Management (IM) work team, but since the list is interactive it also disseminates information contributed by its users, together with their comments and observations.

Moreover, since the list is moderated, the information disseminated through **REDesastres** is mainly

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discussed by the coordinators or other experts, or by whoever is acting as the moderator of a particular forum. The idea is to try to highlight the positive or negative aspects of the information that is circulating in order to play an educational role.

The main purpose of monitoring the information on transboundary diseases is to promptly disseminate sanitary notifications from the OIE and from non-official channels. The network also carries news about the international epidemiological situation, prevention and control programs, and state of the art in diagnostic procedures and vaccinations, as well as comments by national and international experts. Some of the issues discussed include the characteristics of different diseases, prevention measures, biosafety and economic impacts.

Given the complex international sanitary situation of avian influenza (AI) and Cuba's efforts to prepare for the risk of a possible pandemic (MINSAP and MINAG, 2005; Percedo et al., 2006), **REDesastres** has maintained a forum on this topic since its inception. AI accounts for 48.5 % of the messages circulated to date (366 out of 754).

The technical information on AI provided by **REDesastres** to decision makers and to those who implement preparedness measures to address this global threat has included the systematic analysis of the international sanitary situation by experts. There has also been discussion about the properties of the active strain in the current epizootic (H5N1), its clinical characteristics, the lesions or symptoms of the disease, essential biosafety measures for intensive poultry farming operations as well as for medium and small scale farms, and the progress

made in producing vaccinations and antiviral drugs. Other topics analyzed include the prevention and control programs adopted in different countries, including our own, messages from Cuba to the World Trade Organization concerning the sanitary requirements for imports that pose a risk, and the standards and recommendations issued by international health organizations such as the FAO, OIE and WHO.

Notifications warning of the presence of AI in new countries, either in domestic or wild birds, and the reporting of new cases of infection and death in humans, have been issued by the network with the same immediacy with which official health sources and even news agencies make these announcements. This is of extraordinary value in keeping all the technical personnel duly informed and updated, particularly those who work at the country's different entry points or borders to prevent the introduction of this disease into the national territory.

Recently the network launched another forum on Ralstonia solanacearum, with the aim of strengthening prevention efforts and providing training on this major pest, which has a severe impact on several crops, such as potatoes and beans.

For the purposes of **REDesastres**, networking through the use of ICT offers unquestionable advantages:

■ Speeds up communications. This is crucial for prevention, preparation and response to sanitary emergencies, and allows the mechanisms established by the competent national institutions or authorities to guarantee early diagnosis, *early warning and a rapid response.*

- Promotes multisectoral and interdisciplinary cooperation.

- Provides an additional channel for informing interested parties of any risk.

- Facilitates the training of human resources and distance education.

- Increases opportunities for making contacts and exchanging experiences.

- Helps to optimize the use of human resources, especially of highly qualified personnel, through forums and other forms of virtual or distance education.

- Contributes to a better perception of the risks, and to the development of a culture of protection (safety) in the face of any threat of disaster.

The main impact of the **REDesastres** project has been to promote learning and capacity building among the relevant sectors of society. It has contributed to the training and management of the human resources that decide and intervene in the prevention, diagnosis and control of serious diseases affecting animals and plants.

Experience has shown that the severity of disasters depends in great measure on two basic elements: 1) a previous preparedness plan to address the risks, which should include a training program on disaster preparedness and management; and 2) an operating plan to effectively guide the intervention.

At the same time, a successful response to disasters depends on intersectoral and multidisciplinary cooperation. To achieve effective cooperation, training plays a strategic role, provided that it is directed at society as a whole as well as at specific communities, involving all the key social actors.

The Training Center for the Reduction of Sanitary Disasters in Animals and Plants (CEDESAP) and its virtual network, **REDesastres,** have worked together to strengthen the country's defensive capabilities, not only through training but also through research and technology transfer in the agricultural, fisheries and forestry sectors.

In its actions on avian influenza (AI), **REDesastres** has adhered to the instructions issued jointly by the Ministers of Public Health and Agriculture (2005) to strengthen the planning and implementation of special measures to prevent and combat a possible pandemic, in the event that AI should spread to Cuba. Emphasis has been placed on providing technical updates to the Veterinary Assessment Units in the provinces and on training the personnel responsible for monitoring and responding to this threat, as well as the ongoing dissemination of information and education (Percedo et al., 2006).

The network's efforts have been widely acknowledged, particularly by the National Emergency Commission on Birds, operated by the Institute of Veterinary Medicine (IMV) and responsible for overseeing AI monitoring and prevention measures in the country's poultry populations.

REDesastres' performance has also received very encouraging recognition

from the Governing Council of the Ministry of Agriculture, the IMV, the Directorate of Science and Technology, and the Defense Preparedness Department, both of the Ministry of Higher Education (MES), as well as the National Civil Defense.

Numerous university professors have also praised the network's efforts to update their knowledge and its contribution to the teaching-learning process in the courses on Veterinary Medicine in Cases of Disasters.

In recognition of its work, **REDesastres** received the Technology Innovation Prize in 2006, awarded by the Delegation of the Ministry of Science, Technology and Environment (CITMA) in Havana Province.

LESSONS LEARNED

The opportunities afforded by ICT to create a channel for the dissemination and exchange of relevant and up to date information needed to successfully tackle agricultural and livestock health disasters, was decisive to achieve the rapid, growing and stable interconnection of numerous individuals and institutions with converging interests and responsibilities, in the effort to address disasters.

Teamwork between computer experts and specialists in scientific-technical fields, together with technical staff of

the network's specific topics—in this case, veterinarians, agronomists and professionals in other related fields—has been key to the project's success.

In the measure that the network's goals reflect those of its potential users, the more successful will be the effort to increase their number and attract new subscribers to the electronic mailing list.

The tasks of monitoring, gathering and disseminating relevant information, facilitated by ICT, is a very valuable and much-appreciated activity, since it allows for the rapid updating of knowledge and better use of the time available for that purpose. This is particularly important for decision-makers.

E-mail optimizes the use of the Internet, by providing a way to disseminate relevant information instantaneously and uniformly to all users.

Guaranteeing animal and plant health for the benefit of society, both to produce food sustainably and to protect public health from zoonoses, is the goal of the numerous universities and scientific and productive institutions linked through **REDesastres**. This project has been made possible thanks to the advances in ICT and their contribution to technical training and modernization, as well as to multisectoral and interdisciplinary cooperation. These aspects are essential for the success of the activities required in the different stages of the disaster reduction cycle.

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Decision Support System for the Control of Asian Soybean Rust

Marcelo Giovanetti Canteri, Rodrigo Yoiti Tsukahara and Olavo Corrêa da Silva[4]

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[4] *Marcelo Giovanetti Canteri, Ph.D., es un Profesor Asociado en la Universidad Estatal de Londrina, Paraná, Brasil (canteri@uel.br). Rodrigo Yoiti Tsukahara, M.Sc., es el Coordinador de Agrometeorología en la Fundacião ABC, Castro, Paraná, Brasil (rodrigo@fundacaoabc.org.br). Olavo Correa da Silva, M.Sc., es el Coordinador de Protección Vegetal en la Fundação ABC. Los tres son ingenieros agrónomos.*

SUMMARY

During the 2006/2007 season, Brazil lost around US$ 2.1 billion due to Asian soybean rust. Infection by the fungus *Phakopsora pachyrhizi* is favored by temperatures of between 12 and 26°C and a leaf wetness period longer than eight hours. Based on this information, the ABC Foundation together with UEL, UEPG, IAPAR and Embrapa, using resources from FINEP, CNPq and private companies, developed an early warning system for Asian soybean rust for the state of Paraná, and more specifically for the Campos Gerais region, to support decision making by agronomists on rust control. The first component of the warning system is the detection of the presence of primary inoculum, a task that involves monitoring "bait" or trap areas and commercial crops in the region in order to locate rust foci. Scouting is carried out every four days and the information is posted on a Web site using real time maps to show the rust foci areas. The second component of the warning system is weather monitoring. There are around 12 weather stations in the ABC Group region, which generate weekly and monthly climatic favorability maps for the disease and also provide five-day forecast maps to predict favorability for rust development. The maps are available in real time at the Web site http://sid.fundacaoabc.org.br, together with primary inoculum maps, during the soybean season. The use of the warning system during the last three seasons has allowed producers to reduce the risk of losses and effectively control the disease through the rational use of fungicides.

