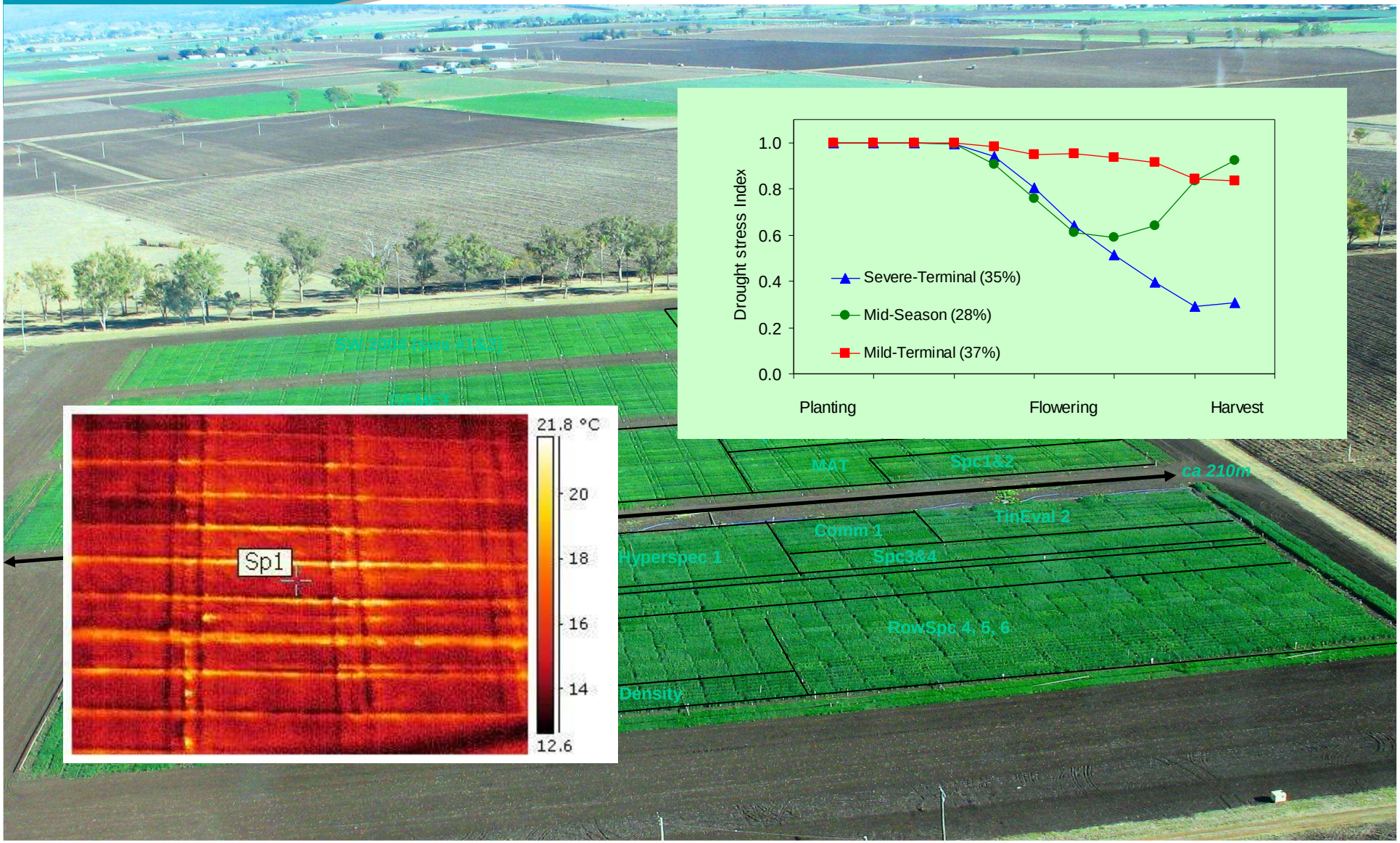
Component 1: Environment Characterisation

