PRODUCTION RESEARCH & SEED PRODUCTION

THE RELEVANCE OF POLLEN QUALITY FOR SEED PRODUCTION

INCREASE RELIABILITY

IMPROVE BENEFITS

INCREASE EFFICIENCY

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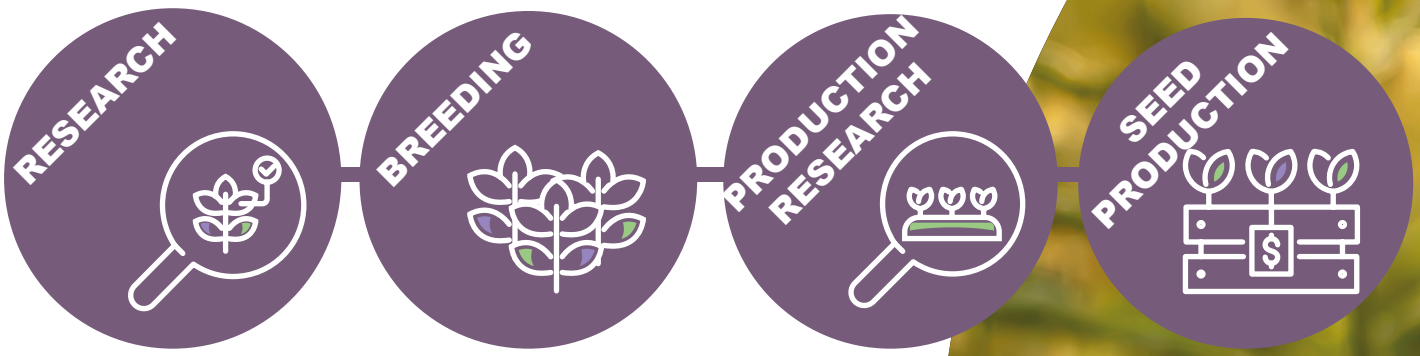
«WITHOUT GOOD POLLEN QUALITY, NO SEED. IT'S THAT SIMPLE.»

The transition from breeding a new variety to commercial seed production involves a comprehensive development process to identify cost-effective production methods. While the genotype and reproductive properties are fixed, optimizing the production pattern is possible. This includes finding suitable methods and conditions for growing the new variety. Pollen quality plays a crucial role, as high-quality pollen is essential for successful reproduction and seed production, impacting the overall success of the commercial production process.

CHALLENGES IN SEED PRODUCTION

The entire process from early breeding to successful seed production is lengthy and costly. Seed formation is influenced by many variables, some controllable (like irrigation, pest management, nutrient supply) and others not (like weather conditions). The better these controllable factors are understood, the more effectively they can be managed. Pollen quality can be easily measured and the resulting knowledge about line characteristics should be incorporated in efficient seed production processes.

Pollen is crucial for seed production as it is key to achieving a full seed set: the right amount of viable pollen is essential. The knowledge of the specific pollen quality directly impacts production patterns, crop placement, storage protocols and other parameters, enhancing the success of seed production.



SYSTEMATIC POLLEN ANALYSIS

The determination of the optimal female to male ratio, the selection of the right location for seed production, the development of the best storage protocol: it all requires a profound knowledge of pollen quality.

With conventional technologies like germination and staining assays, systematic line screening is not feasible and does not allow to build up knowledge about line-specific pollen quality. Amphasys provides a technology which allows systematic pollen analysis and generation of knowledge about pollen quality and reproductive properties. This plays a significant role in enhancing seed production.

