BANANA VARIETIES RESISTANT TO FUNGUS ARE IDENTIFIED USING MUTATION INDUCTION

WORKING FOR safety of consumers of the world's commercial banana crops

WORKING TO develop a banana variety resistant to fungus causing Black Sigatoka disease

WORKING WITH Bioversity International, CIRAD, IAEA

WORKING THANKS TO FAO/IAEA Regular Budget Funding

According to the annals of plant genetic diversity, the world is home to more than 1 000 varieties of bananas. They come in colours ranging from red to black, from green to maroon, from sweet ones ready to be eaten directly from the tree, to starchy ones that need to be cooked. They also vary in nutritional value, including one Nigerian variety used to cure infertility. Yet shoppers are likely to find only one variety of banana in their local supermarkets. That same variety will be for sale at the market across town, in the next district or in the next country – yes, in just about all of the world's supermarkets. The entire global commercial banana industry relies on one sweet, seedless banana variety, the Cavendish.

The variety was adopted by the commercial industry because it had resistance to a disease that was threatening the banana world of the 1960s. Today, history repeats itself. Another banana disease, Black Sigatoka, is circling the globe, and the Cavendish, which has no resistance, is in its path. The threat is especially dire because of the way these bananas are propagated: they are all essentially clones, which means that if one plant is at risk, all plants are at risk.

The Cavendish banana variety, which accounts for 95 percent of all bananas sold commercially, is seedless, making it extremely convenient to eat. But seedless also means sterile – unable to reproduce through normal seeding processes. Today's commercial banana industry relies almost totally on the Cavendish because marketing only one variety makes harvesting, packaging and transport more cost-effective and delivers a uniform product. Yet it also means that the vast majority of the world's bananas are clones, and if something affects one plant, it affects them all. This is exactly what is happening. A banana fungus – *Mycosphaerella fijiensis* (Morelet) – that causes the leaf disease Black Sigatoka, has emerged to threaten the world's entire banana crop. The industry's only defence is to spray enormous amounts of fungicides over plantations, which has human health and financial implications. The Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture, which pioneered mutation breeding using tissue culture, is now developing banana mutations resistant to the fungus.

The entire global commercial banana industry relies on one sweet, seedless banana variety, the Cavendish.

***95% of the world's commercial bananas** are threatened by fungus and must be sprayed every six days with a fungicide.*

FIGHTING BANANA FUNGUS IS A RACE AGAINST TIME

Adopting a new banana variety that is not susceptible to Black Sigatoka would require the banana industry to re-tool its entire processing infrastructure – a drastic and costly measure. So instead, banana producers are relying on a fungicide sprayed on plantations from the air every six days – a fungicide that has been associated with dire side effects for human health, including stunting children's growth and miscarriages. The fungicide is also expensive to use, putting it out of reach for many of the some 400 million local people who rely on banana to feed their families or for extra income.

Unless Black Sigatoka resistance is built into the current global variety, the fungicide spraying will continue. This is why the Joint FAO/IAEA Division, a global pioneer and leader in the field of plant genetic mutation, is in a race against time, working urgently with countries to develop new varieties with the resistant traits.

SEEKING RESISTANCE TO FUNGUS IS A NUMBERS GAME

In the case of bananas, the mutation process calls for irradiating thousands of plantlets with doses of gamma rays or X-rays that cause random mutations. Then it is a matter of screening to see if the mutations have affected the genes in a way that could lead to the sought trait – in this case, resistance to Black Sigatoka. It is basically a numbers game: the better the screening technique, the faster the probability that the specific, one-of-a-kind improved banana will be detected.

To date, the Joint FAO/IAEA Division Plant Breeding and Genetics Laboratory has developed three banana plant mutations that, under laboratory conditions, show a resistance to the Black Sigatoka toxin. The next step is to take the plantlets to the field, to determine if the bananas they produce outside of the laboratory still have resistance.

*New banana varieties developed by the Joint FAO/IAEA Division have increased family income **25-fold** in Sri Lanka.*

The goal of the Joint FAO/IAEA Division's work with plant mutations is to help small farmers and medium-size producers. It has produced commercial bananas that provide Sudanese farmers with a 30 percent higher yield, and introduced 600 Sri Lankan families to micro-propagation techniques that increased family income 25-fold – so successful that the Sri Lankan Government has recommended that local farmers consider switching from subsistence rice to value-added banana.

Front: ©FAO/Giuseppe Bizzarri. Above, left to right: ©FAO/Giulio Napolitano, ©FAO/Simon Maina, bottom: ©FAO/IAEA