BACKGROUND

Soybean rust is considered a major threat in all Brazil's soybean-producing regions, but particularly in the State of Paraná, one of the country's leading soybean producers, whose climatic conditions are particularly conducive to the development of *Phakopsora pachyrhizi*. Disease outbreaks require a susceptible host, a virulent pathogen and favorable environmental conditions. In their efforts to control diseases, humans can intervene in all three aspects, through plant breeding and the selection of resistant cultivars, through pathogen exclusion or eradication, and through the manipulation, monitoring or elimination of environmental conditions that promote disease.

Although resistant genotypes and resistance genes are known for Asian soybean rust, these are not yet available commercially, while the exclusion of pathogens is a difficult task since the pathogen inoculum is easily dispersed by the wind. Therefore, based on our knowledge of the disease's epidemiology, monitoring the environmental conditions becomes essential for disease control and to support decision-making regarding the use of control measures. Nowadays, fungicide sprays are the main tool used to control the disease; however, the goal of any rust control program should be to use these substances rationally. Therefore, efforts to detect the presence of primary inoculum in a region or in a field, and predict the environmental conditions that favor infection, are decisive steps for an effective control of this disease.

Soybean infection by the fungus Phakopsora pachyrhizi (Sydow &

Sydow), the causal agent of Asian rust, is favored by temperatures of between 12 and 26°C and a leaf wetness period of more than 8 hours (Figure 1). Periods of moisture, as well as high altitudes, with longer dew periods and moderate temperatures, create conditions that are more conducive to the disease. Another aspect that increases the probability of infection and disease is the plants' development stage. Soybean plants are most susceptible to infection during the stages of pod formation and grain fill; when this coincides with favorable environmental conditions and the presence of the inoculum, an outbreak is likely. It is important to emphasize that soybean plants can be infected in the first few days of growth if there is an intense inoculum pressure in the area.

Soja, Ferrugem (Phakopsora pachyrhizi)
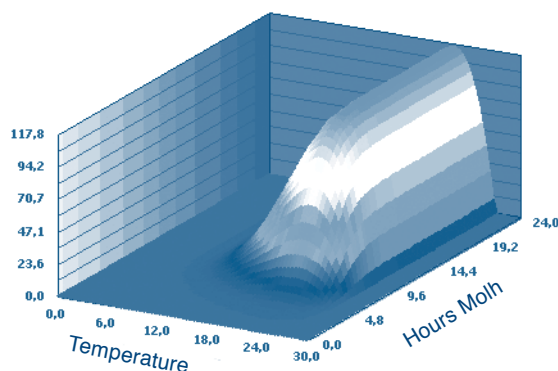
Figure 1. *Climatic model for Asian soybean rust infection (Adapted from Marchetti et al. 1976).*

THE PROJECT

Based on this data, the ABC Foundation, together with Londrina State University (UEL), Ponta Grossa State University (UEPG), the Agronomic Institute of Paraná (IAPAR) and EMBRAPA, with funding from FINEP, CNPq and private companies, have developed an Asian soybean rust early warning system for the state of Paraná, especially for the Campos Gerais region, to support agronomists in decision-making on rust control.

The first component of the warning system (http://sid.fundacaoabc.org.br) is the detection of the presence of primary inoculum. This task involves using "bait" or trap areas and commercial crops in the region to locate rust foci. Trap areas are small soybean plots, measuring about 100 m^2, planted between 10 and 15 days prior to normal sowing time. Inspections are carried out every four days; any suspect materials are sent to laboratories for diagnosis. After detection, the location of the inoculum is marked on a map, together with the areas affected by Asian rust epidemics, corresponding to regions with several foci. The maps are posted on a Web site during the soybean growing season. Maps are
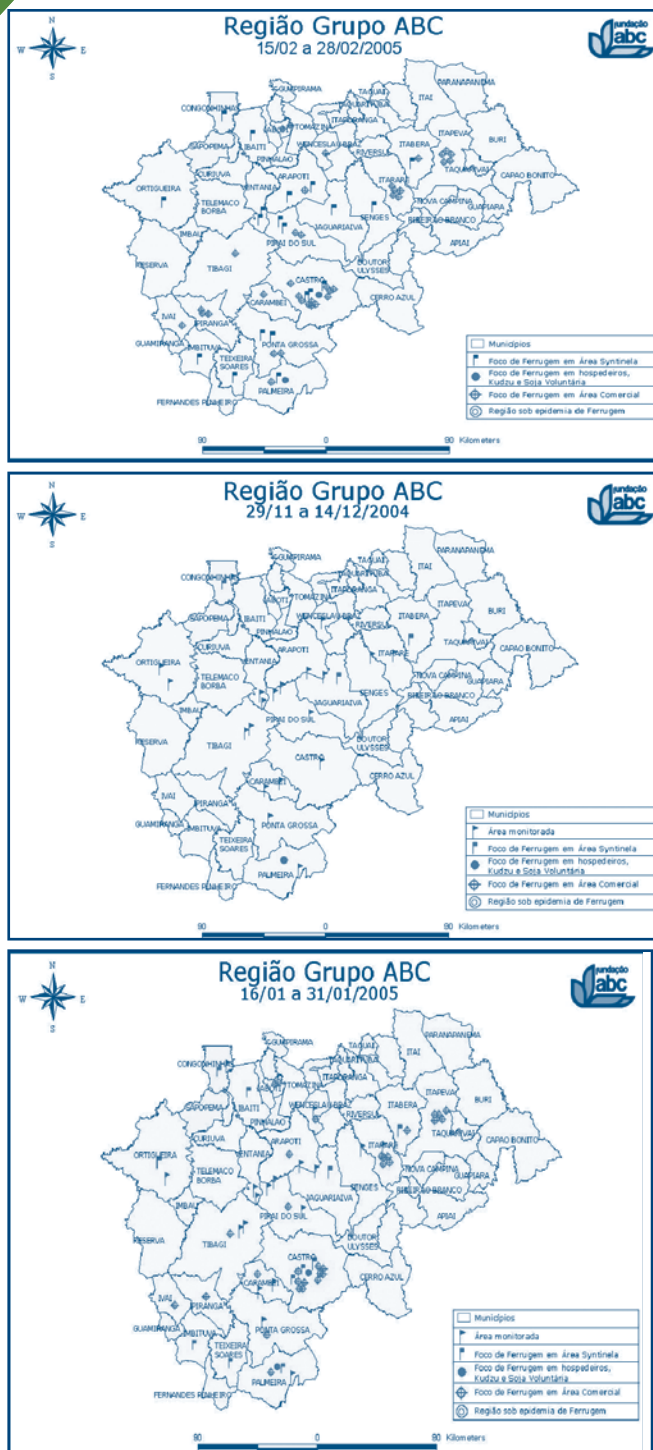
Figure 2. *Maps posted on the Web site showing the development of Asian rust foci during the 04/05 growing season in the Campos Gerais Region.*

generated for the region (Figure 2) as well as for Paraná State, for Brazil as a whole, and for Latin America, with additional information obtained from the Anti-rust Consortium.

The second component of the warning system consists of weather monitoring. There are around 12 weather stations in the ABC Group region, which are used to gather information to generate weekly and monthly favorability maps and five-day forecast maps to predict favorability for rust occurrence. The maps are generated from data on the number of leaf wetness hours and temperature. The favorability maps for the state of Paraná are prepared in partnership with SIMEPAR (Paraná State Meteorological System). Canteri et al. (2005) showed the efficacy of this system.

