

# Sunflower Breeding Achievement and Challenges

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## The Achievements

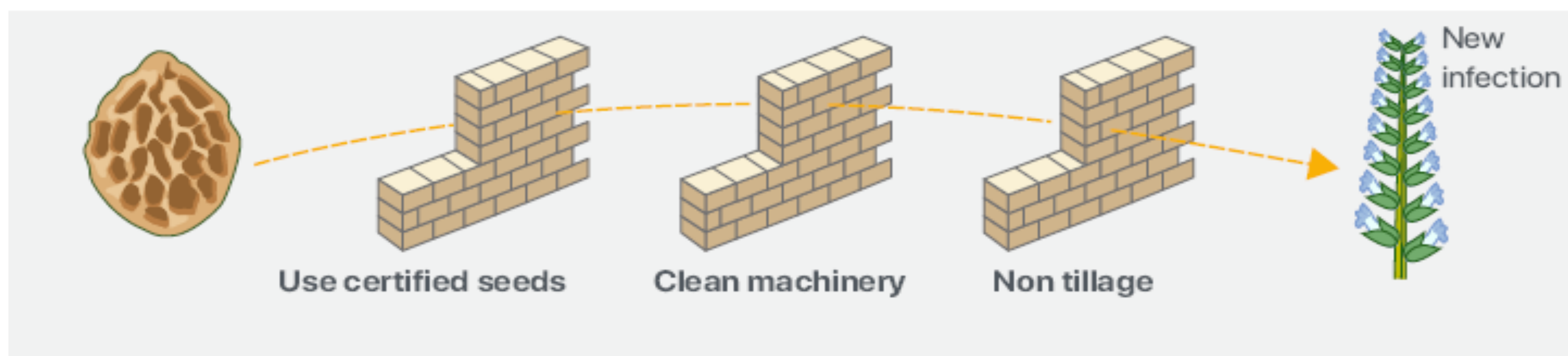
- They are many significant achievements done in last several decades. Discovery of the CMS and development of hybridization based on CMS, novel disease gene discovery, mutation breeding and application of genome selection are probably mostly significant ones.
- It is also many others which should be mention in the list of achievements too: application of MAS and MARS, phenomics, digital phenotyping, metabolomics, crop modeling.

## Main Challenges

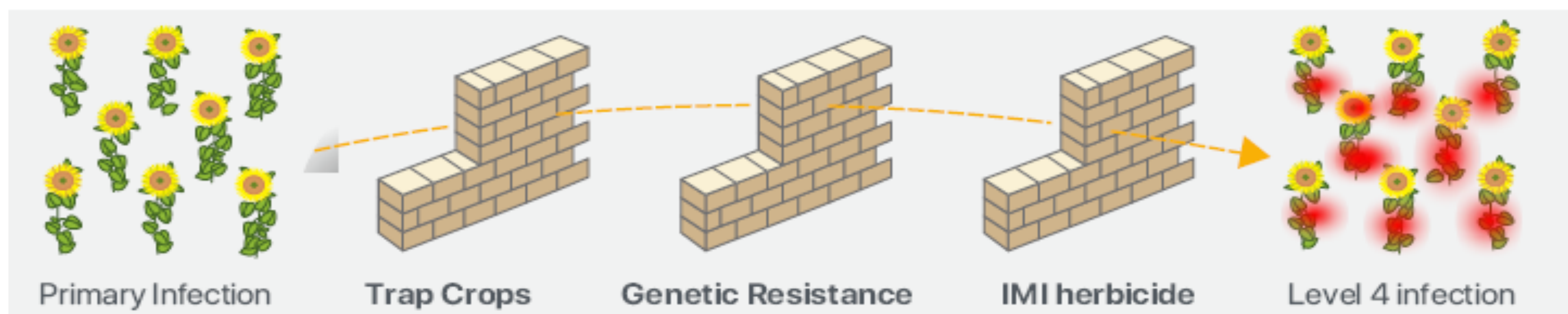
- Development of the palm oil sector has changed the vegetable oil market. To remain competitive in this market, sunflower breeding needs to accelerate efforts to improve yield potential as well as adaptation to abiotic-/biotic-stress.
- Market segmentation complexity increased in last 15 years with introduction of herbicide-tolerance (HT) resistances, disease races present in specific regions or by allowing for the segmentation distinguishing between oil production and confectionary as an end-use.
- DH technology is still not available for the sunflower breeding

## Integral Bromrape Solution Remained Like Primary Targets in Oil and Confectionary Sunflower

### 1. Prevent primary infections. Set barriers to prevent primary infection



### 2. Keep the primary infection as long as possible in Level 1 infection



## Beyond the Gene

$$\text{Genetic gain} = \frac{\text{Accuracy} \times \text{Selection Intensity} \times \text{Genetic Variation}}{\text{Time}}$$

- One of the greatest challenges breeders face is improving the analysis and understanding of gene expression/regulation and the subsequent impact on individual phenotypes, the phenome, and the metabolome given the context of environment
- „Make Genetic Gain, Don't Just Release Cultivars” (Thopson D. , SeedWorld, 2016)
- There are lots of challenges, possibilities, and benefits to be found in the sunflower post-genomic era like using high-throughput sequencing technologies and application is gene-editing technology.

### Genetic gain compounds like interest earnings

