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Plant Survival in Natural and Agricultural Ecosystems

Editorial

Model plants: from Arabidopsis to Petunia

Why would anyone in cancer research want to work with animals as exotic as fruit flies or roundworms? Or, talking about plants, why have thousands of research groups switched to Arabidopsis, a harmless weed without the slightest economic value? Why not simply focus on humans in the case of cancer, and on crop plants in the case of plants? Especially for the NCCR *Plant Survival* this is a relevant question, because our declared goal is not just to accumulate basic knowledge but also to transfer our technologies to address problems relevant for society. So why use model systems?

The answer has to do with genetics. Even though Arabidopsis and maize (or fly and man) are extremely diverse in their outward appearance, there is a surprising similarity in basic cellular processes. This concept is now gaining direct support from the results of genome-wide sequencing. In many cases, plant, animal and even bacterial cells use basically the same molecules to duplicate their DNA, to synthesize their proteins and to respond to internal and environmental signals. There are many examples of distantly related organisms that contain highly related genes with essentially similar functions. This underlying similarity has as a consequence, that work done in plants, yeast or bacteria can be relevant for understanding animal biology, and vice versa.

With the progress of molecular genetics, the use of model organisms has become increasingly popular in academic and industrial laboratories around the world. In the plant field, Arabidopsis has been firmly established. Arabidopsis is easy to grow, is small, has a short life cycle, and produces many seeds, making it ideal for genetic experiments. The Arabidopsis research community has now accumulated a staggering body of information that includes an almost complete genome sequence of high quality. It is hard to underestimate the value of Arabidopsis.

So, why advocate Petunia as an alternative model system? Of course, it is still useful to have a model that is closely related to the important crop plants tomato and potato. On a practical level, the general features of petunias are almost as attractive as Arabidopsis. The lab cultivar *Petunia hybrida W138* is an undemanding plant with a life cycle of only 8-12 weeks. The advantages of the plant are that it can proliferate into large bushes, it can be manipulated to flower early and, even when planted at high density, it produces thousands of seeds. Its genome, slightly larger than tomato's,is approximately 8 times the size of Arabidopsis. A major attraction of *Petunia W138* is the presence of highly active transposons, the so-called "jumping genes" (see *PS News no. 1*), which allows to study gene mutations more efficiently both in terms of time and space. In that respect it is even superior to Arabidopsis.

Model organisms are usually highly inbred and therefore have lost the genetic diversity present in nature. Here lies the main attraction of Petunia. In contrast to Arabidopsis, the genus Petunia contains many highly divergent species and subspecies. Substantial genetic variation for agriculturally relevant characters, such as herbivory, insect pollination, infection by beneficial and damaging microorganisms has been demonstrated or can be expected. Our own work within the NCCR will focus on the genetics of insect pollination, a problem hard to study in self-pollinated Arabidopsis. But the Petunia system also offers unique opportunities to study infection by *Phytophthora infestans,* the causal agent of the devastating potato late blight disease, or the beneficial interaction with phosphate-sequestering mycorrhyza.

Natural variation has been the major source of agriculturally beneficial genes in the past. This variation is lost in a single standard lab model. Petunia offers the opportunity to combine classical plant breeding with modern gene technology such as marker-assisted breeding. This will enable us to study the genetic basis of natural variation.Ultimately, this will make it possible to introduce a large variety of genetically characterized traits into crop plants.

Cris Kuhlemeier
Professor of Plant Science (University of Berne)
Vice-Director of the NCCR *Plant Survival*

Fields, vineyards and labs ... together in the same boat

To celebrate its first year in existence, the NCCR *Plant Survival in Natural and Agricultural Ecosystems* organized on Tuesday, 9 April, a meeting between farmers, wine-growers and scientists at the University of Neuch tel.

The meeting room was just large enough for the many attendees. Chairs - and even tables - were quickly taken. Over 30 representatives of the farming sector, equally split between wine-growers and farmers, made up the assembly. The meeting was also an occasion for the NCCR's young research scientists to test their abilities to communicate with a non-specialist audience. For some, it was the first occasion - and an excellent one - for popularizing their work.

NCCR scientists Claire Le Bayon, Laure Weisskopf, Valérie Page and Virginie Matera opened with a fundamental theme: the chemical exchanges between roots, soil and rock. Their work, under the direction of geo-chemistry professor Karl Föllmi, seeks a better understanding of the nutritional mechanisms of plants, emphasizing the importance of phosphorous as an energy source for plant cells.

Their work also addresses the threat posed by soil pollutants, especially heavy metals, on plant physiology. How does one keep pollutants out of fruit, for example? One possible way, explained Valérie Page, is to modify the plant metabolism so that these undesirable substances are stored in the leaves rather than in the fruit.

For the initiator of the 9 April meeting, Laurent Debrot, president of the Bio-Neuchâtel Association and a member of the cantonal parliament (Green Party): "The soil cannot be considered as a simple layer of matter. It is a living environment, rich in subtle interactions between plants, insects and earthworms,that farmers must manage well." It should be mentioned that Debrot is also a farmer, in Chambrelien near Neuchâtel.

