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First Read This Please: This Questionnaire deals with **drought resistance FIELD testing and phenotyping methods**. This form is for one type of field test at one field location for one crop. Use extra forms (by saving this one in a different name) for any additional locations, types of field test or crops that you work with. This form is therefore *location x test type x crop* specific. As you fill up the form please do not use TAB to move from one field to another; please use the mouse. Since you cannot save this form please fill it up in one session.

As a participant in this survey you will receive the final analysis of the results. The time you invest in responding to this questionnaire is highly appreciated and it will help improve this area of research. If you have any questions regarding this questionnaire please address them to ablum@plantstress.com with subject line "Questionnaire".

== Please feel free to forward this questionnaire and accompanying letter to any of your colleague(s) for responding. ==

Geographical location of this field test (city, station etc')

Latitude

Longitude

Altitude (m)

Describe the general topography of the site where tests are usually performed

General description of soil at the site
(texture, depth, water-holding, etc')

How would you describe the level of soil variability at the site

Average monthly precipitations at the site in mm

Jan.	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Mean maximum monthly air temperature (C) at the site

Jan.	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Mean minimum monthly air temperature (C) at the site

Jan.	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Normal crop season (please check months from planting to harvest):

Jan.	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Crop season during the test if it is different from the normal (please check months):

Jan.	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

The crop in this field test

List the most common crop(s) usually planted previous to this test

Select one type of field test

- Check here if the above selected test is compared with a fully irrigated control
- Check here if you use line-source irrigation system to create a stress gradient
- Check here if you control groundwater level in the process of affecting drought stress
- Check here if you just monitor groundwater level in the process of affecting drought stress

The general maximum number of entries that can be included in this test

Insert comment about any of the above - if needed

Check the following environmental variables that are measured at any time during or just before this test:

- | | | | |
|--|---|---|---|
| <input type="checkbox"/> Soil Moisture content | <input type="checkbox"/> Wind speed | <input type="checkbox"/> Air humidity/vpd | <input type="checkbox"/> Soil nutrient content |
| <input type="checkbox"/> Ground water level | <input type="checkbox"/> solar radiation | <input type="checkbox"/> Air pollutants | <input type="checkbox"/> Soil salinity/alkalinity |
| <input type="checkbox"/> Air temperature | <input type="checkbox"/> Photosynthetic radiation | <input type="checkbox"/> Soil pH | <input type="checkbox"/> Soil biotic factor(s) |

FOR THIS FIELD TEST PLEASE MARK THE COMMON DROUGHT STRESS PROFILE(S) IN THE TEST:

Type of stres and stage of plant development	Your general estimate of the frequency of this stress over years
<input type="checkbox"/> Germination and seedling stage	It occurs ... <input type="text"/>
<input type="checkbox"/> Early vegetative stage (post-seedling)	It occurs ... <input type="text"/>
<input type="checkbox"/> Pre-flowering (or bud formation)	It occurs ... <input type="text"/>
<input type="checkbox"/> Flowering, and pollination	It occurs ... <input type="text"/>
<input type="checkbox"/> Fruit (grain) formation	It occurs ... <input type="text"/>
Comments?	<input type="text"/>

If you use **irrigation** to control the drought cycle please indicate which system-

When you stop irrigation to create drought how do you gage the time without irrigation

Comment about Irrigation control of drought

If you have a defined or a conceptual drought resistant **ideotype** for this target environment please describe it here:

... If you have, please explain on what basis this ideotype has been formulated

FOR THIS FIELD TEST PLEASE ENTER THE FOLLOWING INFORMATION ON DATA COLLECTED :

Yield measured

A Drought Resistance Index is calculated for YIELD

Yield components measured

A drought Resistance Index is calculated for any YIELD COMPONENT

Biomass measured

A drought Resistance Index is calculated for BIOMASS

Any other yield/biomass statistic describing drought resistance?

