

No-till nutrition, warm season crops and weeds

Behold the tortoise. He only makes progress when he sticks his neck out.

I am convinced most farmers should remove all stock from their farm and continuous crop fence to fence for not only maximum profit, but for sustainable farming, improving the family life, and for the environment.

Where's your priority?

Where are you aiming in farming? For mediocrity, or the top? Where you aim is where you will hit and most do not aim high enough.

If you want to farm like you did 20 years ago where you do a working up or three, sow the crop and shut the gate until harvest, you are aiming for the bottom.

If you "attempt" to do what ever is the right thing, you are aiming for the top. Wouldn't you like to be the most profitable farmer in WA? I am sure your family (and bank manager) would like you to.

What about some other goals? May I suggest we all should be aiming for maximum profit, with the least cost (means less risk), with improving sustainability and environmental care.

So many keep trying to fix up the 5% things (five percenters), and keep delaying or ignoring the 20-50% things. Fix the big leaks first before tackling the small ones.

Maximum profit comes from the best financial return for the least cost. For an example of this, trace elements are relatively cheap and can easily give 20+% yield response, yet so many paddocks are marginal to deficient in one or more of them. Why keep on worrying about expensive potash, Urea, phosphate etc... when you are not going to get the maximum response from applying them until you fix up the trace element problems?

Why bother putting Superphosphate on pastures when you don't spend less than \$1/ha to fix up red-legged earth mites?

Why spend \$20-40/ha on new pasture seed when you wont spend \$5/ha on chemical manipulations to fix up poor pasture composition, which will give a much faster and bigger return on investment?

Why won't you put clay on your non-wetting soils and forego one years phosphate fertiliser on some paddocks to pay for it? Every trial I have seen has shown economic responses in year one, and it appears to be a permanent fix giving large responses every year!!! It also makes it so much easier to farm.

Why won't you apply some lime and gypsum every year to paddocks that need it when so many trials show it as an absolute necessity? It can be paid for by reducing phosphate rates on a few paddocks each year.

So what are the "major" things we need to do in cropping? I suggest the following, in no particular order.

- No-tillage seeding
- Clay all non-wetting soils and sandy surfaced soils.
- Apply lime to raise soil pH's towards 5.5 in CaCl_2 .
- Apply gypsum and remove stock permanently from hard setting clays.

- Eliminate all weeds on fence lines, around trees, banks, dams etc...
- Trace element levels to be “high”
- Use up more water than falls.
- Tramlining

No-till and nutrition

In the first few years of no-till, the main difference in nutrition requirements I saw between no-till and full cut, direct drilled crops was a higher nitrogen requirement early in the crops life. As soil structure improved, this difference seemed to decrease.

Since then the scene has changed. Due to low wool prices, crop area increased, as did continuous cropping. Canola, chickpeas, and grass free medic paddocks increased rapidly in the cropping area. These can all increase Root Lesion Nematode numbers, which prune the roots of susceptible crops (eg wheat) slowing the uptake of water and nutrients.

A wheat-canola-wheat rotation is the best rotation for increasing nematode numbers and giving you a problem. If the wheat has its roots pruned, it makes it much harder for it to find immobile nutrients, like trace elements, and phosphate (which can only move through soil very slowly). Less roots also makes it harder to take up water, nitrogen, and potassium. A weaker plant is also more susceptible to other diseases like rhizoctonia.

On many paddocks, all the old research of not needing to add trace elements again for about 20 years after the initial big dose (and mixed in) is just not valid any more. No-till is blamed in some quarters for this because we are not mixing in the nutrients, but yields have dramatically increased over the last 10 years (for many people), which removes extra nutrients, and nematodes have rapidly increased as a problem. Combine this with already marginal or deficient levels of zinc, manganese and copper and it is no wonder why some paddocks fail to yield to expectation.

I suggest you check your plant tissue test results. It is common to have zinc levels of only 12-16ppm, copper of 1.8-2.5ppm, and manganese of 10-15ppm (all these in Youngest Fully Emerged Leaf samples). These levels are all marginal and may not affect the yield in a 1.5t/ha wheat crop with no Glean, Logran or Ally use, and no nematode or other root disease problems. However, if a paddock has a moderate level of nematodes with marginal levels of one or more trace elements, and has a 3.5t/ha yield potential, it is likely to suffer large yield losses (>20%). If phosphate and potassium are also marginal, then the problem can be compounded.