Such interactions are at the heart of the project directed by Karl Föllmi. Thanks to the purchase of an high-performance analytical device, the ICP-MS, it is now possible to identify and quantify most precisely the chemical composition of a sample, whether its origin is organic or inorganic.

Towards healthy grapevines

Without a doubt, the grapevine was also under the limelight at the meeting. Laurent Barnavon, a post-doc in the group of biochemistry professor Jean-Marc Neuhaus, explained his project aiming at identifying genetic factors capable of making certain varieties resistant to downy mildew, a well-known fungal infection.

The public certainly reacted to that presentation. "I expect a lot from research on the grapevine genome," said Eric Beuret, head of the Cantonal wine-growing service. "If we can identify the genes that confer resistance to diseases, we could modify the genome of the plants we use. We could thereby, obtain, without using chemicals, high quality grapes that would guarantee both the quality and character of the wine."

Laurent Debrot countered, "We already have strains resistant to mildew. Why do we need to create genetically modified plants?" Laurent Barnavon replied that the creation of genetically modified plants is not the goal of the project, but only one of its possible applications.

An afternoon filled with the exchange of ideas: researchers and farmers were on the same wavelength.

Of know-how and the land

Bernd Hägele, coordinator of the NCCR *Plant Survival*, shared this view completely, reminding the audience that "research on the expression of genes resistant to a disease, for example, is truly basic research. Because this knowledge can also be applied to traditional breeding methods in order to speed up the creation of new strains or varieties."

"The problem," argued Eric Beuret, "is that the reputation of a wine region is intimately linked to the type of grape grown there. To plant a mildew-resistant strain developed through interbreeding, such as Solaris, instead of the traditional Pinot noir, seems unthinkable in the Neuchâtel region. We would be producing a totally different kind of wine and its reputation would have to be built up from scratch."

So, genetic engineering does not appear to be an option for the moment. It would certainly disturb the wine lovers, who are not ready to accept a product from vines containing modified genes. As Enrico Martinoia, professor of plant physiology, emphasized, "Moët et Chandon were working on genetically modified vines. But the famous Champagne brand finally had to abandon the idea. Wine has a certain aura to it, that does not associate well with genetic engineering."

Pheromone battle against butterflies

Still on the subject of wine-growing, but from a different viewpoint and with flamboyant style, Patrick Guerin gave a presentation on the struggle against grape berry moths and grapevine moths, using so-called "sexual confusion". Guerin showed a video film of a male in mid-flight suddenly disturbed by pheromones, chemical signals given off by females to attract males. The "sexual confusion" technique consists of placing several sources of pheromones in the vineyard so that the flying male doesn't know which way to turn. With the unfortunate male unable to locate a female, the pest's proliferation is necessarily curbed.

This method is already being applied on half of the Neuchâtel vineyard, a winegrower pointed out during a discussion session, and it is showing very positive results particularly in the Bevaix area.

Wildflower strips

The last subject presented by the NCCR Plant Survival scientists concerned the promotion of biodiversity in farm areas through planting of wildflower strips between crop-fields. The selection of plants that make up these zones must be chosen in a way as to ensure their continued proliferation. Upon maturity, some wildflower strips might even become bases for plants and insects that will attack weeds in the neighbouring fields.

Farmers expect much from this research. As Danielle Bouiller, who runs an organic farm, notes: "It takes years before you can distinguish the "good" weeds from those that are really bad." Research could help farmers identify desirable species.
Participants at the meeting also discussed the important issue of the shape of the wildflower strips. According to some studies, a long strip next to the planted field creates optimal biodiversity. Other experts, however, like Jacques Studer, a biologist and agricultural consultant, have doubts about the interest of having adjacent biodiversity-rich areas and single-culture fields.

"Farmers are faced with a new concept of productivity," says Laurent Debrot. "Aiming at the total elimination of pests is an old-fashioned idea. We must learn to tolerate a certain level of sick plants and weeds before using pesticides and herbicides. By allowing some pests to survive, we can maintain a sufficiently strong population of predators that will ultimately preserve the crops by eating these pests. This would be an important step towards a sustainable and environmentally-friendly agricultural system."

The grapevine diseases,in culture or under the microscope, aroused the curiosity of those present

Focus

Annual Conference: a link between generations

In the middle of March,the NCCR *Plant Survival* witnessed its first Annual Conference on the premises of Uni Mail in Neuchatêl.Over 70 people attended the presentations under the watchful eyes of the Advisory Board's experts.

