ENHANCING PLANT BREEDING

THE IMPORTANT ROLE OF POLLEN QUALITY

REDUCE TIME-TO-MARKET

REDUCE COSTS

INCREASE BREEDING EFFICIENCY

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«POLLEN IS THE MOST IMPORTANT MATTER THAT TRANSPORTS GENETIC INFORMATION»

Imagine pollen as a truck, carrying precious genetic information as cargo to its destination. As a seed breeder, you are the logistics company overseeing this operation. Your mission is to ensure that your trucks are in perfect condition, delivering its valuable load reliably and on time.

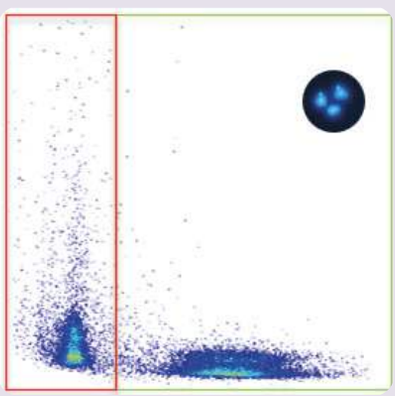
Just like a fleet of trucks needs regular maintenance to avoid breakdowns, electric faults, or flat tires, your pollen must be viable and in top condition. Any issues will prevent the pollen from reaching its target and completing the delivery.

Pollen quality is the cornerstone of plant reproduction success.

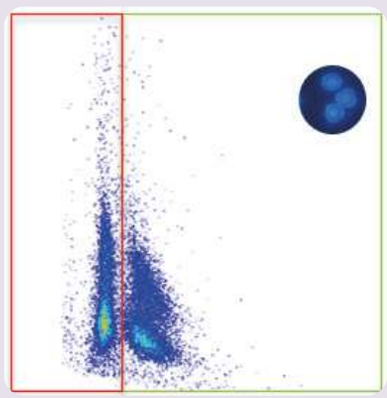
INCREASE EFFICENCY WITH DOUBLED HAPLOIDS

Doubled haploids (DH) are a powerful tool for accelerating breeding programs by achieving fully homozygous lines in just one generation. However, success depends on selecting microspores at the right developmental stage – specifically, the late uninucleate stage.

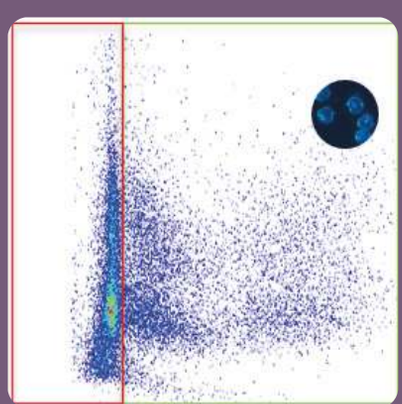
Early Uninucleate



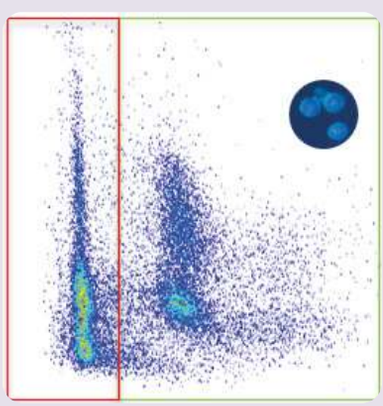
Uninucleate



Late Uninucleate



Bi/Trinucleate



Identifying this critical stage is a key step in efficient DH production. Traditional methods, such as DAPI staining, can be inconsistent and time consuming.

Amphasys' technology provides a precise and reliable alternative, enabling breeders to accurately detect microspores in the late uninucleate stage – crucial for successful androgenesis induction and embryo formation.

This technology allows to differentiate the microspore development stages – from the early uninucleate stage to the trinucleate stage – ensuring optimal selection for DH production.

Inducing androgenesis at this late uninucleate stage significantly increases the probability of successful embryo formation.

Boost your breeding efficiency with doubled haploids — achieve faster, more reliable homozygous lines with precise microspore selection for maximum embryo formation success.

