HART
SA's premier cropping field site

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Probing for soil moisture

During the growing season methods for measuring soil moisture are important to estimate crop grain or hay yield potential. Measuring the soil moisture tells us more than just rainfall because it takes into account the water loss through evaporation and plant water use that has occurred. This might include altering nitrogen rates or not applying any.

One method is a metal push probe. It is a simple, cheap and portable tool for estimating depth and quantity of plant available soil water. It is essentially a metre of 10mm steel rod with a T handle and a larger diameter point (14mm), to aid removing the rod in moist soils (see picture).

The depth reached by the probe with reasonable force is a good indicator of available soil moisture, in most soil types. The crop available water depends on the soil type i.e light or heavy texture, change in soil type with depth and constraints to crop growth i.e salt or boron

(Table 1). Knowledge about crop available water is essential for the values to be useful.

Soil Type	mm water / cm push probe
Sandy loam	0.7
Sandy clay loam	1
Red brown earth	1.2
Clay loam	1.5
Heavy clay	1.8

With a couple seasons of experience and knowledge about their soil, growers gain a very good 'feel' for the amount of water likely to be available.

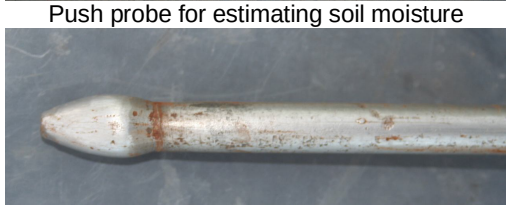
The value of the soil moisture will depend on a number of factors. Research in NSW has shown that moisture below 100 cm in the soil was accessed by wheat and increased grain yield by as much as 60 kg/ha/mm, with an average figure of 34 kg/ha/mm.

The value of the soil moisture to grain or hay yield will depend on:

- Depth of moisture – deeper moisture will be used more efficiently as it is protected from evaporation and will be used during flowering and grain fill
- Crop development – the moisture will be more valuable later in the season progresses as it is likely to contribute to grain number and size
- Crop canopy size – a thin and open canopy might still lose moisture through soil evaporation
- Conditions during grain fill – warm and windy conditions during flowering and grain fill increase crop water use and reduce grain size

GRDC Grains Research & Development Corporation
YIELD PROPHET

Push probe for estimating soil moisture



Push probe tip, the bulb aids removal from wet soil

Making a probe

Cut a piece of 10mm steel rod at 1 meter and use a welder to create a 14mm 'bulb' at one end and grind smooth.
The handle is a 30cm piece of 30mm pipe or similar.
It is important that the handle is secured firmly to the rod as if it breaks off when you are leaning over it to push it into the ground it could stab you in the chest.
Drill a 10mm hole through the side of the handle so that the rod passes through at 90 degrees and weld securely in place.

New trials at Hart in 2009

- Fence line weed control
- Controlling wild oats
- Oaten hay evaluation
- Pulse row spacing in standing stubbles
- Wheat row spacing
- New herbicides

Dates for 2009

Winter Walk
Tuesday 28th July – at the site
9:00am - noon

Hart Field Day
Tuesday 15th September Gates open 9:00am

Spring Twilight Walk
Thursday 15th October – at the site
4:00pm

Hart Site information as of 24th July 2009

Soil type: Sandy clay loam
PAWC: 201mm
Average annual rainfall: 400mm
Average GSR (Apr to Oct): 305mm

The season so far

Rain to date: 177mm
GSR to date: 168mm
GSR decile: 5
Maximum temp since sowing: 22.7ºC
Minimum temp since sowing: 0.5ºC
Day degrees since sowing: 863ºC
Current predicted soil N status: 77kg/ha
Current predicted PAW: 43mm
Current push probe depth: 68cm

Grain & hay yield predictions

Yield prophet estimate: (Date of report 24/07/2009)
50% chance of producing 3.5t/ha grain or 6.3t/ha hay when sown on the 18th May (see graph).
50% chance of producing 4.0t/ha grain or 6.4t/ha hay when sown on the 5th May.

These graphs show the chance of reaching the corresponding yield given weather, soil conditions and agronomic inputs to date, and historical climate data (100yrs) to simulate remainder of the season.