The first Annual Conference of the NCCR *Plant Survival* took place last March 14 and 15.The event was highlighted with the active participation of three members of the Advisory Board.This was a great occasion for members of the NCCR to meet the players who from the outside can offer valuable advice for the benefit of the projects.Prof.Ian T. Baldwin, a chemical ecology specialist of the Max Planck Institute of Jena (Germany), presented a talk on the defence mechanism that plants (in this case tobacco) exhibit while attacked by plant eating insects. Also from Germany, was Prof.Thomas Hartmann who conducts his research at the *Institut für Pharmazeutische Biologie* of the Technical University of Braunschweig. He followed up on the previously mentioned plant phenomenon by discussing the capacity of several insects to benefit from the plant-derived toxins and using them for their own defence against their predators.As for Barbara Hohn,professor at the Friedrich Miescher Institute for Biomedical Research in Basel,she is interested in the DNA repair mechanisms in plants. More specifically, she studies the repair mechanisms that occur when a pant suffers lesions caused by burns, ultraviolet B rays,or even radiation,to cite a few examples.

International concerns

"The three presentations have demonstrated that we have the same questions as those addressed by eminent international specialists. Notably, our network of competence is forging links in the EU and USA", stated Martine Rahier, director of the NCCR *Plant Survival*. The Annual Conference of March 14 and 15 constituted the first event reflecting the international facet of the research undertaken.

NCCR's management was quite enthused by the active participation of the post-docs,most of whom have been there for less than six months. The spotlight on the researchers during the two days underscores NCCR's commitment to value the ideas of the next generation.Without a doubt,the academics' successors are making their presence felt.

The experts are watching

The NCCR *Plant Survival* is surrounded by two expert panels that advise the researchers and judge their progress. An overview of their respective roles follows.

Advisory Board

The Advisory Board, as well as its functions, is defined by the managing body of NCCR *Plant Survival*. The honorary members offer their advice to the researchers of the NCCR. They are invited, as well, to the NCCR Annual Conference. The members are listed below.

Prof. Ian T. Baldwin, Max Planck Institute of Chemical Ecology, Jena, Germany
Prof. Valerie K. Brown, University of Reading, Great Britain
Prof. Thomas Hartmann, Technische Universität Braunschweig, Germany
Prof. Barbara Hohn, Friedriech Miescher Institut, Basel,Switzerland
Prof. Reinhard Töpfer, BA Züchtungsforschung, Siebeldingen, Germany

Review Panel

The review panel is designated by the Swiss National Science Foundation (SNSF).The panel ensures the smooth functioning of the projects and offers its comments (positive or negative) in an annual report.The NCCR *Plant Survival* obtained high marks and mainly positive feedback after its first evaluation at the end of January. The constructive comments were well received and appreciated by the NCCR researchers.In January 2002,the review panel consisted of the following members:

Prof.Oreste Ghisalba (chairman),SNSF, Berne
Prof.Charles Godfray, NERC Centre for Population Biology, Imperial College,Ascot,Great-Britain
Prof.Maria L.Gullino,Università degli Studi di Torino, Facolta Agraria, Torino,Italy
Dr. Jost Harr, Research Council of the Federal Office for Agriculture,Berne
Prof.Dieter Imboden,SNSF, Berne
Prof.John Pickett,Biological Chemistry Division,IACR-Rothamsted,Great-Britain
Prof.Dierk Scheel,Department of Stress and Development Biology, Halle,Germany
Dr. Stefan Bachmann,SNSF, Berne
Dr. Urs Christ,SNSF, Berne

In the line of fire, plants fight back

Although immobile and incapable of fleeing from danger, plants are not altogether helpless. From April 24 to the 26, participants of the phytopathology course, given at the Graduate School, had the opportunity to supplement their knowledge on this subject.

Thanks to the advancements made in the field of molecular biology, we now know more on the defense mechanisms that have evolved in plants to counter their natural enemies. Whether the plants are faced with bacteria, viruses or fungi their arsenal of defense mechanisms is vast. "It all starts with physical barriers, explains Brigitte Mauch-Mani, phytopathologist in Neuchatel and organizer of the course. A good example is the cuticle of cabbage,the thin layer that protects the vegetable against unwanted guests." What's even more impressive is the plants' capacity to acquire defense mechanisms by a phenomenon called induced resistance to pathogens. What occurs is that during a second infection by a certain pathogen the plant has learnt to respond quicker and more viciously. That's exactly what occurs when cucumber is attacked by *Colletotrichum lagenarium*, a fungus that, after the first assault, causes a reinforcement of the plant's cell walls. The result is the fabrication of a protective armour against subsequent aggressions by the fungus. Another example is the radish, which maintains a symbiotic relationship with beneficial bacteria, present in the soil, to protect itself against *Fusarium*, also a fungus that causes diseases.

Aside from the scientific aspects, the goal of the seminar was to, above all, stimulate the young researchers' sense of criticism. Clearly, organizing 'Journal Clubs' or forums, where graduate students can comment on published articles from specialized journals, is indispensable. The discussion becomes even more enriching since the members of the NCCR *Plant Survival* possess different scientific backgrounds. For example, an ecologist may have a different, but useful point of view on a problem brought forth by biochemists and viceversa.