The first information provided by the Asian rust warning system (http://sid.fundacaoabc.org.br) is an assessment of the regions at risk for disease outbreaks. This information is obtained by analyzing the months with the greatest probability of rust infection for each season. Records show that Asian rust infection varies from season to season, in accordance with the favorability of weather conditions, as shown in Figure 3. However, by analyzing the last four seasons (Figure 4), it may be possible to identify the areas at risk for outbreaks of the disease.
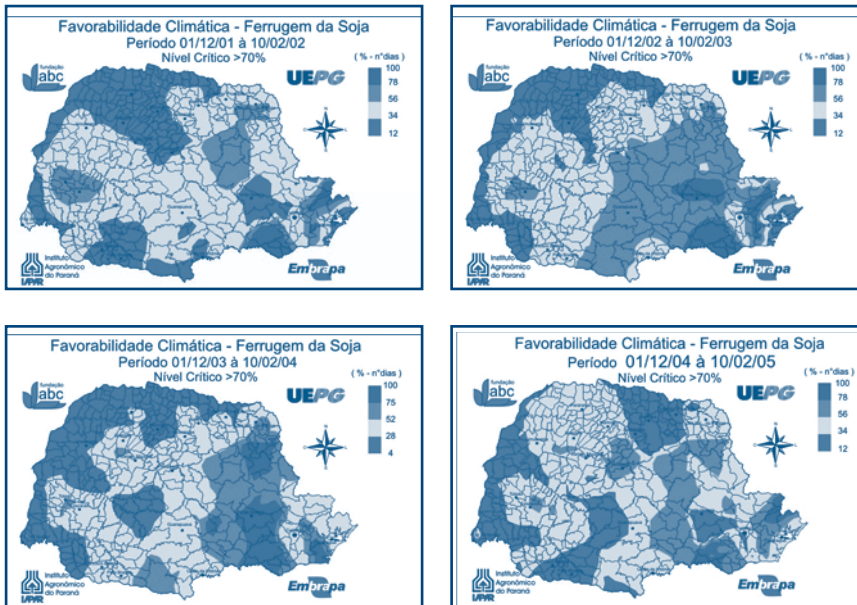
Figure 3. *Single analysis of weather favorability using number of days with critical level above 70%, in the state of Paraná.*
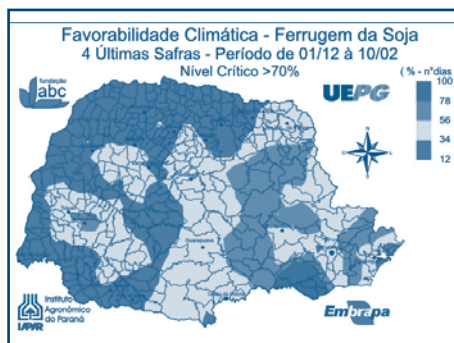

Figure 4. *Joint analysis of climatic favorability for Asian rust occurrence using the number of days with critical level above 70%, in the state of Paraná.*

POSITIVE IMPACT

Based on Asian rust management techniques, the first application of fungicide during the reproductive phase, between stages R_1 and R_4, is essential for successful disease control. Moreover, this spraying should be preventive; that is to say, it should be done as soon as the very first symptoms of disease appear in the crop or in the region. Curative spraying reduces the fungicides' protection period, resulting in a greater number of applications and increasing the risk of failure.

In addition to providing information on the location of rust foci and epidemics, the warning system used during the '03/'04 and '04/'05 seasons significantly contributed to the disease control strategy. In the first place, the system warned of a possible infection risk during the crop's vegetative stage, which was avoided during both seasons. The second important factor in the control strategy was determining when to apply the first or only fungicide application during the reproductive phase. During the '03/'04 season, spraying began between stages R_2 and R_3, either due to the presence of primary inoculum, or due to weather conditions. By contrast, during the '04/'05 season, it was necessary to advance spraying to stage R_1, which resulted in a greater number of applications compared with the previous season. The occurrence of primary inoculum 30 days earlier than in the previous season and its dispersion over a wide region, together with very favorable weather conditions, were the reasons for changing strategies from one season to the other.

The warning system has made it possible to reduce the risk of losses due to rust, and has led to effective control through a rational use of fungicides.

LESSONS LEARNED

Even in areas such as Campos Gerais there are climatic differences between micro-regions. As shown in Figure 5, the counties of Castro and Ponta Grossa, which are located at a distance of 40 km from each other, have different weather favorability for rust outbreaks. The favorability difference between the counties reflects the real disease pressure observed in the fields. These facts underscore the need to establish a warning system by micro-region in order to ensure a more rational and sustainable approach to rust control.

The system is being improved using the models designed by Del Ponte et al. (2006a and 2006b), which utilize rainy days and rain volume. These variables are easier to measure in the field and show a high correlation with the severity of soybean rust. Weather forecasting and the monitoring of fungicide residues have also improved the system (Figure 6).

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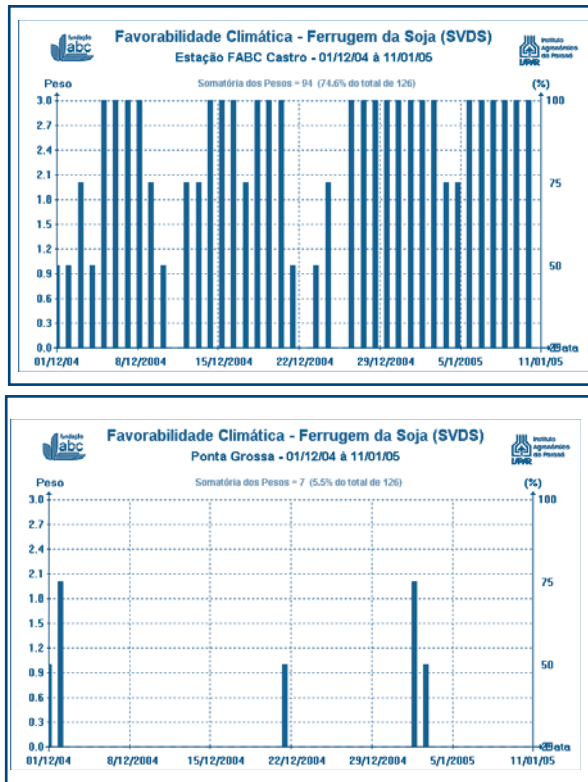
Figure 5. *Comparison between the counties of Castro and Ponta Grossa for rust weather favorability using the sum of daily severity values 0 to 3.*
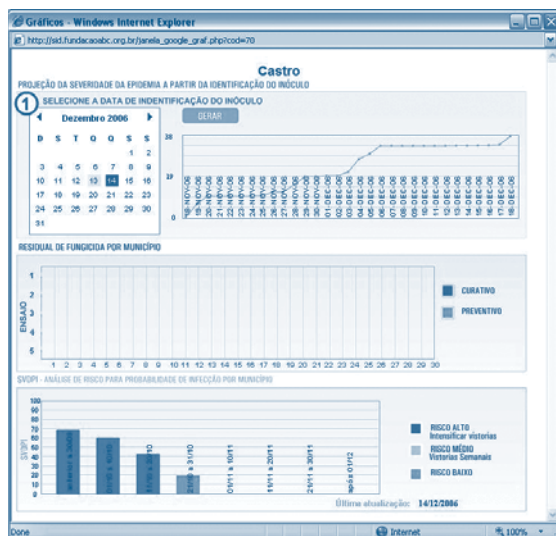
Figure 6. *Graphic analysis of severity forecast and residual fungicide.*

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Cauca Valley Agricultural Sector Information System (SISAV), Colombia

Piedad Montaño de Mayolo [5]

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[5] *Piedad Montaño de Manolo is SISAV's Director. She may be reached at sisavagricola@uao.edu.co*

SUMMARY

In Cauca Valley, Colombia, a territorial agricultural information system has been established based on information and communication technologies (ICTs). It began as a research project at the Universidad Autónoma de Occidente with the technical and financial support of the departmental (state) government's Agriculture and Fisheries Agency and a body whose objective is the integration of resources, people and institutions: the Planeta Valle Foundation. A total of 20 agricultural institutions have come together to share their information resources. One of the results has been the electronic portal known as the Cauca Valley Agricultural Sector Information System (SISAV), which has allowed participating institutions to disseminate and socialize the knowledge generated, which can be accessed in real time through online databases. Also on offer is geo-referential information as well as information about the people and institutions that make up the most relevant production chains of the Cauca Valley region, from small farmers to international consultants and heads of institutions. SISAV has facilitated the integration of the agricultural sector by interconnecting everyone with an interest in agriculture in Cauca Valley. It promotes the use of the Internet and fosters e-commerce among farmers, disseminating knowledge about strategic issues in the Cauca Valley region and encouraging the emergence of virtual communities. To date, more than 3,000 agricultural information resources have been processed and had value added to them. Moreover, the portal offers links to more than 700 information resources worldwide.

