



Agricultural development in northern Australia

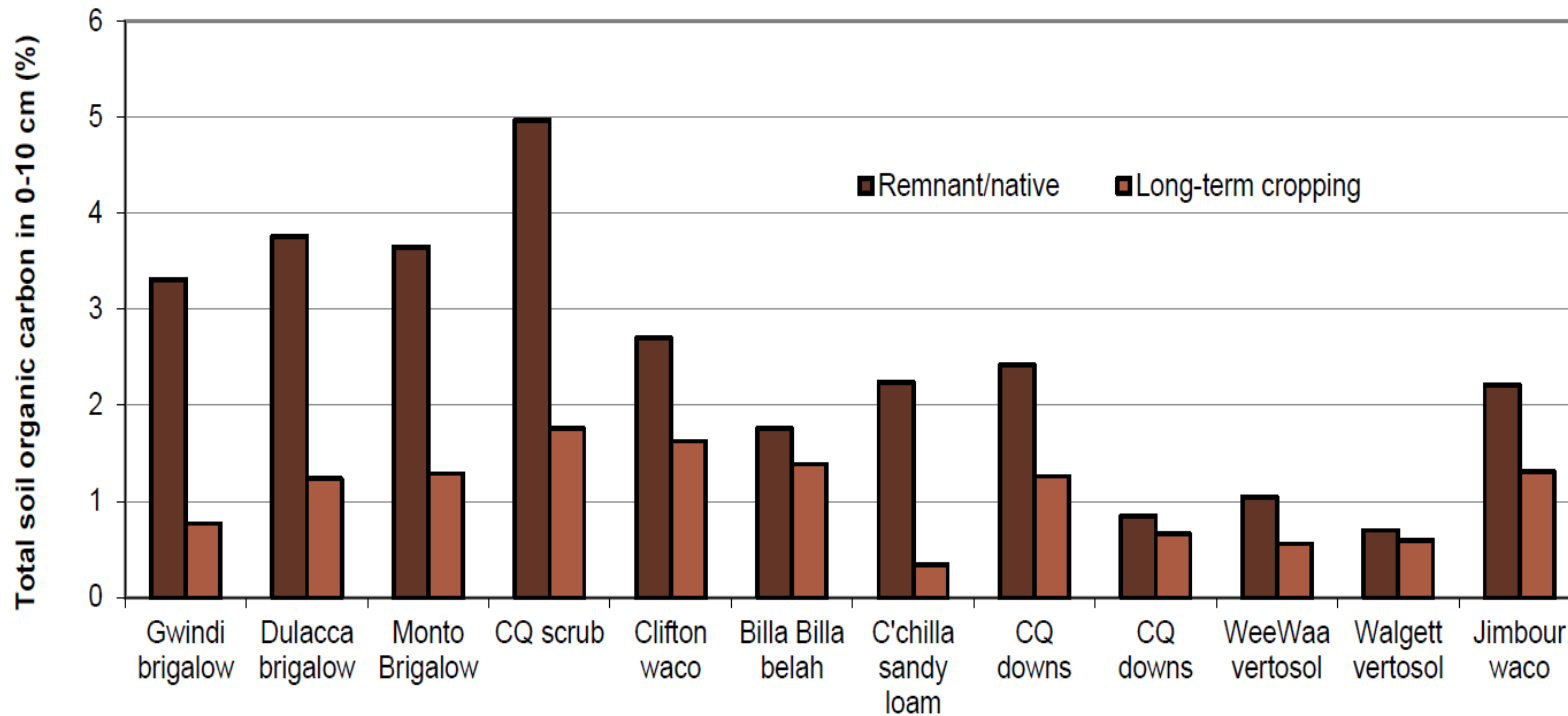


Cropping for ~120 years, expanded last 50 years

- Ancient soils with low phosphorus, zinc and soil organic carbon
- 500 - 650 mm summer dominant rainfall
 - Crop dependence on stored soil water (winter <80%; Summer <30%)
 - Zero-tillage used to capture rain with stubble
 - Crops only use 20-40% of rainfall (evaporation 60%)

