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MINICHROMOSOMES IN AGRICULTURE

Kajal Bhardwaj

M. Sc. Genetics and Plant Breeding, Lovely Professional University, Phagwara, Punjab

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INTRODUCTION

Though viruses are excellent when it comes to sneaking into cells, but their carrying capacity is limited. Being foreigners, they can elicit an immune attack and have oncogenic and cytopathic potential. Artificial chromosome can overcome such problems anSd can be considered more stable and better platform. Artificial chromosomes are capable enough of replacing the current technology of virally gene transfer. Though genetic engineering has changed the face of plant science but it still has some limitations like issues of gene stacking, transgene position effects and insertion site complexity which can be overcome with the help of minichromosomes. Mini-chromosomes are small chromatin like structure resembling with centromere, telomere, origin of replication and additional genetic material present in it. Minichromosomes are used to insert new genes into a host cell. Minichromosome makes it easier to pass on the traits from one plant to another which made breeding new plants faster, better, cheaper and more predictable. Minichromosomes are produced by two methods de novo (bottom-up) and top-down approach.

Minichromosome technology was developed by Preuss while working with Arabidopsis thaliana in the laboratory of Chicago.

PRODUCTION OF MINICHROMOSOMES:

De novo:

By using molecular cloning technology, all the parts of a chromosome are assembled and desired chromosomal content is constructed in vitro. The desired content of mini-chromosomes is transformed into a host. This approach has been used in introducing the minichromosome into maize.

Top-down:

Mechanism of telomere- mediated chromosomal truncation is utilized in this method. Truncation is generated by selective transformation of telomere sequence into a host genome. This insertion results in the generation of more telomeric sequence and the newly synthesized

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truncated chromosome can then be altered through insertion of new genes for desired traits. Though this approach has the limitation of being labour intensive, it is preferred more than the de novo method.

ROLE IN GENETIC ENGINEERING:

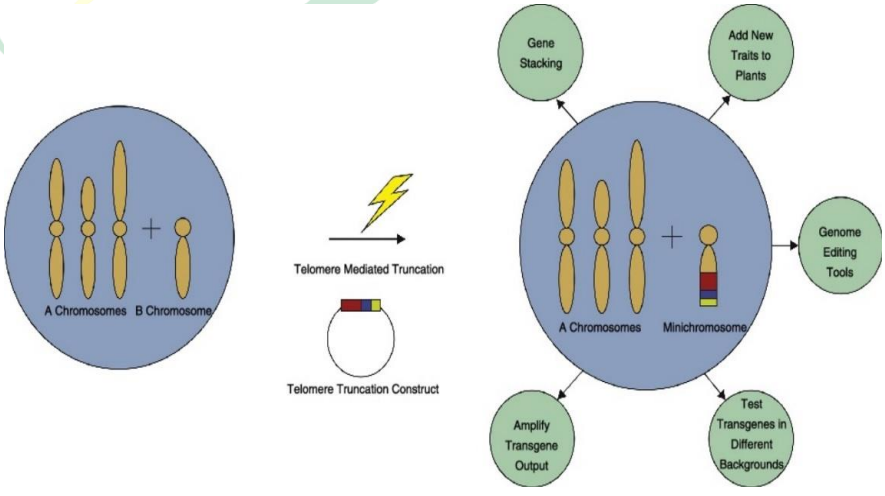
Minichromosomes can be used to transfer multiple sets of genes onto one engineered chromosome package. Traditional methods result in disruption of endogenous genes which affects the host cell negatively. Minichromosome technology allows the stacking of genes side by side on the same chromosome which reduces the probability of segregation of novel traits.

MINICHROMOSOME TECHNOLOGY IN AGRICULTURE:

Minichromosomes have very little genetic material but still can hold a large quantity of information. Agricultural geneticists can add a number of traits in plants using minichromosomes and these traits can help with drought tolerance and nitrogen usage. Minichromosome technology does not change the plant genes which results in a quicker acceptance by the farmers and faster regulatory approval.

Being the second largest populated country, food demand in India will increases by 50%- 70% in the upcoming years. Our present agricultural methods need yield increases based on the moderated usage of natural resources, which leads to the need of superior crops with new technologies.

Genetic engineering is one of the most needed development in the field of agriculture and genetically engineered crops have been proved to be a boon to agriculture. The induction of both Bt toxin and herbicide resistance genes from micro-organisms to plants has improved agriculture by reducing the use of chemical pesticides. Through traditional farming, it is impossible to produce such genetically modified crops whose genetic makeup have already been altered in order to produce more desirable crops.



Here are the few genetically modified crops and their superiority over the normal ones.

Bt Cotton: It is a modified pest resistant plant variety which protects the plant from bollworm by producing natural insecticide in its tissues.

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Alfalfa: It is the fourth largest U. S. crop in terms of acreage. The modified form of this crop carries a gene which makes the plant resistant to the Roundup herbicide, which permits the farmers to spray chemical to kill weeds without worrying about harming the plants.

Potato: Genetically engineered potato is resistant to potato blight which can reduce the use of chemical fungicides by up to 90% which will be helpful in maintaining environmental health.

Soyabean: DuPont developed genetically modified soyabeans that has 0 grams of trans-fat and more of monounsaturated fats that are proven to keep heart healthy.

Corn: Corn yield can be increased by 10% by altering just one gene which increases the plant growth.

Papaya: Rainbow and SunUp, genetically modified papaya varieties are promised to resist the papaya ringspot virus.

Canola crop: Over 90% of canola crop grown in United States are genetically modified which are proven to improve plant tolerance to herbicides and the quality of oil.

CONCLUSION:

Minichromosome application is mostly used to inherit the new plants with herbicide and pest resistance by stacking the genes involved with the resistance. Our population is increasing day by day but the land and resources are limited, so producing more and better crops is far-reaching. Minichromosomes can be produced in most of the crops for a wide spectrum of new applications in agricultural crops. With the help of minichromosomes we can meet the global demands by bringing a new generation of improved crops.