On this topic, Oliver Viret, of the Federal Research Station in Changins, demonstrated that meteorological conditions could assist in preventing the development of certain diseases. The downy mildew of grapes, for example, needs humid conditions in order to reproduce. Therefore, if the climate is dry, it is possible to reduce chemical treatments while minimizing the quantity of pesticides released in the environment.

Torn between algae and fungus

Amongst the pathogens stealing the spotlight over the three days, were the oomycetes. Microorganisms where the classification of has given the systematics specialists lots of food for thought. Simply said, they form a class of their own while possessing physiological characteristics found in algae and in fungi.

The study of oomycetes is of great importance. Primarily because of *Phytophthora infestans*, causing the late blight of potato, which belongs to that category of organisms. "Each year this pathogen has a devastating impact on all continents, leaving billions worth of economic losses in its tracks, underlines Sophien Kamoun, one of the invited speakers and assistant professor at Ohio State University. Of historical importance, *Phytophthora* was responsible for the destruction of the potato crop in Ireland in the middle of the nineteenth century causing widespread famine."

Approximately sixty or so species of *Phytophthora* cause considerable damage to plants. These organisms use plants for reproductive purposes and attack not only the leaves but also the roots and other parts of the plants' anatomy as well. A characteristic symptom of diseases caused by *Phytophthora* is the rapid destruction of plant tissues, whereas the spores of oomycetes are easily dispersed, which explains the rapidity of disease transmission. To date, fungicides are the main control methods used, however they are expensive and consequently researchers are turning towards the field of genetics to find suitable control measures. "The idea, pursues Sophien Kamoun, is to transform host plants into non-host plants."

In such a scenario, as the one stated above, one is identifying the genes and corresponding proteins responsible for the resistance to those pathogens. After which, conventional plant breeding practices can be used selecting plants resistant to the disease and this resistance passed on to the next generation.

Some of the people present during the course given at the Graduate School,from left to right: Christiane Bobillier (University of Neuchâtel),Erick Kombrink (Max Planck Institut,Köln, Germany),Brigitte Mauch-Mani (University of Neuchâtel),John Mansfield (Imperial College at Wye,UK), Sophien Kamoun (Ohio State University, USA)

Starch is where it's at

Sam Zeeman has recently been appointed assistant professor at the University of Berne and has settled in his new quarters as of January. At 31 years of age, the young biologist holds a position entirely financed by the NCCR and focuses his efforts on the study of starch metabolism.

Of British nationality, Sam Zeeman studied sciences at the University of Cambridge,where he obtained both his MA and PhD.Early on, he specialized in the study of starch metabolism using his favorite model plant arabidopsis."Starch,explains Sam Zeeman,is the major storage carbohydrate of most plants. This compound is used for the production of energy and to supply building blocks for plant metabolism throughout development.While the mechanism of starch synthesis is relatively well known,many questions remain concerning the manner by which starch is subsequently transformed by the plant back into a usable sugar."

Do they work around the clock?

In fact,plants are faced with a problem analogous to that which occurs in the field of solar energy. The basic principle of photosynthesis involves the transformation of carbon dioxide into sugars using light energy. In the absence of light, the sugar production halts.This is comparable to the production of electricity by solar cells. Night should therefore result in dire consequences to the plant's health. Fortunately, Mother Nature has provided for such a scenario.Similar to the storage capacity of batteries for solar energy, most plants are equipped with 'starch batteries' lodged in the leaf cells. In fact, these are microscopic starch granules with a diameter between one and one hundred microns.

In short, during the day, part of the carbohydrates made via photosynthesis are transformed into sugar and the rest contribute to the buildup of starch granules. During the night, enzymatic reactions enable the plant to dip into its starch reserves as needed. The core of Sam Zeeman's work deals with identifying the biochemical and genetic factors involved in the last step of this important physiological process.

An excellent model

To advance in his chosen path,the young biologist worked for six years at the prestigious John Innes Centre (Great Britain),where he studied the starch metabolism using a multidisciplinary approach unifying techniques used in genetics, molecular biology and biochemistry. It goes without saying that his vision blends in well with that of the NCCR *Plant Survival*. Sam Zeeman is convinced that arabidopsis remains an excellent model, since the basic process of starch storage in this plant resembles that of starch-storing field crops, such as rice, wheat and potato.

A "tailor-made" production

From his research, Sam Zeeman has proposed a new mechanism that better explains the production of starch. This is something that has attracted the attention of industry, which finances fundamental research in that domain."We already use starch in the food industry to enhance the texture and improve nutritional quality. It is also utilized extensively in non-food industries,for example as a packaging material in the form of chips,which are a biodegradable alternative to the traditionally used styrofoam chips. It is realistic to imagine that in the future we will be able to grow plants that make a specific type of starch in which we are interested. Thereby producing plants which are adapted to particular industrial uses."In other words, a "tailor-made"production.

However, before jumping ahead to the realization of his goals, Sam Zeeman must first verify his hypotheses and build up his research team. To date, he has hired a PhD student and will soon be hiring another assistant.