If **yield** is measured, what is your general average (over seasons) rate of yield reduction caused by stress as compared with the estimated potential yield or the fully irrigated yield at the site?

If **Biomass** is measured, what is your estimated average (over seasons) rate of biomass reduction caused by stress as compared with the estimated potential biomass or the fully irrigated biomass at the site?

Product quality measured

phenology measured

Which phenology traits?

Check if you perform any type of a statistical spatial analysis to correct data for site variability

Which analysis?

Please review carefully and check any of the following plant/crop drought response observations or assays that are performed **under drought stress** in this test. Note: only tests performed in the field or in plant samples taken from the field. For plants grown out of the field a "non-field" form is to be used.

- | | | |
|---|----------|----------------------|
| <input type="checkbox"/> Leaf rolling score (in cereals) | Details? | <input type="text"/> |
| <input type="checkbox"/> Leaf desiccation ("firing") score | Details? | <input type="text"/> |
| <input type="checkbox"/> Green leaf area retention after stress | Details? | <input type="text"/> |
| <input type="checkbox"/> Plant/leaf wilting score | Details? | <input type="text"/> |
| <input type="checkbox"/> Plant death score/count | Details? | <input type="text"/> |
| <input type="checkbox"/> Plant recovery estimate after stress | Details? | <input type="text"/> |
| <input type="checkbox"/> Sterility estimate (score or count) | Details? | <input type="text"/> |
| <input type="checkbox"/> Flower drop estimate | Details? | <input type="text"/> |
| <input type="checkbox"/> Damage to fruiting (fruit drop, etc') | Details? | <input type="text"/> |
| <input type="checkbox"/> Grain/seed shrivelling score | Details? | <input type="text"/> |
| <input type="checkbox"/> Canopy temperature | Details? | <input type="text"/> |
| <input type="checkbox"/> Thermal imaging | Details? | <input type="text"/> |
| <input type="checkbox"/> Spectroscopic imaging | Details? | <input type="text"/> |
| <input type="checkbox"/> Photographic imaging | Details? | <input type="text"/> |
| <input type="checkbox"/> Leaf photosynthesis | Details? | <input type="text"/> |
| <input type="checkbox"/> Leaf transpiration | Details? | <input type="text"/> |
| <input type="checkbox"/> Chlorophyll fluorescence | Details? | <input type="text"/> |
| <input type="checkbox"/> Leaf diffusive resistance | Details? | <input type="text"/> |
| <input type="checkbox"/> Leaf viscous flow porometry | Details? | <input type="text"/> |
| <input type="checkbox"/> Leaf relative water content | Details? | <input type="text"/> |
| <input type="checkbox"/> Leaf water potential | Details? | <input type="text"/> |
| <input type="checkbox"/> Stem stored carbohydrates analysis | Details? | <input type="text"/> |
| <input type="checkbox"/> Chemical desiccation test (nonstress) | Details? | <input type="text"/> |
| <input type="checkbox"/> Carbon isotope discrimination | Details? | <input type="text"/> |
| <input type="checkbox"/> Cell Membrane stability (leakage) | Details? | <input type="text"/> |
| <input type="checkbox"/> Leaf surface properties (wax, hairs, etc') | Details? | <input type="text"/> |
| <input type="checkbox"/> Leaf color estimate or measurement | Details? | <input type="text"/> |
| <input type="checkbox"/> Leaf chlorophyll content | Details? | <input type="text"/> |
| <input type="checkbox"/> Leaf ABA content | Details? | <input type="text"/> |
| <input type="checkbox"/> Leaf osmolyte content | Details? | <input type="text"/> |
| <input type="checkbox"/> Antioxidant analysis | Details? | <input type="text"/> |
| <input type="checkbox"/> Leaf or grain ash content | Details? | <input type="text"/> |
| <input type="checkbox"/> Non-senescence / delayed-senescence | Details? | <input type="text"/> |
| <input type="checkbox"/> Root-pulling force | Details? | <input type="text"/> |
| <input type="checkbox"/> Root depth (direct or indirect method) | Details? | <input type="text"/> |
| <input type="checkbox"/> Root nitrogen fixation capacity | Details? | <input type="text"/> |
| <input type="checkbox"/> Flowering or heading delay | Details? | <input type="text"/> |
| <input type="checkbox"/> Flowering or heading advance | Details? | <input type="text"/> |
| <input type="checkbox"/> Plant height or its rate of reduction | Details? | <input type="text"/> |

Any other observation/measurement?