BACKGROUND

Cauca Valley Department lies in southwestern Colombia, between the Pacific Ocean and Occidental mountain range. It measures 2,214,000 hectares, of which 984,170 (44 per cent) are covered by forests in various successional stages; 22.81 per cent (505,115 ha) corresponds to pasture land, and 406,245 ha constitute the agricultural frontier, for a total cultivated area of 346,857 ha: 85.4 per cent of the arable land and 15.66 per cent of the Department's total area.

Its economy depends almost exclusively on agriculture, which is responsible for most of the sources of employment in the region; it is also the main stimulus for the adoption of new technologies. Sugarcane accounts for 84 per cent of local agricultural production, making the department Colombia's major producer of that crop; 11 of the 13 sugarcane mills in the country are in Cauca Valley. Sugarcane plantations extend over 195,097 ha, that is to say, 56.24 per cent of total crops. Coffee occupies 90,695 ha (26.14 per cent); fruits, 27,956 has (8.05 per cent); and corn 16,545 ha (4.76 per cent). Bananas occupy 15,430 ha (4.44 per cent); molasses sugarcane, 6,288 ha (1.81 per cent); and sorghum, 4,000 ha (1.15 per cent) (SAP, 2005). Other crops, such as aromatic and medicinal plants and spices, extend over a mere 180 ha, only 0.02 per cent of the total cropland (SAP, 2007).

Although the Valley continues to focus on sugarcane, new crops are making inroads, such as fruit production:

grapes, papaya, golden pineapple, avocado, bananas, peach palm (*Bactris gasipaes*), guava, borojó (*Borojoa patinoi*), blackberry, passion fruit, oranges, naranjilla or lulo (*Solanum quitoense*), banana passionfruit, tamarillo or tree tomato, tangerine, melon and soursop. Of the area occupied by these crops (see above), 9,000 ha have been mechanized. The Department is the second fruit producer in Colombia. To these must be added a variety of vegetables, which are expected to play a key role in future free-trade agreements.

Cauca Valley has some of the best agricultural research centers, widely known academic institutions, and agricultural production centers (the latter located mainly in the Northern areas of the Department), which have been working closely with small farmers. However, a study carried out by Planeta Valle Foundation and disseminated in July 2002 showed that the people, bodies and businesses linked to the sector could not realize their full potential because of the lack of timely access to (often widely scattered) information, affecting decision-making in the agricultural sector at all levels and preventing the structured participation of small farmers.

Cauca Valley's agricultural institutions had developed information systems in an isolated way based on a "supply approach " that did not meet the real needs of farmers and business people and did not lead to the development of production chains or clusters. These institutions, moreover, did not provide direct online access through the Internet to their specialized databases. This inward-looking attitude restricted the effective use of new technologies and prevented access to significant information in real time.

What was required was the establishment and consolidation of an integrated and efficient information system based on an institutional platform of absolute credibility and leadership and enough management capacity to develop an interinstitutional project of this magnitude.

THE PROGRAM

SISAV is one of the results of the Cauca Valley Prospective Science, Technology and Innovation Agenda, a tool for the design and launch of a new human-development scheme based on endogenous capabilities to generate, use and appropriate knowledge, in keeping with the socioeconomic development objectives defined in the Integral, Prospective and Sustainable Regional Development Master Plan toward 2015 and the Cauca Valley Department Regional Science, Technology and Innovation Agenda.

The system arose as a proposal by the Sectional Agricultural Development Council (CONSEA). A private university, Universidad Autónoma de Occidente, agreed to take over the implementation of this project because, even though the university did not have any agricultural programs of its own, it considered the initiative a valuable social project that would contribute to improving the Valley's agricultural sector.

The University's role was ratified by the participating institutions, which considered it *"an ideal environment to operate a system of these characteristics given its […] infrastructure, knowledge management capacity, relations with the private, public and non-governmental sectors and human and technological*

capital required for its consolidation." (SISAV's Board of Directors.) On 9 May 2003, during one of CONSEA's general assemblies, 23 of Cauca Valley's agricultural institutions, under the technical and administrative direction of the Universidad Autónoma de Occidente, signed a Letter of Understanding in which they agreed to share their agricultural information resources.

In late 2006, SISAV was officially launched as a territorial information system based on the use of open software and information and communication technologies (ICTs). The objective was to build a regional culture that would value information as a public good. (SISAV's Portal is governed by a Creative Commons license that enables users to copy, distribute, communicate and execute publicly the works covered by the license, as well as producing derived works, as long as authors' rights are acknowledged and there is no profit motive.)

According to this scheme, information should be seen as a strategic resource for social development by identifying more precisely local farmers' needs. This made it essential to have a system that would enable the dissemination of reliable and up-to-date data to facilitate business decision-making and the establishment and strengthening of public policies for the entire agricultural community.

Among the benefits that SISAV has been providing at the regional, national and international level, its main contribution has precisely been the construction of a culture of information-sharing among the bodies in the sector. Partners have understood that sharing their research

and institutional processes can serve as a valuable input not just for the development of the Cauca Valley region but potentially of Colombia and other nations.

The following principles have guided the project from the start:

■ The information generated has to be timely and reliable, and of practical value to farmers and other people in the sector.

■ This information must be disseminated widely, as a collective good, without excluding anyone.

■ Interested citizens should enjoy easy access to that information.

■ Standards and best practices must be adopted within a compatible system, defining information categories common to all participating institutions.

■ Advantage must be taken of State incentives within an institutional and regulatory framework of agricultural policies based on agricultural, fisheries and forestry production chains and their various stakeholders: researchers, technicians, producers, processors, marketers and exporters.

THE ROLE OF ICTs

ICTs have made it possible to gather in one place all the information resources generated by Cauca Valley agricultural institutions by processing and adding value to the public information organized and disseminated in its electronic portal: http://sisav.valledelcauca.gov.co

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The use of email has enabled the establishment of a virtual community that facilitates the interaction of the various users based on their own needs, such as showing farmers business opportunities at the territorial level. Other media, such as the telephone, fax, radio and television, have also been used to communicate and integrate the various information resources.

Every day, networks and individuals send regional, national and international information to be disseminated and processed by SISAV. Open software resources are making it possible to develop databases, run the portal and build an intelligent rural map of Cauca Valley.

The databases allow users access to digital publications such as research results or statistics about production, yield and the area dedicated to each crop in the region, as well as to free software packages.

The portal was launched publicly on 10 November 2006. Thanks to its users, especially small farmers, can access information they would have been hard pressed to consult or compile in the past. By 20 April 2007, 7,958 individuals had visited the site – and this was before it even began to be formally publicized, since no resources were yet available for that purpose.

POSITIVE IMPACT

At present, SISAV executives are invited to most work meetings related to agriculture in Cauca Valley, and not only to participate in activities and projects but also to engage in decision-making. SISAV has a seat on the board of directors of 13 production chains in the Cauca Valley region. Thanks to its activities, the local agricultural community enjoys greater visibility at the national and international level.

SISAV has had an important institutional impact on the integration of the agricultural sector in production chains and the organization of their databases in conformity with those chains. It has also established the following information subsystems:

- Cauca Valley Agricultural Digital Library;
- Directory of Cauca Valley People and Institutions; and
- Projects Underway.

Moreover, one of SISAV's sections, called Market Intelligence, offers farmers market price information for their products in real time, preventing price manipulation by intermediaries. At present, any farmer can sell his or her products through SISAV's "classified ads" service. During a later stage, the intention is to develop a Virtual Marketing Service to facilitate the sale at the regional, national and international level of agricultural products, particularly those that are organic or have positive environmental or social attributes, through the creation of virtual agricultural markets.

The United Nations Food and Agriculture Organization (FAO) has included SISAV in its Case Studies program, which strives to disseminate and encourage the replication of successful experiences that can be implemented in other developing

countries, helping to bridge the digital gap in the rural sector and to systematize information that would otherwise remain scattered. As part of this process, SISAV's execution guidelines are to be translated into several languages. In the meantime, they are available in Spanish at FAO's Web site: htp://www.fao.org/rdd/case_details_IS.asp?pub_id=216575&lang=IS.

