

Research Areas and Methods

- Evaluation of genetic resources and recent cultivars with respect to essential breeding traits as well as fungus and virus resistance
- Genetic analysis of important breeding traits
- Development of specific resistance tests and selection methods using plant organs (bioassays) or whole plants (greenhouse, open field)
- Establishment of reproducible methods for quantitative resistance assessment and differentiation; symptom score, digital image analysis, immunoassays
- Plant cell, tissue and organ culture, somatic hybridization, embryo rescue technology
- Mutagenesis and transformation
- Polyploidization in vitro and in vivo as well as determination of the ploidy level
- Analysis of the centromer function of CENH3 mutants and their use for the induction of haploids
- Development of molecular markers for marker assisted selection (MAS) and estimation of the genetic diversity
- Distance analysis, gene mapping, development of chromosome specific markers and QTL analysis

Head of the Institute

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By car

Coming from the A36, take exit „Quedlinburg-Ost“ and continue on L66 towards Quedlinburg. After 2km, you get to a roundabout, here follow signs to Gernrode/Ballenstedt (NOT Quedlinburg). At the next roundabout (after 3km), take the 1st exit and continue on L242 towards Quedlinburg. When entering Quedlinburg, leave the roundabout at the 1st exit (sign „Julius Kühn-Institute“) and immediately turn right into the JKI premises.

By train

In front of the Quedlinburg railway station, you will find the central bus station. Take the bus numbers 253 or 255 and get off at the bus stop „Julius Kühn-Institut“ (it is behind a roundabout and immediately after a petrol station on your right). Cross the road, turn right and you will find yourself at the entrance to the Julius Kühn Institute.

Or take the bus numbers 240 or 242 and get off at the bus stop „Suderöder Chaussee“. Now you have to cross the roundabout. You can buy tickets on the bus. Journey time is 5 minutes.

„Julius Kühn-Institut“ and „Suderöder Chaussee“ are request stops. So, you have to indicate that you want to get off at the next stop. If you prefer to walk, it will take you appr. 30 minutes.

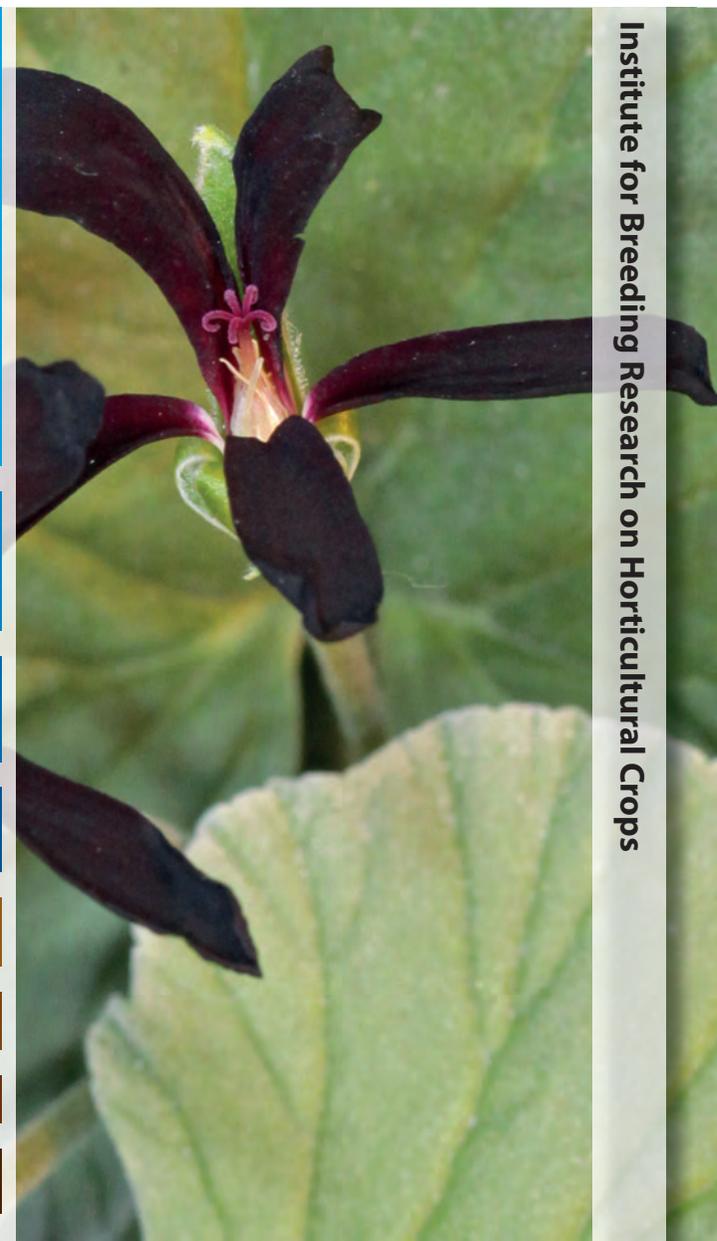
By plane

The next airport is Airport Leipzig-Halle.