I recommend the target levels be: Zinc >20ppm, Copper >5 and Manganese > 25ppm (again all in Youngest Fully Emerged Leaves at the late tillering stage).

The following tables illustrate what I am seeing in the field. Though Ally is not Root Lesion Nematode, it causes a similar effect in reducing the root area of the plant.

The critical level of manganese is considered to be about 11ppm. Almost all treatments were therefore considered to be adequate for manganese (Table 1). However, by early flowering, the concentrations of manganese were below 11ppm (data was not presented), which resulted in substantial yield losses (Table 2).

Peter O’Keeffe also presented results (at the 7th Aust Agronomy Conference) of a trial with zinc and Glean in a high zinc soil, and showed no yield losses, but showed large yield losses on soils with moderate zinc levels. These again started off at adequate levels in the plant, but developed into deficient levels late in the plant’s life.

Table 1: Leaf concentrations of manganese in wheat at early tillering - from Peter O'Keeffe, SA DPI.

Metsulfuron-methyl (eg Ally) (g/ha)	YEL ^a manganese concentration (ppm)					
	Manganese applied (kg/ha)					
	0	1	3	7	12	Mean
0	18	22	28	41	56	33
3	16	19	24	32	43	27
6	15	18	21	28	39	24
9	14	16	20	29	37	23
Mean	16	19	23	32	44	

^a Youngest Emerged Leaf

Table 2: Grain yield of wheat - same trial as in Table 1.

Metsulfuron-methyl (eg Ally) (g/ha)	Grain Yield (t/ha)					
	Manganese applied (kg/ha)					
	0	1	3	7	12	Mean
0	3.0	3.3	3.6	3.9	4.1	3.6
3	2.9	3.3	3.3	3.6	3.6	3.3
6	2.2	2.5	3.1	3.3	3.6	3.0
9	2.1	2.4	2.6	2.9	3.3	2.7
Mean	2.6	2.9	3.1	3.4	3.6	

It MUST be a priority to make sure trace elements are “high” on all paddocks. This can be done at the expense of phosphate if needed. The best way of overcoming zinc and copper problems in the coming season is to use Summit’s or CSBP’s special No-till fertilisers as they are just what you need in many no-till situations, and are the cheapest and best way of applying zinc and copper.

Table 3 shows why these No-till fertilisers are the main ones you should be using if you need any trace elements. For just over \$4/ha more, you are getting 5 times the amount of copper and 10 times the amount of zinc as in Agflow CZM. Many people will not need 100kg/ha, but 50-70kg/ha, which makes it only \$2-3/ha more. To supply 1kg copper and zinc from the cheapest pure products (like copper oxy-chloride and zinc sulphate), it will cost you at least \$12/ha, but that would only be in a blended form and not in every granule as is needed – plus some extra cost for doing the blending.

Also, you do not have the risk of nitrogen poisoning with the no-till fertilisers and the products are suitable for canola and all pulses (at 40-50kg rates, they would also be quite suitable for lupins).

If you have a deficiency of copper or zinc, there is no cheaper way of applying them than by using a No-till fertiliser in 1999.

Table 3: Fertiliser costings ex Kwinana - freight not included.

Fertiliser	Cost/100kg (\$)	Nutrients supplied at 100kg/ha (kg/ha)					
		N	P	S	Cu	Zn	\$/ha more than DAP
Summit's No-till Special	\$53.30	10	17	10	1	1	\$4.30
CSBP's No-till	\$53.90	11	16	6.7	1	1	\$4.90
AgflowCZM	\$49.00	13.1	17.8	6.5	0.2	0.1	\$0.00
DAP	\$49.00	17.5	20	-	-	-	-

I predict that by using a No-till fertiliser at seeding, it will make it more obvious where manganese and potassium are deficient. Currently many marginal deficiencies of manganese and potassium are masked by deficiencies in zinc, copper, and phosphate.

Trace element deficiency is such a relatively cheap problem to fix and is your No. 1 nutrition priority. Fix up zinc and copper and then aim to get manganese levels high.

