



MAIZE GRAIN RESEARCH 2024



PIONEER[®]
BRAND · PRODUCTS

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INTRODUCTION

Welcome to the Pioneer Maize Grain Research update for 2024.

For many years we've produced Maize Grain Hybrid Performance Information which provides

comprehensive hybrid yield data enabling growers to make informed decisions on which hybrid to plant. However, our research programme covers so much more than just hybrid evaluation. Each year we aim to deliver more value to growers by conducting a range of agronomic, farm system and environmental research. In this publication, we've summarised some of our latest nitrogen research.



An IMPACT™ small plot planter at Gordonton, Waikato. IMPACT is the acronym for “Intensively Managed Product Advancement and Characterisation Training” trials.

Long term breeding delivers higher yields

The annual rate of increase in maize grain yield in New Zealand is estimated to have been over 180 kg/ha/year over almost 60 years (Figure 1). Crop management and genetic improvement have both made significant contributions to yield increases.

A newly introduced Pioneer hybrid will usually have considerable yield advantage over older hybrids. To maximise returns, grain growers should look to introduce suitable new hybrids regularly. Desired harvest timing, soil type, cultivation methods and agronomic traits such as early growth, drought tolerance, stalk and root strength, disease resistances and grain quality are all important considerations to include in the hybrid selection process.

The most reliable way to select superior hybrids is to consider trial yield and grain quality data gathered over several seasons from a wide range of locations within a growing region. Individual on-farm trial results should not be used to select a hybrid because in isolation, they are not a reliable predictor of future hybrid performance. Hybrids should be planted and harvested at the same time. Trial data should be statistically analysed to determine if there is a real yield difference between the hybrids being compared.

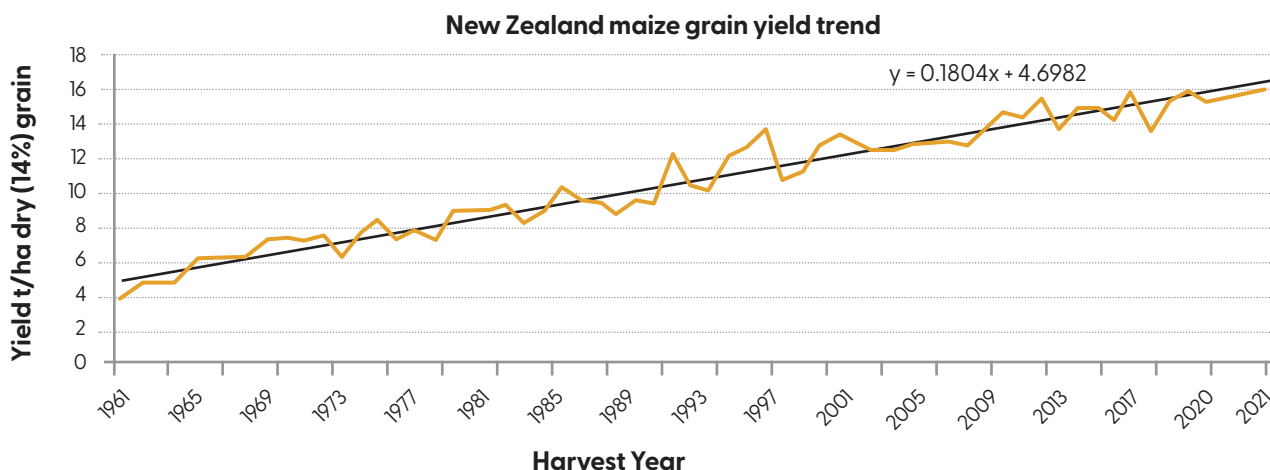
This publication provides a summary of the investment made to evaluate the yield performance of Pioneer® and other brands of maize grain hybrids in five defined growing regions; **1)** Northland and South Auckland **2)** Waikato **3)** Bay of Plenty **4)** Gisborne and northern Hawke's Bay **5)** Lower North Island and South Island.