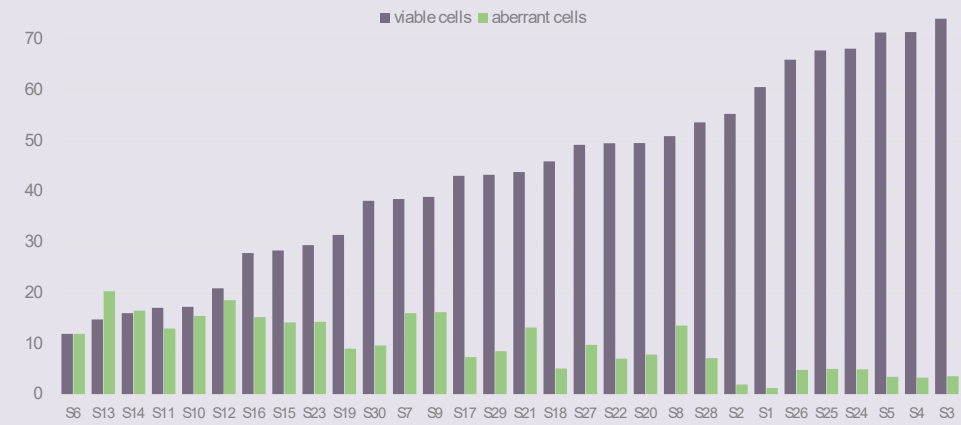
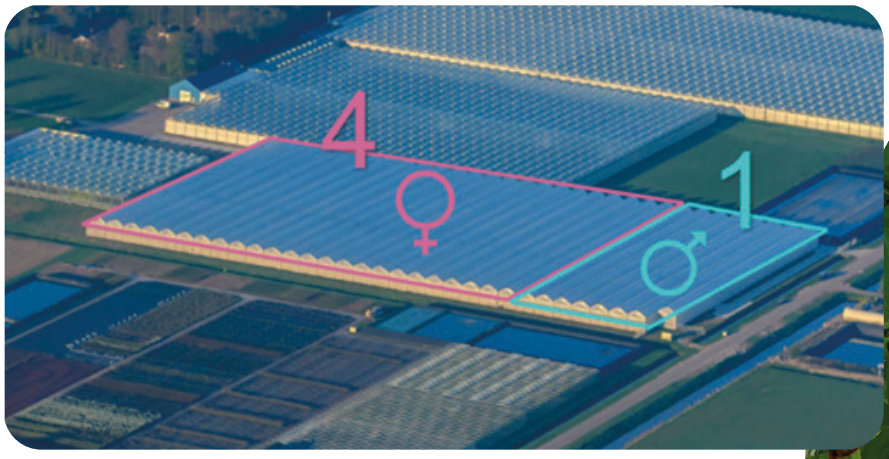


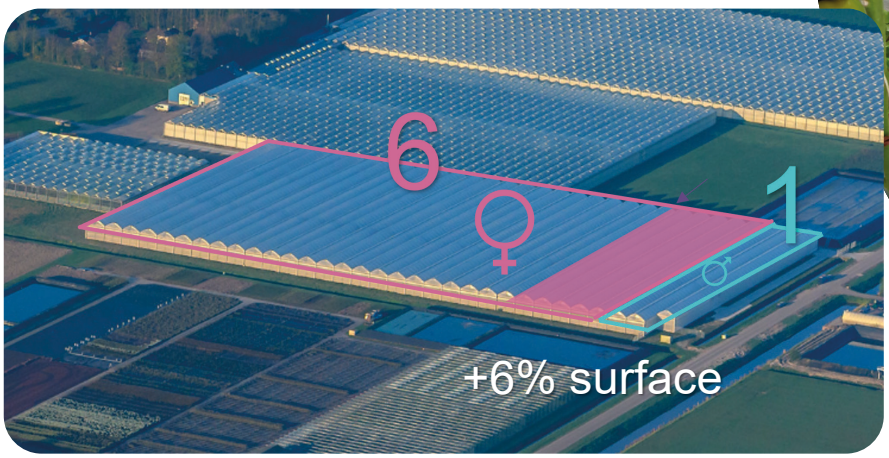
Figure: 30 different broccoli lines, grown under the same conditions

IMPROVEMENT OF PRODUCTION PATTERN: FEMALE-TO-MALE RATIO

One of the important parameters to develop in hybrid seed production is the female-to-male ratio. The males cost money and resources, only the females earn money. Therefore, the space needs to be organized to have enough viable pollen but with the males on the smallest possible surface. Especially for greenhouse seed production, the cost of surface is expensive and the smaller the required space demand for the males, the more revenue is achieved with the females.