Editorial and Layout

Stefanie Hahn and Anja Wolck (JKI)

The Julius Kühn-Institut (JKI) is a research institution as well as higher federal authority under the jurisdiction of German's Federal Ministry of Food and Agriculture (BMEL).





Competence in Horticultural Plant Breeding

The Institute for Breeding Research on Horticultural Crops, located in Quedlinburg, is one of the 17 institutes of the Julius Kühn-Institut, Federal Research Centre for Cultivated Plants (JKI).

Its core competence are vegetables, ornamentals, medicinal and aromatic plants. The Institute conducts state-of-the-art breeding research with the goal of evaluating and enlarging the genetic basis of plant genetic resources. Regarding agricultural policy, this work allows an effective contribution to achieving the goals set out for the advancement in horticultural crop breeding. For performing its tasks, the Institute is involved in numerous scientific networks at national and international levels. It works closely together with other JKI institutes as well as with research institutions and universities at home and abroad.

Our Main Tasks

Evaluation of Plant Genetic Resources and Enhancement of Genetic Diversity using Pre-Breeding and modern breeding methods

The Institute develops breeding methods for crop improvement. The insights gained provide a fact-based support for political and administrative decisions. In particular, the results are a valuable aid to promote agricultural policies directed at ecologically sound farming and a sustainable horticultural production of high-quality and healthy food. For this reason, breeding research carried out by the Institute is aimed at providing the conditions for an economically efficient plant breeding and an ecologically balanced horticulture. The Institute elaborates methods and strategies that help tap genetic resources for important horticultural crops, and thus increase biological diversity in horticulture. Besides current targets in crop breeding, the scientists also address the challenges of the future such as the adaptation to further climate changes.



Vegetables

Vegetables possess a special importance due to their high vitamin, mineral and dietary fibre content. At the start of a consumer-oriented horticultural production chain, plants, which ensure product quality and beyond sufficient abiotic and biotic resistances, are necessary. The Institute evaluates old and new cultivars, and wild species (plant genetic resources) with regard to „product quality“ and „healthy plant“. In carrot (*Daucus carota*), for instance, special focus is given to the variability embedded in the genes.

New methods (molecular markers) are applied to select for and examine the resistance to distinct pathogens (e. g. *Alternaria*). Using genotyping by sequencing (GBS) and genome-wide association studies (GWAS), the influence of polyacetylenes on fungal pathogens (storage diseases) is analyzed within a broad assortment of carrot species, cultivars and breeding material.

In asparagus (*Asparagus officinalis*), an interspecific crossing program is aimed at improving the genetic basis of resistance to viral and fungal diseases as well as abiotic stress (e. g. dryness) and of quality-determining compounds (e. g. flavour).

Ornamental Plants

Within the plant types classified as horticultural crops, ornamentals by far represent the largest group of cultivated plants. In Europe, approximately 400 species assigned to some 250 genera are of economic importance. They encompass at least 100 different plant families. Ornamental plants are important genetic resources. Together with their native relatives they are an essential component of our ecological system. Therefore, the Institute is engaged in the German Gene Bank for Ornamental Plants and coordinates the subnetwork *Pelargonium*.

Basis of ornamental research is the steady improvement of plant genetic resources through breeding. The Institute's main focus is currently on *Hydrangea* and *Pelargonium*. The latter belongs to



Germany's most important ornamentals. The present diversity of the cultivars is based on crosses of only a few wild species. However, sexual incompatibility between different *Pelargonium* species prevents an improvement by crossing. Biotechnological methods such as embryo rescue and somatic hybridization may be feasible alternatives to overcome these difficulties.

Medicinal and Aromatic Plants

Medicinal and aromatic plant products provide a broad spectrum of desired effects due to special substances being generated in the secondary metabolism, and therefore find application in herbal remedies, spices, food additives, natural plant protecting and forage additives. Genome-wide association studies allow us to investigate several favoured traits e. g. resistance and important flavour carrier at once. Using these results, marker assisted methods could be developed to facilitate the breeding process of cultivars fitting consumer desires.

Current research focuses on the development of productive annual caraway (*Carum carvi*) cultivars with a high content of essential oils. In St John's wort (*Hypericum perforatum*) and anise (*Pimpinella anisum*), economic relevant traits such as resistance and bioactive secondary metabolites should be optimized by breeding.