Summarised hybrid comparison data published in this book has been collected from field trials conducted over one or more growing seasons up to and including the 2023 harvest. The most recent regional Hybrid Performance Information (HPI) can be found at pioneer.nz.

Sometimes we publish comparisons between hybrids which were not trialled during the most recent growing season. There are two main reasons why this happens. Firstly, where two commercial hybrids have been extensively trialled and a statistically significant difference has been achieved, there is no need to continue trialling these hybrids. Secondly, not all competitor hybrids have trial seed available every season. In addition, because trial results are published prior to the spring sales season, we occasionally publish comparisons which include recently retired competitor hybrids.

It is impossible to publish every possible hybrid comparison. When determining which competitor hybrid comparisons to publish we:

- **only publish comparisons where the P value is less than 0.10 which means there is a greater than 90% probability the reported yield difference is real and not just due to chance. This includes trials where the result is commercially acceptable (CA) (see opposite page). Consequently, comparisons involving new hybrids may take several seasons to generate sufficient data to publish.**
- **don't compare hybrids based on Comparative Relative Maturity (CRM) ratings because there is no industry standard. This means hybrids from different companies can have the same CRM rating but take varying amounts of time to reach grain harvest maturity.**
- **only include comparisons where the grain harvest moisture difference is +/- 2%. This is an objective measure and a more robust way to compare the relative maturity of grain hybrids. We also always publish the actual harvest moisture difference so growers can consider this as a measure hybrid maturity along with grain yield in their hybrid decision making process.**



Source: New Zealand Year Book (1961 to 1996) and Pioneer® brand products New Zealand Research Programme (1997 to 2020).



Interpreting the hybrid comparison t-test

The table below presents a summary of the possible t-test outcomes.

P value	Confidence level	Scientific designation	Level of significance	Yield advantage	Interpretation
<0.001	>99.9%	★★★	Very highly significant	YES	Hybrid superiority for yield can be claimed. Can confidently plant the winning hybrid providing no key agronomic traits are limiting. Check the trait ratings for any considerations.
<0.01	>99.0%	★★	Highly significant	YES	
<0.05	>95.0%	★	Significant	YES	
<0.10	>90.0%	CA	Commercially acceptable	YES	Not a significant result, but may be regarded as a commercially acceptable basis for a decision.
>0.10	<90.0%	NS	Not significant	NO	Hybrid superiority for yield cannot be claimed. Ignore the yield comparison and refer primarily to important trait ratings to select between the hybrids.

The more stars (★) present for the comparison, the more confident we can be that the measured average yield difference is due to an actual genetic yield difference between the two hybrids rather than just chance.

Where a result is commercially acceptable (**CA**), the P value is <0.10 indicating the result is suitable for making a hybrid decision based on yield. Always remember to include key agronomic traits in your hybrid selection process

Where a result is not significant (**NS**), we cannot conclude there is a yield difference between the hybrids. There are two principle explanations;

1. Where the yields are very similar and the comparison has been made over a large number of locations, no significance may indicate there is little measurable difference between the two hybrids or;
2. Where there appears to be a large yield difference, no significance likely indicates there are too few trial locations, or there have been inconsistent or fluctuating results. It is therefore not possible to indicate that the difference is real.

In both instances above, growers should use regionally important hybrid trait ratings to select which hybrid to plant.

In other comparisons, yield differences may appear to be relatively small but still achieve significance – this happens in cases where yield data quality is high, and the number of trial locations is large.

A t-test analysis of statistical significance is carried out on all Pioneer hybrid comparisons and we take great care to base our product yield statements and recommendations on the outcome.





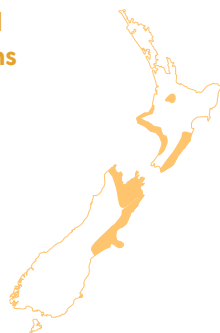
HIGHER YIELDS FOR SOUTHERN GROWERS.

