Plant genomics is much more than GMOs

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Plant genomics is a fast moving field with applications ranging from crop improvement and protection, to production of compounds of pharmaceutical interest as well as bioremediation of contaminated soil. Moreover, with market pressure increasing on the large food crops such as wheat, corn and canola for the production of biofuels, the field is attracting growing attention globally and in many European countries in spite of the red tape still in the way of the introduction of GM plants. Chiara Tonelli, a plant geneticist at the University of Milan, explains what lies ahead for research and industry.

You are working on the genomics of Arabidopsis, why is this plant so important to plant geneticists?

The decoding of Arabidopsis thaliana's genome has been the equivalent of the Human genome project. In a word it's the mouse of plant genetics, as it's a wonderful model organism for many crop plants as it's small, easy and fast to grow as it has a life cycle, from seed to seed, of three months. Many of the more sophisticated innovations, which we will see in the next generations of transgenic crops, have been discovered in this plant. Today there is great deal of potential innovation in this field but launch on the market is very slow as industry focuses on large crops such as corn and soy and changes in regulations are very slow.

Plant genetics is commonly associated with the production of GMOs, still widely opposed by consumers in Europe. What are actually their applications in traditional plant breeding?

Genetic engineering is just a technology use to insert genes into plants, but what is really valuable is to understand the role of genes and which are responsible for traits such as resistance to pathogens, tolerance to low or high temperatures, high salinity in the soil, drought, in order to select plants capable to grow and produce in adverse conditions or in marginal lands. Our lab has two main lines of research, one is studying the regulation of anthocyanins, the red/blue pigments which give plants protection against environmental stresses and disease. This pigment could be used as natural food colourants to replace many artificial colours used in various foods. This improved understanding of the genetics of anthocyanins also provides a better platform for studying their antioxidant properties, important in the fight against cancer, cardiovascular disease and age-related degeneration We have already produced a line of corn with a high concentration of anthocyanins. The second line of research is on genes conferring tolerance to environmental stress such a drought or salinity. We have identified a gene that controls the rate of water consumption in Arabidopsis domain and we have been able to cut up to 30% of water consumption through the inactivation of this gene. This innovation is potentially applicable in soybean, rice, corn and cotton. Transgenic technologies, involving the insertion of genes from other species into plant DNA is not the only way to use genetic information. Today we are looking at cisgenesis, namely the modification of the endogenous plant genes, or the insertion of genes from other plants. This approach raises less concern in the public opinion.

Is it possible to envisage non GM biotech crops for Europe, especially for valuable but minor food crops such as tomatos, zucchini and other vegetables typical of the Mediterranean?

Yes and it would be a great advantage as for typical products that are experiencing growing difficulties due to viruses and other pathogens. An example is the San Marzano tomato developed in Southern Italy by Agrobios Metapontum but never cultivated because of GM-free regulations. To make a comparison with the pharmaceutical industries where orphan drugs have a dedicated approval protocol, I believe we should have a regulation for minor crops not relevant to major industries.

Even after 15 years on the market GM crops are still not completely accepted by consumers, what do you think could make them more appealing?

In spite of the research completed there have actually been few GM products on the market and we have still not seen much from the latest and more sophisticated research. I believe more innovative products should make it to the market with characteristics appealing to consumers as, for instance, higher vitamin content and pathogen resistance. An example, though poorly conveyed to the general public is Bt corn, which has a lower level of fumonisin, a cancer inducing toxin.

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