Cotton Catchment Communities CRC
Queensland Government Department of Primary Industries and Fisheries

COTTON *TALES*

Central Queensland

2007/08
No.2
24/08/07

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Nitrogen Use Efficiency Assessments

Last season nitrogen use efficiency assessments were conducted on 8 fields (from 4 different enterprises) in Emerald, as part of a wider industry benchmarking survey. While insufficient N will reduce yields, overuse of N is not only a waste of money, it also delays maturity, causes defoliation problems and can potentially reduce yield. There is also growing community pressure over fertiliser use due to the energy required to manufacture as well as Nitrous Oxide (N_2O) emissions (a greenhouse gas with 300 times more warming potential than CO2) and Nitrate (NO_3) in water.

What did we do?

We measured crop N uptake which is the amount of N (kg N/ha) taken up and contained in the crop. Measuring crop N uptake involves taking 1 square metre of crop (whole plants) after cut-out and approximately 3 weeks before defoliation (at about 10-15% bolls open) and before leaf starts to drop. These plants are then dried, weighed, ground and analysed for N content.

Crop Nitrogen Use Efficiency (NUE) indicates how effectively a crop produces lint yield from the N that it has accumulated. The crop NUE measurement does not discriminate between soil N or fertiliser N sources and is therefore independent of how much N fertiliser was applied. It indicates how efficiently the cotton crop uses all N sources available to it. It is measured by dividing the lint yield by the crop N uptake (i.e. kg lint produced per kg N uptake). Hence, crop N uptake and crop yield must be determined.

Nitrogen use-efficiency– what is our target?

Based on long-term cropping systems experiment at ACRI, NUE values between 11 and 13 indicate that N fertiliser rate was sufficient. Values less than 11 indicate excessive rates of N fertiliser may have been applied. Values greater than 13 indicate insufficient N fertiliser may have been applied, that the crop was drought stressed or another nutrient deficiency limited crop development.

One of the lessons to be learnt from the data below is that the crop can take up Nitrogen that exceeds its requirements. For example, the highest yield was not produced from the crop with the highest amount of nitrogen uptake. NutriLOGIC and NUTRIpak provide guidance to critical levels and fertiliser requirements. With the cost of fertiliser increasing quickly, there could be some significant savings to be made. The one thing to be careful of is that there is nothing restricting the plants ability to take up nitrogen, such as soil compaction, waterlogging, or deficiency of another key nutrient.

Parts of this article have been taken from an article by Ian Rochester published in the August/September 07 Cotton Grower Magazine. Thanks to Ian Rochester, Julie O'Halloran & the co-operators for their assistance with this trial.

For 07/08 we plan to continue NUE monitoring, and would like to have sites in both Central Highlands and Dawson. If you would like to participate please contact Susan or Doug.

Table 1. Crop dry matter (DM), crop N uptake, lint yield, N use-efficiency (NUE), estimated amounts of N fertiliser (kg N/ha) applied in excess (or insufficiency), soil analysis for start & end of season and actual fertiliser applied (Emerald Data)

Site	Crop DM	N uptake	lint	lint	NUE	Fertiliser excess	Start Soil test		End Soil Test		Units N applied
	t /ha	kg N/ha	b /ha	kg/ha	kg/kg		Nitrate N ppm	Ammonia N ppm	Nitrate N ppm	Ammonia N ppm	
1	18.5	289	11.5	2611	9.0	76	na	na	na	na	200
2	16.8	359	11.2	2542	7.1	126	31	0.8	5	13.5	150
3	9.4	208	10.4	2361	11.3	16	6.3	0.9	13.9	7.6	200
4	13.8	238	9.6	2179	9.2	72	33.3	nt	5	14.5	130
5	9.6	144	9.9	2247	15.6	-95	4.6	2.1	6.4	20.5	180
6	11.2	268	8.3	1884	7.0	127	19.4	2.7	23.2	nt	219
7	11.6	151	8.3	1884	12.5	-13	19.4	2.7	23.2	nt	219
8	9.2	163	9.3	2111	13.0	-26	33.3	nt	1.6	12	130