CRM 82

Feature hybrid	Comparison hybrid	Number of trials	Harvest moisture difference (%) ¹	Yield advantage to P8240 (kg/ha) ²	Yield statistical significance ³	Test weight difference (kg/hl) ²
Lower North Island & South Island						
P8240	P8000	23	-0.39	1,371	★★	-2.26
P8240	P8086	8	0.20	78	NS	0.93
P8240	P8333	22	-0.42	813	★	-1.43
P8240	P8666	26	0.02	-83	NS	0.33
P8240	P8711	18	1.04	-1,723	★★	0.05

¹Positive harvest moisture differences indicate that the bolded Pioneer hybrid was drier at harvest, negative harvest moisture differences mean it was wetter. ²Positive yield and / or test weight differences indicate the bolded Pioneer hybrid had higher yield and / or grain test weight. ³For information on interpreting hybrid comparison data and statistical significance see page 3. Includes all data to the end of the 2023 harvest.

Recommended growing regions



Recommended established plant populations (000's/ha)

- Challenging yield environments **90**
- Medium yield environments **100**
- High yield environments **115**





PRODUCTIVE OPTION FOR COOLER REGIONS.

CRM 83

Feature hybrid	Comparison hybrid	Number of trials	Harvest moisture difference (%) ¹	Yield advantage to P8333 (kg/ha) ²	Yield statistical significance ³	Test weight difference (kg/hl) ²
Lower North Island & South Island						
P8333	P8000	45	-0.13	1,269	★★★	-1.19
P8333	P8086	8	0.49	-1,117	NS	1.29
P8333	P8240	22	0.42	-813	★	1.43
P8333	P8666	47	0.52	-593	★★	1.69
P8333	P8711	20	1.72	-2,309	★★★	1.69
P8333	P8805	35	0.11	-579	CA	1.89

¹Positive harvest moisture differences indicate that the bolded Pioneer hybrid was drier at harvest, negative harvest moisture differences mean it was wetter. ²Positive yield and / or test weight differences indicate the bolded Pioneer hybrid had higher yield and / or grain test weight. ³For information on interpreting hybrid comparison data and statistical significance see page 3. Includes all data to the end of the 2023 harvest.

Recommended growing regions



Recommended established plant populations (000's/ha)

- Challenging yield environments **85**
- Medium yield environments **95**
- High yield environments **105**





BALANCED ALL-ROUND PLANT DESTINED TO “TIP THE SCALES”.

CRM 85

Feature hybrid	Comparison hybrid	Number of trials	Harvest moisture difference (%) ¹	Yield advantage to P8532 (kg/ha) ²	Yield statistical significance ³	Test weight difference (kg/hl) ²
Lower North Island						
P8532	P8000	8	-0.59	2,211	★	1.93
P8532	P8086	8	-0.20	1,974	CA	3.90
P8532	P8240	8	-0.40	1,895	CA	2.96
P8532	P8333	8	-0.69	3,091	★	2.61
P8532	P8666	8	-0.52	1,628	NS	2.50
P8532	P8711	8	0.79	-366	NS	3.47
P8532	P8805	7	-0.93	1,439	CA	2.82

¹Positive harvest moisture differences indicate that the bolded Pioneer hybrid was drier at harvest, negative harvest moisture differences mean it was wetter. ²Positive yield and / or test weight differences indicate the bolded Pioneer hybrid had higher yield and / or grain test weight. ³For information on interpreting hybrid comparison data and statistical significance see page 3. Includes all data to the end of the 2023 harvest.

Recommended growing regions



Recommended established plant populations (000's/ha)

- Challenging yield environments **90**
- Medium yield environments **100**
- High yield environments **110**





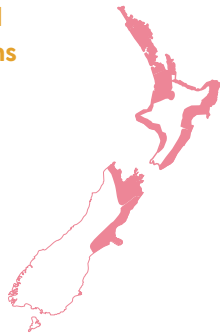
HIGH PERFORMANCE HYBRID WITH STRONG AGRONOMIC PROPERTIES.

