Is it right to write off Gene Editing?

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By : Rahul Koul - March 22, 2019

The World Health Organization's special committee on gene editing has recently called for maintaining an international database for the ongoing research work in the area. The WHO panel's statement said that it would be irresponsible for any scientist to conduct human gene-editing studies in people, and a central registry of research plans should be set up to ensure transparency. This committee's comments have come in the wake of the birth of the first gene-edited babies — the result of an experiment by a Chinese scientist, He Jiankui, who genetically altered human embryos.

In such a backdrop, the mere mention of word 'Gene Editing' makes most of the people think it is the same as Genetically Modified Organisms and then they go on to associate it with controversies surrounding the latter. So is it really the same, after all, we are talking about editing the genes? But the fact is that it is different and the difference lies in the way the genome is modified. Instead of insertion of a foreign gene in the DNA, here it is limited to the

modification or deletion of the mutated gene within the individual's genome.

Not that the Gene Editing is without any controversies, here the question is not on the side effects of the product but the priority of its usage and avoiding unnecessary experimentation. Point in case is the He Jiankui's gene edited baby claim which is ridden with bioethical issues and an unnecessary hype that doesn't solve any problem. So could it have been avoided? Certainly yes, if there would have been guidelines established in respective countries.

In India, the Department of Biotechnology is shortly coming up with the draft guidelines for gene editing, as revealed by the Principal Scientific Advisor to the Government of India, Prof K Vijayraghavan recently on Twitter. It would be interesting to see how would the cross sections of our scientific community and the society, in general, would react as and when this draft comes up for consultations.

The question, meanwhile, is that should the 'Gene Editing' be discarded just because its use in humans involves bioethical issues or we should look at its immense potential in agriculture and ensuring food security for our population? Since one cannot disagree with the fact that bioethical issues in human gene-editing need thorough detailing, let us limit this discussion to the potential of Gene Editing in revolutionizing agriculture.

Gene Editing in agriculture: A look at positives

Given its immense potential, Gene Editing is seen as a powerful tool for global agriculture, offering options to wipe out genetic disease, improve drought resistance, boost nutrient efficiency, and prolong shelf life. The approach involves making a cut in the plant's DNA using molecular scissors, then the changes to the sequence are made by the plant's own repair process. The technology enables breeders to insert, delete or replace genetic traits within the organism's genome.

There are several approaches, but it is the method called CRISPR-cas9, which has created a huge buzz within the scientific community. However, questions have been raised over who will determine the technology's future and how.

With gene editing, the ability to pick livestock traits will be just as easy. For agriculture, the desirable animal health and productivity traits to sell to producers for use in breeding programs will be possible. The discoveries could include the gene-edited polled cows, heat-tolerant cattle, foot-and-mouth disease resistance, genetic castration, meat quality, and what not.

Apart from CRISPR, there are many who are creating their own proprietary technologies for gene editing. This includes many companies in US and Europe who are not much interested in CRISPR because of patent and licensing disputes with the technology.

> **CRISPR stands for clustered regularly interspaced short palindromic repeats. These repeats were discovered in the genomes of bacteria where it acts as an adaptive immune system. It uses RNA to guide molecular scissors (Cas) to cut up invading viruses. Using these same molecular tools, scientists reprogrammed the molecular scissors to cut and edit or correct specific spots in DNA. CRISPR-Cas tools can now be engineered to cut out the DNA at the exact site of a mutation for a disease in a pig,**

As per experts, while the GMO technology is focused on a small number of traits, gene editing covers more traits and more crops.

Notwithstanding the controversies and bioethics surrounding the use of gene editing in humans, agriculture is an area where its usage looks much realistic. Therefore, in the current scenario, it is important to remain transparent and keep educating people on the benefits of these new gene-editing technologies.

Indian context: What should be the way forward?

Recently a panel discussion on gene editing comprising of eminent persons from the government and industry was held at Hyderabad. The discussion was in the backdrop of "Gene Editing in Agriculture: Science, Policy, Story", a 3.5-day intensive training which was held in Hyderabad from February 25-28, 2019, for scientists, communicators, and regulators. The Cornell Alliance for Science and Cornell Sathguru Foundation for Development (CSFD) organized the event towards promoting access to scientific innovation as a means of enhancing food security, improving environmental sustainability, and raising the quality of life globally.

The theme of the round table was "Gene Editing: What is to gain? What is at stake?".

Experts agreed that the Indian research community has developed the capability to do genome editing with ease owing to the past technical exposure and experience with GM crop research, molecular data generation, and safety assessment. This technology can offer enormous benefits to address the problems of local and commercial crops. If appropriate handling of political and democratic issues is not addressed in a timely manner, then this benefits of the technology will be lost.

The probability of experiencing the same fate for the release of gene editing crops will be high as experienced with the release of genetically modified (GM) crops. Adopting new technologies like gene editing should not encourage abandonment or undermine the benefits of GM technology.

The regulatory policy was an important aspect discussed during the session. Predictability regarding the regulatory policies in India would ensure continued investment in gene editing research by both private and public sectors. The government needs to understand the necessity of technological intervention in crop improvement. Without significant government involvement, the benefits associated with the technology will never see the face of light. Due to the delay in the government taking a stand regarding gene editing technology, most of the companies have started mutation breeding to get the desired products. This is a concern, which requires immediate attention as it may lead to concealment of technology used in the products. Hence, responsible regulations will be the key to the future in terms of development. Safety issues, import regulations were also discussed.

IP landscape for GM technology is much clear and very different from gene editing. The context of patent pooling for gene editing is coming up, but the licensing mechanism is not clear for gene editing technology as it is for GM technology. Also, patent enforcement of

crops using gene editing technology might be challenged in the near future which must be addressed.

Another aspect of the discussion focused on communication which summed up that it is imperative that the journalists understand the latest technologies and the science behind to interpret and write in an effective way. Public engagement and building awareness for this technology among the stakeholders is essential. The opportunities and the bad effects, if any, of the technology, must not be exaggerated. There has to be a balance between regulators, activists and policymakers' understanding of the technology. Communication is a key to promote the gene editing research and can be effectively achieved by using non-scientific language by researchers to create awareness about the technology. Renaming the terminology of Gene editing was suggested for wider acceptance.

The discussion ended with a consensus that no science will come up in a large way without the necessary political support and will. No doubt such discussions would encourage an active dialogue in the current scenario and the future of gene editing in India. Hope the coming days would lead to better clarity and transparency on the usage of Gene Editing and it wouldn't follow the same path that GM technology has!

***This article is based on the recent deliberations at an event in Hyderabad where the author was at the invitation of Sathguru Management Consultants. The author outlined the role of effective communication in demystifying gene editing.**

The panelists who shared their views at the discussion focussed on gene editing in agriculture included Dr S R Rao, Adviser, Department of Biotechnology, Minister of Science & Technology Government of India; Dr Usha Barwale Zehr, Director and Chief Technology Officer, MAHYCO; Prof.C.Kameswara Rao, Founder and Executive Secretary, Foundation for Biotechnology Awareness and Education (FBAE); Prof P.Balasubramanium, Scientific Director, South Asia Biotechnology Centre (SABC); Dr Padmavati Manchikanti, Professor and Dean, Rajiv Gandhi School of Intellectual Property Law, IIT Kharagpur; Somasekhar Mulugu, Bureau Chief, Hindu Business Line; Chander Mohan, Sr. V. P. Special Initiatives & Sr. Executive Editor, Krishi Jagran and Mandeep Kaur, Associate Editor, Business of Agriculture. Dr Sarah Evanega, Director, Cornell Alliance for Science hosted and moderated the discussions.