#015

Increasing the certainty of canola establishment by identifying critical temperature and moisture limits

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Background:

Climate change is causing a negative effect on Western Australian dryland cropping. Taking advantage of very early sowing opportunities can mitigate this effect. However, very early seeded crops have a higher risk of poor establishment due to high temperatures at seeding. In addition, high temperatures and marginal moisture are likely to have a compounding effect, such that the magnitude of response is increased by the combination, or the critical limits are lowered when both are present.

Objectives:

Identify the critical temperature limit and the critical moisture limit for successful canola germination and establishment.

Methods:

1. Laboratory trial: six different canola seed sources were subjected to germination testing over a range of temperatures (20, 26, 30, 35, and 40°), under otherwise standard germination test conditions.
2. Small plot trial: Three canola seed types (RR hybrid, TT hybrid, TT OP) were hand sown weekly, over seven sowings between March 5 and April 15.
3. Field trials were sown near Geraldton in 2021, at Merredin in 2022 and near both Geraldton and Merredin in 2023. All trials were irrigated pre-seeding, to simulate a cyclone rainfall event. Trials also had top-up irrigation treatments, as well as multiple sowing times.

Results:

In the laboratory trials, germination testing at 35° caused a marked decrease in normal germination, corresponding primarily to a higher incidence of abnormal germination, as well as an increase in dead seed. Further, the germination was slower, and the hypocotyl of the normal seedlings was shorter, compared to germinations at 20, 26 or 30°.

In the small plot trial, field establishment was below 40% (range 10-39%) when temperature peaks over 33° (range 34-38°) occurred either during germination or emergence stages, compared with 89 and 65 for later seeding under cooler conditions.

The 2021 Georgina field trial showed an increase in germination with higher moisture levels, however all treatments were above 57% field establishment, apart from a poor seed source which was 24-39% FE for March seeding.

The 2022 Merredin trial included different soil types, with the heavy soil type carrying more water than the lighter one. Conversely, plant emergence was higher on the lighter soil. Both soil types showed low but increasing FE% corresponding to increased moisture treatments, after seeding on 16/3. However, the lower moisture treatments had the highest final plant density, after subsequent rainfall.

2023 trials are in progress with seeding from late March until May, irrigation and depth treatments.

Conclusions:

Early sown crops are more prone to reduced emergence due to hot temperatures, and this can be compounded by marginal moisture. Soil type, seed source, temperature and moisture all affect the emergence and can be difficult to manage on-farm and in trials. Preliminary conclusion that germination or emergence of canola may be affected by ambient temperatures greater than 32°, depending on many factors. Germination in marginal moisture and drying profile can cause irreversible seed damage.