



# GEORGOFILI WORLD

Newsletter of the Georgofili Accademy

## **ORGANIC AGRICULTURE CANNOT SAVE US. GENOME EDITING CAN.**

by Anna Meldolesi

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**We are republishing Anna Meldolesi's interview with Sanjaya Rajaram from "La Lettura", the Corriere della Sera supplement from Sunday 29 May 2016. Born to a humble family in a farming village in Uttar Pradesh, India, Sanjaya Rajaram was encouraged to study, becoming one of the best students in his district and going on to graduate in agronomy. He has developed about 500 new varieties of wheat grown in fifty-some countries.**



He does not write pamphlets with easy recipes for a better world. He has spent more time in the fields than captivating audiences. However, it is a symptom of a cultural disease that few people know Sanjaya Rajaram - and many know Vandana Shiva. This former is an Indian agronomist, who won the 2014 World Food Prize, has picked up the torch of Nobel Peace Prize winner Norman Borlaug, father of the Green Revolution who, in the second half of the last century, doubled grain production in much of the globe, as a result of better seeds, irrigation, fertilizers and pesticides. Rajaram has developed 500 new varieties of wheat grown in 51 countries. He came to Italy for the World Food Research and Innovation Forum promoted by the Emilia Romagna region.

**There are 795 million people who do not eat enough. Is it the fault of politics or of droughts, floods, and epidemics?**

The majority of the hungry are unemployed and landless. They live in remote areas without access to the market and do not have the basic education to develop skills. Although in many countries they would have enough food to feed everyone, policies to distribute are lacking.

In the immediate future, special arrangements are needed to provide basic necessities free of charge and relieve chronic hunger but education programs are essential in the long term.

**You come from a farming family in Uttar Pradesh, but you were able to study and have**

**achieved extraordinary results. What are you most proud of?**

At the beginning of the Green Revolution, there were few wheat varieties and there was a real danger that they would succumb to pathogens and insects. In the early 1970s, a hybrid corn was attacked by the fungus *Helminthosporium* in the USA. I managed to get enough funds to expand the program of the International Center for the Improvement of Maize and Wheat (CIMMYT, based in Mexico) reaching 10 thousand cross-breeds per year. We went on with hybridizations for 25 years, developing 500 varieties adapted to different environments, that combine yield and better disease resistance, high temperature tolerance and resistance to water stress. So we protected the crops from the threat of large epidemics for the rest of the twentieth century. These varieties have increased the annual production by 200 million tons, bringing \$3-4 billion to small farmers in developing countries.

**Our agricultural practices contribute to climate change which threatens them in turn. So what can be done?**

Agriculture is partly responsible for global warming, mainly because of the carbon dioxide released from the soil and the methane emitted by rice paddies and livestock breeding. I guess you could remove a billion tons of CO<sub>2</sub> through such appropriate practices as "conservation agriculture" that limits interventions on the soil. However, financial support is needed to deploy them in small landholdings. In addition, we should stop deforestation.

**Borlaug said that peace is not built on empty stomachs. In 2050, the earth will have to feed 9 billion people. Will organic agriculture be enough? Is it opposed to the scientific one or does it complete it?**

Organic farming can produce food for 3 billion people but already today we are 7.3 billion. Current yields with modern farming practices are about 2.5 tons per hectare worldwide. With the organic, the average production is only 1,600 kilos of corn per hectare. Organic farming can offer only some benefits to those who grow vegetables, fruits, flowers. But to meet the global demand for cereals and tubers, a large amount of nitrogen is needed that cannot come from organic fertilizers. It is possible to put together different approaches in the future, taking advantage of the soil's microbial flora and resorting to chemical pesticides to control pests.

**In "Starved for Science", Robert Paarlberg argues that Western policies are depriving poor countries of biotechnology. But many activists believe that innovation favors "agribusiness" and hurts small farmers.**

I am convinced that small farmers need advanced technologies. Without improved seeds, without an appropriate use of water and nutrients, they would be condemned to remain poor. They require the same technologies as large farms, even if they use them differently. Already today, they are combining organic farming with modern inputs. What they lack above all is access to the market.

**We often imagine innovation as a sudden leap, as regards the future, for example, we are expecting super plants with stunning properties. Is this a cartoon vision?**

In reality, the changes are incremental, step by step. We should constantly examine the way we work and our professional ethics and create strong partnerships with countries and international organizations committed to the fight against poverty. We must bequeath to local staff a wealth of experience made up of hard work, self-esteem, skills, but continued investment in developing human resources are needed. There are hundreds of agencies,

working in different parts of the world, which need young scientists who will devote themselves enthusiastically to the mission of solving the problems of small farmers.

**The latest fashionable technology in laboratories is called CRISPR. Will it mark a turning point?**

Yes, genomic editing will have a strong impact, because it allows precise changes to be made to the gene of interest while avoiding the introduction of undesirable traits, as usually happens with conventional crosses. It enables preserving all the original genome's features, with the exception of the desired mutation, and shortens the time needed to develop new varieties. But the sequence of the gene to be modified must be known.

**If a genie were to grant you three wishes, what would they be?**

One, a 30% increase in production per unit area for the same natural resources used in order to keep up with population growth. Two: the transferring to cereals of the ability to fix nitrogen that is typical of legumes, so as to reduce pollution from fertilizers. Three: that public opinion be more accepting of modern genetic improvements, including new precision biotechnologies.