- Objective
  - Demonstrate EC to characterise a breeding region and testing sites for GCP
- Result
  - Showed variation in occurrence of drought patterns and coincidence of drought patterns with the testing locations for rice and maize
- Consequences for GCP
  - Methods and tools produced to characterise occurrence of drought environment for a 'region of interest'
  - Can place phenotyping sites in context of the local TPE
- Recommend to GCP
  - Must engage with plant breeders to proceed (?)
  - Assume that it is useful (either now or in the future) to describe the drought experienced in any field phenotyping platform trial
  - Whether the data is used for modelling or not, it is appropriate to collect a minimal set of environment data for each year and field for sites in the drought phenotyping network
    - Daily temperature, rainfall and solar radiation for **site**
    - Basic soil nturient analysis (0-30 cm) for **field**
    - Soil water characterisation (upper, lower limit, initial soil water)
  - If appropriate, for specific breeding programs and regions of interest, undertake environment characterisation using models
  - For global applications - many options (not always models!) to undertake 'global' summaries of drought occurrence/frequency
  - Consideration of potential needs for understanding of current climate variability as part of Climate Change CP?
  - Compilation of sources of information (web sites etc) for geographic summaries of weather data suitable for understanding of breeding program target regions
  - Technology transfer for tools developed and 'standing offer' made to supply future training in use of models in the context of breeding programs…

Perspectives for model-assisted TPE Characterisation

CSIRO PLANT INDUSTRY



Component 1: Environment Characterisation

- Objective
  - Demonstrate EC to characterise a breeding region and testing sites for GCP
    - Rice and maize environments of the Cerrado (Central Brazil)
- Result
  - Showed variation in occurrence of drought patterns and coincidence of drought patterns with the testing locations for rice and maize
  - Minimal validation of the models, but likely sufficient for use in EC
- Consequences for GCP
  - Methods and tools available to characterise occurrence of drought environment for a 'region of interest'
  - Able to place phenotyping sites in context of the local TPE
- Recommend to GCP
  - Must engage with plant breeders to proceed
  - Presume that it is useful (either now or in the future) to be able to describe the drought experienced in any field phenotyping trial
  - Whether the data is used for modelling or not, it is appropriate to collect a minimal set of environment data for each year and field for sites in the drought phenotyping network
    - Daily temperature, relative humidity, rainfall and solar radiation for **site**
    - Basic soil nturient analysis (0-30 cm) for **field**
    - Soil water characterisation to 2m depth in 30 cm increments for **field**
      - Upper limit – soil water content when soil filled, covered, drained
      - Lower limit – for each crop species, soil water content when established crop (say 2-3 weeks before flowering) is protected from rain and allowed to extract all water til death
    - Initial soil water at sowing or near….
  - If appropriate, for specific breeding programs and regions of interest, undertake environment characterisation using models
  - Considering global applications
    - Many options (not always models!) to undertake 'global' summaries of drought occurrence/frequency

Environment Characterisation in the Generation CP

- Considerations for GCP
  - ‘global’ and ‘local’ applications
  - Subsistence to mechanised cropping systems
  - Desire for ‘phenotyping support service’?
  - ‘Field Phenotyping Platform’
- Where does EC sit in value for breeding programs?
  - Defining breeding needs
  - Applications in selection process
  - Practical issues
  - Theoretical issues

Environment Characterisation in the Generation CP

- Defining breeding needs
  - Range of environments in ‘global’ target population
    - Need for GIS/maps etc for GCP?
    - Practicalities (!)
  - Defining attributes of existing/proposed ‘drought phenotyping’ sites
  - Inference regions of drought sites – zones of similar environment and/or genotype interaction
  - Targetting germplasm (‘product placement’)
  - Interaction of management and cropping system with breeding objectives
    - Farmer risk aversion/choice
    - Planting/management rules
    - Changing management over time, e.g. alleviation of acid soils…, farming system
- Applications in selection process
- Practical issues
- Theoretical issues

Environment Characterisation in the Generation CP

- Defining breeding needs
- Applications in selection process
  - Ensuring environments are sampled
  - Explaining (and exploiting) GxE interaction
    - Improving heritability in METs
  - Indirect selection
- Practical issues
- Theoretical issues

Environment Characterisation in the Generation CP

- Defining breeding needs
- Applications in selection process
- Practical issues
  - Access to weather data
  - Size of GxExM?
  - Capturing local management information
  - Benchmarking sites and/or individual genotypes
  - Local soil variation – remote-sensing and reverse-calculation
- Theoretical issues

Environment Characterisation in the Generation CP

- Defining breeding needs
- Applications in selection process
- Practical issues
- Theoretical issues
  - Appropriate/alternative measures of EC
    - Stress patterns
    - Relative grain yields
    - other
  - Clustering strategies?
  - Genotype specific ECs?
  - Linkage to genetics landscapes/simulations
  - Statistical models to apply genotype specific ECs?
  - Dealing with multiple stresses
    - N, flowering time, flexibility of crop calendar