Assuming a 4:1 female-to-male ratio for hybrid tomato seed production, this ratio can be improved by proper pollen management.



Optimize seed improving the ratio through pollen quality maximizing revenue with management!

With pollen viability monitoring, a pollen storage protocol, a pollen dilution formulation, and knowing the minimum pollen quantity required for full pollination, the female-to-male ratio can be improved.

Assuming an increase to a ratio of 6:1 results in a gain of surface for the females of 6%. Does not sound a lot but with three growing cycles it accumulates.

Learn more about best-practice in the tomato seed production: amphasys.com/tomato-pollen

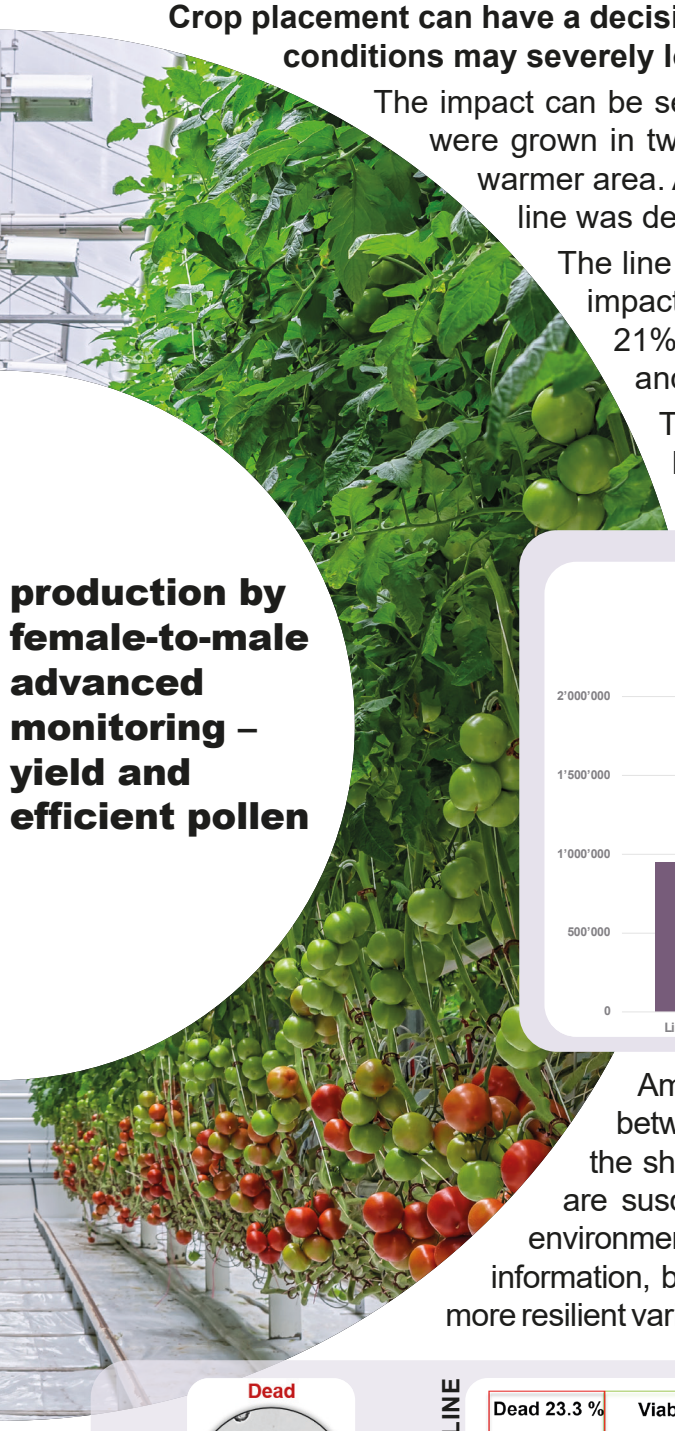
INCREASE IN SEED YIELD: CROP PLACEMENT

Crop placement can have a decisive impact on seed yield. Choosing the wrong growing conditions may severely lower the seed set.