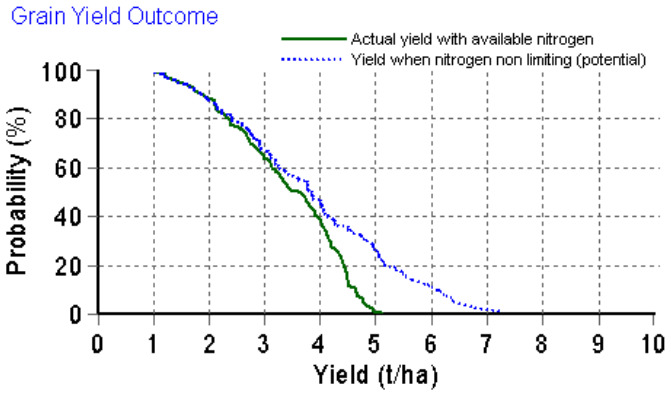
French & Schultz yield estimate: 3.8t/ha
This model assumes that there is 110mm of evaporation and decile 5 (131mm) rainfall for the remainder of the growing season.

Pre-sowing soil nitrogen and water

(measured 2nd April)
Soil N prior to sowing (0-90cm): 94kg/ha
Plant available water at sowing (0-90cm): 0mm

Crop growth

Variety: Gladius
Sowing date: 18th May
Nitrogen fertiliser at sowing: 30kgN/ha
Plant density: 162 plants per square metre
Current growth stage: stem elongation (GS30)
Predicted date of stem elongation (GS30): 30th July
Predicted date of flowering: 23rd September



Condowie Site information as of 22nd July 2009

Soil type: Sandy loam
PAWC: 127mm
Average annual rainfall: 349mm
Average GSR (Apr to Oct): 252mm

The season so far

Rain to date: 155mm
GSR to date: 146mm
GSR decile: 6
Maximum temp since sowing: 24.5ºC
Minimum temp since sowing: -1.2ºC
Day degrees since sowing: 1062ºC
Current predicted soil N status: 191kg/ha
Current predicted PAW: 29mm
Current push probe depth: limestone @ 25cm

Grain & hay yield predictions

Yield prophet estimate: (Date of report 24/07/2009)
50% chance of producing 3.5 t/ha grain or 5.2t/ha hay when sown on the 30th April (see graph).
50% chance of producing 2.6t/ha grain or 5.5/ha hay when sown on the 15th May.

These graphs show the chance of reaching the corresponding yield given weather, soil conditions and agronomic inputs to date, and historical climate data (100yrs) to simulate remainder of the season.

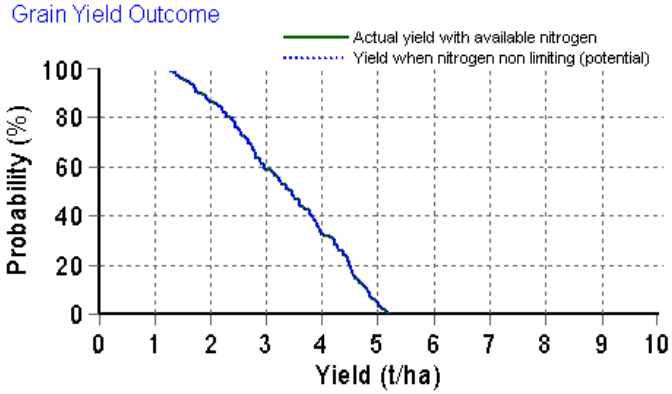
French & Schultz yield estimate: 2.8t/ha
This model assumes that there is 110mm of evaporation and decile 5 (105mm) rainfall for the remainder of the growing season.

Pre-sowing soil nitrogen and water

(measured 23rd March)
Soil N prior to sowing (0-90cm): 244kg/ha
Plant available water at sowing (0-90cm): 0mm

Crop growth

Variety: Gladius
Sowing date: 30th April
Nitrogen fertiliser at sowing: 20kgN/ha
Plant density: 162 plants per square metre
Current growth stage: 1st node (GS31)
Predicted date of stem elongation (GS30): 4th July
Predicted date of flowering: 31st August



Spalding

Site information as of 22nd July 2009

Soil type: Red brown earth
PAWC: 150mm
Average annual rainfall: 434mm
Average GSR (Apr to Oct): 322mm

The season so far

Rain to date: 216mm
GSR to date: 196mm
GSR decile: 6
Maximum temp since sowing: 23.7ºC
Minimum temp since sowing: -1.2ºC
Day degrees since sowing: 892ºC
Current predicted soil N status: 70kg/ha
Current predicted PAW: 91mm
Current push probe depth: 77cm

Grain & hay yield predictions

Yield prophet estimate: (Date of report 24/07/2009)
50% chance of producing 4.7t/ha grain or 7.8t/ha hay when sown on the 9th May (see graph).
50% chance of producing 4.8t/ha grain or 8.5/ha hay when sown on the 15th May.