Another proof of SISAV's growing credibility is the decision by the European Union to launch an assured marketing project in Cauca Valley. European representatives have indicated that they approached SISAV because the System is organized by production chains and offers timely and relevant information.

LESSONS LEARNED

SISAV is a territorial system whose strategy was to persuade its partners to view information as a public good. Today it has become a strategic input for the development of Cauca Valley by compiling and processing contents that are made freely available to the region's agricultural sector.

Many believe that all the information needed can be found through search engines like Google. They are wrong. Statistics regarding intellectual production in Latin America that is available on the Internet reveal that it does not amount to more than a fraction of the knowledge generated in the region. Few bodies are working on retrieving, structuring, processing and dissemination agricultural knowledge. Nor is there a culture of free contents: most bodies restrict the dissemination of their information. If Latin America wants to be duly represented on the Internet, document managers face the challenge of correcting these deficiencies.

FAO, through its AGRIS Network, has been engaging in valuable efforts in this regard. However, it is necessary for international financial institutions to provide support to those bodies at the regional level that strive to provide farmers with access to key technical, financial and marketing information in real time about their products.

SISAV can document its own experiences so they can be replicated not only in other Colombian departments but also in other countries in Latin America and the rest of the developing world.

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The National Voice Network as a support for technological innovation and research at the National Agricultural Research Institute of Venezuela (INIA)

Edwin Rodríguez and Félix Carreño[6]

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[6] *Edwin Rodríguez is analyst of the Division of Information and Communication Systems, Office of Institutional Development, INIA, and coordinator of the Subproject of the National Voice Network. Félix Carreño is in charge of the Information and Communication Systems Division. This document was completed in Maracay, Venezuela, in June, 2007.*

SUMMARY

Information and communication technologies (ICTs) cut across all sectors of society and are nowadays essential to any endeavor. The project described below has enabled the National Agricultural Research Institute of Venezuela (INIA) to establish a voice network over its existing data transmission infrastructure by means of digital telephone switchboards that can reach the most remote rural areas over the Internet, overcoming their traditional isolation. This national-level project is coordinated by INIA's General Management with the participation of technicians at 25 Agricultural Research Centers in 18 of the 22 States of the country. Thanks to this application of ICTs, farmers, researchers, technicians and professionals throughout Venezuela can interact in real time through individual and conference calls, describing and comparing agricultural research experiences and promoting innovation and development.

BACKGROUND

Information and communication technologies (ICTs), whose most recent innovations culminate in the digital realm, are based on highly complex scientific and technical principles but have nowadays become an essential part of human activity, since they cut across practically all sectors of society.

In this new economy, more than ever, information plays a key role. The ability to capitalize on this value becomes a critical factor for success and competitiveness through the continual adaptation of ICTs to business strategies and the organizational model as a whole.

Many agricultural rural areas in Venezuela have traditionally had to put up with little or poor telecommunications infrastructure. This has affected their relations with the regional and national environment and their access to information, preventing the exchange of experiences and knowledge and hindering innovation.

In order to alleviate problems of this sort, the National Information Technologies Center (CNTI) launched the Reacciun Voice over IP Project. The Academic Research Centers and National Universities Network (Reacciun) brings together 19 universities and national public research institutions. The project was designed to facilitate the exchange of information, the development of joint research projects and the integration of academic, scientific and technological endeavors by using Voice over Internet Protocol (VoIP) technology, which provides the functionality and quality of a normal telephone conversation but at much lower cost.

Initially, however, efforts such as this one had little impact on the agricultural sector. What was needed was a project that would improve communications between INIA's research stations and the country's cities, and help rural farming communities, traditionally neglected and isolated, exchange information and experiences. This improvement in communications

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should lead to greater efficiency by integrating interdisciplinary and interinstitutional work teams and securing the participation of the farming communities themselves.

With the technology available then (analog and rural telephony), researchers and technicians working on national projects needed a dedicated person to man a central switching unit in order to communicate. By relying on VoIP technology, these same individuals could communicate directly and at much lower cost by "piggybacking" onto the global network, even participating in conference calls involving people in different regions of the country.

THE PROJECT

INIA is a body of the Ministry of Science and Technology that carries out scientific research, develops new technologies, and provides technical advice and specialized services to generate the knowledge and technologies demanded by the agrifood chains that are a priority for the Venezuelan government, thereby contributing to the sustainable and competitive development of agriculture, livestock, forestry and fisheries, as well as the rural milieu in general. (www.inia.gob.ve)

A high percentage of INIA Research Centers and Experimental Stations (which make up the organization's working units throughout the country) are located in rural areas far away from towns and cities. This geographical situation allows researchers to interact with small farmers, experience conditions on the ground and carry

out their experiments in the field, but it does limit their access to information transmission.

In 2000, INIA began to look into the potential of ICTs to alleviate this problem. In 2002, it designed and implemented a project to link internally and externally all of the Institution's Centers and Experimental Stations through Voice over Internet Protocol (VoIP) infrastructure at the national level. The system employs digital telephone switchboards that communicate over the Internet and can reach the most remote and isolated rural areas. The project, coordinated by INIA's General Manager's Office, links technicians at 25 Stations and Agricultural Research Centers in 18 of the country's 22 States, or 81% of Venezuela's territory.

The initial step was to establish data networks in every one of INIA's field offices. Each of these networks employs a point-to-point system in a star network topology; that is to say, the cables extend from a central hub to each of the voice (telephone) service points. The network uses Category 5e structured cable, cable protection pipes and ladders, and Cat 5e couplers. The cabling reaches the telecommunications room, which is fitted with a 24 and 48 Cat 5e ports patch panel, a switchboard and a router. In addition, a computer enables local and remote administration and collects fee information. (See figure 1.)

When someone makes a telephone call, this equipment digitalizes the information and sends it out as data packets over the Internet to a central node, located in INIA's headquarters in Maracay, Aragua State, where a switchboard analyzes and distributes these packets. This implementation

of VoIP is completely independent of the country's telecommunications companies, which means that INIA offices can communicate at the national level without generating any external costs for the institution.
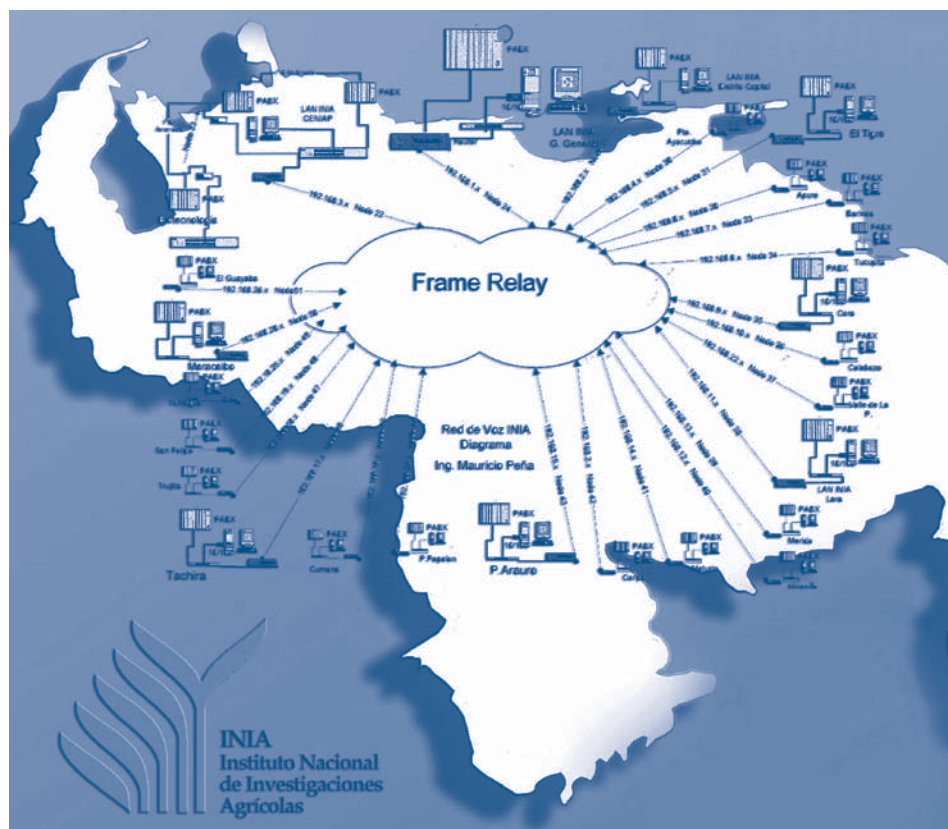
Figure 1. *Distribution of the INIA Voice Network, Venezuela.*

THE ROLE OF ICTs

In developing this project, use has been made of satellite and wireless connections, radio and microwave signals, and ATM, ground, fiber-optic and telephone accesses for VoIP transmission, as well as TCP/IP protocols and QoS standards with voice and data over the same communications channels, as well as software for call control and fee information gathering. Close to 1,400 telephone points benefit some 1,500 users in 25 offices across the country.

