SAGIT UA1415 Heat Stress Durum Experiment Information (Trials in 2016)

Experimental Design

- **Entries** – 38 Durum lines with additional wheat checks (Wyalkatchem-susceptible and Halberd-Tolerant)
- **Replicates** – 3 replicate, replicated by block
- **Pots/Experimental units** – 252 (12 ranges, 21 rows)
- **Treatments** – 2 treatments, an unstressed control and a heat stressed treatment (36°C with 40 kph wind speeds) with treatments randomised across split-plots
- **Secondary tillers** – If present, when the plant was due to be stressed (10 days after the primary tiller finished anthesis) a secondary tiller that was undergoing currently undergoing anthesis, was identified and tagged for further lab measurements
- **Design** – Split-plot design – Adjoining split-plots aligned in adjoining ranges

Experimental Methodology

Using the experimental design detailed above, single seeds were planted in 10cm x 10cm x 18 cm black olive pots. Pots were placed on an irrigation mat with computer controlled irrigation, supplying water on a daily basis. This process was managed such that after irrigation the mat was saturated without runoff, with irrigation occurring again before too much dryness was evident on the mat. Due to differences in plant growth, plant water requirements and greenhouse temperatures this is not a constant irrigation rate throughout the growing season.

As plants were planted in a very low nutrient potting mix (coco peat), once the three leaf stage was reached, an aqueous complete nutrient solution was applied weekly.

As plants approached heading, twice weekly maturity observations were taken. This allowed for complete head emergence on the primary tiller to be observed. At this point a piece of tape was applied to the stem of the primary tiller to aid in identification. Heading was used as an indicator of imminent anthesis, with the recording of the date that anthesis is completed on the primary tiller.

Ten days after the end of anthesis; plants, both those designated as controls or for heat stressing, were removed from the irrigation mat. The primary tiller was tagged with a barcoded tag for later lab identification and the flag leaf of the primary tiller was given a visual damage score. This 1-9 score is roughly proportion to the area of leaf that is not viable (Score 1 – 0-10% of leaf area not viable, through to 9 – 90-100% of leaf area not viable). In addition, if a secondary tiller was present, it was also labelled with a barcoded tag for later lab identification.

Plants to be heat stressed were staked with bamboo, and tied loosely to this to ensure plant integrity during the heat stress treatment. Staked plants were then aligned in trays designed to hold the pots and trays were positioned in the heat chamber aiming to have the heads and flag leaf region in the flow of hot air. Drip irrigation was applied to each pot individually, with irrigation occurring morning and evening. Control treatment plants were returned to the irrigation mat as originally located without stress applied.

At the completion of the three days of heat stress (normally the following morning), plants were removed from the heat chamber. A second leaf damage score was recorded, as it was for the control plants (stressed plants were then returned to the irrigation mats). A third leaf damage score was

observed on both the control and heat stressed plants 10 days after the initial leaf score was observed.

Plants were then left to mature under the growing conditions described above. At maturity, irrigation ceased allowing full senescence to be managed evenly. Plants were harvested by cutting off at ground level. Tillers that have a barcoded tag were collected and separate plants individually bagged in to paper bags. Plants were dried in drying oven for 48 hours before processing in the laboratory.

Data/Laboratory File Information

Data collected from the experiment included the following and analysis for some of these traits has been conducted (see progress report).

- **Matanthjul** – The day of year that the main tiller reached the end of anthesis (GS69)
- **tillernum –** For primary tillers this will be '10' indicating 10 days after anthesis, for secondary tillers this is the growth stage at the start of the heat stress treatment
- **batchno** – Batch number indicates the group and order that plants were stressed (that is, all plants listed as batch 1 were the first plants to be stressed and were all in the chamber at the same time)
- **stressjul** – The day of year the stress treatment started for a particular plant
- **leaf1** – 1-9 leaf damage score at the start of the treatment (before stressing) – 1 no damage, 9 - 90-100% unviable leaf area
- **leaf2** – 1-9 leaf damage score at the completion of the three days of stressing
- **leaf3** – 1-9 leaf damage score approximately 10 days after the initial leaf1 score
- **pedunclel** – Length of the peduncle
- **flagleafw** – With of the flag leaf at maximum width
- **flagleafl** – The length of the flag leaf
- **spikeletno** – The number of spikelets on the head
- **grainwt** – The weight of the grain in the head
- **tillerwt** – The weight of the whole intact primary tiller
- **headwt** – The weight of the whole intact head
- **grainno** – The number of grains contained in the head
- TGW ('**thokernwt'**) – derived by ('**grainwt'/'grainno')*1000**
- **'Headhi'** (harvest index of head) – derived by ('**grainwt'/'headwt')**
- Harvest index ('**harindex'**) – derived ('**tillerwt'/'grainno')**
- **'fertility'** (average number of grains per spike) – derived by (**'grainno'/'spikletno'**)

Statistical Analysis

GenStat (Release 15.3) and R were used to analyse selected trait measurements from the recorded data.

As we are primarily interested in identifying germplasm that yields well under heat stress conditions, grain yield determining traits including fertility, TGW and Headhi have been given priority. However, other secondary traits such as grain number, grain weight, head weight, spikelet number and tiller number are also considered important.