THE SCIENCE WORLD
A Monthly e Magazine
Popular Article
ISSN:2583-2212
January, 2023; 3(01), 10-12

Plantibodies: a plant-based production-system

Nisha Devi[1] and Kanika Rani[1*]
Deptt. of Molecular Biology, Biotechnology & Bioinformatics,
CCS HAU, Hisar-125004
https://doi.org/10.5281/zenodo.7512782

Abstract

Genetically modified plants might be used for production of non-native proteins as they have artificially inserted gene(s) or transgene(s) that comes from an unrelated plant or from a different species. Thus, the production of antibodies via these transgenic plants could be achieved in a low cost and scalable option. Though plantibodies have many advantages in the treatment of different pathologic conditions however, the technology is not well known and only practiced in Africa (in general) and in Ethiopia (in particularly in the veterinary sector). The low-cost, high-scalability and safety characteristics of a plant-based production system offer an attractive alternative for commercial pharmaceutical products.

Introduction

An antibody or fragments of antibodies generated by using genetically engineered or transgenic plants is termed as 'Plantibody'. Genetically modified plants might be used for production of non-native proteins as they have artificially inserted gene(s) or transgene(s), for example, production of insect toxins for disease-resistance. Plants don't naturally produce antibodies as being devoid of adaptive immune system or any circulating immune defense cells. Despite this, plants can be made to express and assemble full length antibody heavy chains and light chains. First successful introduction of mouse immunoglobulin genes to tobacco plants for fabrication of functional antibodies with reasonable efficiency was carried out by Hiatt and co-workers in 1989. Planet Biotechnology company produced first approved therapeutic plantibody, 'CaroRx' from tobacco plants. CaroRx binds to the bacteria *Streptococcus mutans* to prevent tooth decay in human. Another important plantibody, 'LeafBio' from tobacco plants was developed against Ebola [Zhang *et al*., 2014].

Most of the procedures of production of these plantibodies use a viral vector (encoding the target antibody) for the infection in plant, and these can be harvested and extracted from the plant parts like leaves. In contrast to the usage of mammalian cells for antibody-production, plantibodies might be a low cost and highly scalable alternative. Antibodies may have improved safety profiles due to lower risk of

animal pathogen contamination, although plant-specific toxins also exist and would need to be screened against. There may also be differences in antibody properties such as glycosylation when compared with mammalian systems, which could affect antibody function. These might be beneficial for different ailments but still more detailed studies are required on a larger scale in all domains as currently mostly practiced in Africa and Ethiopia [Nair *et al*., 2016].

Selection of plants for production of Plantibodies

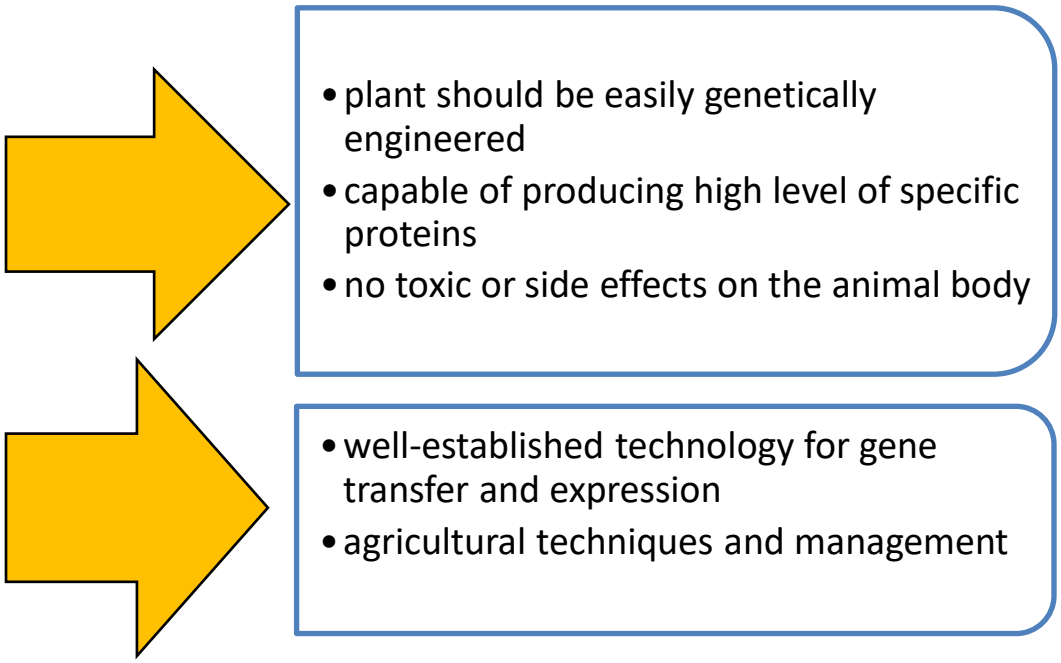

Fig.1 Selection criteria for plants for plantibodies-production

Different recombinant proteins have been expressed in several important agronomic species of plants like tobacco, soybean, corn, tomato, potato, banana, alfalfa, canola, spinach, maize, lettuce etc. Major techniques for purification of Plantibody are Filtration, Immunofluorescence, Chromatography, Diafiltration and Polymer fusion while for their evaluation Radioimmunoassay, ELISA (enzyme-linked immunosorbent assay), western blot analysis and Immunofluorescence are available [Jain *et al*., 2011].

