



Improving topdressing recommendations for rice

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- The current nitrogen fertiliser topdressing rates for rice (PI topdressing) have been revised using historical trial data to provide better outcomes for growers
- Farmers should aim for a plant nitrogen uptake of between 100 and 140 kg N/ha at panicle initiation (PI) to achieve top yields and the most efficient use of nitrogen fertiliser
- Inappropriate recommendations can occur due to inaccurate sampling area, by sampling in areas not representative of the field or sampling at the wrong growth stage

Rice growers' expectations of yield have increased considerably in the last 10 years or so. Of recent years, some farmers have considered the recommended panicle initiation (PI) nitrogen fertiliser topdressing rates based on NIR tissue testing to be lower than crop requirements. Upon investigation it was discovered that the PI nitrogen topdressing recommendation tables presented in Ricecheck and used by the NIR tissue testing service have not been updated since 1996.

A project was established to use data from the many district nitrogen experiments conducted by NSW DPI to determine the suitability of the current PI nitrogen fertiliser topdressing

recommendations and to revise the recommendations if necessary.

Data were accumulated from 86 experiments conducted over 16 seasons from 1986 to 2006. From these experiments 310 treatments were identified that included replicated results comparing zero and PI applied nitrogen fertiliser treatments. Most experiments were located in commercial crops with deep water applied during the young microspore stage of pollen development (microspore), and included the varieties Amaroo, M7, Jarrah, Millin, Opus, Langi and Quest. Table 1 lists the years in which the experiments were conducted and the researchers who undertook the experiments.



Figure 1. Fertiliser recommendations for nitrogen topdressing at PI have been updated to reflect the increase in yield potential and grower expectation of crop performance over the last 10 years

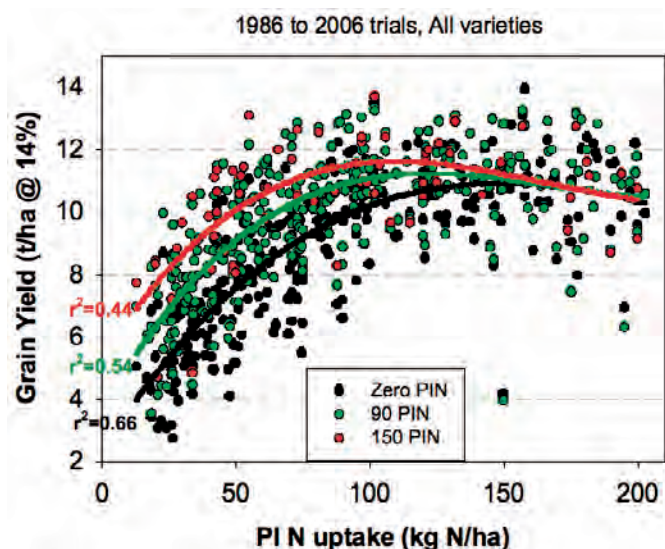


Figure 2. Combined results from the 86 district nitrogen experiments showing the grain yield achieved for each treatment at the measured PI nitrogen uptake

Results

Treatments were selected from the experiments that had replicated comparative zero and PI applied nitrogen fertiliser treatments. All of the relevant results from the 86 experiments are included in Figure 2 which shows the grain yield achieved for each treatment at the measured PI nitrogen uptake. The black dots illustrate the yield when no nitrogen was applied at PI, while the green and red dots represent the grain yield when corresponding plots received either 90 and 150 kg N/ha at PI, respectively. The regression curves developed from the experimental data represent the average yields for 0, 90 and 150 kg N/ha PI applications for a number of semi-dwarf varieties over many seasons, districts and soil types.

Using the fitted curves displayed in Figure 1, differences in grain yield between the 0, 90 and 150 kg N/ha PI applied nitrogen fertiliser treatments can be determined (Table 2). Figure 1 shows that when PI nitrogen uptake is greater than 150 kg N/ha, yield does not increase, regardless of the nitrogen applied at PI, and in fact decreases at very high nitrogen uptakes.