Fertility decline in aging soils and systems

Soil organic carbon and nutrients are still declining



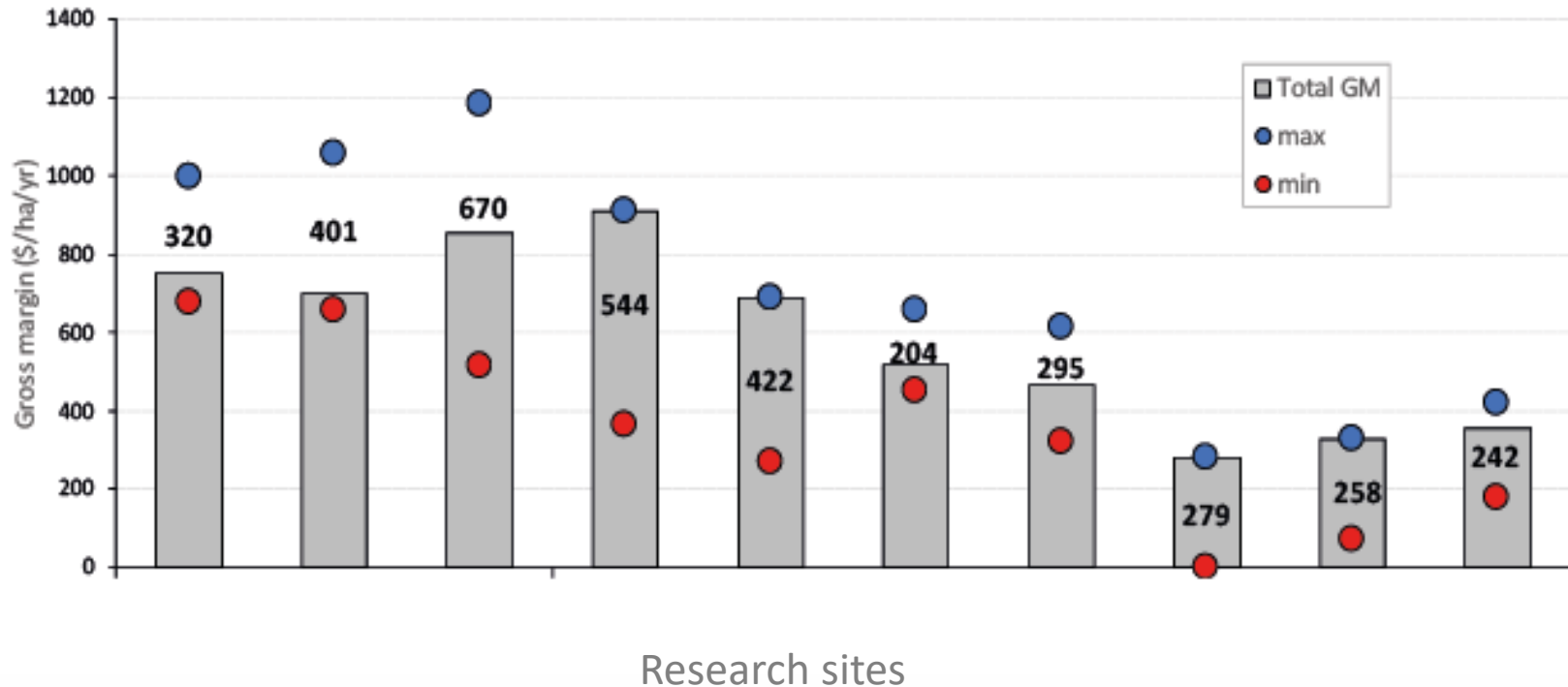
RDE on overall systems performance

<30% crop sequences reaching 75% water-limited yield potential

- Strategies to improve farming system performance
 - Crop intensity (increase, decrease)
 - Crop diversity (increase)
 - Increased legume crops
 - Increased nutrient supply
 - Boosting soil fertility (pasture, manure, compost)
- System performance and soil health metrics include
 - Profitability per hectare (\$/ha/year) and per mm rainfall (\$/mm/year)
 - Soil organic carbon (organic matter)
 - Nutrient balances (N, P, K, Zn...)
 - Pathology, weeds
 - Costs, cashflow, labour etc