Deciphering the language of plants

Jean-Pierre Métraux has been professor of biology at the University of Fribourg for a little over ten years. Throughout his career, he has had great interest in scientific cooperation with the European Union. Here, he gives us a few examples of his work in this area.

Jean-Pierre Métraux, to what extent has your experience with other countries on the continent been useful to the NCCR *Plant Survival* ?

On the European scale, a number of projects already exist with the same concerns as those of the NCCR, notably, the problems faced by agriculture. Today, there is great awareness of the need to massively reduce our use of pesticides in order to preserve the environment. Potential alternatives are under study, including biological control to diminish the impact of insect pests by, for example, creating specially adapted areas. Another promising development involves making plants resistant to disease, a phenomenon called “systemic acquired resistance”, or SAR.

How is that done?

A product is already on the market called Bion, marketed by Syngenta. It stimulates the plant to produce various proteins of which some have an anti-fungus effect, preventing the development of pathogenic agents (in this case, fungi in plant tissues). Bion has been a first in the fight against plant diseases: instead of eradicating the pathogens, it seeks to stimulate the plant’s defenses against them. But to fine-tune the action of these substances, we must understand the mechanism of resistance to the pathogens.

What research have you made in this area?

We are trying to decipher what we could metaphorically call the language of plants. When plants are subjected to external stimuli (for example, an attack by a fungus, a virus, a bacterium, or changes in light or humidity, etc.), they respond by secreting endogenic substances, “signals”,that can be compared to hormones in mammals. Among these substances are salicylic acid (the active molecule of aspirin), jasmonates or ethylene. It is the combination of these substances that induces the resistance mechanisms to pathogens. The problem is that these substances do not respond in a linear, direct manner to stimuli. Rather, they are part of a certain number of biochemical reactions that make up a network of information. This means that to induce the resistance to a given disease, you need to understand the regulating elements of these information paths.

And to identify these regulating elements, you are calling on a scientific discipline far removed from the living world: electronics.That’s rather surprising!

Indeed, we are working on a model electronic circuit. Once completed, this logic representation will sum up our knowledge and allow us to construct a global view of the network on internal signals that stimulate resistance to a given pathogen. We can then “follow” the logic of the propagation of chemical signals. The next step consists of identifying the proteins, this time in the living organisms, that participate in the regulation of this resistance.

Do you see the development of resistance inducers as a definitive and sure solution?

As these products will be targeted on plants selected for treatment, the impact on the environment can be reduced - which is very positive. It then remains to be determined with precision what intrinsic properties these products may have on human health. As for the protection of plants, it is difficult to ensure over the long-term. The introduction of a new plant variety resistant to a fungus usually leads to the development of new strains of the pathogen that have found a way to overcome this resistance. We must remember that with the introduction of a resistant plant appears a new process of selection to be taken into account. Biological control (like any other kind of control) will never be definitive. We must continually search for new resistant varieties or new means of fighting.

Which leads us to your collaboration with the European Union…

Exactly. For that, we have two organisations in which Switzerland participates: the framework-programmes of the EU and COST (*Coopération européenne dans le domaine de la recherche scientifique et technique*).The latter concerns highly specialized research, which is why I do not think the NCCR can take part, as such. However, I strongly encourage our scientists as individuals to take an interest in any participation that directly concerns their own research. We should note, for example, that a five-year COST project is now finishing on toxigenic fungi, a project we participated in (the group of Jean-Pierre Métraux,) as well as the professors Geneviève Défago and Raphaël Tabacchi, two other members of the NCCR. My colleague, Heinz Müller-Schärer (Vice-Director of the NCCR) is one of the Swiss delegates on the COST project on biological control of weeds in Europe. We have everything to gain from this type of cooperation.

News from the Labs

Three Schools to the rescue of sick vines

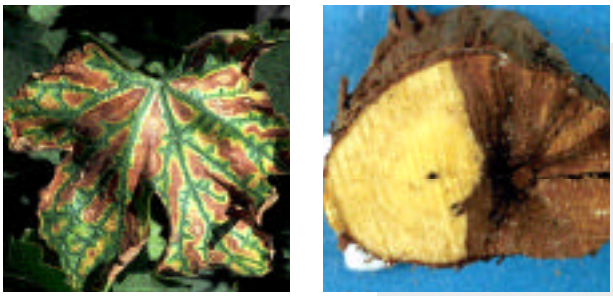
Last March marked the beginning of the first collaboration between a group from the NCCR and one of its partners. Prof. Geneviève Défago and her PhD student Danilo Christen of the Swiss Federal Institute of Technology in Zurich (ETHZ) along with the team of Prof. Raphaël Tabacchi of the University of Neuchatêl are sharing with Wolfgang Patzwahl, of the University of Applied Sciences in Wädenswil (ZH), a study concerned with two grapevine diseases, Esca and Eutypa. The fungi responsible for these diseases take advantage of lesions on the vine to infect the plant.They produce toxins that are transported throughout the plant causing a slow intoxication resulting in plant death after a few years.

