Irrigation constraints

- Bowman Farm, on the Bowman River, has a small catchment and historically restricts access to irrigation water when needed over drier months. Tom’s challenge is to make use of rain and the runoff flows while they last.
- Kywong Flat is on the Barrington River with much better river flows but high power costs drive Adam to irrigate in off peak periods to reduce costs. Restrictions may eventuate on the Barrington River in coming months.
- Soil moisture monitoring (SMM) probes require a period to settle and calibrate in any situation. The user must understand and interpret readings and what it means to water management at that particular location (soil characteristics, weather exposure & plant biomass) and season. Tom and Adam are still within this learning window.

Key points from the November to January period

- Rainfall in October (120 mm) provided a big boost to river flows and gave confidence to sow maize on Bowman Farm using irrigation to help with establishment.
- SMM was used to gauge the effectiveness of good rainfall (124mm) in late December. This allowed both farms to use irrigation as a supplement for the three weeks following, resulting in more efficient water and power use.
- High crop evaportranspiration (ETo) rates of 6 to 8 mm/day in late January resulted in a steep decline in soil moisture levels. With water still available, irrigation was applied on both farms, however, was less effective than previous applications.
- Kywong Flat may have considered increasing rate of application but was restricted by a management strategy of using off peak power only, limiting irrigation events to 12mm due to system capacity during overnight off peak periods. Taking ETo into consideration, effective wetting was 4-6mm each application only.
- Reducing plant competition (spraying of paddocks) resulted in more efficient water use.
Seasonal Summaries for Bowman Farm - Summer Maize Crop

Soil Moisture Graph

- Period above full maintained during crop development
- Significant rain event lifts soil moisture levels
- Start-up irrigation
- Crop planted
- Dry conditions, higher soil temperatures effects soil moisture levels even with irrigation applied

Probe calibration period

Stacked Graph

Rainfall + irrigation mm (light blue) & Plant Available Soil Moisture (dark blue)
Soil Moisture Commentary

- Throughout November to mid-December paddock soil moisture was well below the optimal Plant Available Water (PAW) range (light green shading on Soil Moisture Graph).
- Irrigation applied early in the season helped to establish the maize crop but carried risk of no follow up rain. This year it paid off getting the crop established before significant rain.
- A late December rainfall event (124mm) and smaller early January events (totalling 26mm) saw moisture levels rise to above soil capacity. Irrigation was then used to supplement this rainfall (2 x 20mm) to keep soil moisture in an optimal position (light blue shading on Soil Moisture Graph).
- This follow up irrigation in January made use of declining flows after the rain, but declining supply restricted irrigation in late January.
- Hot conditions late January Eto of 6-8mm/day saw moisture levels drop to just below refill point, with the top 25cm affected early. Irrigation was applied (20mm) but had little effect on soil moisture levels.
- Response to rainfall and supplementation irrigation was effective to a depth of 1m (dark blue line on Stacked Graph), however, drying occurred quickly in the top 0-35cm of the paddock after watering (Brown & Red lines on Stacked Graph).

Left: Tom Middlebrook, Bowman Farm - reports that the maize crop of this season is going to yield substantially higher this season compared to last season. He attributes this production gain to better use of irrigation at the start-up of the crop and improved soil moisture level maintenance during early development.
Seasonal Summaries for Kywong Flat- Paddock F3 Kikuyu/ Paspalum pasture

Soil Moisture Graph

Optimal Range
Refill 245

Period of rapid drying but rapid effect of watering assisted rye grass to persist.

Significant rainfall & some follow-up irrigation applied

Soil Moisture levels drop - irrigation applied at 12mm to use off-peak night power - stressed conditions.

Paddock dry, 16mm applied followed by applications of 12mm applied (off-peak power) seeing moisture levels to fall again

Early January rainfall events supported by irrigation generally maintains soil moisture

Late January high temperatures & dry conditions

Stacked Graph

25cm

95cm

Jan 01

Nov 01 Dec 01 Jan 01

Hunter Smarter Farming: Irrigating for Profit Project
Seasonal Summaries for Kywong Flat - Paddock F6 Lucerne/Chicory pasture

Soil Moisture Graph

Stacked Graph

25cm

95cm
Soil Moisture Commentary

- During November soil moisture levels responded to irrigation (above refill point Site F3 and just on refill point Site F6) but quickly dried in the days following.
- The overall soil moisture trend was downwards to near PAW stress levels by mid-December on both sites—so whilst irrigation was applied, it was not enough to maintain soil moisture within the optimal range for plant growth.
- Good late December/ early January rainfall (total 150mm) saw the SMM trend upwards but still sitting only just above (F3) or just below (F6) the refill point.
- F6 cumulative totals (Soil Moisture Graph) are deceptive as the increased soil moisture was only experienced in the top 35cm (lighter, shallow soil), resulting in an initial over-watered top layer but drying occurred very quickly. With a deeper rooting depth, Lucerne may have experienced some stress.
- F3 is experienced dry conditions down to 75cm but is also responsive to irrigation/ rainfall to this level (Stacked Graph).
- Kywong Flat is using a strategy of water scheduling to chase off-peak power use, limiting water applications to 12mm during week nights or larger applications over the weekend. This rate of water was not enough during early January and so soil moisture levels fell. Mid-January rainfall events (3) totalling 26mm assisted to lift levels again. F3 soil moisture levels fell again quickly, however, F6 has been better able to maintain levels.
- It is suspected that reduced weed competition for water has been a major factor with a spray-out occurring mid-January on F6.

February/ March Soil Moisture tips

- Bowman and Barrington River water access may become a limiting factor.
- Both farms will need to optimise the opportunities which arise from any rainfall- using SMM to assess how irrigation can be used to “top-up” soil moisture levels.
- Scheduling of irrigation should be determined using the Scheduling Irrigation Diary tool (water balance calculation using forecasted temperature, Eto & rainfall) along-side the in-situ SMM equipment.
- Consideration of power costs V lost production in using only off-peak power may need to be assessed. Maintaining good production may have longer-term profitability benefits than reduced power costs during the drier months.
- In a high rainfall environment, irrigation is supplemental and is always a balance between using rain effectively and avoiding crop stress. We expect can expect good rain by March so over irrigation could lead to waterlogging.
- The maize crop will be harvested in March at Bowan Farm and yield will be measured and assessed against the 2018 crop.
- During the fallow/transitional period soil testing is recommended so that nutrient requirements are considered in preparation for winter pasture sowing and are not constraining the effectiveness of adequate soil moisture.

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