
[nature](#) > [nature italy](#) > [q&as](#) > [article](#)

Q&A | 23 November 2022

Protecting Italian rice from a warming climate

Agricultural researcher Filip Haxhari explains why genetic improvement is key to the future of rice production in Italy.

[Sara Moraca](#)



Rice fields surround the abandoned church of Sant'Antonio at Casaleggio di Novara, Piedmont, Italy. Credit: Mirko Costantini / Alamy Stock Photo.

Global warming is taking its toll on Italian agriculture, including rice grown in Northern Italy, that accounts for 52% of all rice produced in the European Union. During this year's harvest, between September and October, high temperatures and drought have almost erased the yield of more than 26,000 hectares of rice fields between the provinces of Pavia and Novara and caused an unprecedented yield loss in the other rice-growing areas of Italy. To understand how research can help adapt to climate change, we spoke with Filip Haxhari, head of genetics at Ente Nazionale Risi (National Rice Institute), the Milan-based agency charged with safeguarding and promoting Italian rice.

The Ente Nazionale Risi boasts the largest rice seed bank in Europe. What is its function?

The seed bank grew out of the institute's first research activity in 1969. Researchers and farmers collaborated to collect all the varieties of rice that were grown in Italy and went to other European countries to recover seeds from Italian varieties that were grown abroad. Today the bank has a storage capacity of 30,000 genotypes, and we currently store 1,600, making it the largest collection in Europe. It includes all the varieties derived, tested, or cultivated in Italy since 1800. We also have some of the most important varieties found elsewhere in Europe, and varieties with special characteristics, such as resistance to cold or pests, or low glycemic index.

How can the seed bank ensure that Italian rice is improved for the benefit of all?

To maintain the biodiversity of the seed bank, each variety is cultivated every five to ten years. This allows us, for example, to see how the Bertone variety, dating back to 1819, behaves today, compared to 10 or 20 years ago. Every time it is recultivated, we collect detailed information. We have noticed that, compared to 30 years ago, Bertone's vegetative cycle is at least a week faster from seed to ripening, decreasing from about 160 days to about 148-150 days. This type of evidence gives us confirmation of the impact of climate change, and we can understand how to make use of the genetic plasticity typical of this variety.

From crossing, to selection, to marketing, what testing does a variety undergo?

It takes about 10-12 years to get from crossing to selection, and each year the plants that have the desired characteristics are gradually selected. We create 200 to 300 crosses every year and evaluate 30,000 to 40,000 genotypes. Once the desired variety has been obtained, we do tests and production trials. The first year, we evaluate resistance to heat, cold, and disease in a specific region; the second year, we cultivate it in all the Italian rice-growing regions and collect data from each area. In addition, a research greenhouse called a phytotron has recently been built at our centre, allowing us to simulate extreme weather conditions and to verify the effect of temperature changes on the flowering phase. Specific varieties are placed in the phytotron, and their resistance to cold or heat is tested over time at temperatures below 15 °C and above 35 °C. It is also important that the variety has a high genetic plasticity to adapt well to different climates. We do in-depth analysis of less obvious characteristics such as light sensitivity, root structure, and leaf shape. To give an example, this year we presented the CL18 variety, after years of tests. The production yield is generally 6.500 kg per hectare, while this new variety is around 10.000 Kg per hectare, with an excellent level of resistance to diseases.

Ente Nazionale Risi also works with varieties from other parts of the world that are not in the seed bank. How and why?

We also have collaborations with countries such as Japan, where they are working on cold-resistant varieties. In Southeast Asia they have created varieties resistant to the various types of rice blast fungus (*Magnaporthe grisea*), the most serious fungal disease for rice. We have requested these varieties, and we want to verify which ones respond best to the species of rice blast fungus present here. We are also working to create varieties with a glycemic index below 50, by crossing with varieties from the Philippines.

Do you use traditional genetic crossing techniques, or newer genetic editing techniques, such as CRISPR?

We only do traditional crosses, a choice we made because legislation on new breeding techniques (NBT) has not yet been established. As an institution we cannot take this path until European and national standards have been established. This also applies to GMOs. However, we have prepared our laboratory and documentation for when these standards may be established.

**What role could these new gene editing techniques play in the rice industry?
What kind of limitations does the lack of legislation have?**

CRISPR opens interesting scenarios for agricultural research in general, but rice research is much more complex than most people believe. CRISPR only allows you to operate on monogenic characteristics, which are easy to control. With climate change, for example, it is necessary to operate on the centres of genetic aggregation, the set of genes that allows you to create the complex varietal response necessary.

How do you evaluate access to research funds and international collaborations, especially when consideration Italy's National Recovery and Resilience Plan (PNRR)?

The PNRR represents an excellent development opportunity for new projects, especially because there is generally not enough agricultural research investment in Italy. In the rice sector, funding has increased significantly because of private investment by companies. Fewer bureaucratic restraints would be beneficial because, for example, we must fill out many documents just to request seeds from another research body.

doi: <https://doi.org/10.1038/d43978-022-00159-1>

Nature Italy (*Nat Italy*) | ISSN 2730-7999 (online)