List any plant traits that are measured in this test in plants never exposed to drought stress at the time of measurement:

If you had unlimited resources, which trait(s) would you prefer to measure as the best estimate(s) of drought resistance?

The following factors may interfere with drought field phenotyping experiments. To the best of your knowledge please provide an estimate of the level of probability for each factor to occur in this test at this location, where **0= Non exist and 5= very high. If it is irrelevant or unknown please leave unmarked.**

- | | |
|--|--|
| <input type="checkbox"/> Major shoot diseases | <input type="checkbox"/> Check if major shoot diseases can be controlled |
| <input type="checkbox"/> Major root diseases | <input type="checkbox"/> Check if major root diseases controlled |
| <input type="checkbox"/> Major insect pests | <input type="checkbox"/> Check if insect pests can be controlled |
| <input type="checkbox"/> Nematodes | <input type="checkbox"/> Check if nematodes can be controlled |
| <input type="checkbox"/> Weeds | <input type="checkbox"/> Check if weeds can be controlled |
| <input type="checkbox"/> Birds | <input type="checkbox"/> Check if bird damage can be controlled |
| <input type="checkbox"/> Foraging animals | <input type="checkbox"/> Check if foraging animals can be controlled |
| <input type="checkbox"/> Theft of field equipment or product | <input type="checkbox"/> Check if theft can be controlled |
| <input type="checkbox"/> Saline or sodic soil | |
| <input type="checkbox"/> Saline or brackish water | |
| <input type="checkbox"/> Soil acidity | <input type="checkbox"/> Check if acidity can be amended by liming |
| <input type="checkbox"/> Soil mineral toxicity (Al, Mn etc') | |
| <input type="checkbox"/> High ground water level | <input type="checkbox"/> Check if groundwater can be drained to allow drought stress |
| <input type="checkbox"/> Some flooding during rains | <input type="checkbox"/> Check if flooding can be controlled |
| <input type="checkbox"/> Hard-pan limiting root penetration | |
| <input type="checkbox"/> Other problems --- Please explain | <input style="width: 100%; height: 20px;" type="text"/> |

If you encounter difficulties in optimizing your drought testing and phenotyping please check the main causes:

- Lack of expertise in drought resistance testing
- Lack of general technical proficiency in conducting field/breeding work
- Undecided about the most important plant traits to test
- Lack of appropriate land
- Problems of excessive field variability
- Poor soil (acidity, salinity, etc')
- Inability to control drought timing and/or level in the test because of weather factors
- Inability to control drought timing and/or level in the test because of technical factors
- Severly interfering biotic factors (diseases, pests etc')
- Lack of capacity (infrastructure/equipment/help)

Other factors? (please explain)

If possible please provide some estimates of cost for this phenotyping activity on a per entry or per 100 entry basis, as a service provided to an external client. This estimate is not binding.

List any available publications (journal citation and year is sufficient) typically describing your work in phenotyping as per this questionnaire.

Total number of scientists from your or other institution who collaborate with you on this test

Please list scientists' names and affiliations

Number of technical personnel who are involved with this test (person/year)

In principle, is there an option for training in drought phenotyping and testing methods in your program

Finally, feel free to add any relevant information or an opinion on traits, methods, testing and drought resistance:

Check here if you are submitting additional form(s) for another field location or another crop

Check here if the above overwhole response to this questionnaire is similar for another crop that you test

Which crop(s)

Your Name

Address

City

State

Zip Code

Country

email

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