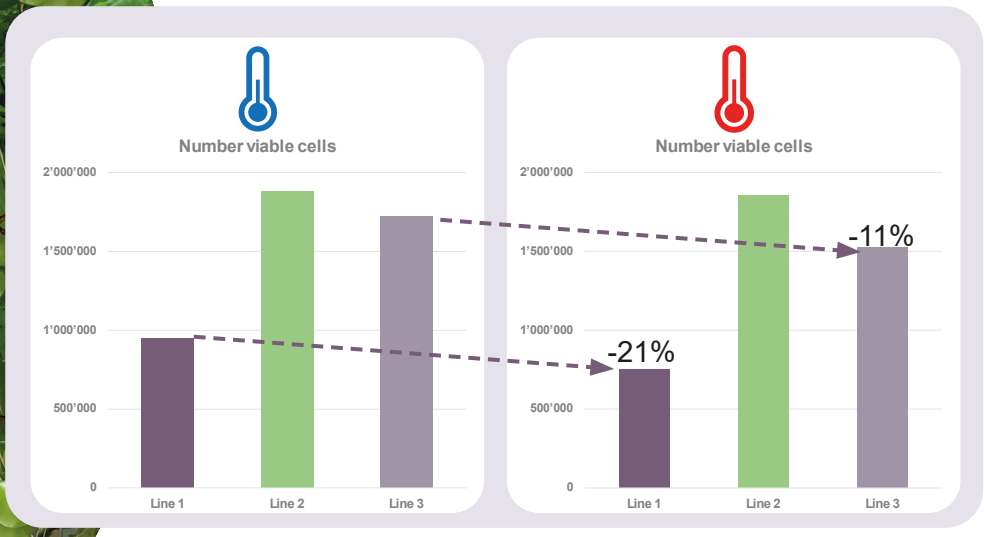
The impact can be seen in the following case study: Three different corn lines were grown in two areas of which one was a colder area and the other a warmer area. At flowering time, the quantity of viable pollen cells of each line was determined.

The line with the highest number of viable cells (line 2) was hardly impacted by the warmer conditions. Line 1 showed however a 21% lower quantity of viable pollen cells in the warmer area and line 3 still with an 11% reduction.

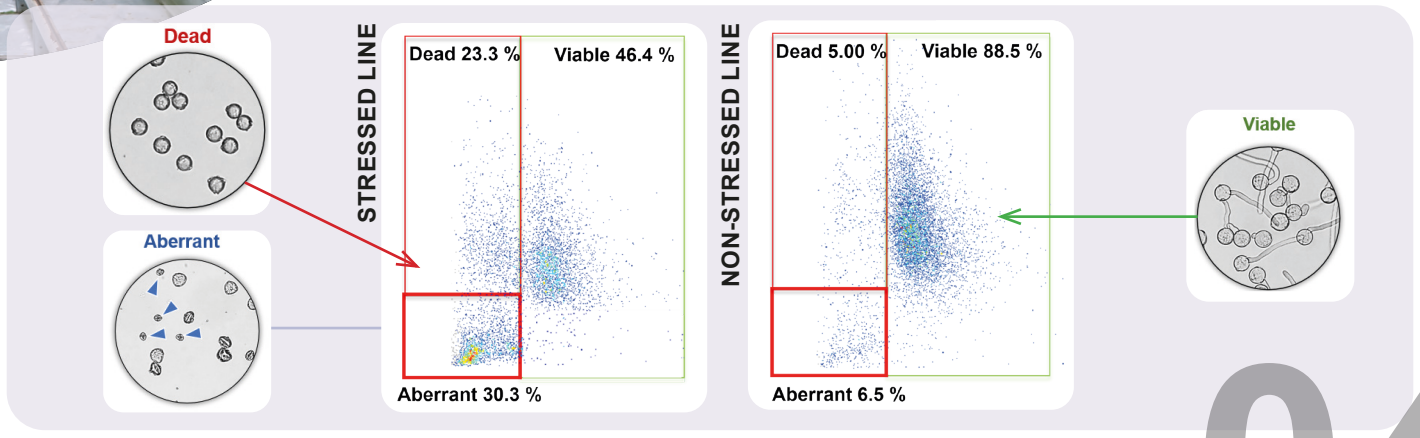
To prevent a loss in seed set, the knowledge about the line behavior under certain environmental conditions is indispensable.



production by female-to-male advanced monitoring – yield and efficient pollen



Amphasys' advanced screening technology distinguishes between dead, viable, and aberrant cells in one run. Especially the share of aberrant cells allows breeders to pinpoint which lines are susceptible to stress. But not only the genotype, but also the environmental conditions impact the formation of aberrant cells. With this information, breeding efforts can be focused on selecting and developing more resilient varieties – ensuring greater success in challenging environments.



