CANOPY MANAGEMENT- CURRENT CATCHPHRASE OR AN ACTUAL TACTIC?

BY DAVID STEAD, REVIEWED BY TIM TREZISE

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SUMMARY

- Canopy management is the management of the green leaf area of a crop.
- Nitrogen application and timing is an important factor in canopy management.
- Time of sowing, seed quality, and seeding rate also have a great influence on canopy management.
- There are many factors that influence canopy-size and density that are beyond the control of the grower.
- Knowing soil moisture levels and the current nutritional status of the soil and plant aids in the decision making process in managing a crop's canopy.

In recent times, we've heard quite a lot about 'canopy management' and how implementation can achieve higher crop yields. Canopy management is the management of the green leaf area of a crop in order to optimise profit. The immediate thought is that nitrogen is the main controller of 'canopy managing'; however, the question is "what IS canopy management, and can it be independent of applied nitrogen"? The simple answer is that while there are many factors that influence the crop canopy, nitrogen timing and rate do play the largest factor in the holistic] approach to managing our crop canopy.

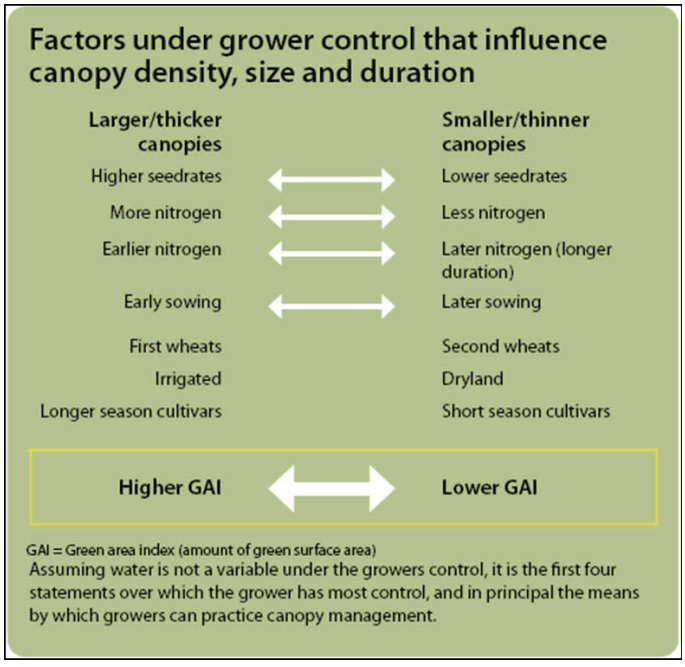
The factors that contribute towards canopy management are;

- Seasonal rainfall events
- Paddock limitations – pH, geography, etc
- Soil moisture holding capacity
- Weed burden, type and size
- Pest and disease management
- Cultivar, sowing date, row spacing and seeding rate
- Soil nitrogen, and fertiliser planning

Implementing the practice of Canopy Management starts by identifying the principal interactions within an individual crop. This is done through the use of measuring tools, visual indicators (and gut feel sometimes!). Various crop models can also be useful in the consideration and implementation of canopy management.

There are many factors that are not within our control. Rainfall, paddock geography, soil type and cultivar reaction to seasonal variances are generally considered to be outside of our circle of influence. Factors that are able to be controlled like good land and crop husbandry, contribute to a certain degree of canopy management by default. Most growers know where the 'champagne' paddocks, or well performed areas within paddocks are. They are generally good soil types for that rainfall zone. Getting the best of the best and limiting the worst pulling down your average is where canopy management may play a role. GRDC has spent considerable time and effort on identifying the key factors, and I shall attempt to summarise this.

As Fig. 1 below shows we are strictly speaking in terms of Green Area Index (GAI) – how much of an engine do we require to obtain the maximum profitability for our crop? GAI is essentially defined as the amount of green leaf area per unit of ground area.Most inputs that manipulate the canopy are applied during stem elongation. These



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growth stages need to be recognised for both nutritional and disease prevention strategies in order to obtain the maximum GAI. Keeping paddocks weed free by this stage allows efficient utilisation of moisture and nutrition reserves in the soil – as well as keeping our herbicide costs down!

Canopy management requires an acute awareness of soil moisture levels. How does this season compare with an average season? Most crops look great at the start of stem elongation, but they have used little soil reserve of both nitrogen and moisture. From GS30 and beyond the canopy literally explodes and paddocks begin to show some variability based on the soil water holding capacity and/or other factors, like uncontrolled weeds. If the moisture is limiting at the beginning of stem elongation, you will not be able to manipulate your canopy with nitrogen, so the best management principle in this case is not to apply any! Likewise with water logging, the profile will denitrify amongst other things – but to what extent?