To determine suitable PI nitrogen fertiliser topdressing rates economic factors must also be included. The grain yield and

Table 1. Nitrogen experiments used in reviewing the PI nitrogen topdressing recommendations

Years conducted (Year of harvest)	Researchers
1986, 1987	Bacon, T. Dunn
1993, 1994	Batten, Ciavarella
1995, 1996, 1997	Williams, Beecher, B. Dunn
1996, 1997, 1998	Batten, Ciavarella
1998, 1999, 2000, 2001, 2002	Williams <i>et al.</i>
2003, 2004, 2005, 2006	Subasinghe <i>et al.</i>

Table 2. Grain yield (t/ha) for treatments with 0, 90 and 150 kg N/ha applied at PI over a range of PI nitrogen uptakes

PI N uptake	Yield 0 PI N	Yield >90 PI N	Yield >150 PI N
40	6.8	1.6	2.6
60	8.3	1.4	2.3
80	9.4	1.2	1.8
100	10.2	0.9	1.4
120	10.7	0.5	0.9
140	10.9	0.3	0.5
160	10.9	0.1	0.2
180	10.7	0.0	0.0

Table 3. New rice PI nitrogen topdressing recommendations

Variety group	Water depth @ microspore	PI Nitrogen uptake (kg N/ha)					
		40-60	61-80	81-100	101-120	121-140	>140
Nitrogen fertiliser recommendation (kg N/ha)							
Amaroo, Quest, Illabong, Jarrah, Langi, Opus, Reiziq	Deep	150	120	90	60	30	0
	Shallow	120	90	60	30	0	0
Kyeema, Doongara, Koshihikari	Deep	120	90	60	30	0	0
	Shallow	90	60	30	0	0	0

Table 4. Previous rice PI nitrogen topdressing recommendations (Source: Ricecheck Recommendations, 2007. NSW DPI)

Variety group	Water depth @ microspore	PI nitrogen uptake (kg N/ha, from Table 7)								
		<28	28–42	43–57	58–72	73–87	88–102	103–117	118–132	> 132
Amaroo, Quest, Illabong, Jarrah, Langi, Opus, Reiziq	Deep	<28	28–42	43–57	58–72	73–87	88–102	103–117	118–132	> 132
	Shallow	–	<23	23–37	38–52	53–67	68–82	83–97	98–112	> 112
Kyeema Koshihikari	Deep	–	–	–	< 38	38–52	53–67	68–82	83–97	> 97
	Shallow	–	–	–	–	–	<33	33–47	48–62	> 62
Doongara	Deep	–	–	< 33	33–47	48–62	63–77	78–92	93–107	> 107
	Shallow	–	–	–	–	< 28	28–42	43–57	58–72	> 72
Recommendation (kg N/ha)		135	120	105	90	75	60	45	30	nil

nitrogen relationships are combined with the cost of applying the fertiliser and the extra income achieved from the change in grain yield. The recommendations (Table 3) are based on a 2:1 benefit cost ratio. Recommendations for shallow water and for the varieties Kyeema, Doongara and Koshihikari are calculated from the variety and deep and shallow water relationships developed in the maNage Rice computer model. These relationships, combined with the historic nitrogen experimental data, are the basis of the new PI nitrogen topdressing recommendations.

The new recommendations (Table 3) are simpler and easier to interpret than the current recommendations (Table 4). The nitrogen fertiliser topdressing recommendations that will be produced from the NIR tissue test service and faxed to growers in the 2008–09 rice season will be at a finer scale than Table 3, with PI nitrogen uptake ranges of 10 kg N/ha and fertiliser application increments of 15 kg N/ha.

Differences between current and new recommendations

In the new table, recommended nitrogen rates for PI topdressing have been increased in the lower and mid nitrogen uptake ranges, compared with the current recommendations (Table 5). It is evident from the historic nitrogen experiment data that applying nitrogen fertiliser when the PI nitrogen uptake is above 150 kg N/ha is not economically viable. It should be noted that the PI nitrogen topdressing recommendations are only suitable if the rice crop is accurately sampled at panicle initiation. Inaccurate sampling area, samples taken in areas not representative of the field or at the wrong growth stage will lead to inappropriate recommendations.

Further information

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Table 5. Current PI nitrogen topdressing rates compared with the new recommendations for the main variety group with deep water at microspore

PI uptake ranges (kg N/ha)		Nitrogen topdressing recommendation (kg N/ha)		Increase in rec. rate (kg N/ha)
New	Old	New	Old	
40–60	43–57	150	105	45
81– 100	88–102	90	60	30
101–120	103–117	60	30	30
> 140	> 132	0	0	0



Figure 3. Accurate PI fertiliser recommendations depend on samples for NIR assessment being collected from areas representative of the field, at the right growth stage and according to sampling instructions