UNDERSTANDING LINE SPECIFIC DIFFERENCES IN REPRODUCTIVE PROPERTIES

For plant breeders, understanding the reproductive properties of parental lines is crucial for successful breeding programs. Systematic screening of parental lines for pollen quality is essential. Selecting parent lines with poor pollen viability, low number of pollen cells, or a high number of aberrant cells – an indicator of abiotic stress – can lead to serious reproduction challenges in future generations.

If root cause analysis is only started when reproduction problems have occurred and only the affected line is considered, this may result in a significant delay in the breeding program and may not prevent future problems. Only systematic screening of pollen quality provides deep insight into line- specific reproductive properties.

To ensure strong and reliable offspring, systematic screening of pollen quality should re-start at F5 or F6, once a high level of homozygosity is reached. At this stage, detailed knowledge of reproductive traits becomes essential for making informed selection decisions.

Amphasys' technology enables large-scale, high-throughput screening of pollen quality with minimal effort. This allows breeders to gain valuable insights into reproductive characteristics and stress susceptibility, optimizing the selection process.

By integrating precise pollen analysis into breeding programs, breeders can increase efficiency, reduce risks, and accelerate time-to-market for new, high-performing varieties.

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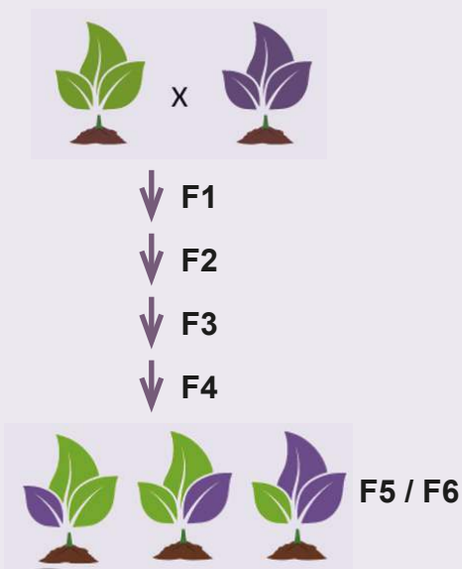