The implantation and use of ICTs at INIA has made it possible to coordinate actions, exchanges and reflections from various points of the country without incurring in large travel expenses. The main function of ICTs in the project has

been the gathering, organization and dissemination of information among agricultural stakeholders who were previously neglected and isolated. It has also helped to provide training and facilitate high quality communication in real time among farmers, researchers, technicians and professionals through individual and conference calls.

This has enabled teams of technicians at the regional level to work with coordinators in headquarters to provide prompt solutions to agricultural and management problems, and has established INIA as a public institutional leader in the use of ICTs and other cutting-edge technologies for agricultural development.

LESSONS LEARNED

Before installing technologies such as these, it is important to collect baseline information. This will make it possible later to compare the new situation with the old one, thereby assessing more precisely the success of the project.

The application of ICTs calls for qualified personnel. A system such as the one described here incorporates new features such as conference calls, voice mailboxes, call transfers and automated messages and directories. This can intimidate users if they do not feel adequately supported.

These two aspects call for careful planning and preparation, including awareness-raising. The institution's top management must be fully aware of the process and participate actively in it; their role is crucial for the success of the project in the short and the long term.

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The Potato Electronic Network (REDEPAPA)

Jorge Luis Alonso G.[7]

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[7] *Web content manager, Colombia 1118 (E), San Juan, Argentina. Email: jorgealonso@redepapa.org*

SUMMARY

The Potato Electronic Network (REDEPAPA) was established in 1999 under the coordination of the Colombian Agricultural Research Corporation (CORPOICA). In 2004, its administrator and facilitator – and only member of the work team—resigned from that institution. Since then, the Network has been administered ad honorem from Argentina with the economic support of Papa Andina, a joint project of the International Potato Center (CIP) and the Swiss Agency for Development and Cooperation (SDC). REDEPAPA has USED ICTs to consolidate and energize a virtual community centered on the crop. Its main success lies in having been able to keep going over eight consecutive years with very limited economic resources (particularly in the last four years) thanks to the use of low-cost technologies. Three main lessons can be learned from the experience: (1) more than money, what is needed to sustain an initiative like this one is discipline and willingness to work hard; (2) the resources provided by international cooperation agencies are indispensable but must be used to improve services, not to sustain the initiative; this enables it to operate independently of external aid; and (3) the administrator-facilitator must be able to devote 100 percent of his or her time to the project if its goals are to be met.

BACKGROUND

In 1999, Regional Chapter One of the Colombian Agricultural Research Corporation (CORPOICA) decided to revive an initiative that had remained dormant for a while, the *Colombian Potato Network*, taking advantage of the new information and communication technologies (ICTs). This initiative responded to a policy by the Corporation to assemble into networks the main stakeholders of the agrifood chains of greatest economic significance in the country. The knowledge was there, but not the conditions for it to be shared and disseminated. Even then, moreover, the resources provided by the State were beginning to dwindle. Thus, any initiative aimed at establishing a community of knowledge would have to be inexpensive and above all efficient. It was in that context that REDEPAPA was established.

THE PROJECT

REDEPAPA's general objective was to consolidate and energize a virtual community centered on potato production. In order to achieve this objective, REDEPAPA has sought, selected and disseminated information about the potato by means of a Web site; it has also established spaces for the exchange of knowledge and developed training documentation on how to transfer information using ICTs.

Although the impact that REDEPAPA has had among its users has not been evaluated technically, the following indicators suggest that the services offered are benefiting a large number of them:

- An average of 88 individuals visit the REDEPAPA Web site every day (see statistics at http://es.nedstat.net/cgi-bin/vistastat?name=redepapa).

- *The Boletín de la Papa* (Potato Bulletin) had as of 21 May 2007 a

total of 3,879 voluntary subscribers from 37 countries.

- A high percentage of the queries and requests for assistance sent by the users and published in the *Boletín de la Papa* are answered satisfactorily by other users (according to communications between the administrator-facilitator and the users themselves).

- REDEPAPA has published a total of 53 papers produced by its users (see documents at http://redepapa. org/documentosred.html, and the *Boletín de la Papa* at htp://redepapa. org/boletinpapa.html).

- When users were asked for their opinion of the network, the degree of satisfaction expressed was acceptable (visit http://redepapa.org/ cgi-bin/Ultimate.cgi?action=intro and click on the last of the forums: *Hablemos sobre comercialización y agroindustria de la papa)*.

THE ROLE OF ICTs

REDEPAPA has used the following resources to achieve its objective: a Web site, an electronic newsletter, a mailing list, a Web log (blog), a wiki, electronic forums, a news and content syndication service (RSS), and email alerts.

The functions of each, classified according to the management activity involved, are the following:

a) Compilation, selection and dissemination of information

▲ *Web site*

The potato electronic network (htp://redepapa.org) is the virtual

community's "center of operations". Researchers, extension officials, academics, industry leaders, producers and students consult the information offered there: documents, images, a selection of links, and news. Once they have reached the Web site, users have access to the rest of the digital tools mentioned here.

▲ *Electronic newsletter*

El Boletín de la Papa (htp:// redepapa.org/boletinpapa.html) is a free semi-monthly electronic publication distributed by email to its subscribers. It was used as a tool for establishing a virtual community made up of the above mentioned scholars, extension workers, industry leaders and producers.

▲ *Web log (blog)*

News is updated once a week about a polemical subject: transgenic potatoes (htp://papatransgenica. blogspot.com). The blog serves as a tool for consolidating the virtual community.

▲ *Wiki*

Wiki-papa (htp://wikipapa. pbwiki.com/) is intended to become the first virtual book about potato growing. It is a collaborative project; that is to say, the product will be the result of the work of all users. It is another tool for consolidating the virtual community.

▲ *Alerts*

Google Alerts are used to obtain information about potato growing. This information is received by

REDEPAPA's administrator-facilitator, who organizes it and disseminates it among the users.

▲ *News and content syndication system (RSS)*

It is used as a way to notify users that the contents of the blog and wiki have been updated.

b) **Establishment of spaces for the exchange of information and experiences**

▲ *Mailing list*

Infopapa (http://redepapa.org/readyred.html) is a space that encourages the discussion of various aspects of research on potato growing in Latin America and the Caribbean. It is used as a tool for consolidating the virtual community.

▲ *Electronic forums*

Investigación sobre Papa en Línea (potato research online) (http://redepapa.org/cgi-bin/Ultimate.cgi?action=intro) is a service that enables users to exchange information and experiences in this field with their peers in Latin America and the Caribbean. It is another tool for consolidating the virtual community.

c) **Training**

▲ *Web site*

It stores the following papers written by REDEPAPA's administrator-facilitator:

• Cómo construir una red electrónica de información: Instrumento para la gestión del conocimiento (How to build an electronic information network: A tool for knowledge management) http://redepapa.org/ponence.doc
• Cómo planificar, editar y distribuir un boletín electrónico: Herramienta para crear y administrar comunidades virtuales (How to plan, edit and distribute an electronic newsletter: A tool for creating and managing virtual communities) http://redepapa.org/boletin.doc
• Cómo administrar listas de correo y foros de discusión: Espacios virtuales para el intercambio de información (How to manage mailing lists and discussion forums: Virtual spaces for the exchange of information) http://redepapa.org/ereadys.doc
• Cómo consolidar y dinamizar comunidades virtuales creadas a partir de boletines electrónicos (How to consolidate and energize virtual communities built on a foundation of electronic newsletters) http://redepapa.org/communided.doc

The use of ICTs has been essential for the pursuit of REDEPAPA's objectives. Each of these technologies has contributed to the process, some more successfully than others. For instance, the *Boletín de la Papa* is distributed by email and users receive the information at home or work without any cost to them. Dial-up Internet connection time is minimal since users normally disconnect after they have downloaded the newsletter to their computer. This feature

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ensures that the information reaches nearly 100 percent of users.