These graphs show the chance of reaching the corresponding yield given weather, soil conditions and agronomic inputs to date, and historical climate data (100yrs) to simulate remainder of the season.

French & Schultz yield estimate: 4.7t/ha
This model assumes that there is 110mm of evaporation and decile 5 (147mm) rainfall for the remainder of the growing season.

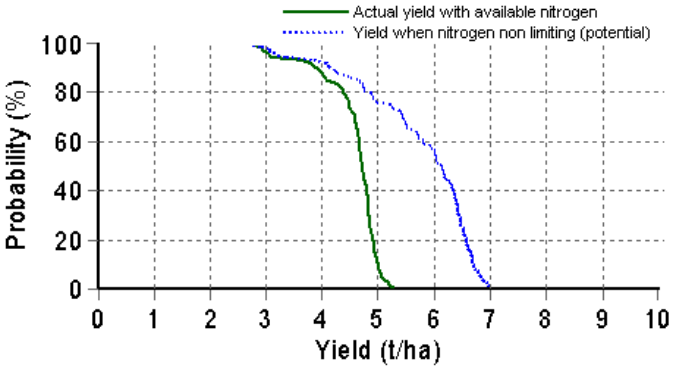
Pre-sowing soil nitrogen and water

(measured 2nd April)
Soil N prior to sowing (0-90cm): 107kg/ha
Plant available water at sowing (0-90cm): 0mm

Crop growth

Variety: Gladius
Sowing date: 9th May
Nitrogen fertiliser at sowing: 40kgN/ha
Plant density: 182 plants per square metre
Current growth stage: stem elongation (GS30)
Predicted date of stem elongation (GS30): 21st July
Predicted date of flowering: 18th September

Grain Yield Outcome



Tarlee

Site information as of 22nd July 2009

Soil type: Clay loam over rock
PAWC: 122mm
Average annual rainfall: 469mm
Average GSR (Apr to Oct): 350mm

The season so far

Rain to date: 242mm
GSR to date: 222mm
GSR decile: 7
Maximum temp since sowing: 22.2ºC
Minimum temp since sowing: 0.6ºC
Day degrees since sowing: 596ºC
Current predicted soil N status: 138kg/ha
Current predicted PAW: 113mm
Current push probe depth: 61cm

Grain & hay yield predictions

Yield prophet estimate: (Date of report 24/07/2009)
50% chance of producing 4.8t/ha grain or 7.2t/ha hay when sown on the 1st June (see graph).
50% chance of producing 4.9t/ha grain or 6.0t/ha hay when sown on the 10th May.

These graphs show the chance of reaching the corresponding yield given weather, soil conditions and agronomic inputs to date, and historical climate data (100yrs) to simulate remainder of the season.

French & Schultz yield estimate: 5.4t/ha
This model assumes that there is 110mm of evaporation and decile 5 (160mm) rainfall for the remainder of the growing season.

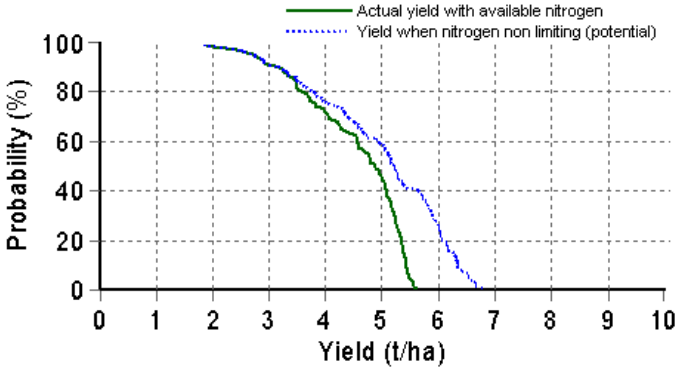
Pre-sowing soil nitrogen and water

(measured 27th March)
Soil N prior to sowing (0-90cm): 143kg/ha
Plant available water at sowing (0-90cm): 7mm