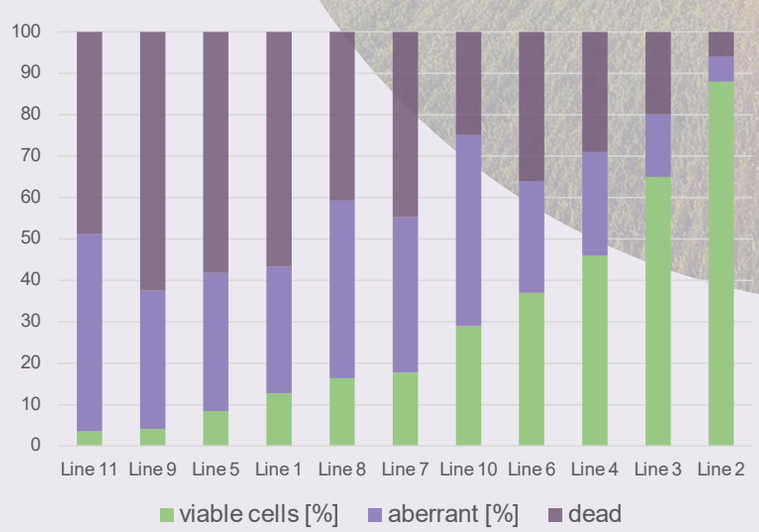
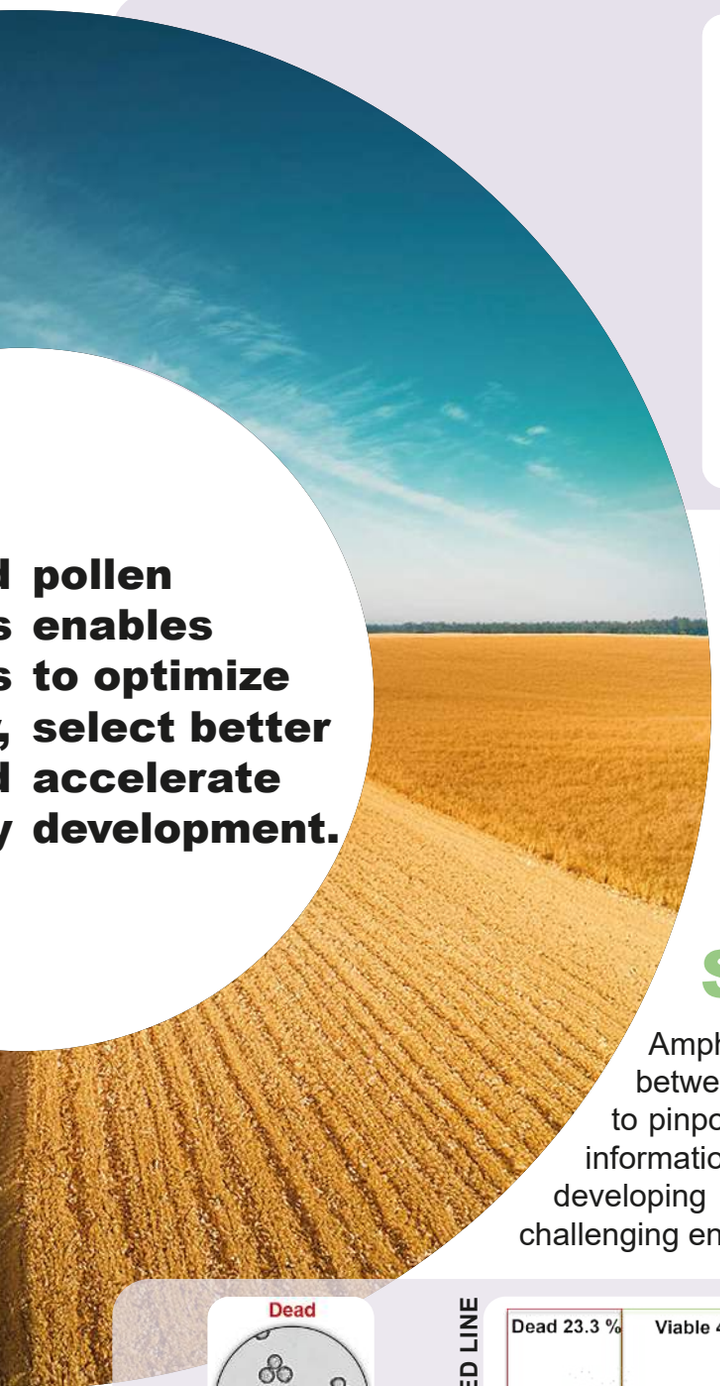


Figure: line-specific differences in pollen viability, share of aberrant and dead cells of different carrot lines

PHENOTYPE-GENOTYPE INTERACTION

With climate change driving more frequent heat stress events, plants are especially vulnerable during flowering – the critical stage when pollen develops. High temperatures can cause pollen abortion, leading to aberrant (small, shrunken) cells that can be identified using Amphasys' technology.