Plant derived vaccines

Mostly involve in treatment of infectious disease like Respiratory Synctial Virus (RSV), HIV, anthrax, diphtheria, SARS, small pox virus, inflammation, autoimmune diseases or cancer. Some of the most popular antigens expressed in the transgenic plants are: 6 Hepatitis B surface antigen (HBsAg), rabies virus glycoprotein E coli heat labile enterotoxin, and Norwalk viral capsid protein. Plant derived vaccines offers the advantage of convenient storage, elimination of health professionals for their delivery and the use of renewable resources for large scale production [Nair BJ, 2017]

Pros and Cons associated with plantibodies

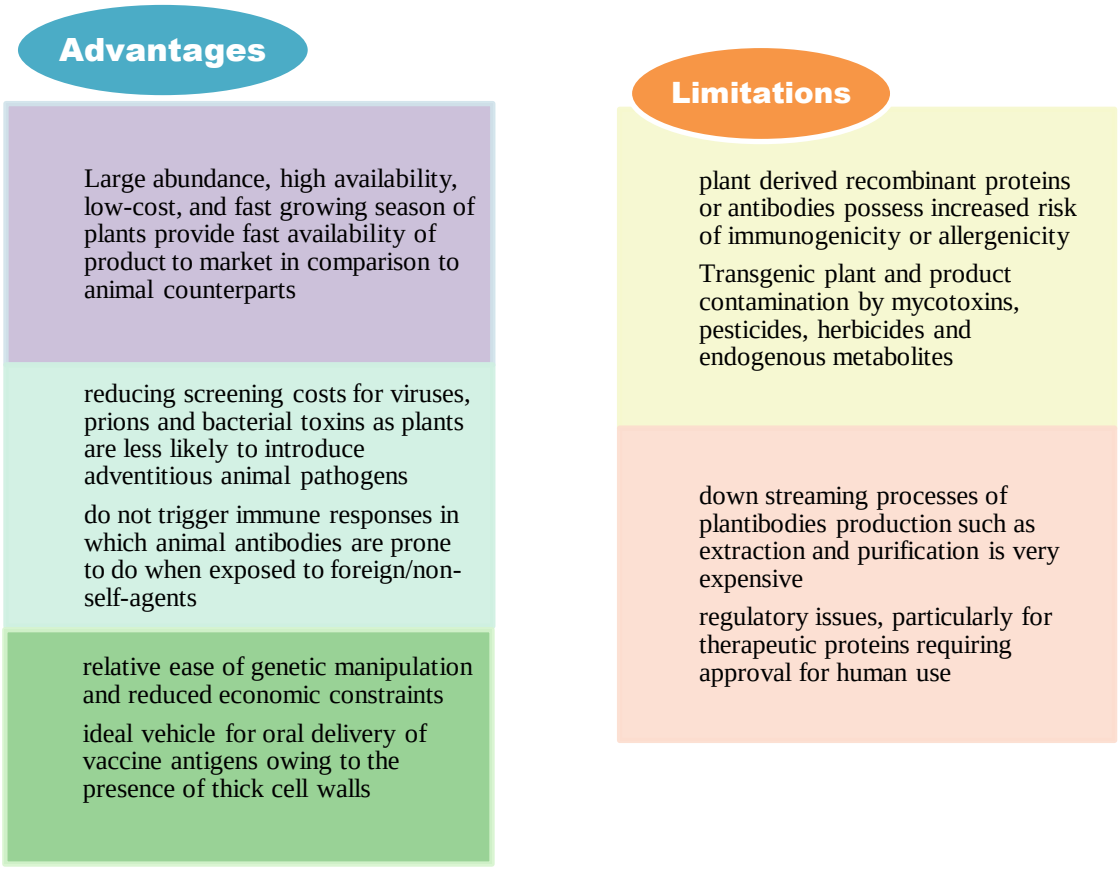

Fig.2 Pros and Cons associated with plantibodies

Conclusion

Global health will always be a hotspot of research and the need to develop more suitable therapeutics or any technological approach is critical. To explore new ways for vaccine development is a challenging task itself and plantibodies may be a useful alternative to meet it.

References

Zhang, Y., Li, D., Jin, X. and Huang, Z., 2014. Fighting Ebola with ZMapp: spotlight on plant-made antibody. Science China. Life sciences, 57(10), p.987.

Nair BJ. Plantibodies: paving novel avenues for immunotherapy. MOJ Surg. 2017;4(4):75-77. DOI: 10.15406/mojs.2017.04.00078

Jain P, Pandey P, Jain D, et al. Plantibody: An overview. Asian journal of Pharmacy and Life Science. 2011;1(1):87–94.