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ORIGINAL ARTICLE

AFFECT OF PLANT GENETICS ON NUTRIONAL QUALITY OF OUR FOOD: A STUDY

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ABSTRACT

Plant Genetics encompasses the examination of genetic material within plants to enhance food crops, bolster resistance to pests, and facilitate growth in difficult environmental conditions. Through genetic modification, novel plant varieties can be created to improve nutrition, flavor, and marketable traits. Just as researchers are mapping the entire animal kingdom genetically, similar efforts are being made in the realm of plants. The aims include not only enhancing food and commercial crops but also increasing plants' ability to resist pests and thrive in challenging or less-than-ideal environments, such as dry areas and saline conditions. By genetically crossbreeding plants—introducing genetic material from one species into another—we can significantly diversify the human diet, increase the nutritional value of foods, and produce new, more flavorful, and visually appealing items with extended shelf life. This paper represents a humble endeavor to explore the fundamentals of Plant Genetics.

KEY WORDS: Genome Sequencing, Genetic Manipulation, Nutritional Value, Plant Genetics.

INTRODUCTION

Plant genetics focuses on the investigation of genes, genetic diversity, and inheritance specifically in plant species. It is typically regarded as a branch of biology and botany but frequently overlaps with various other life sciences and has strong ties to information systems research. While plant genetics shares similarities with animal genetics, it also has several distinct features. Gregor Mendel, a scientist and Augustinian friar from the late 19th century, is credited with the discovery of genetics. He explored "trait inheritance," which refers to the patterns of how characteristics are passed down from parents to their offspring. Mendel found that organisms (notably pea plants) inherit traits through distinct "units of inheritance." This concept, which is still relevant today, offers a somewhat vague understanding of what a gene is. A significant portion of Mendel's research on plants continues to underpin contemporary plant genetics.

Plants, like all known living organisms, utilize DNA to pass characteristics to the next generation. In animal genetics, the focus often lies on ancestry and lineage; however, this can pose challenges in plant genetics because, unlike most animals, many plants can self-fertilize. The process of speciation can be more straightforward in numerous plants due to special genetic traits, such as their adaptability to polyploidy.

Plants are distinct in their ability to generate energy-rich carbohydrates through photosynthesis, a process facilitated by chloroplasts. Chloroplasts, which share some superficial similarities with mitochondria, contain their own DNA. This means that chloroplasts serve as an extra source of genes and genetic variation, creating an additional layer of genetic intricacy that is not present in animals. The

field of plant genetics has significant economic implications: many key crops are genetically engineered to enhance yields, provide resistance to pests and diseases, offer resilience to herbicides, or improve their nutritional profile.

IMPORTANCE OF PLANT GENETICS

Plant Genetics is important not only in the field of agricultre but also in ecology. Here are the some importance of plant genetics.

- **Crop improvements:** It has been widely used in the field of agriculture to improve crops with desired characteristics such as high yields, resistance to pests, high nutrition, resistance to biotic and abiotic stresses.
- **Conservation of biodiversity:** It can help to conserve the indangered plant species to prevent ecosystem from falling down.
- **Medicine and pharmaceuticals:n**Plant has been used for their medicinal properties from the ancient time. Scientist can used genetic engeenring to increase the production metabolites in plants.
- **Environmental sustainability:** Plant have been used to decrease the increasing environmental pollution. Ability of absorbing pollutants can be increases via gene editing.

PLANT GENETICS AFFECT ON THE NUTRIONAL QUALITY OF OUR FOOD:

Throughout history, humans have understood that the most flavorful and plentiful fruits could be chosen and replanted in the following season. The genetic characteristics of food crops continuously evolve through natural mutations and recombination. Nowadays, advancements in our knowledge of genetics and molecular biology enable scientists to identify specific genes that can be transferred between different species. Genetic material can be moved from viruses, bacteria, plants, and animals, resulting in notable alterations to the original species. In contrast to traditional breeding, gene transfer makes it possible to share genes between organisms of varying species. It also allows for the transfer of only specifically selected genes to achieve the desired results in a controlled lab environment. Terms often used to refer to the gene transfer and modification of plants and animals include: Genetically Modified Organisms (GMO), Genetically Engineered (GE), and Biotechnology-Derived (BD).

