

## Hunters of lost treasures

**Crops in the future will be expected to grow on the worst soils whilst being able to survive on limited water at the same time as producing high yields and being resistant to diseases and pathogens – the demands on future crops are enormous. In order to prepare for such a future, the University of Hohenheim is taking a look into the past. From a farmer's point of view, many of the desired, and hence valuable, properties were already present in the precursors of today's varieties of rice, maize and corn. They are just waiting to be rediscovered. On 1st December 2008, Prof. Dr. Karl Schmid, the first person to hold the F.W. Schnell Foundation's endowed professorship for crop biodiversity and breeding informatics, started the ball rolling on a unique, European-wide project. Schmid and his colleagues are searching gigantic databases, in which genetic analyses and plant descriptions are stored, for hidden treasures.**

How can new varieties be bred that have few requirements, are highly resistant and that produce high yields? These are issues for the future that we need to find answers to, in a world where production conditions for agricultural products are changing dramatically: the world's population is constantly growing at the same time as climate change is having its effect. Natural resources like soil and water are not unlimited and a large proportion of annual harvests is lost due to diseases and pathogens. Modern plant breeding therefore has a key role to play in the development of suitable plants. With its research and breeding activities and the seeds resulting from its work, modern plant breeding is at the very beginning of the agricultural value creation chain.

Prof. Dr. Karl Schmid, an experienced population geneticist, is the first person to hold the endowed professorship for crop biodiversity and breeding informatics at the University of Hohenheim, a post that is unique in Europe. Schmid creates and analyses comprehensive databases in which the properties and the genetic sequences of modern crops, old agricultural breeds and their wild ancestors are stored. "We are aiming to rediscover plants with beneficial properties as well as hoping to maintain the yields of today's top varieties."

## Centre of Excellence and contribution to safeguarding the future of Baden-Württemberg

"We are convinced that Prof. Dr. Karl Schmid will be able to bring new insights into breeding research and thus contribute to effectively shaping German plant breeding," said Philip von dem Bussche, CEO of KWS SAAT AG in Einbeck, which will finance 50% of the professorship over the next eight years. Peter Hauk, Baden-Württemberg Minister of Agriculture and Rural Areas, congratulated the cooperation partners on the "outstanding cooperation which will make a considerable contribution



Prof. Dr. Karl Schmid  
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to safeguarding global nutrition and to maintaining Germany's and Baden-Württemberg's economic competitiveness."

The rector of the University of Hohenheim, Prof. Dr. Hans-Peter Liebig, expects Schmid's research to become an international centre of excellence. The University of Hohenheim is co-financing Schmid's professorship. In addition, the Stifterverband für die Deutsche Wissenschaft, contributes financial as well as contextual and organisational support.

## Great potential for new varieties

There are many ways to create new crossbreeds: "We know of hundreds and thousands of old agricultural varieties and wild corn and crop varieties," reports Prof. Dr. Schmid. Crossing these varieties leads to an unbelievably high number of possibilities. Previously, researchers found it problematic coping with such enormous numbers. In order to select the varieties that are best suited for plant breeding, genetic and computer analyses are used to find new varieties, varieties that are characterised by a particular genetic variability and that have the desired properties. "Our barley project took us to Israel where we collected wild plants at different locations, including plants from the humid and cool north, plants from the dry and hot desert and plants from the salty shore of the Dead Sea," said Prof. Dr. Schmid explaining one particular project. Genetic analyses provide the biologist with information on different patterns in plant genomes, including, for example, which genomes make certain varieties more resistant to cold, more frugal in

terms of water requirements or more tolerant of salty soils. The scientist uses population genetics and evolutionary biology methods to create phylogenetic trees from gene segments derived from modern varieties and wild ancestors. "We then cross the varieties in the traditional way and use the progeny to assess whether we were indeed able to extrapolate the desired property from the assumed pattern in the genes."

## Searching the phylogenetic tree of modern varieties

Prof. Dr. Schmid's research group is hoping to find out which genes were important in which adaptation stage. This is done by comparing the genes of the different plants with each other. "During early domestication, the important genes were those that ensured that the seeds remained on the stalk. Later plant populations showed that pathogens and plant resistances developed simultaneously. As time went on, focus was put on plants with high yields," said Schmid explaining his approach.

Major focus is put on identifying relationships between genetic patterns, the plants' environment and their properties. "Plants have a genome that is at least as big as the human genome, sometimes even bigger," said Prof. Schmid. "It is like looking for a needle in a haystack – only very few genes are actually responsible for the adaptation of the plant to its environmental conditions and it is these genes that we hope to specifically identify."

Once the genes have been identified, the most promising parent plants can be selected and used to breed modern varieties. "The targeted crossing of plants considerably speeds up plant breeding."

## Worldwide demand for well-trained specialists

Most of Prof. Schmid's work is still basic research and method development. However, in political and economic terms, Schmid believes that the time is now right for more complex breeding approaches: "Agricultural research has not received a lot of attention in recent years. However, food and energy crises, population growth and climate change have once again directed the world's attention to the safeguarding of human nutrition."

According to Prof. Schmid, genome research and bioinformatics will not only revolutionise the breeding of plants, but will soon become a standard approach. He recognises that this offers young people excellent career prospects. "There is a huge demand world-wide for plant breeders. For our young scientists, this is an excellent opportunity: they have promising future perspectives at the same time as being able to do something to help society."

## Future-oriented cooperation between the University of Hohenheim and KWS SAAT AG

The directors of KWS SAAT AG agree with Professor Schmid. "The development of ideas and methods, the way previously unused genetic potentials are evaluated and transferred into valuable resources for modern plant breeding, the transfer of this knowledge to future breeders – that's what we expect from Prof. Schmid," confirms Philip von dem Bussche from KWS. "Cooperation with universities is essential for plant breeders such as ourselves, both with regard to the training of young scientists and to cooperative research programmes."

Minister Hauk congratulated the University of Hohenheim on this commendable cooperation. "This

underlines the university's international lead and high reputation in plant breeding. Plant genetic resources are an integral part of sustainable plant breeding. The breeding-related utilisation of the biodiversity of species and genes is a thematic focus of the endowed professorship," emphasised the Minister who also hopes that the successful implementation of new breeding goals will lead to the sustainable protection of food and natural resources.

Prof. Dr. Hans-Peter Liebig referred to the new professorship as an important strategic building block. "Among breeders, the 'Hohenheim School' has always had a good reputation – and with this cooperation we are opening up a new research direction which is the only one of its kind in Europe at the moment."

Liebig also pointed out that this research is essential for the agricultural sciences at the University of Hohenheim. He explained that the University of Hohenheim is the only German university that pursues an approach focusing on the thematic complex of nutrition and health by dealing with food production and processing as well as medical effects. With the establishment of new courses and the biogas research plant, the University of Hohenheim has also established a presence in the thematic complex of bioenergy and renewable raw materials. "Plant breeding plays an important role in both nutrition and bioenergy."

Source: University of Hohenheim - 24 December 2008

**Further information about the new chair:**

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Endowed Professorship for Crop Biodiversity and Breeding Informatics

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**Press release**

14-Jan-2009