Agras is not for No-till

In no-till, we are concentrating the fertiliser in a narrow slot causing closer contact of the fertiliser with the seed, and increasing the nitrogen poisoning potential. This causes less and slower emergence. The problem is compounded at wider row spacings. This is why Agras has caused so many problems with nitrogen poisoning of the crops in no-till. What was once WA's standard seeding fertiliser has now become one of the least desirable for the new way we are farming.

With only 7.6% phosphate, but 17.5% nitrogen and 17% sulphur, to get enough phosphate on you will be adding far too much nitrogen to be safe to the seed, and far more sulphur than your cereal crop will need. For example (also see Table 4): To supply 17 units of phosphate like 100kg of Summit's No-till Special fertiliser does, you need 224kg Agras, which costs ~\$73/ha, or an extra \$20/ha more than No-till Special. The biggest problem though is that at 224kg/ha, you would go close to killing all of your crop in no-till seeding. You are also adding a huge waste of sulphur, and would have to fill up many more times in the paddock when seeding. These reasons are why I state that Agras is not for no-till.

Table 4: Cost comparison between Summit's No-till Special and CSBP's Agras No. 1 for the same rate of phosphate (P).

Fertiliser	Cost (\$/ha)	Nutrients supplied (kg/ha)				
		N	P	S	Cu	Zn
Summit's No-till Special	\$53.30 (100kg/ha)	10	17	10	1	1
Agras No. 1	\$73.47 (224kg/ha)	39.2	17	38.1	-	0.13

It is wrong to say that it is best to use Agras for canola, which needs a lot of sulphur, because the nitrogen is going to cause germination problems if you apply enough phosphate.

In a 10-12" row spacing in no-till, you should not be using more than 10 units of nitrogen close to the seed (100kg/ha of a 10% nitrogen fertiliser, or ~60kg Agras). However, 60kg Agras only supplies 4.5 units of phosphate, which is nowhere near enough (generally speaking).

Prior to this season, there was no ideal seeding fertiliser for no-till that had high phosphate, low nitrogen, some sulphur (in the sulphate form) and high zinc and copper levels in every granule. So I asked CSBP and Summit last year if they would make a seeding fertiliser suitable for no-till. I asked for a fertiliser that handles like Agras in moist conditions, and to have approximately the following nutrients in every granule (a compound and not a blend): 10% nitrogen, 17% phosphate, 10% sulphur, 1% zinc and 1% copper. They both have and fortunately have priced them where they should be the main fertilisers for most people.

There have been two main arguments against my request from some quarters. 1) You just don't need such high levels of trace elements, and 2) distribution of the granules is more important than the amount of trace elements.

I disagree strongly with both these arguments.

- 1) What was working in the past with trace elements is not working, especially in a nematode situation (eg after canola – Post Canola Syndrome!!!). A full dose of Super CZM or Agras CZM and worked in should have been enough trace elements to last for 20 years. However, there are many paddocks that have had trace elements incorporated this way within the last ten years and are suffering trace element deficiencies – even though products like Agflow CZM or DAPSZC have been used in the mean time. The problem is most severe in cereals after a canola crop. The results presented in Tables 1 & 2 are what I am seeing in the field more and more, so we do need to add higher rates of trace elements.
- 2) Trace element deficiencies are so important to yield that we cannot afford to take several years to fix up the problem. The deficiency must be corrected immediately and fully. Products like DAPSZC and Agflow CZM have not prevented deficiencies (induced or real).
- 3) We need to get maximum profit from this year's crop, and not just be concerned about next year's crop not having trace elements next to the seed. This means that if you sowed next year's crop without trace elements, some of the seed will be in between last year's row and be too far away to get trace elements (unless you add trace elements again). My advice is that most people will need to add high amounts of trace elements for two, maybe three years in a no-till situation, but this year's crop is the priority to make sure it is not deficient.
- 4) Cultivation to mix in trace elements is just not a desired option for erosion and weed control reasons. This is a very large topic that I will only touch on in the "Better Way" section below.
- 5) It is the cheapest way of adding trace elements this season (have a look at someone's Optifert software to see this, and Table 3.). Using a No-till fertiliser should prevent the need for a trace element spray later on (though manganese will still be needed on some areas), will not give nitrogen toxicity, and will give the plant it's best chance of tolerating nematodes.
- 6) The argument of not needing 1% copper and zinc may be true if it was not the cheapest way of adding trace elements. A 0.5% level would be good for next year, especially if the price is not too expensive, but if 1% is still the cheapest, then why complain? I am far more concerned about fixing up the trace element problem immediately (this year's crop) rather than over several years and miss out some yield each year until the levels are high.

