INTEGRATION OF AGROMETEOROLOGICAL, GEOGRAPHICAL AND COMPUTATIONAL TOOLS FOR MANAGEMENT OF DISEASES AND PESTS IN BRAZIL

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The process of knowledge and technologies transfer generated by public or private research in Brazil, as well as the use by farmers and technical advisers, is associated with factors such as: i) integration of the various areas of agronomic engineering knowledge to better proposal of scientific hypotheses and thereby increase the likelihood of innovations in process; ii) economic, technical and environmental benefits, respectively; iii) applicability of the technology, process or proposed management, in any scale of productivity; iv) impartiality and not personal interests of researchers and your institution/ company; v) recognition of the main limitations of each technology or process, either by the providers and farmers; vi) quality, experience and suitability of technical assistance; vii) integration of the farmer on economic, environmental and social context, which will impact on the commitment to the proposed technologies; viii) global strategies, regional and local adopted for the dissemination of knowledge, as well as monitoring of some indicators of use of these technologies; ix) organizational hierarchy between research, technical assistance, cooperatives, farmers, businesses (multi) national, agencies for development scientific, technological and industrial innovation; x) integration of the research and technical assistance, cooperatives and farmers, with a view to a better characterization of agriculture and research methods practiced locally, regionally and globally.

The recognition of some of these limiting factors for the generation process and especially for technology transfer culminated in the establishment of ABC Foundation - Research and Agricultural Development on 23 October 1984, the first Brazilian non-profit private research foundation, founded by a group of farmers, technical assistants and local researchers associated with Dairy Central Cooperative, together with the Cooperative Agro Industrial Arapoti, Batavo and Castrolanda (ABC Cooperatives), located in the Campos Gerais region of Parana State. This regional organization resulted in the development of major technologies, like no-tillage system, with some important achievements: i) the organization of the first no tillage national meeting in 1981 (more than 600 producers); ii) the signing of the Technical Cooperation Agreement involving the Dairy Central Cooperative and the EMBRAPA (Brazilian Agricultural Research Corporation), in order to promote, develop and disseminate the no tillage system in Brazil; iii) organization of third national no-tillage meeting in 1985; iv) 10 years of no-tillage in Campos Gerais region - Reflections in Brazil in 1987; v) no-tillage seminar for southern cone of South America in

1989; vi) national meeting of corn and sorghum in 1992; vii) international symposium on no tillage sustainable systems in 1993, among others.

The social historical context with the direct participation of farmers in decision-making processes, together with the high organizational and hierarchical level established between local research (ABC Foundation), ABC cooperatives, technical consultants and farmers with the other segments of the production chain resulted in decisions on technical and economic parameters. This premise by local technical solutions helped the development of research, especially in the processes of creation and adaptation of new methodologies or processes, and assist / facilitate the transfer of knowledge to the associated farmer over the last 31 years. Obviously we must recognize the significant advancement of research methodologies and scientific instrumentation in all areas of knowledge, with special emphasis on nanotechnology and biotechnology, in addition to the contributions of social networks in the dissemination of facts, news and knowledge. In the agricultural scenario, also highlight the benefits generated by the integration of geotechnology, agronomic and meteorological knowledge, with statistics and computational tools inserted in decision support systems. The strategy of integrating of geographic, agrometeorological, phytopathological, entomological, physiological or any agronomic knowledge in the decision support systems continues being adopted in countries with higher economic development, where: technological innovation is generated in universities, but with direct participation of private companies; farmers have financial, political and social stability; the cost is high and the skilled labor is scarce; labor obligations and their rates too borne by the farmer; environmental problems resulting from the use of agrochemicals and their residual levels in the air, water and soil are monitored by society in general.

A consultation on the decision support systems with a focus on plant pathology and entomology resulted in 14 operational services in Brazil, where 5 were developed through public-private partnerships, generating and free availability of information:

1. Agroalerta = monitoring system and dissemination of agro-meteorological warnings, developed by Agricultural Research Corporation and Rural Extension (EPAGRI) and Environmental Resource Center Information and Hydrometeorology of Santa Catarina (Ciram), focusing on banana crops, grape and mace to the state of Santa Catarina;
2. CIIAGRO = Integrated Center of agrometeorological information, under the responsibility of the Agronomic Institute of Campinas (IAC), focusing on the provision of meteorological records and agro-meteorological bulletins for the state of São Paulo;
3. Consortium Anti Rust = consortium of private universities and business divesas multi (national), led by the research team of the Brazilian Agricultural Research Corporation (EMBRAPA - soy) and the Federal University of Rio Grande do Sul (UFRGS) and University of Passo Fundo (UPF), focusing on the identification of the Asian soybean rust inoculum, throughout Brazil;
4. Sisalert = a multi-model that collects meteorological data from automatic weather stations and short-term weather forecasts platform, processes the information by various epidemiological models, simulates the risk of epidemics in apple and wheat to 8 states. The responsibility for this system is the University of Passo Fundo (UPF) and the Brazilian Agricultural Research Corporation (EMBRAPA - wheat).