The situation is particularly disconcerting in the Lake Geneva region, where 70% of the plots observed by the Federal Research Station in Changins revealed symptoms indicating the beginning of disease.This is explained by the fact that Chasselas, a widely grown variety in French speaking Switzerland,is very susceptible to the disease.Such is not the case in the rest of the vine growing regions:The Riesling-Sylvaner and the Pinot Noir, the main grape varieties grown in German speaking Switzerland,are hardly affected by the disease,whereas the Merlot,the jewel of the Tessin,tolerates the infections.Since the ban on the use of sodium arsenite against Esca, the control methods adopted are mainly preventative measures.

Ecological Remedies

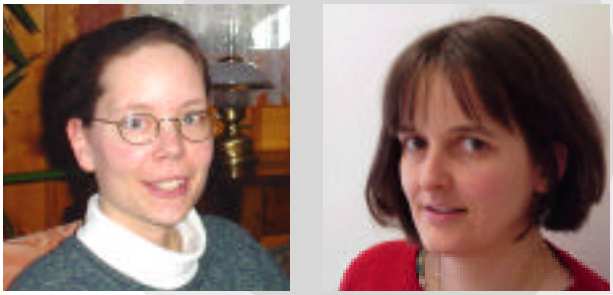
The team in Wädenswil would like to know if the aromas from the must, and ultimately the quality of wine, are modified when coming from grapes harvested from vigorous plants that are at the early stages of the disease. Prof.Tabacchi and his colleagues are looking at the chemical structures of the toxins produced,while the group of the ETHZ is trying to identify microorganisms capable of degrading those toxins. So far they have found some in the group of fungi (*Fusarium* and *Trichoderma*) used as biological control measures for other plants.Their main advantage being that they are environmentally friendly. Genevieve Défago and Danilo Christen hope to protect the grapevine while, at the same time, demonstrating the role toxins play in the disease and the subsequent changes in the quality of the wine.

During the preliminary phase of this collaboration the researchers of ETHZ provided their colleagues in Wädenswil with plants inoculated with the pathogens.The must collected from the autumn harvest will be chemically analysed,then vinified and finally tested by the team of the HES in Wädenswil.It will be compared with the wine produced from healthy grapevines grown on the same plot.This will permit,during the next few years,the establishment of a point of reference used in the evaluation of the influence that the disease and the biological control method proposed have on the quality of must and ultimately on the quality of wine.



Examples of foliar symptoms caused by Esca, and Eutypa in the woody parts of the grapevine

Two newcomers to the Graduate School Committee



Laure Weisskopf **Helene Wagner**

Laure Weisskopf and Helene Wagner were elected last March to represent respectively the PhD students and post-docs of the NCCR *Plant Survival*. Here is a brief sketch of the two newcomers.

Laure Weisskopf

"My aim on the committee is to act as a contact point with the management of the Graduate School and to represent the opinions, ideas,comments, criticism and suggestions of PhD students. I belie-

ve a graduate school is a considerable asset for the post-graduate education of young scientists and I am therefore very happy to be doing this work."

This PhD student from Neuchâtel, aged 25, is looking into the mechanisms plants develop to offset a phosphate deficiency. As her plant model, Laure Weisskopf has chosen the White Lupin, which develops special roots to make up for a lack of phosphate. These roots secrete substantial quantities of organic acids, which they use to release phosphate that is « captive » in the soil.

Under the guidance of professors Enrico Martinoia (plant physiology) et Michel Aragno (microbiology), Laure Weisskopf is studying amongst others the role played by the genes that control this root secretion of organic acids, and the mechanisms the plant uses to select potentially beneficial micro-organisms.

Helene Wagner

"I see my role in making the concerns and ideas of the postdocs and the PhD students heard, and in promoting constructive solutions to any arising problems. I want to ensure that the Graduate School provides many great opportunities and no obstacles for the young scientists involved in the NCCR *Plant Survival*".

Helene Wagner, a geographer by training, is doing research at the Swiss Federal Institute WSL for Forest,Snow and Landscape Research in Birmensdorf (ZH), after spending two years at Colorado State University (USA). She is currently working on NCCR project 6, under Christoph Scheidegger, a specialist in molecular ecology.

The subject of her research is methods of computer modelling applied to the pasture-woodlands of the Jura mountains. Helene Wagner is trying to recreate the spatial and temporal evolution of these ecosystems, in the hope of identifying the past disturbances that led to the biodiversity observed at the present time.

"Forum" section

For the next issue,the editor will set up a section where PS News readers will have the opportunity to offer their opinion. Whether your are a student, a scientist, a farmer, a politician or simply curious,your comments to the "Forum" section are always welcome.Please do not hesitate to write via e-mail to:
igor.chlebny@unine.ch

Expo.02 and F te La Terre together with the NCCR *Plant Survival*

A bunch of Chasselas grapes and its leaves

This summer marks two important events for the NCCR *Plant Survival.* From July 23 to the 25, the researchers will be present at Expoagricole, one of the displays of Expo.02 set up in Murten. One month later, August 24 and 25, the meeting place is at the very popular 'Fête La Terre' regional festival in Cernier.