To use an excellent quote from Arthur Hearn:

"The scientist may say there is not enough data, let's get some more! The engineer (agronomist) makes best use of what data is available"

No seed = no weed !!!!

So simple, but profoundly true. Dwayne Beck from South Dakota in the USA asks a very important question we all need to answer when we have a weed in our crop. “What have I done to allow that weed to be there?”

I strongly believe that aiming for economic control of weeds is wrong (right in the short term, but wrong in the long term). Only achieving economic weed control just makes techniques like crop-topping, herbicide resistant crops, autumn tickles etc... continue to be necessary, as well as the need to keep on using herbicides every year. Isn't there a better way? Wouldn't all these things be mostly unnecessary if there were no weed seeds in the first place?

Waterlogging

Let's consider another problem and that of waterlogging. Even I used to promote not to crop waterlogged prone areas in a paddock because the risk of crop failure was so high. Going around “wet” areas in a paddock so that they are not seeded and fertilised was sometimes impractical, but is now much easier with GPS technology. Drains are also a very cost effective means of alleviating some waterlogging, however, I now believe there is an even better way to farm many waterlogged areas.

The Better Way

The better way is to start by doing the right things, and by asking questions along the line of “what have I done to let that weed be there”? eg. “What have I done to allow waterlogging to happen in this spot”?

Let's say you had a wheat paddock this year with lots of resistant ryegrass in it and it is now stubble. Normally today we would suggest that this year you look at an autumn tickle, perhaps a burn, delayed sowing, higher seed rate, increased nitrogen and fertiliser to compete better against the ryegrass and most likely a Roundup then Sprayseed knockdown and a TT canola with Atrazine, and maybe even some Treflan. Seed catchers work (though select for ryegrass and other weeds that shatter), but are one of many short-term solutions to the problem.

The above are such big and continuing costs for allowing weeds to set seed! Even if you had crop-topped the wheat, some ryegrass will still set seed needing some of the above treatments this coming season, and no doubt you would have lost some of your income in the wheat by crop-topping it.

I believe the better way is to remove all livestock and consider a summer crop in the rotation, probably no matter where you are in the cropping areas, but certainly for most of the current cropping areas in southern WA.

In conjunction with good farm hygiene (spraying out fence lines, controlling all weeds around dams, sheds etc...), a summer crop can eliminate all weeds that year from setting seed, use up water and nutrients beyond the depth our winter crops can, and may even make some good money. However, I believe we should be very happy just to cover our costs growing a summer crop as there will be at least several subsequent crops that will have less cost, less risk and higher yield potential because of that one summer crop.

To explain further, if you planted a sorghum crop in Spring with Atrazine and did not allow any weeds to grow for several months before planting, then you have made it extremely difficult for a winter weed to complete it's life cycle. We have not only used a chemical to control weeds, but have shifted the growing season to be antagonistic to their success (setting seed). In this scenario, following up with a TT canola would be the logical choice, or on the south coast on a wet prone paddock, perhaps another summer crop, like sunflowers, to dry the soil out even further?

It makes it even harder for a weed to germinate and succeed the longer you have been in no-till, and with the complete absence of livestock from the paddock. Livestock push weeds back into the soil. If we only let weed seeds stay on the surface amongst lots of stubble, then that gives us an excellent form of weed control. To me, stimulating a weed to germinate also gives it a chance to survive. If we do everything possible to not let them germinate, we go close to winning the battle. If none set seed, nor germinate, we win the battle.

This is why the following crops will have less cost (very little, or no weeds means less cost to control them), less risk (because weeds are not there to cause crop damage and none or less chemical means none or less risk of chemical damage), and a higher yield potential because there is little yield loss from weeds, and much less root disease (like take-all).

