

NAPPN Annual Conference Abstract: Non-destructive seed phenotyping and time resolved germination testing using X-ray

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During the last years, X-ray technology has been applied for the non-destructive visualization of optical inaccessible plant structures. With X-ray computed tomography (CT) the 3D volume information of objects can be reconstructed using X-ray projections of the object from different points of view. This enables the non-destructive analysis of hidden structures like root systems or the analysis of internal seed organs. Thus, seeds can be phenotyped in as single seed, bunch of seeds, spikes and during germination. With automation, this high throughput CT analysis can be done. All plant organs can be automatically segmented and measured in 3D, currently 50 seedlings in 2 minutes, or 200 seeds within 5 minutes. Additionally, tracing of individual seedlings over time across the developmental process is possible, without disrupting the germination containers. The process can be run in fully-automated and is industrially validated for multiple years.

In this presentation, we will demonstrate the range of applications for X-ray based seed analysis. This ranges from a high resolution single seed approach over batches of seeds to the germination testing. The output of the measurements are segmented seed or plant organs for each individual seed and plant. This process enables a quantitative, objective and reproducible assessment of morphological seed and seedling traits in 4D, which can substitute visual germination and vigor testing. We will present traits such as seed quality, seedling development, degree of abnormalities, germination capacity and vigor of seed lots of different crop types.

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