The NCCR is participating in 'Expoagricole' in the framework of a temporary event called 'Vivre la recherche sur les plantes/ Pflanzenforschung erleben'. Four themes, four outlooks on the plant in its environment will give the general public an overview of the projects coordinated by the University of Neuchâtel. The subjects touched upon will be the mechanisms used for the movement of chemical elements between the soil and the roots, grapevine diseases, the practice allowing for wild flower strips to preserve the biodiversity and finally the subtle relationships that plants maintain with insects to protect themselves from natural enemies. It will be an interactive show where the visitors will have the opportunity to smell and touch the living organisms that are at the heart of the research at the NCCR.

A similar approach was favored by the NCCR representatives at the 'Fête La Terre' festival that will be held in Cernier (NE). For this occasion, the young scientists chose to put forth the theme of '*La plante dans tous ses états*' ,in a very light and playful way. The public will be able to discover how plants deal with stresses (yes, plants can be stressed as well!) to ensure their survival. Another appropriate topic on the eve of the grape harvest is the presentation of grape varieties resistant to the grapevine mildew, which is still widely spread. Let us not forget, of course, the added bonus of wine tasting!

Last, but certainly not least, the icing on the cake is a demonstration by the researchers who will show how it's possible to extract DNA from tomato, using techniques worthy of Harry Potter, with common ingredients such as a pinch of salt, a sprinkle of lemon juice, a scoop full of detergent and a shot of alcohol. Quite astonishing to say the least! At 'Fête La Terre', NCCR offers a scientific voyage that will arouse the senses seducing the eyes, nose and taste buds.

Partners

Education without borders at the Swiss College of Agriculture

The Swiss College of Agriculture's (SCA) campus in Zollikofen is only ten minute's by train from Berne's central station.The campus consists of roughly two hundred students who enrol there to obtain a degree in agricultural engineering. A closer look at this campus reveals that education goes hand-in-hand with an open attitude towards the world around us…

Each year in Cameroon a virus ravages cassava fields causing heavy losses, at times up to 30%,to this vital food crop.In order to counteract this scourge, a team led by Urs Scheidegger, professor of tropical plant production at the SCA,lent its help to a Cameroonian centre for agricultural training called the Fonta Rural Training Centre.The assistance given by the Swiss experts enabled a method called "positive selection"to be tested there.The method consists in identifying plants, which show no virus symptoms and therefore considered to be healthy and suitable for the plantations. Furthermore, the SCA researchers have facilitated the centre's access to these virus resistant cassava varieties. Urs Scheidegger recalls that "before our intervention in 1996,those responsible for the centre already taught the "positive selection" method but did not evaluate its effectiveness under local conditions,hence the creation of the joint research project with the SCA.If fact, most of the course material,which was taught in the centre,had never been tested locally leading to the team's fears that the material might not in itself be appropriate under specific ecological or socio-economic considerations".

This example provides a modest insight into one of the numerous interventions which the SCA undertakes throughout the world in countries such as India, Bhutan, Kirghizistan, Mali, Ethiopia, Madagascar, North Korea and Malaysia to name a few. The SCA's worldwide presence, which includes the ex-soviet countries, is closely linked to the creation in 1992 of an educational-training network called "International Agriculture". But the SCA does not content itself only in training engineers, alongside the more common specialisations such as agricultural economics,plant and animal production or even dairy farming,the centre's originality lies in its open-minded attitude towards far off countries.

Whether the centre is collaborating with other training institutes,universities or government bodies,many of its current activities are orientated towards research & development and with providing services.As such, the problems it encounters don't always pop up from where one might expect.

Technology and economy: a fine balance

When working in developing countries it is not the technical aspects that give the biggest headaches but rather the obstacles that arise when one is faced with a specific country's agricultural policy. In Cameroon, certain people argued that the price of maize could double between the time of harvest and of short supply. Motivated by the prospects of medium-term gains, the question was asked whether corn storage facilities should be constructed. This sort of reasoning, however, does not always hold true in reality and investing in storage facilities may well have proven to be economically risky.

While we're on the subject of experiences in Africa,let's look at one particular experience which led a group of researchers headed by Gil Ducommun, professor of rural development and director of the "International Agriculture " network, to Burkina Faso. The project, which is currently underway, consists of facilitating the transformation of traditional foodstuffs such as millet, sorghum and niébé into cash crops. According to Urs Scheidegger "this is what we call converting a subsistence culture into an income generating culture". In cases such as this one, strategies need to be developed to make it economically viable while at the same time conserving soil fertility.

The SCA is also very active in Asia where Harald Menzi, the College's Research and Development coordinator, supervises a programme supported by the FAO (Food and Agriculture Organization of the United Nations). The programme is concerned with managing pig manure in suburbs where between 10 000 and 20 000 animals are sometimes concentrated in one single farm! This researcher from Zollikofen is working on establishing a structure that would allow these waste materials to be transferred to farms where they would then be used as fertiliser. Harald Menzi offers his advice in Thailand, China and Vietnam, the three countries concerned by this project which began in 2000 and which will undoubtedly go on for another ten or so years.