CRM 86

Feature hybrid	Comparison hybrid	Number of trials	Harvest moisture difference (%) ¹	Yield advantage to P8666 (kg/ha) ²	Yield statistical significance ³	Test weight difference (kg/hl) ²
Lower North Island & South Island						
P8666	P8240	26	-0.02	83	NS	-0.33
P8666	P8333	47	-0.52	593	★★	-1.69
P8666	P8711	30	1.65	-1,622	★★★	-0.28
P8666	P8805	60	-0.27	19	NS	0.46
P8666	PAC007 (Booster)	27	1.02	905	★	-8.36
Waikato						
P8666	P8240	7	-0.81	716	NS	-1.16
P8666	P8333	13	0.08	390	NS	-1.81
P8666	P8711	17	0.55	-1,178	★★	0.01
P8666	P8805	23	0.04	560	CA	1.07
Gisborne & Hawke's Bay						
P8666	P8711	10	1.67	-1,010	★	-0.57
P8666	P8805	13	0.34	884	CA	1.34

¹Positive harvest moisture differences indicate that the bolded Pioneer hybrid was drier at harvest, negative harvest moisture differences mean it was wetter. ²Positive yield and / or test weight differences indicate the bolded Pioneer hybrid had higher yield and / or grain test weight. ³For information on interpreting hybrid comparison data and statistical significance see page 3. Includes all data to the end of the 2023 harvest.

Recommended growing regions



Recommended established plant populations (000's/ha)

Challenging yield environments	85
Medium yield environments	95
High yield environments	105





DEFENSIVE WINNER WITH GAME-CHANGING YIELDS.

CRM 87

Feature hybrid	Comparison hybrid	Number of trials	Harvest moisture difference (%) ¹	Yield advantage to P8711 (kg/ha) ²	Yield statistical significance ³	Test weight difference (kg/hl) ²
National						
P8711	P8240	26	-1.13	1,541	★★★	-0.20
P8711	P8333	34	-1.34	1,912	★★★	-1.56
P8711	P8666	58	-1.29	1,330	★★★	0.16
P8711	P8805	50	-1.47	1,466	★★★	0.42
P8711	P9127	52	-0.96	354	NS	2.17
P8711	P92575	26	0.95	-989	NS	2.85
P8711	PAC007 (Booster)	21	0.44	2,546	★★★	-6.96
Waikato						
P8711	P8333	12	-0.55	1,114	★	-1.07
P8711	P8666	17	-0.55	1,178	★★	-0.01
P8711	P8805	13	-0.37	1,116	★★★	0.15
P8711	P9127	21	-0.57	544	NS	2.22
P8711	P92575	13	0.79	-965	NS	3.51
Gisborne & Hawke's Bay						
P8711	P8666	10	-1.67	1,010	★	0.57
P8711	P8805	8	-1.63	1,055	NS	0.85
Lower North Island & South Island						
P8711	P8333	20	-1.72	2,309	★★★	-1.69
P8711	P8532	8	-0.79	366	NS	-3.47
P8711	P8666	30	-1.65	1,622	★★★	0.28
P8711	P8805	29	-1.93	1,736	★★★	0.42
P8711	PAC007 (Booster)	15	0.33	1,554	★★	-7.08

¹Positive harvest moisture differences indicate that the bolded Pioneer hybrid was drier at harvest, negative harvest moisture differences mean it was wetter. ²Positive yield and / or test weight differences indicate the bolded Pioneer hybrid had higher yield and / or grain test weight. ³For information on interpreting hybrid comparison data and statistical significance see page 3. Includes all data to the end of the 2023 harvest.

Recommended growing regions



Recommended established plant populations (000's/ha)

- Challenging yield environments **90**
- Medium yield environments **100**
- High yield environments **110**





TOUGH ALL-ROUNDER.