NUTRITIONAL CONTENT OF FOOD

There are several ways to modify the nutrient composition and density of a food product, including genetic modification, agricultural practices, conventional plant breeding, and vitamin biofortification. A gene chosen for modification can enhance or reduce the levels of vitamins, minerals, or fatty acids present in the altered food. A case in point is golden rice, which has been genetically engineered to boost its beta carotene levels. Occasionally, increasing one nutrient can lead to a decrease in another as an unintended effect. For instance, canola oil that has been genetically modified to include vitamin A saw its vitamin E levels drop. Farming methods, such as raising animals on grass rather than corn, along with the distinction between wild and farmed fish, can influence the fatty acid composition of the animal. The amount of omega-3 fatty acids in eggs fluctuates based on what the chickens are fed. Additionally, conventional techniques of plant breeding and selection can also modify the nutritional aspects, a practice that has been around for quite some time. Finally, many grains and cereals are often enhanced with iron and vitamins prior to being sold, without involving any genetic alterations. There are both intended and unintended results from genetic modification. Some of the primary objectives behind genetically altering food include modifying the nutritional profile, extending shelf life, and enhancing texture and flavor. Other aims encompass improved agricultural traits such as resistance to insects and diseases, as well as tolerance to herbicides and environmental conditions. For example, plant geneticists can isolate a gene linked to drought resistance and incorporate it into a

different plant, resulting in a new genetically modified plant that exhibits drought tolerance. With the growing global population, genetic modification may have the potential to boost crop production.

The unintended effects of genetic modification include a heightened risk of introducing new allergens into the food supply, antibiotic resistance, toxicity concerns, and environmental issues. Genetic modification ultimately leads to the incorporation of new proteins into food products. Authentic antibody-mediated food allergies pose a significant health concern, affecting around 2% of adults and nearly 5% of children. Safeguarding individuals with food allergies from exposure to these newly introduced proteins presents a substantial public health challenge associated with genetically modified foods. Moreover, the consumption of genetically modified foods that utilize "antibiotic resistance markers" could diminish the efficacy of antibiotics in treating bacterial infections. Genes that confer antibiotic resistance can produce enzymes that break down antibiotics, and these may be transferred to pathogens in humans or animals, rendering them resistant to antibiotic treatment as well. Lastly, a gene that is chosen for modification might have dual roles; one that achieves the intended purpose and another that leads to an undesirable effect, such as increasing natural plant toxins. This phenomenon is seen in legumes (protease inhibitors), lima beans (cyanogens), and canola plants (goitrogens).

PROPERTIES OF PLANT RELATED TO GENETICS

Properties of plant related to genetics includes the following:

- Plants have nucleic acid through which they pass on the genetic traits to the offsprings.
- Plants have a unique feature that they have choloroplast, which has its own DNA like mitochondria have.
- Plants undergo somatic mutation on regular basis .
- Plants are self fertile means some plants have both male and female organs, which make them enable to self reproduce.
- Plants can survive and bloom themselves as polyploids. Polyploids are those organisms which have 2 sets of homologous chromosomes.
- Polyploids organism are self fertile and give rise to new offsprings.
- Polyploids plants have larger fruits, numerous in numbers and are very economical. For instance, potato, peanuts, wheat, maize, strawberries and tobacco.

GENETIC MANIPULATION

The genetic manipulations are considered more advanced than an ordinary cross or hybridization. The obvious limitation of the **in vivo** manipulations is that the genes to be fused must be present in the same cell. If genes belonging to different strains have to be operated upon, they must be first brought together in the same cell. This is done relatively easily between fairly different bacterial strains, often classified under different generic names. Mutagenic treatments usually have no genetic specificity, in the sense that they attack equally strongly different regions of the exposed chromosomes. One consequence of this is that with powerful mutagenic treatments, one runs the risk of introducing a number of different mutations in the same chromosome. This can be avoided by applying another selective technique, localized mutagenesis.

GENOME SEQUENCING

Genome sequencing identifies the entire DNA sequence of an organism by determining the arrangement of nucleotides (A, T, C, G) within its genome. Whole genome sequencing facilitates the study of genetic differences, the identification of mutations that may cause diseases, and the advancement of personalized medicine, research in evolution, and the identification of microbes. Methods for genomic sequencing include Sanger sequencing, next-generation sequencing (NGS), and

third-generation sequencing, which are utilized to analyze DNA or RNA. There are three primary types of gene sequencing: Sanger sequencing, next-generation sequencing (NGS), and third-generation sequencing (such as nanopore and PacBio). Genome sequencing allows for early detection of diseases, tailored treatment plans, a deeper understanding of genetic disorders, insights into evolutionary processes, and enhanced research in agriculture and microbiology.

CONCLUSION

Plant breeding involves using genetic principles to develop plants that offer greater benefits to humans. This process is carried out by choosing plants that are deemed valuable either for economic or aesthetic reasons, starting with regulating the reproduction of chosen specimens, followed by selecting specific individuals from their offspring.

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