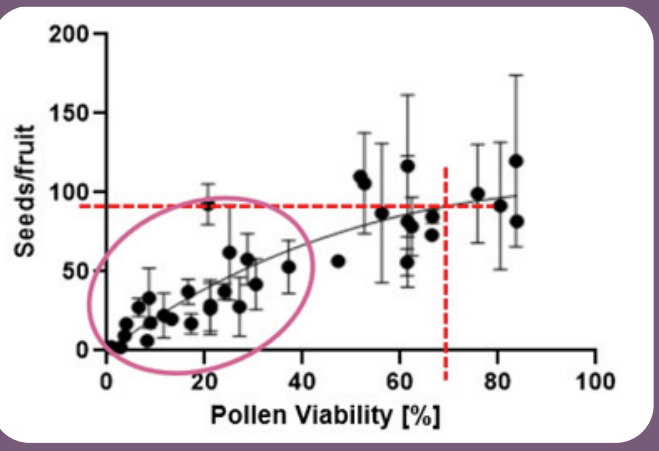
VIABILITY-SEED SET CORRELATION

To optimize the seed production process, the knowledge of the minimum pollen viability for a full seed set is necessary information. This refers to the viability-seed set-correlation.

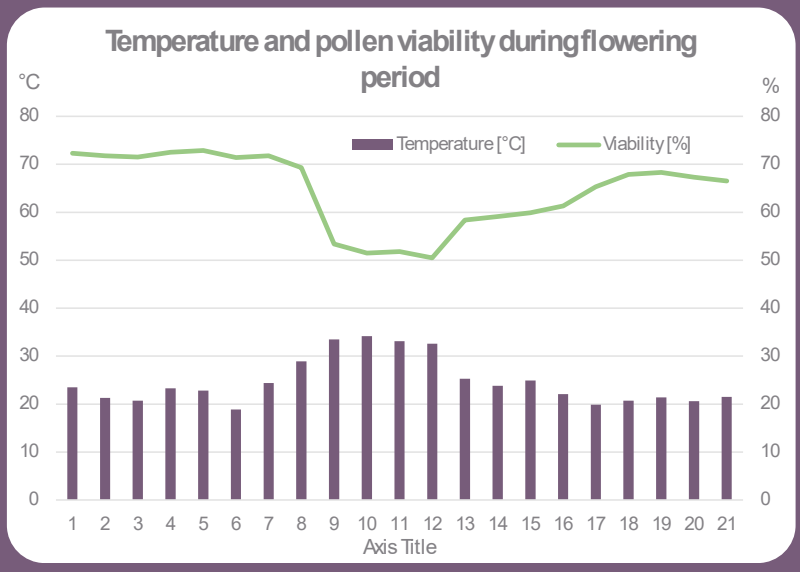
To establish such a correlation, a wide range of viabilities needs to be regarded. If this goes beyond the “natural” viabilities, viable pollen can be artificially diluted with dead pollen to achieve a full range of viabilities.

The figure shows the natural viability range between 50 and 90% and the artificially generated between 0 and 40%. After harvesting, based on the obtained seeds per fruit, a correlation could be established. This allows to calculate that, for example, to achieve a desired seed set of 90 seeds per fruit, a minimum viability of 70% is required. Knowing this threshold and being able to control it during production ensures more predictable and reliable seed production.

If pollen can be stored, a pollen formulation can be established, using pollen of lower viability – or dead pollen – and mixing it with pollen of higher viability to adjust the right level and not waste pollen. This pollen management helps to save resources and establish an efficient process.