CRM 88

Feature hybrid	Comparison hybrid	Number of trials	Harvest moisture difference (%) ¹	Yield advantage to P8805 (kg/ha) ²	Yield statistical significance ³	Test weight difference (kg/hl) ²
National						
P8805	P8333	51	-0.09	412	CA	-1.82
P8805	P8666	97	0.10	-263	★	-0.72
P8805	P8711	50	1.47	-1,466	★★★	-0.42
P8805	P92575	31	2.54	-2,663	★★★	0.90
P8805	PAC007 (Booster)	48	1.26	1,717	★★★	-7.38
Lower North Island & South Island						
P8805	P8333	35	-0.11	579	CA	-1.89
P8805	P8666	60	0.27	-19	NS	-0.46
P8805	P8711	29	1.93	-1,736	★★★	-0.42
P8805	P92575	19	3.14	-3,350	★★★	1.03
P8805	PAC007 (Booster)	34	1.35	1,217	★★★	-7.82
Waikato						
P8805	P8333	13	-0.14	-12	CA	-1.55
P8805	P8666	23	-0.04	-560	NS	-1.07
P8805	P8711	13	0.37	-1,116	★★★	-0.15
P8805	P92575	7	1.68	-2,066	★★	1.83
P8805	PAC007 (Booster)	13	1.13	3,052	★★★	-6.43
Gisborne & Hawke's Bay						
P8805	P8666	13	-0.34	-884	CA	-1.34
P8805	P8711	8	1.63	-1,055	NS	-0.85
P8805	P92575	5	1.50	-888	NS	-0.89

¹Positive harvest moisture differences indicate that the bolded Pioneer hybrid was drier at harvest, negative harvest moisture differences mean it was wetter. ²Positive yield and / or test weight differences indicate the bolded Pioneer hybrid had higher yield and / or grain test weight. ³For information on interpreting hybrid comparison data and statistical significance see page 3. Includes all data to the end of the 2023 harvest.

Recommended growing regions



Recommended established plant populations (000's/ha)

Challenging yield environments **95**

Medium yield environments **105**

High yield environments **110**





SOLID, BALANCED HYBRID, WITH TOP-OF-THE-LINE FOLIAR HEALTH.

CRM 92

Feature hybrid	Comparison hybrid	Number of trials	Harvest moisture difference (%) ¹	Yield advantage to P92575 (kg/ha) ²	Yield statistical significance ³	Test weight difference (kg/hl) ²
National						
P92575	Obelix	21	-1.20	3,524	★★★	-2.51
P92575	P8711	26	-0.95	989	★	-2.85
P92575	P8805	31	-2.54	2,663	★★★	-0.90
P92575	P9127	48	-1.80	1,743	★★★	-0.73
P92575	P9400	47	-1.71	932	★★★	-4.31
P92575	P9650	15	-0.65	-193	NS	-2.06
P92575	PAC119	16	-1.73	1,031	★	-2.34
Waikato						
P92575	Obelix	13	-1.07	2,933	★★★	-2.34
P92575	P8711	13	-0.79	965	NS	-3.51
P92575	P9127	20	-1.44	1,717	★★★	-1.38
P92575	P9400	20	-1.29	410	NS	-3.84
P92575	P9650	7	-0.54	-539	NS	-1.62
Lower North Island						
P92575	P8711	7	-2.04	1,337	★	-1.36
P92575	P8805	19	-3.14	3,350	★★★	-1.03
P92575	P9127	21	-2.62	2,325	★★★	-0.46
P92575	P9400	21	-2.28	1,572	★★★	-5.22
P92575	P9650	7	-0.72	323	NS	-2.39
P92575	P9721	15	-1.05	1,245	★	-0.87

¹Positive harvest moisture differences indicate that the bolded Pioneer hybrid was drier at harvest, negative harvest moisture differences mean it was wetter. ²Positive yield and / or test weight differences indicate the bolded Pioneer hybrid had higher yield and / or grain test weight. ³For information on interpreting hybrid comparison data and statistical significance see page 3. Includes all data to the end of the 2023 harvest.

Recommended growing regions



Recommended established plant populations (000's/ha)

- Challenging yield environments **85**
- Medium yield environments **95**
- High yield environments **105**





TRUSTY AND RELIABLE. DELIVERS YEAR AFTER YEAR.

