Wheat Seed Rate x Nitrogen Rate x Soil Type

Aim: To observe how seed rate and nitrogen rate impacts wheat yield and quality in two different soil types.

Background: The varying soil types of the dune swale systems on the northern Yorke Peninsula can be difficult to manage in regards to seed rate and nitrogen rate. With vastly different water holding capacities, matching input rates and tiller counts to soil type can be challenging. This trial looks at the interaction of these factors to attempt to find out the best options for maximising biomass and yield, thereby reducing the risk of erosion.

Results:

Table 1. Summary of yield and protein assessments: Sandhill.

UAN Rate /ha	Seed Rate /ha	Yield T/ha	Ave. Yield T/ha x UAN rate	Protein %	Ave. Protein % x UAN rate
45L + 90L	50kg	1.01	**1.05**	12.9	**12.7**
	75kg	1.09		12.7	
	100kg	1.06		12.5	
90L + 90L	50kg	1.14	**1.12**	12.7	**12.7**
	75kg	1.11		12.5	
	100kg	1.11		12.8	
0L + 90L	50kg	1.21	**1.23**	11.5	**11.3**
	75kg	1.17		11.3	
	100kg	1.32		11.2	
Ave. Yield T/ha Seed Rate	**50kg**	**1.12**			
	75kg	**1.12**			
	100kg	**1.16**			

Table 2. Summary of yield and protein assessments: Clay loam flat.

UAN Rate /ha	Seed Rate /ha	Yield T/ha	Ave. Yield T/ha x UAN rate	Protein %	Ave. Protein % x UAN rate
45L + 90L	50kg	4.58	**4.08**	12.8	**12.4**
	75kg	4.11		12.0	
	100kg	3.56		12.4	
90L + 90L	50kg	4.29	**4.04**	13.3	**12.8**
	75kg	3.95		12.7	
	100kg	3.88		12.5	
0L + 90L	50kg	4.71	**4.34**	11.4	**11.2**
	75kg	4.04		11.2	
	100kg	4.28		11.1	
Ave. Yield T/ha Seed Rate	**50kg**	**4.53**			
	75kg	**4.03**			
	100kg	**3.91**			

Discussion:
This trial, whilst only replicated twice, has shown some strong trends that can assist with matching seed and nitrogen rates to soil type.

Soil Type: The first noticeable result is the large yield difference between the sandhill and the clay loam flat. For a later sown crop such as this one, the sandhill did not establish very well in the cooler winter months and struggled to promote tillers and thus yield. The reason for the poor establishment is likely due to a low organic carbon and nitrogen level, which was preceded by heavy rainfall in May that leached nitrogen away. The clay loam flat, with its heavier soil type, was able to retain more mineralized nitrogen.

Seed Rate: In the sandhill soil type, the increase of seed rate only had a minimal impact on yield. There was no difference in increasing from 50 to 75kg/ha, however, the increase to 100kg/ha did see a slight increase of 40kg/ha in yield. The small variation in yields between the seed rates demonstrates that the sandhill only had low yield potential right from the emergence of the crop, again, probably due to nitrogen being the greatest limiting factor.

The difference in yield between seed rates in the clay loam flat is much more apparent. Increasing from 50 to 75 to 100kg/ha saw the yield decrease. This observation has been made before and is primarily driven by too many tillers in the higher seeding rate competing for resources to fill grain. Higher seeding rates generally produce more biomass, using up more resources like nutrition and water, leaving little for the key grain filling time. Less tillers in this environment led to more available resources during grainfill, bigger heads of grain and therefore more yield.

Nitrogen Rates: In respect to the way the season finished off with a dry October, it could be argued that the highest nitrogen rates (90 + 90L/ha UAN) was too high. Indeed, there would not have been too many grain producers applying 90L/ha of UAN on September 11th this season. The trend of nitrogen rates on the sandhill show the best result with one application of UAN at early booting; however, this had the lowest protein, which would have placed it outside the specifications for H2. In the clay loam flat, there was very little yield difference between 45 and 90L of UAN applied at first node. The single application of UAN at 90L at early booting easily had the highest yield, nearly 300kg/ha more than the next treatment. This would probably go against typical thinking, but it must be taken into account that this is not a replicated trial. Perhaps, the earlier applications of nitrogen at first node saw more secondary tillers set which petered out when September remained dry, whilst the treatment that had no nitrogen applied at first node, had less secondary tillers and thus was able to fill all those it had.

Again, it is not surprising that the treatments with two applications of nitrogen (in both the sand and clay loam flat) had significantly more protein than the single application. This protein level pushed it up to a H2 grade, although it is debatable whether this would have been economic. What does stand out with the protein levels when comparing the two soil types is that the average yield across all treatments in the sandhill was 1.14T/ha and 12.2% protein whilst the clay loam flat averaged 4.16T/ha and 12.2% protein as well. This indicates a very poor conversion rate of nitrogen into protein in the sandy soil type. It would naturally be expected that this would be in residual for next season though.

Take Home Points:

- Sand hills, or sandy, lighter rises, require more nitrogen early in the crop's life to promote vegetative growth/tillering. This is due to the low organic carbon present, less mineralization and also ability of the sand to leach valuable nutrients deeper into the profile.
- On a wet year like 2013, even high amounts of nitrogen applied after seeding can be lost due to leaching. Further trials may be required to assess nitrogen stabilisers in these soil types in wet years.
- Seeding rates can be lowered in the heavier/loamier flats due to the inherent fertility available there. This leaves more nutrition and moisture available for later in the year, which is especially vital if moisture becomes limiting later during a spring drought.
- Conversely, in a paddock with weed problems, thought should still be given to higher seeding rates in the flats for weed competition. It has been well researched that increasing seeding rates assists with reducing weed seed set.
- Finally, this trial again documents the huge differences in soil type and how we need to treat them differently with each crop. Sowing rates at seeding, and nitrogen applied after seeding, are two of the biggest controllable factors that can influence yields in the NSS's dune swale landscape.