Emerging challenges for modern cropping systems

Gross margin (GM) varied by \$200-500 /ha/year at each site



Cover crop: surprise results from an old idea

Cover crops protect against erosion in low-cover fallows, build organic matter...even boost net fallow water storage



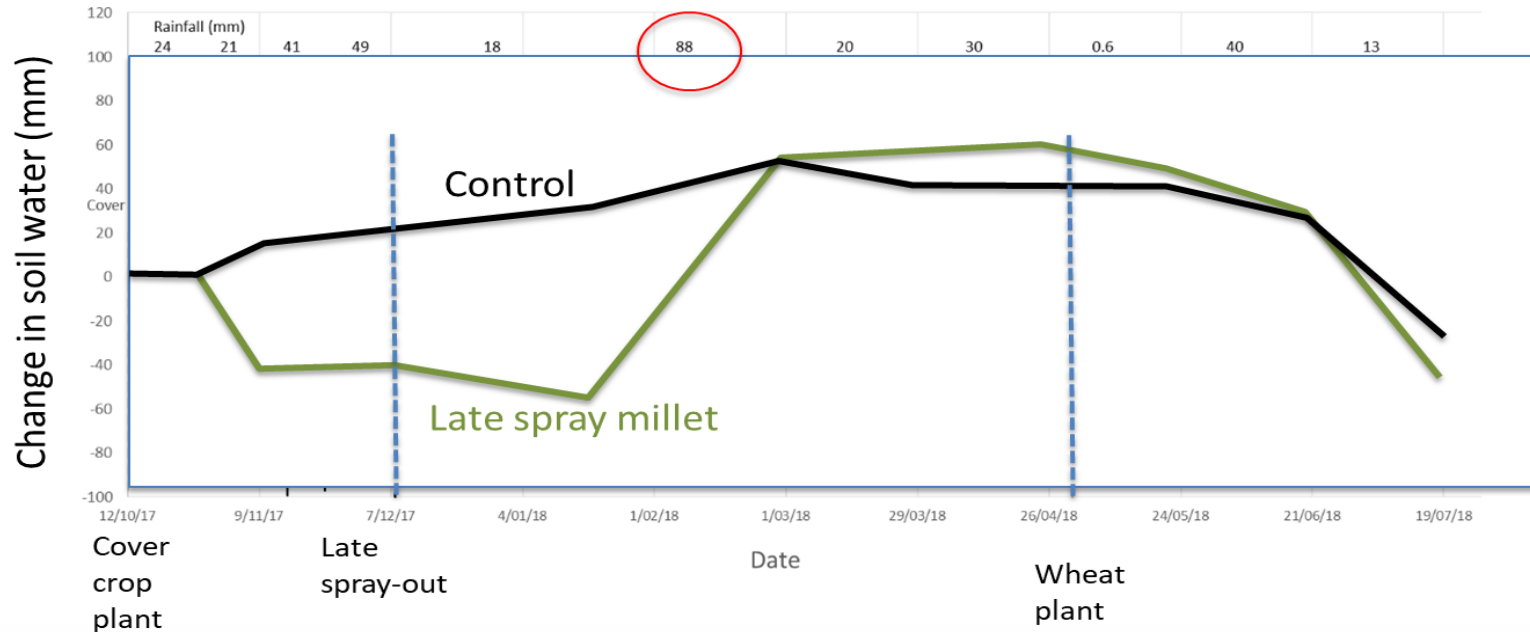
Shows surface moisture
3 days after 30 mm rain

Effects last for ~21 days
to store extra rain

Terminate cover crops before they use too much water!