PRODUCIBILITY AND RELIABILITY



Producibility of crops for seed production should be considered from the beginning of the breeding and development process of a new variety. Once the line has been selected for commercialization, reproductive properties are set, and only small adjustments remain for optimization in crop placement and seed production. Therefore, it is important to characterize the reproductive properties and know the plant behavior under stress conditions and changing environments.

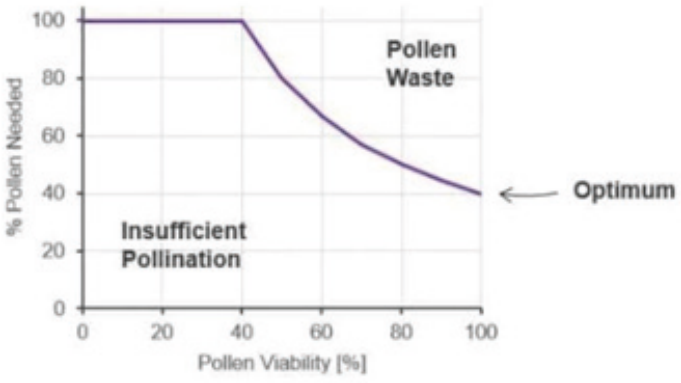
Even if the behavior of the lines is known, the systematic screening of the lines during the flowering period provides important information. The appearance of a sudden heat wave reduces pollen viability and lowers the expected yield. Monitoring pollen viability enables to give an early warning and prediction about the expected seed set.

POLLEN SUPPLY CHAIN

Pollen storage is of high interest in hybrid seed production to lever the needed amount over time. Pollen storage and transport are particularly important when pollen production and seed production are dislocated (e.g., pollen farms, third-party growers). For the development of pollen storage protocols and for routine quality control of pollen, a standardized test method is required.

Amphasys provides a technology which allows to monitor pollen quality along the whole pollen supply chain and to provide measurement results in a standardized way and location independent. It also allows to develop appropriate storage protocols to minimize the loss of viability during storage.

POLLEN DILUTION FORMULATION



To optimize seed production and spend as less resources as necessary on male plants, the knowledge of the needed minimum pollen viability level for full seed set and a working pollen storage protocol are the needed requirements.

The right protocol needs to be in place to minimize the loss of viability, because pollen viability will only decrease upon storage. To regain full viability after storage, a proper rehydration step needs to be included in the protocol.

If viability of a pollen batch is higher than required for full seed set, this batch can be used to mix with a batch if inferior quality, meaning, viability below the threshold.

CHECK OF CMS LINES

Under certain circumstances, CMS lines can lose their sterility. This loss is often triggered by temperature, light, and other environmental conditions. Additionally, spontaneous mutations and the presence of restorer genes can also contribute to this undesired event.

The loss of sterility in hybrid seed production can lead to significant economic damage. If crops self-pollinate, it results in a mix of hybrid and non-hybrid seeds, compromising the overall performance of the crop.

Regular checks of pollen viability respectively sterility is crucial to ensure continued sterility and to prevent negative economic impacts.

Ampha P20

Ampha Z40

The Ampha P20 is the ultimate tool for in-field 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. Ideal for tomato, pepper, Brassicaceae, Cucurbitaceae, onion, carrot, beet, sunflower, wheat, and corn, the Ampha P20 brings laboratory precision directly to the field.

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

The Ampha Z40 is your all-in-one solution for advanced pollen analysis, microspore development tracking, and ploidy determination. Its sophisticated software allows for high-throughput screening, detailed research applications, and customized non-standard analysis across over 250 crops. Whether you're working with vegetables, row crops, ornamentals, forage, fruits, or nuts, the Ampha Z40 delivers unmatched accuracy, speed, and efficiency.

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

UNLOCK THE FULL POTENTIAL OF YOUR CROPS

The information provided is, to the best of our knowledge, accurate. However, variations in samples and cell species may cause deviations from other analysis methods. Amphasys AG assumes no liability for damages, and users agree to indemnify Amphasys AG against claims from potentially inaccurate data. Results from the Ampha P20/Ampha Z40 should be regularly validated against reference methods.