5. smaABC = agrometeorological monitoring system developed by ABC Foundation in partnership with the Agronomic Institute of Paraná (IAPAR) and the Brazilian Agricultural Research Corporation (EMBRAPA), whose main objectives are related to monitoring (network agro-meteorological stations), weather time and simulation models the risk of diseases in soybeans, corn, beans and wheat, to the states of Paraná and São Paulo.

The other identified services offer phytopathological information to Brazilian farmers pay, with values that vary according to: the purpose of monitoring (disease, pests, irrigation), the total area monitored (hectares), signing time (year), the number of access keys, the number agrometeorological stations and sensors provided, the profile of the users (farmers, service provider, cooperative). The main ones were:

6. Pest and Disease Information System= restricted and free access only to the cooperating ABC Foundation, which focuses on the monitoring of diseases and pests in soybean, corn, beans and wheat at field level, with weekly shipment of incidence levels and neglecting the associated farmers, plus the use of epidemiological models, simulation data and weather forecast;
7. DRIA = monitoring service through automatic agrometeorological stations offered by ClimaOnLine and focused on environmental conditions versus application technologies;
8. Fieldclimate = developed by Pessl Instruments, using agro-meteorological records inserted in disease simulation models in plants and weather services;
9. Greening Alert System = under the responsibility of Fundecitrus supported by Syngenta, using similar tools as above with the addition of management information for classification of risk levels;
10. Digilab = magnifying glass attached to a mobile device, with high resolution camera, GPS and a picture library on major diseases and pests developed by BASF Brazil;
11. ClimaVista System Agro = offered by MMeyer Environmental Consulting, this service has a GIS platform that integrates agro-meteorological and satellite information;
12. Dacom Plant Protection = service offered by APH Group, very similar to Fieldclimate with international coverage in potato cultivation;
13. AgroDetecta System = developed by ABC Foundation in partnership with BASF, focusing on the planning and management of land ownership, agricultural operations storage, use of plant growth simulation models of diseases and pests (automatic camera traps), weather stations, regional weather forecast, gathered on a single platform;
14. Agronomic and Meteorological Management System for ABC Group = developing the ABC Foundation, with characteristics similar to the previous item, also added the costs of producing tools, generation of different vegetation indices, using remote sensing for monitoring the spatial variability and temporal caused by aerial or foliar diseases, water physical properties of the soil, mineral nutrition of plants and attack or pest infestation, and the use of ENSO information applied to the planning, monitoring and forecasting of regional agricultural harvest.

Agreeing with the title of the presentation held on July 21, 2015, there are no independent systems, or even the best monitoring technology and forecast. All we need greater integration between: farmers and researchers; public and private; university and private companies; between crop science / phytopathological / agrometeorological / geographical / computational knowledge and even human behavior. Finally all brought together to

a greater probability of success in the transfer of knowledge. Because according to Paulo Freire, one of the greatest Brazilian educators: "Teaching is not to transfer knowledge, but to create the possibilities for its own production or construction." That is, the transfer of knowledge and applicability of certain technology not only linked to the researcher, as well as learning is not something only the farmer, the assistant or service provider, but the complementation between each activity performed within the production chain.

Keywords: decision support system, weather station, spatial variability, plant disease, broadcasting technologies.

Reference of Decision Support Systems:

1. http://ciram.epagri.sc.gov.br/index.php?option=com_content&view=article&id=62&Itemid=201
2. http://www.ciiagro.sp.gov.br/
3. http://www.consorcioantiferrugem.net/portal/
4. http://sisalert.com.br/site/?page_id=64
5. http://sma.fundacaoabc.org.br
6. http://sid.fundacaoabc.org.br/
7. http://anovatec.com.br/climaonline.html
8. http://www.fieldclimate.com/
9. http://www.fundecitrus.com.br/alerta-fitossanitario
10. http://www.agro.basf.com.br/agr/ms/apbrazil/pt_BR/content/APBrazil/tools/index
11. http://www.ecoclimasol.com/climavista-bi/climavista-agro/
12. http://en.dacom.nl/products/fungal-disease-system/
13. http://www.agrodetecta.com.br
14. ttp://sigma.fundacaoabc.org.br