That is not the case with the wiki and blog, which require users to be online while examining the information; people without a broadband connection find it difficult or expensive to take advantage of these technologies.

Moreover, sharing experiences among users is still not a generalized custom, since they participate little in the spaces devised for that purpose. The only logical explanation for their not doing so, in spite of having the tools needed , is that Latin Americans still prefer "face to face" contact when interacting and do not feel comfortable participating in virtual meetings.

LESSONS LEARNED

Nowadays, REDEPAPA is one of the most complete and up-to-date sources of information on potato production in Latin America. The following are the main lessons that have been learned as a result of this experience:

■ **About the creation of virtual communities**

• More that financial resources, what is needed to sustain an initiative like this one is *discipline* and *willingness* to work.

• A single individual can organize and manage an initiative of this type.

• Creating a virtual community is easy; what is difficult is consolidating and energizing it. If the administrator-facilitator lacks

the necessary discipline and will, he or she might as well not even bother. Remember that what is at stake is not just your prestige but that of your institution.

■ **About cofinancing**

• Cofinancing by international cooperation agencies must be restricted to *improving services* and not to *sustaining them*; this enables the project to function independently of external resources.

• To secure the sustainability of the initiative, before thinking of selling services, what should be done is to procure *permanent economic support*; the more specialized the community, the greater the possibilities of securing funding.

• Cofinancing should only be sought once there is something to show (a Web site, a blog, a wiki); international cooperation agencies pay a lot of attention to such considerations.

• Once cofinancing has been secured, the administrator-facilitator must ensure that his or her work is serious and effective, if additional funding is to be obtained in the future.

■ **About ICTs**

• Before creating the community it is necessary to know what kind of access to the Internet users enjoy; this information can guide the administrator-facilitator in deciding which tools are the most appropriate for the community.

- Strategies based on Web sites are more costly to implement and require more maintenance time than those based on email.

- The total cost of using ICTs only provides a generic estimate; to choose the appropriate technology, the administrator-facilitator should complement this information with reflections within his or her own community.

- ICTs generally have a non-commercial version that is free; it is a matter of finding it and adapting it to the community's needs.

■ **About the administrator-facilitator**

- Facilitation is the key to building and maintaining a group effectively. The main role of the administrator-facilitator is to help the group achieve their own objectives. He or she must be aware of the various styles of communication and group dynamics.

- What is ideal is for the administrator-facilitator to devote 100 percent of his or her time to working for the benefit of the virtual community.

- The administrator-facilitator must know the ICTs that are implemented in his or her community so he or she can assist users in technical matters.

- It is highly advisable for the administrator-facilitator to understand English; this ability will make it a lot easier to implement ICTs by providing access to recent information about the subject that has been published in that language.

■ **About user participation**

- Active participation by users in Latin America is low compared to their North American and European peers.

- There appears to be a certain fear of sharing lessons learned. It is almost as if users saw each other as potential competitors.

- Even if user participation is low, the administrator-facilitator must try to stimulate it in ongoing fashion; this calls for patience and persistence.

PRODARNET: A Virtual Community Dedicated to the Promotion of Rural Agroindustry

Marvin Blanco and Hernando Riveros [8]

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[8] *Marvin Blanco M. is Information Manager at PRODAR-IICA (mblanco@infoagro.net). Hernando Riveros is the head of PRODAR/IICA (Hernando.riveros@iica.int).*

SUMMARY

After more than 10 years of operations, the Virtual Network on Rural Agroindustry and Related Issues (PRODARNET), sponsored by IICA's Program for Rural Agroindustry Development (PRODAR), has become a space for dialogue and exchange of information benefiting a community dedicated to promoting rural agroindustry. PRODARNET brings together more than 2,600 members who share technical information and news about rural agroindustry and related issues. The main communications tool is email, since it is accessible, inexpensive, timely and easy to use. The key to PRODARNET's success has been to create a virtual space that brings together the members of a community who identify with shared principles and objectives–not necessarily explicit— which make them feel at ease and motivated to express their needs and disseminate information, thereby contributing to rural development in Latin America and the Caribbean.

BACKGROUND

In the late 1980s in Latin America and the Caribbean, information on rural agroindustry was scarce and scattered. The challenge then was to compile it, systematize it and, above all, disseminate it.

From the start, the Program for Rural Agroindustry Development in Latin America and the Caribbean (PRODAR) of the Inter-American Institute for Cooperation in Agriculture (IICA), given its open and participatory nature and hemispheric scope, considered information dissemination one of its key activities and raisons d'être. In its nearly 20 years of operations, the Program's conception and implementation of that service has evolved over several stages.

In its first phase, the Program took on the task of giving continuity to the work that had been carried out by its predecessor network, RETADAR, with a monthly print newsletter. At first, the newsletter was produced laboriously on a mimeograph; it was eventually produced in a proper print shop and reached a circulation of 300. But the production capacity and distribution costs became significant limitations as the network of institutions and individuals involved in the Program started growing and expanding throughout Latin America.

The best option for confronting these challenges was to use the tools that the new information and communication technologies (ICTs) were starting to provide to non-specialized users.

It later became clear that the simple dissemination of information did not meet PRODAR members' needs. They were also looking for a permanent space for discussion, the exchange of knowledge and experiences, and the submittal of requirements.

More recently, when the Program was deprived of financial resources for arranging research projects and national and international conferences, PRODARNET practically became the Program itself; it is the medium through which events are announced, results are shared, activities are promoted, problems are shared, and specialized groups come

together. The impact is not the same, but the spirit of PRODAR has been maintained, with fewer financial resources but with an efficient administration of the human and technological resources available.

THE PROJECT

In October 1996, the PRODARNET virtual network was created. It started, with 20 members, from a server at IICA headquarters, and relied on the Majordomo electronic mailing list program.

The general purpose was to establish a virtual space for the exchange and dissemination of information among producers, business people and technicians about issues related to rural agroindustry, in order to contribute to the growth of a collective knowledge base.

During its first five years, the number of subscribers to the Network grew slowly. The use of email was still not widespread in Latin America. Moreover, there were frequent technical problems due to the server's limitations (little storage capacity, downtime lasting even days sometimes, and inability to send large documents). In the face of these obstacles, the decision was taken in 2001 of moving the mailing list to Yahoo! Groups, a free service, with excellent results in terms of technical operation, acceptance among users, and participation.

Since then, the number of Network users has been growing steadily at an average rate of 35 a month. At present, 2,650 members exchange an average of 75 messages a month.

These members, from 25 countries in Latin America and Europe, include small producers, owners of small businesses, institutional technicians, academics, researchers and students.

Coordination links have been forged with other information systems, making it possible to improve still further the services provided. The following are a few examples:

- Participation in the Information Network for the Sustainable Development of Latin America and the Caribbean (REDISAL)

- Participation in the Dialogues and Documents for Human Progress (DPH) network

- Participation in WAICENT/FAO's News and Events Management System (NEMS)

- Agreement for the production of technical information for the INFO-FAO system

- Linkages with IICA information systems

- Cooperation agreement with Soluciones Prácticas ITDG, Practical Solution's Latin American affiliate, to support its Technical Enquiry Service

To date, the services offered on this information platform have remained free thanks to the specific initial funding for this activity by cooperation projects funded by IDRC, CIRAD and IICA, and to the institutional support provided by IICA in the past four years. Nevertheless, the system's financial sustainability remains a major challenge. Mechanisms to attract funds have been discussed.

However, consultations with users show that they would be reluctant to pay for access to the information and would only do so if they were offered more specialized products of immediate practical value.

Currently, the basic premise of the Network is that the most valuable information comes from people's experiences. What must be done, therefore, is to put those who are looking for solutions to their problems, and do not have the time to look for them in libraries or the Web, in contact with to those have the information and are willing to share it .

The key to PRODARNET's success has been to create a virtual space that brings together the members of a community who identify with shared principles and objective–not necessarily explicit— which make them feel at ease and motivated to express their needs and disseminate information.