Harald Menzi can be proud of the international presence of SCA, most notably in Africa and in Asia

Regional preoccupations

Even though this institute is concerned with problems lying beyond Switzerland's borders, it does not neglect the problems encountered in its own back yard. In that respect, research programmes such as the "PROMI" project have been undertaken. This project, whose mission was to elaborate more competitive milk production methods, was completed in autumn 2000. Thanks to the project, the SCA persuaded diary farmers from Switzerland's central "Mittelland"plateau to abandon the wide-spread farming practice observed during the summer months which consists of feeding additional fodder in the cowshed to cows that have already spent hours grazing outside in the pasture. After four years of study, experts showed that the best way was to simply let cows graze non-stop on short grass. The results were more than convincing and brought about a reduction in labour, calmer cows and thicker grass resistant to trampling.

A College geared towards practical applications

Besides the Swiss Federal Institute of Technology in Zurich (ETHZ), the SCA is the only college in Switzerland that offers a university level training in agronomy. It boasts 130 individual rooms in the student residence available to students wishing to live on campus. The College differs from the ETHZ in that its courses are resolutely oriented towards practical field applications.Furthermore, in order to be accepted in a course,it's not enough just to be interested in agricultural sciences, but a minimum of practical experience is required.
There are two possible ways of entering the SCA. The first, which applies to two thirds of the students , consists in taking a post apprenticeship high school trade diploma over and above their initial agricultural apprenticeship followed by a year at a secondary school for agricultural training. The remaining third, who hold a high school diploma, follow the second path which requires them to complete their programme with a required one year training period on a farm approved by the Zollikofen college.

Future graduates from the SCA not only receive an education in agriculture but also the knowledge which will enable them to harmonize economic growth with respect for the environment in the aim of promoting sustainable agriculture. As an answer to this modern-day requirement, the SCA has concentrated its training course into a three year modular syllabus wherein students sign-up for courses lasting from as little as a week up to an entire term depending on the depth of specific knowledge sought after. Thanks to this modular structure the SCA is able to participate in student exchanges with similar institutes within European Union countries.

External research funding

As with all the other Swiss Specialised Colleges (HES),the SCA was required, in 1999, to re-evaluate its objectives. In fact, since that date these colleges can no longer satisfy themselves with just teaching but are also required to undertake scientific research projects. However, since Swiss HES do not benefit from the same grants as the ETHZ or other Federal Research Stations,these new activities have to be financed by external resources.With the aim of satisfying these new requirements, Harald Menzi has been recruited as coordinator of applied research and development.His mandate is to secure external funding and to coordinate the projects.

"We can be proud of the progress we've made in this field",he stated."In 1999 the number of research positions have never exceed more than four or five and today, in 2002, there are as many as twelve to fifteen positions involving more than twenty-five people. What's more external funding has multiplied by a factor of eight to ten attaining approximately one million francs."

Cameroon Farmers receiving a course on cassava production

In SCA's tropical greenhouse, biological control measures are used against white flies

Upcoming events

Graduate School courses

«Effective public speaking»

Prof.Marcel Lucien Goldschmid, EPFL
October 4,2002 (and 1/2 day t.b.d.)
University of Neuchâtel, Uni Mail, Institut de chimie, room B1

«"Safe data mining": applied statistical regression modelling for biologists using R»

Dr. Diego Kuonen, EPFL and Statoo Consulting, Lausanne
October 24 and 31,November 7 and 14, 2002

University of Neuchâtel,Uni Mail, Institut de chimie, room B1

Seminars

«Sugar transport and signalling during grape berry ripening: the example of a hexose transporter gene expression»

Prof.Rossitza Atanassova, University of Poitiers (France)
June 21,2002
13:30 - 14:30
University of Neuchâtel, Uni Mail, B-wing, room B316

«The role of ethylene in resistance of tobacco to pathogens»

Prof.L. C. van Loon, Utrecht University (The Netherlands)
July 9, 2002
13:30 - 14:30
University of Neuchâtel, Uni Mail, Institut de chimie,room B1

Participant Meeting

«Plant defense against biotic toxins»

June 27, 2002
13:30 - 16:30,
University of Neuchâtel, Uni Mail, Institut de chimie,room B1

More information on our website www.unine.ch/nccr

Special Events

Inauguration of the ICP-MS

June 17,2002
16:15
University of Neuchâtel, Uni Mail, room E003
Further information: karl.foellmi@unine.ch

Expoagricole

«Vivre la recherche sur les plantes/
Pflanzenforschung erleben»
July 23 - 25,2002
Expo.02, Murten, "Forum" sector (free entrance)
www.expoagricole.ch

F te La Terre

«La plante dans tous ses états»
August 24&25, 2002
Cernier (NE)

www.ne.ch/FetelaTerre/

PS News

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