RNA INTERFERENCE IN DESIGNING NEW CROPS

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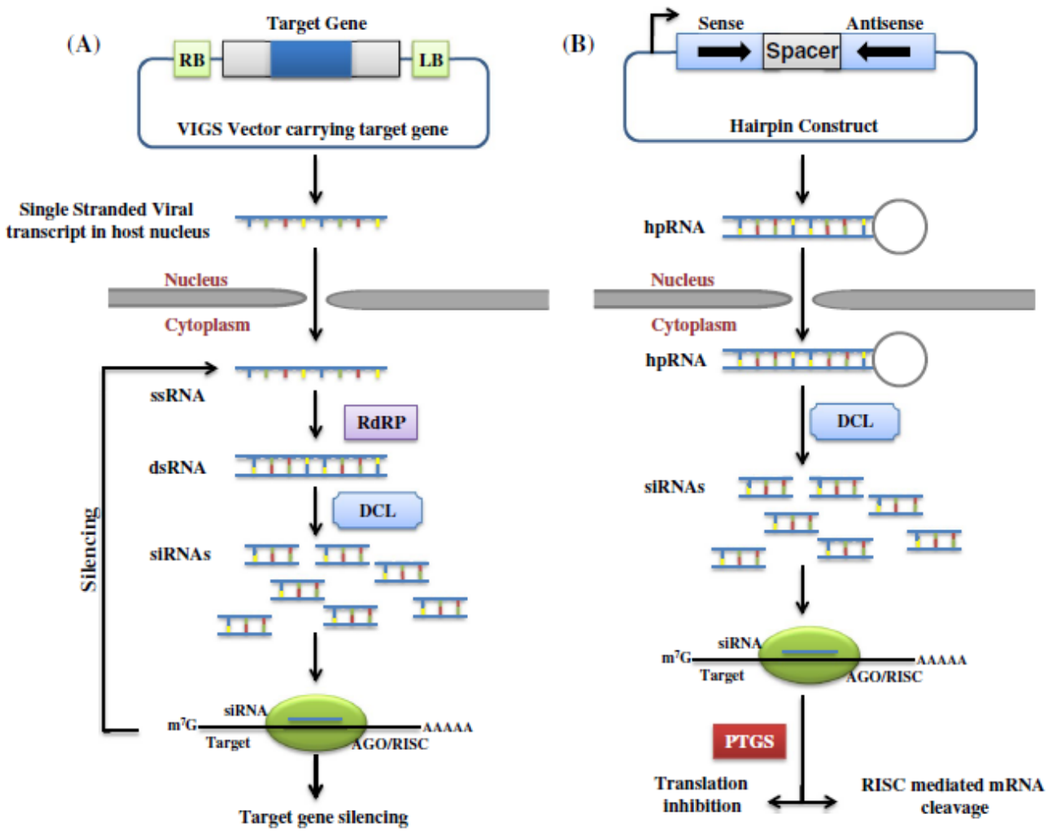
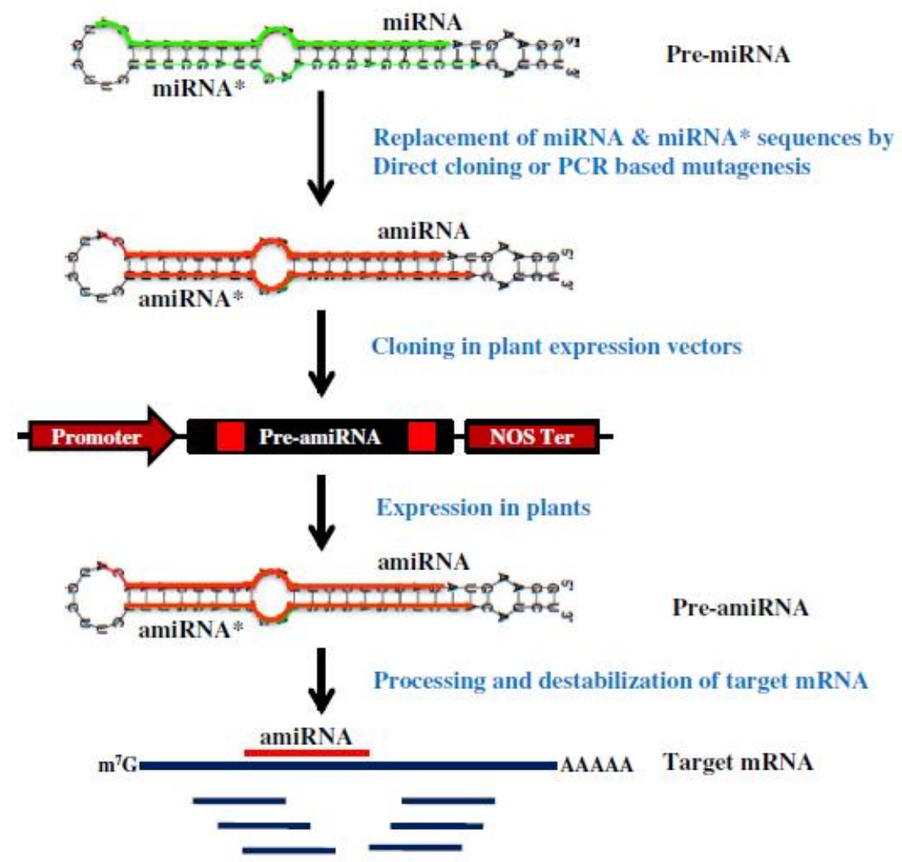