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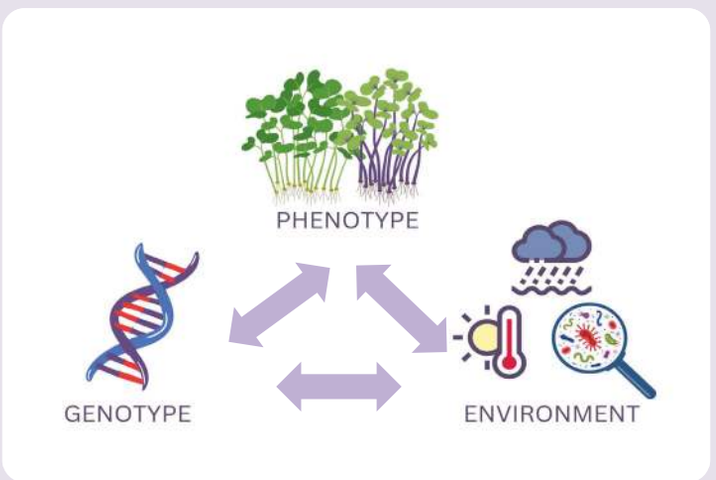
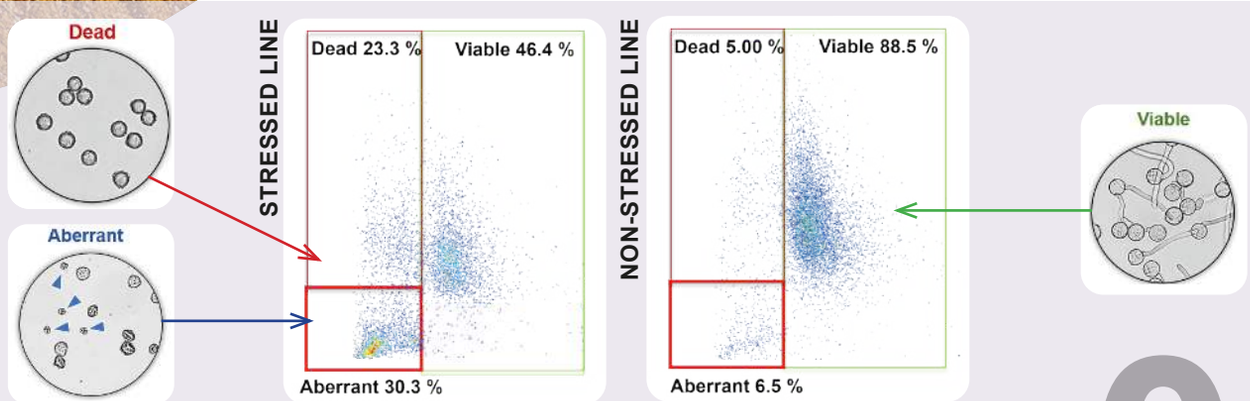


By systematically phenotyping pollen quality, breeders gain valuable insights into how specific genotypes respond to stress. This knowledge enhances breeding reliability by preventing unexpected failures under extreme conditions and supports the identification of key QTLs for developing stress-resistant varieties.

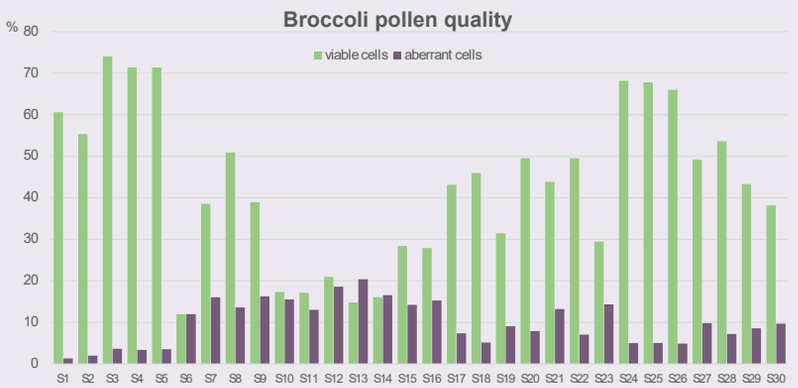
ENVIRONMENTAL IMPACT – ABIOTIC STRESS

Amphasys' advanced screening technology distinguishes between dead, viable, and aberrant cells, allowing breeders to pinpoint which lines are most susceptible to stress. With this information, breeding efforts can be focused on selecting and developing more resilient varieties – ensuring greater success in challenging environments.