The mailing list format adapts well to these requirements and has made it possible to establish a virtual community that operates within Yahoo! Groups and has the following functions:

■ Dissemination of general news about the performance of the rural agroindustry sector in LAC

■ Announcement of events (courses, seminars, meetings)

■ Response to queries and inquiries regarding technological and commercial issues

■ A virtual showcase for the marketing of agroindustrial products

■ A forum for the exchange of opinions

■ A contact mechanism

The Network has a moderator who is responsible for fostering a pleasant work environment that encourages users' participation. He is also responsible for the technical operation of the Network and the quality of the messages, remains in permanent contact with members, and guides their participation in order to ensure that the information shared is of interest to the community. The work of the moderator is complemented by that of a part-time assistant who supports information management by looking for pertinent data, helps to stimulate debate, and complements subscribers' contributions. The team is completed by PRODAR's Director, who follows up on what is going on in the Network, identifies potential allies, suggests modifications and adaptations, and serves as a liaison with IICA and the Program's partners.

THE ROLE OF ICTs

Since the birth of the Network in 1996, email has been used as a means of communicating directly with users. Over time, taking advantage of the interactive characteristics of this technology, the initial high dependency on the moderator has given way to a gradual appropriation and self-management of the Network by its own members.

The electronic mailing list complements the institutional Web site. The former feeds off the information stored in the latter, while the list also promotes the resources available on the Web site. It has been determined that users are

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more reluctant to look up references on the Web site, in part because they have limited access to this tool. In any case, they appear more interested in obtaining information from the other users, since the information has greater value added, has been processed up to a point, and comes from a known source.

The use of the Internet has enabled the widespread and democratic dissemination of technical and commercial information. Much of that information was not registered anywhere; it was stored in the minds of producers, small business owners, technicians and academics who now find this space to be a practical and friendly tool for sharing their experiences and asking questions.

LESSONS LEARNED

PRODARNET's success is owed to the fact that an informal communication space has been consolidated whose users have appropriated the tools provided by ICTs. This gives them the confidence to ask questions and share their experiences without expecting any remuneration for their contribution.

Such a collective exchange of technical and trade information is useful for the promotion and development of rural agroindustry as a viable alternative for small agricultural producers in Latin America.

The experience can be replicated in any geographical or thematic area. What is needed is to create a community around an issue, a vision, and certain shared principles and objectives, as a result of awareness-raising and encouragement to ensure that the mailing list can reach the necessary momentum and achieve self-management.

The development of an information platform such as this one is an ongoing process of construction and learning. Its design and maintenance will surely never be completed.

Conclusions

The cases compiled in this publication illustrate various ways in which information and communication technologies (ICTs) are being used to promote technological innovation in the agricultural field. The various instances show how these tools have made it possible to work in a network, have facilitated the organization, dissemination or exchange of information, and have even favored capacity building.

In general, the experiences gathered here are quite different from each other, both in terms of their purpose – the objectives chosen – and their degree of specialization, their scope, and the tools used. Some center on a particular crop, or even a disease that afflicts a given crop. Others focus on a discipline, circumstance or region. Some of the cases pay attention mostly to the transmission of information, while others emphasize the exchange of knowledge and experiences among the members of a virtual community gathered around common interests or goals. In some cases participants belong to highly specialized communities, while others

have a broader scope. In general, all underscore the significance of the value added by the retrieval, structuring, digital processing and dissemination of the information.

Each of these chapters gathers the lessons learned in that particular case. However, some common elements can be put forward as the factors that may have led to success in these cases.

One of the elements is the importance of choosing the specific ICTs to be used according to the characteristics and needs of the users and the project. In this respect, although there are no universal formulas, several of the cases underscore how significant it is to apply certain mechanisms such as email (in the form of mailing lists or e-groups) rather than focusing on a presence on the Web, when users' broadband access is limited.

Another point worth stressing is the importance of the effort and dedication shown by the facilitators or organizers of these experiences. The promotion of fluent and productive exchanges, as well as the ongoing growth of the virtual communities involved by taking advantage of new

possibilities and tools as they emerge, are vital for achieving a positive impact.

A final challenge evidenced by the cases gathered here is the need to focus more on the qualitative assessment of information projects. It is necessary to document not just the experiences themselves but also the conditions prevailing before the start of the project. Only then will it be possible to show more precisely the positive impact of the effort. This is vital when trying to raise the awareness of decision-makers regarding the need to support and promote technical information aimed at agricultural innovation.

Annex 1

Proposals of success stories received through INFOTEC

Proposals of success stories received through INFOTEC

Name of the case (ordered by submission date	Proponents	Country
1. Participative diagnosis of communities for territorial planning and the formulation of a rural development plan	Abner Chávez Leandro	Peru
2. Development of a Community of Practice on International Agriculture Trade	Graciela Bonomelli	Chile
3. Indigenous potato project in the high Andean communities of the Province of Canchis Sicuani Cusco Peru	Genaro Vargas Apaza.	Peru
4. Red Electrónica de la Papa, REDEPAPA	Jorge Luis Alonso Gonzalez	Argentina
5. Agricultural Information System for Cauca Valley, Colombia (SISAV	Piedad Montaño de Mayolo	Colombia
6. Network for the Association of FMV - UNMSM graduates using yahoogroups	Gino Oscar Mariño Arquiñigo	Peru
7. The network of campesino organizations for agricultural trade - ROCCIA	Jorge Tomas Vera Pren	Mexico
8. Inter-university distance postgraduate program "Doctorate in Natural Sciences for Development"	Tomás de Jesús Guzmán Hernández	Ecuador
9. Technology transfer on the transformation of agricultural products.	Hernán F. Gudiño S.	Ecuador
10. Available prices vis SMS	Jorge Ordóñez	Venezuela
11. Online course – current challenges and future perspectives in regional negotiations for the agricultural sector (DAP)	Graciela Bonomelli, Marta Cabeza	Argentina
12. Establishment of the agricultural information and documentation system at Venezuela's National Agricultural Research Institute (INIA	Alexander Mackenzie Rivero	Venezuela
13. Relevant information on the most prominent agro-industrial and food export products.	Juan Pedro Puignau Draper	Uruguay

14. Web page for the area of sustainable livestock and pastures from the Amazon Initiative in Peru	Luis Quintanilla Chacón	Perúu
15. Multimedia IPM in cucurbits	Zenia Flores Lovo	Honduras
16. Agrarian Portal	Carlos Emilio Alegria Rojas	Peru
17. Mechanized reception center: collection, screening and bagging of grains "Navolato, Sinaloa, Mexico".	Jose Luis Hernandez Juarez	Mexico
18. Diploma on management of agro-entrepreneurial value networks.	Roberto Rendón Medel, José Alberto Zarazúa, Manrrubio Muñoz Rodríguez, Jorge Aguilar Ávila y J. Reyes Altamirano Cárdenas.	Mexico
19. SIDALC and Google Scholar – Enhancing the information service	Manuel Hidalgo O.	Costa Rica
20. Technological evolution and the challenge of involving the less privileged peoples.	Germán Muñoz Almanza	Mexico
21. The Program for integrated management of the domestic fly (IPM), a successful experience promoted through communication	Jorge Pereira	Argentina
22. An early warning system on Asian soybean rust, Paraná State, Brazil	Marcelo Giovanetti Canteri	Brazil
23. The National Voice Network as a pillar for technological innovation and research at Venezuela's National Agricultural Research Institute (INIA)	Edwin José Rodriguez Maldonado	Venezuela
24. REDesastres: A contribution to the management of health disasters involving plants and animals.	Adela Encinosa Liñero	Cuba
25. Agricultural Informatics (Agromatics) course - FCA – UNL (National Litoral University, Faculty of Agricultural Sciences)	Daniel Arnaldo Grenón	Argentina
26. The Virtual Network on Rural Agro-Industry (PRODARNET)	Hernando Riveros Serrato	Costa Rica
27. Courses on "Information Systems"	Cindy Hernández	El Salvador
28. Importance of Information and Communication Technologies (ICTs) in the organizational learning profile at Venezuela's National Agricultural Research Institute (INIA)	Angel Antonio Berrio Gonzalez	Venezuela