Figure A. Gene silencing in plants via siRNA. Source: Artificial microRNA mediated gene silencing in plants: progress and perspectives (Tiwari et al., 2014), available at https://link.springer.com/article/10.1007%2Fs11103-014-0224-7



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OBJECTIVES

1. Describe the basics of RNAi-based plant improvement techniques.
2. Explain the different applications of the RNAi in the design of new varieties of plants through a representative example of each one.
3. Understand the current state of RNAi in terms of its use, legal status (legislation or lack of legislation), research channels, companies involved, ethical and environmental implications.

CONCLUSIONS

1. RNAi-based food products might be successful upon market implantation depending on many factors, most of which are subjective.
2. RNAi has yet to reach the public, but due to the many chances it offers and the investment received it might experience a great expansion within the next 10 years.
3. Despite its many possibilities there are still many things to learn about the pathways of RNAi, making it all the most interesting, due to both pros and cons yet to be discovered.

Figure 8. Uses of the RNAi technology on crops. Information from: Small RNAs in plants: recent development and application for crop improvement (Kamthan et al., 2015; *Pocket K No. 34 RNAi for Crop Improvement*, 2008), available at https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4382981/ and https://www.isaaa.org/resources/publications/pocketk/document/Doc-Pocket%20K34.pdf

Traits improvement	Targeted gene	Plant	Application
Enhanced nutrient content	Lyc	Tomato	Higher concentration of lycopene
Reduced alkaloid production	COR	Opium poppy	Production of non-narcotic alkaloid
Heavy metal accumulation	ACR2	*Arabidopsis*	Arsenic accumulation for phytoremediation
Reduced polyphenol production	σ-candinene synthase gene	Cotton	Lower gossypol levels, allows use of cotton for human feeding
Ethilene sensitivity	ACC oxidase gene	Tomato	Extended shelf life
Reduced allergenicity	Arah2	Peanut	Allergen-free peanuts
Reduced production of lachrymatory factor synthase	Lachrymatory factor synthase gene	Onion	Onion that does not cause lacrimation
Biomass	OsDWARF4	Rice	Increase in the biomass production via reducing the growth limiters
Resistance to African cassava mosaic virus	AC1 of the ACMV	Cassava	Blocs non-structural essential viral proteins
Drought tolerance	miRNA used: miR169. Target gene: NFYA5	*Arabidopsis*	Enhanced resistance to low water availability