Canopy management **cannot** be practised unless you know the soil nitrogen levels. Deep soil testing can assist, as can utilising tissue test benchmarks. However, the simplest benchmark tool we can use is to apply an excess of N at seeding to a small area - N-Rich it!! This area need not be bigger than an average commercial company's trial plot, but it does need to represent the average soil type across the paddock.

During the winter, and definitely in the spring, general crop greenness and vigour can be compared to this area. Where there are large differences in the N–Rich area and the crop, it indicates with confidence that nitrogen is required. Higher soil nitrogen reserves at seeding allow the opportunity to review application rates and timing of further nitrogen. Many areas in 2008 were able to delay the top-up N to just before flag leaf emergence and apply less, whereas we viewed several struggling crops last year at Z30 despite receiving 25 to 30kg/ha N at seeding.

This kind of visual difference has given rise to the advent of crop sensors - Greenseeker® for example - which measures the reflectance of particular wavelengths emanating from the canopy.
Using these wavelengths, this instrument is able to derive the Normalised Difference Vegetative Index – NDVI – which indicates both biomass and greenness of that biomass. These kinds of sensors being employed on tractor mounted booms is probably not far away and will give rise to utilising liquid nitrogen far more efficiently.

There is one area where most people will stumble when it comes to canopy management. If all cereal seed rates are the same for a variety across the farm, and no adjustment is made for seed size or planting date, you have already lost control of the crop canopy! Matching tiller numbers to plant population is a more successful way of gaining sufficient shoots for manipulation at stem elongation than nitrogen application at seeding. How many plants are targeted depends on the sowing date and rainfall zone. Earlier plantings allow more time for tiller development (whatever the cultivar) and likewise in lower rainfall zones, lower plant populations are sustainable than in the wetter areas. More work needs to be done in this area as I have not seen any information alluding to the optimum plant populations for the current more widely grown varieties in terms of differences in seeding rates, dates and nitrogen application timings. Grading seed to obtain our largest seed is important for vigour, although be aware that crop competition by numbers may be

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necessary to obtain greater grass weed control.

Multiple nitrogen applications and later fungicide strategies have presented us with a range of new grower support tools, by way of modelling. From simple nitrogen calculations to the APSIM model (Yield Prophet®) or New Zealand's SIRIUS Wheat Calculator, we now have a better understanding of the interactions taking place between the plant and the environment presented.

While a lot more work is required on the higher end models, particularly for the lower rainfall zones, the results from ground truth trials is encouraging. One thing we do know from this level of work is that it is far more beneficial to target the nitrogen application ahead of a rainfall event – so the 'optimum application window of GS31' is probably more likely to be GS25 (end of tillering) to GS37 (flag leaf just emerging).

Tactical split use of nitrogen has been shown to give equal or superior yields when compared to upfront nitrogen, even in drier years. Logistics can limit some growers. However, this is a management choice that can be altered. Potentially an incorrect balance of shoots to individual grain sites can be created by applying nitrogen upfront. This may not limit yield if the crop manages to finish before water stress approaches, but it has been seen time and again that the most moisture stressed crops in spring are those with the largest canopies. Splitting nitrogen application can encourage a greater nitrogen use efficiency. Trials have shown that crops with lower tiller numbers compensate for yield with more grains/ear and larger grain size, with usually higher proteins. It appears that where moisture is not limited during grain fill, crops are better fed by stem elongation nitrogen. It therefore stands to reason that we should:-

- Ensure a smaller canopy through winter,until early spring.
- Save nitrogen inputs for later in the season, easing the cashflow perhaps?
- Avoid excess tiller formation, thus ensuring better water use efficiency and less tiller loss combined with better nitrogen use efficiency.
- Maintain greenness longer – more contemplation on the use of fungicides BEFORE disease becomes established. Fungicides are there to protect the inherent yield – not create more!

Unfortunately, rainfall is the key influence on what our

crops are capable of. Those in the northern and eastern parts of the wheatbelt know that what has the greatest influence on their green leaf retention is the constraints of high temperatures and low moisture reserves. Acknowledging the key factors responsible for influencing the greatest yield component can be then factored into canopy management strategies.

Which paddocks should we be targeting for canopy management? As highlighted above, they need to have low weed pressures, good background nutrition, optimal pH, good water holding capacity and soil moisture reserved at the break, high nitrogen reserves (high organic matter will play a part these days, more so than good pasture country or lupin stubbles) and good land husbandry. This will ensure an even, more vigorous establishment. Once these are identified, the successful employ of different strategies to manipulate canopies can result in a more efficient crop and better profitably.