Yes sheep can control weeds, but they are also a cause of weeds. Sheep in our farming system inherently means compromise. No sheep does mean less weeds, less erosion, less stubble bunching, less cost in cropping, more holidays, better family life and more profit. I guess you can see why I started off by talking about the tortoise and his neck. However, I am convinced this is the better way we should be farming in southern WA.

I think that within several years of cropping the better way, knife points will not be wanted on many paddocks because we do not want weeds to be covered or stimulated to germinate, and there should be minimal need for Treflan type products. Disc type seeders should become the preferred seeding method on most paddocks.

Now to waterlogging, salinity and the better way of cropping. A summer crop can put roots down considerably deeper than our winter crops, therefore using up water and nutrients that are only contributing to the water table problem by being left behind under a winter crop or pasture system.

We cannot keep on just growing winter crops to use up water. It is unsustainable!!!! We must use deeper rooted plants, be it trees, lucerne or summer crops, or all three. Summer crops are the easiest to incorporate into the cropping rotation because trees and lucerne need to be in the one spot for at least a few years.

If a summer crop has dried the soil down to 2 metres (instead of perhaps only 1m with a winter crop), then obviously it will take a lot longer for the soil to become water logged. This is why it will help lower the water table, as well as greatly reduce the risk of waterlogging in the winter crop.

What about a green manure crop for weed eradication? This is certainly a good option too, though it is a nil income year (some would say just like lupins ☺) and doesn't use up enough water. At least with a summer crop it uses up more water and can make money. Carting a green manure crop off as hay or silage removes much of the nutrition and carbon that we want in the soil.

What about a hay crop? Similarly to the green manure, it can give complete weed control, but does not use up enough water and you remove very large amounts of nutrients (potassium particularly) and carbon.

What about lucerne? Grown as a crop, and not just as a few plants per square metre, lucerne will lower the water table by using up large amounts of water outside the winter growing season. I have yet to see data (may be presented at this conference?) showing a water use comparison between a summer crop and lucerne. Just looking at the growth in summer of a summer crop compared to lucerne makes me think a summer crop is using up much more water than lucerne, but how that compares to 12 months water use, time will tell.

However, lucerne is a tool to consider planting on recharge areas, but it needs to be grown as a crop and be much thicker than is currently the practice. As with summer crops, the marketing, or what to

do with the cut lucerne is a problem that needs solutions developed for – assuming no livestock walk on the paddock remember, otherwise they would just graze the lucerne.

Nevertheless, it is the total water use that must be a priority for a sustainable future. Dwayne Beck introduced us West Aussies to Kansas farmers as *“the farmers who come from the land of droughts where the biggest problem is too much water”*. Too true and a very apt description that should motivate us to change.

What about oil mallee and other trees? Yes, these are a very good option for using water on or above recharge areas. They should be used wherever practical, especially if they make money.

Summary

It was during the last decade that for the first time since Adam laid longing eyes on Eve, there was more arable land removed out of production than was brought into production. To explain, Mankind cleared more land for agriculture as population increased. Over time, some agricultural land was taken out of production for housing, roads, industry, salinity, re-forestation etc...

Now that this critical point in Earth's life has been passed, the world must now produce more and more off less and less for more and more people and animals.

Mankind can do it, but because of Mankind's other nature, plus some inevitable natural disasters, there will be times when food in many parts of the world will be scarce. Regardless whether people can pay for it or not, people must eat to survive. Food prices will be volatile and there will be a harvest or three soon when the price of produce will be double today's prices.

The top farmers are the ones who will kill the fatted pig in these years, as well as still make some profit or small losses off poor years when the majority make large losses. It is no good deciding to become a “top” farmer” when wheat is \$250/t. You need to start now to reduce costs/tonne of grain, maximise profits, and improve the sustainability of your farm.

So use no-till correctly, preferably with no sheep or cattle, use summer crops in rotation, have good farm hygiene, and fix up the 20-50% jobs ASAP.

May you be good stewards of the land and be in the top 5% of farmers in the near future!! Happy farming.

Wayne Smith
(Agronomy consultant)

Agronomic Acumen
Ph 9842 1267
Fx 9842 1964
wsmith@agronomy.com.au