KNOWING THE REPRODUCTIVE PROPERTIES – OPTIMIZE BREEDING EFFICIENCY

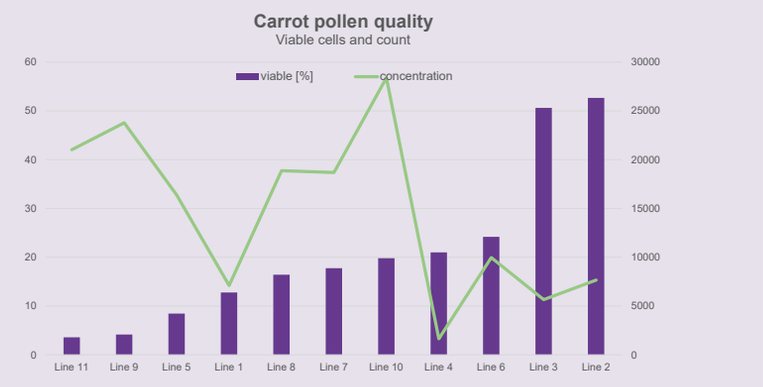
Selecting the right parental lines is a key factor in ensuring successful breeding and efficient seed production. Amphasys' technology provides scalable and standardizable pollen quality assessment to help breeders identify the best-performing lines for optimal pollination and seed yield.



Crop: broccoli

For many crops, pollen viability is the distinguishing parameter between individual lines (see broccoli example). In contrast cucurbits typically exhibit very high pollen viability, whereas the number of pollen grains can significantly vary per line.

A thorough knowledge of reproductive properties by measuring pollen quality ensures better breeding outcomes and prevents the selection of lines with mismatched reproductive traits. The example of different carrot lines highlights this challenge: some lines with high viability produce low pollen quantity, while others with high pollen quantity show low viability. Selecting the right lines for reproduction based on measurement results can improve and accelerate the breeding process.



Crop: carrot

CASE STUDY: HYBRID WHEAT BREEDING

Explore how Amphasys' innovative methods for measuring wheat pollen shed can boost hybrid seed production and improve breeding outcomes.

Go to Case:

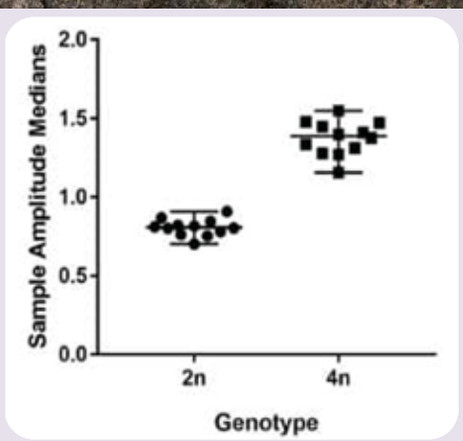


Figure: Analysis of ploidy in Watermelon Pollen (Citrullus lanatus).

PLOIDY DETERMINATION

Plants with increased ploidy levels often exhibit distinct morphological traits, such as thicker, broader leaves, larger flowers and fruit, and larger pollen. This is due to the increased cell size.

Amphasys' technology enables the determination of pollen cell ploidy. It characterizes mature pollen grains through volume-based particle size analysis, providing additional viability information.

Polyploidy is common in many crops including potatoes, wheat, brassicas, strawberries and watermelon. In watermelon breeding, ploidy is a selection criterion as triploid (3n) watermelons are seedless.

Comparative measurements of pollen with diploid (2n) and tetraploid (4n) cells reveal different positions in the scatterplot, allowing the determination of triploid (3n) cells as well.

Ampha P20

The portable Ampha P20 is the ultimate tool for in-field and routine pollen analysis, providing instant, automated results within a minute. With its smart chip technology, it enables high-throughput screening of multiple lines, ensuring fast and efficient selection of the best-performing plants.

- Portable & easy-to-use
- Automated viability & pollen count
- Smart chips for standardized analysis
- Quick decision-making for better breeding outcomes

Ampha Z40

The Ampha Z40 is your all-in-one solution for advanced pollen analysis. Its sophisticated software allows for high-throughput screening, detailed research applications, and customized analysis for all crops. The Ampha Z40 delivers unmatched accuracy, speed, and efficiency.

- Full pollen insights: viability, aberrant cells, quantity, microspores, ploidy
- Automated, machine-based & standardizable method
- Supports all crops – over 250 templates available
- Enhance breeding precision & optimize seed production

UNLOCK THE FULL POTENTIAL OF YOUR CROPS