

Potential seeds in heat – Improving pea ovule heat tolerance

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SPG Contributions	Project Status	Duration/Timeline of Project (Year to Year)	Co-funders	Total Project Cost
\$195,068.75	Completed	May 2017 – December 2022	Natural Sciences & Engineering Research Council	\$305,181.75

Project Description

To investigate heat stress effects on ovule fertility and ovule damage in ovaries of pea; to measure heat stress effects on ovule fertility and damage in ovaries for 18 genotypes of pea.

Pea yield is sensitive to heat stress, and the crop loses pods and seeds in warm years. Poor pollen and pollen viability are part of the problem as heat damages pollination, but little is known about the heat robustness or fate of ovules in heat stress. Ovules, once fertilized by pollen, are destined to become pea seeds in pods. Prior to this project, we believed that pea varieties and their ovules in pods have a range of heat sensitivity to resistance. Some varieties are more likely to keep all their seeds in pods in warm summers, and we must determine these pea varieties.

Outcome

In this project we looked at thousands of young pods and ovules with a light microscope to detect damage in ovules, and then we screened 18 varieties to find those that were the most robust in heat. Moderate heat usually advances flower, pod, and ovule development. Severe heat or moderate heat on heat-sensitive varieties usually slows down development and more ovules abort. Most ovules have been fertilized, even in heat, so we believe the seed loss is due to starvation. We found increased callose, a carbohydrate like cellulose used in plant wounds, accumulates around the vein supply to ovules. Heat alters carbon compounds moving to the embryo sac within an ovule. Cultivars with more heat robust ovules are less likely to have seed abortion in pods from heat stress.

The order of cultivars having heat-robust to heat-sensitive ovules was: most robust; 40-10; Naparnyk, CDC Golden, TMP 15213; CDC Patrick; CDC Bronco; Aggasiz; Outlass; CDC Sage; CDC Meadow; Argus; CDC Mozart; CDC Striker; Nitouche; CDC Treasure; Carneval; CDC Centennial; MFR043; most heat sensitive.

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Results will be used by pea breeders to build better cultivars to withstand heat.

Research Objective

OBJECTIVE 1

To investigate heat stress effects on ovule fertility and ovule damage in ovaries of pea.

OBJECTIVE 2

To measure heat stress effects on ovule fertility and damage in ovaries for 18 genotypes of pea.