Cost: 40-60 mm water in low-cover years

'Predicted' recovery or gain in 70% of years (mean +15 mm)

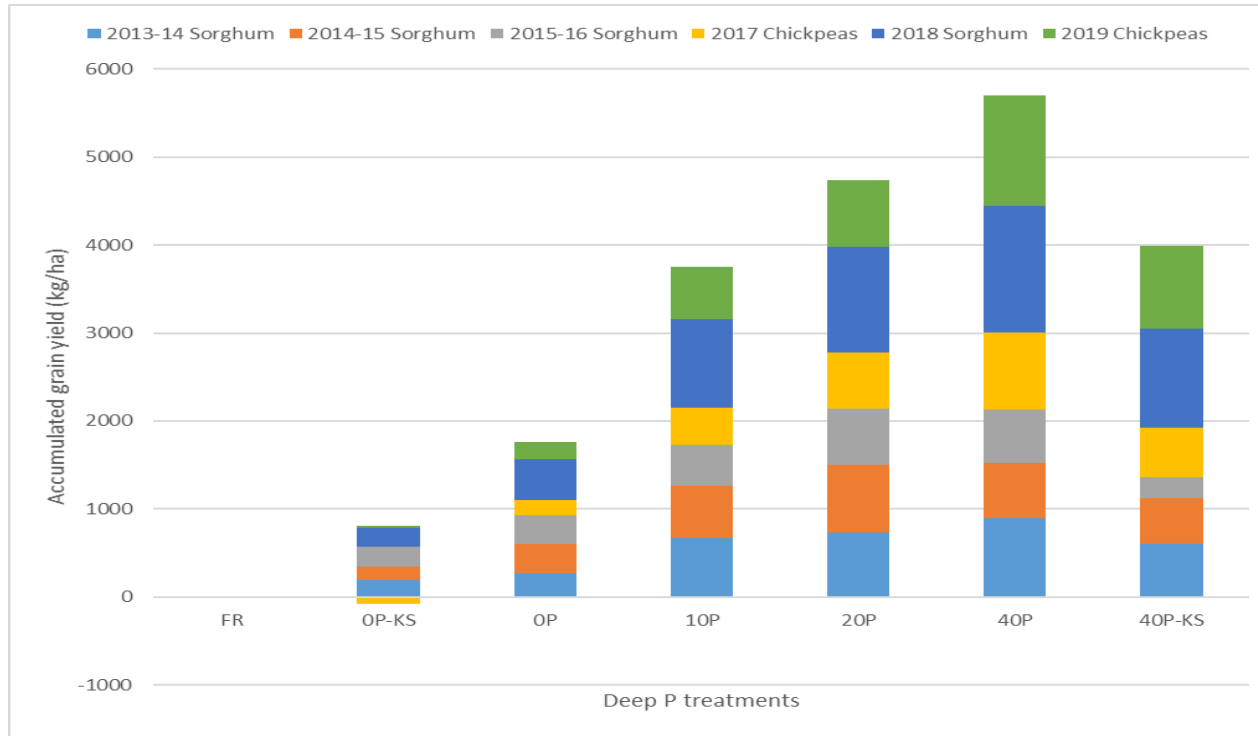


Deep placement of fertiliser for immobile nutrients



- Crop residues and fertilisers returned to soil surface (0-10 cm)
- Immobile nutrients stratified (0-10cm - high; 10-30cm - low)
- Fertiliser at ~20 cm is in moist soil for longer in dryland systems
- Major growth and yield responses

Deep-P yield responses for at least 5-10 years



This example:

- Costs recovered in the first year
- Still responding after six years (42% overall)



Simple agronomy for pasture legume establishment



- Legumes can double animal production, but over-sowing legumes into established pastures usually fails
- Competition is usually too high for young seedlings. Increased sowing rates just loses more money
- Simple agronomy with fallowed strips boosts establishment dramatically