Crop growth

Variety: Gladius
Sowing date: 1st June
Nitrogen fertiliser at sowing: 50kgN/ha
Plant density: 142 plants per square metre
Current growth stage: 4 leaf / 2 tillers (GS14/22)
Predicted date of stem elongation (GS30): 10th August
Predicted date of flowering: 29th September

Grain Yield Outcome



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WUE site locations

Hart Beat definitions

Each site has been characterised for plant available water capacity (PAWC) and bulk density to determine how much of the measured water and nitrogen is available to the crop during the season.

Push probe – a 10mm, steel rod 1m long with a rounded bulb on one end and a 30mm T handle on the other (see picture on cover) the probe is pushed down into the soil with reasonable force.

Push probe depth (cm) – is the depth reached by the push probe when reasonable downward force is applied.

Drained upper limit (DUL) – is the amount of water that a saturated soil holds after it has drained.

Crop lower limit (CLL) – is the amount of water remaining in the soil after crop senescence.

Plant available water capacity (PAWC) – is the difference between the drained upper limit of the soil and the lower extraction limit of a crop over the depth of rooting. It is the maximum water available to a crop from a particular soil type.

Plant available water (PAW) – is the amount of water contained in the soil at a given time minus the crop lower limit.

Bulk density (BD) – is a measure of the weight of dry soil per unit volume of soil.

Day degrees – the accumulation of temperature units, or warmth. It is the main environmental property that controls plant development.

Growing season rainfall (GSR) – is rainfall for the period between and including April to October.

Decile – is a measure of seasonal rainfall on a scale of 1 to 9. In a decile 7 year, 70% of previous years were dryer, in a decile 3 year 30% of previous years were dryer.

The **French & Schultz** formula estimates the rainfall limited grain yield based on the growing season rainfall (GSR). It assumes evaporation of 110mm, it does not include stored water at sowing and a maximum grain yield potential of 20 kg/mm/ha.
Yield Potential = GSR (April-October) – Evaporation (110mm) * 20 kg/mm/ha.

***Yield Prophet*®** has been very accurate throughout Australia, over the past 5 seasons. At the Hart fieldsite the *Yield Prophet*® prediction on the 15th September, using an average finish, has been only 16% above the final grain yield, averaged over the past 4 years, making wheat growth models such as APSIM highly valuable.
Yield Prophet® is an internet based service which uses the APSIM wheat prediction model.

The model relies on accurate soil, crop, historical climate data and up to date local weather information to predict plant growth rates and final hay or grain yields. These are critical measurements specific to the site being analysed and may not fit closely to individual situations. Instead the predictions will give a realistic guide to seasonal prospects based on a site with similar rainfall and / or soil type.

Using climate data for the current season, *Yield Prophet*® simulates the soil water and nitrogen processes in the paddock, and crop growth. *Yield Prophet*® calculates the amount of water and nitrogen available to the crop and the water and nitrogen demand of the crop.

Important Notice: *Yield Prophet*® does not generate recommendations or advice, it is only a guide and must be combined with local paddock and district knowledge. APSIM does not take into account weed competition, pest/disease pressure, pesticide/herbicide damage, farmer error, or extreme events (such as extreme weather, flood and fire). For more information about APSIM or *Yield Prophet*® please visit or www.yieldprophet.com.au.

Disclaimer: *Yield Prophet*® information is used entirely at your own risk. You will accept all risks and responsibility for losses, damages, costs and other consequences of using *Yield Prophet*® information and reports. To the maximum extent permitted by law, APSRU and BCG excludes all responsibility and liability to any person arising directly or indirectly from using the information generated by *Yield Prophet*®

Site	Average annual rainfall (mm)	Soil type	Drained upper limit (mm to 150cm)	Crop lower limit (mm to 150cm)	Plant Available Water Capacity (mm)
Condowie	350	Sandy loam	376	249	127
Hart	400	Sandy clay loam	683	482	201
Spalding	430	Red brown earth	469	319	150
Tarlee	470	Clay loam over rock	383*	263*	120*

*depth to 125cm

Hart field site contact information

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