CRM 94

Feature hybrid	Comparison hybrid	Number of trials	Harvest moisture difference (%) ¹	Yield advantage to P9400 (kg/ha) ²	Yield statistical significance ³	Test weight difference (kg/hl) ²
National						
P9400	Obelix	24	-0.15	2,585	★★★	3.17
P9400	P92575	47	1.71	-932	★★★	4.31
P9400	P9650	16	1.18	-1,032	★★	1.70
P9400	P9721	635	0.50	-607	★★★	3.24
P9400	P9978	79	2.01	-1,825	★★★	4.17
P9400	PAC249	91	0.69	672	★★★	4.30
Waikato						
P9400	Obelix	14	-0.09	2,502	★★★	3.24
P9400	P92575	20	1.29	-410	NS	3.84
P9400	P9650	8	1.70	-720	CA	0.95
P9400	P9721	186	0.68	-294	★★	3.35
P9400	P9978	35	1.96	-1,771	★★★	4.91
P9400	PAC249	26	0.64	1,956	★★★	4.74
Gisborne & Hawke's Bay						
P9400	P92575	6	1.11	-432	NS	2.69
P9400	P9721	73	0.56	-964	★★★	3.03
P9400	P9978	15	1.48	-2,427	★★★	3.04
Lower North Island						
P9400	P92575	21	2.28	-1,572	★★★	5.22
P9400	P9650	7	0.57	-1,436	★	2.54
P9400	P9721	282	0.39	-777	★★★	3.45
P9400	P9978	21	2.81	-1,819	★★★	4.41

¹Positive harvest moisture differences indicate that the bolded Pioneer hybrid was drier at harvest, negative harvest moisture differences mean it was wetter. ²Positive yield and / or test weight differences indicate the bolded Pioneer hybrid had higher yield and / or grain test weight. ³For information on interpreting hybrid comparison data and statistical significance see page 3. Includes all data to the end of the 2023 harvest.

Recommended growing regions



Recommended established plant populations (000's/ha)

Challenging yield environments	85
Medium yield environments	95
High yield environments	105





SECURITY WITH PERFORMANCE.

CRM 96

Feature hybrid	Comparison hybrid	Number of trials	Harvest moisture difference (%) ¹	Yield advantage to P9650 (kg/ha) ²	Yield statistical significance ³	Test weight difference (kg/hl) ²
National						
P9650	P0021	26	0.02	58	NS	1.06
P9650	P92575	15	0.65	193	NS	2.06
P9650	P9400	16	-1.18	1,032	★★	-1.70
P9650	P9721	16	-1.03	1,289	★★	1.82
P9650	P9978	25	0.75	-105	NS	2.22
Waikato						
P9650	P0021	16	-0.12	140	NS	1.31
P9650	P92575	7	0.54	539	NS	1.62
P9650	P9400	8	-1.70	720	CA	-0.95
P9650	P9721	8	-1.44	800	CA	1.86
P9650	P9978	15	0.55	236	NS	2.08
Lower North Island						
P9650	P0021	14	0.36	155	NS	2.08
P9650	P9127	7	-0.66	2,334	★★★	3.97
P9650	P9400	7	-0.57	1,241	★★★	-3.04
P9650	P9978	15	0.46	-824	CA	3.74

¹Positive harvest moisture differences indicate that the bolded Pioneer hybrid was drier at harvest, negative harvest moisture differences mean it was wetter. ²Positive yield and / or test weight differences indicate the bolded Pioneer hybrid had higher yield and / or grain test weight. ³For information on interpreting hybrid comparison data and statistical significance see page 3. Includes all data to the end of the 2023 harvest.

Recommended growing regions



Recommended established plant populations (000's/ha)

- Challenging yield environments **85**
- Medium yield environments **95**
- High yield environments **110**





THE HERO FOR FAST DRYDOWN AND TIMELY HARVEST.

CRM 97

Feature hybrid	Comparison hybrid	Number of trials	Harvest moisture difference (%) ¹	Yield advantage to P9721 (kg/ha) ²	Yield statistical significance ³	Test weight difference (kg/hl) ²
National						
P9721	Obelix	39	-0.44	2,265	★★★	-0.92
P9721	P0021	604	0.73	-115	★	-1.80
P9721	P92575	30	1.04	-803	★★	1.02
P9721	P9400	635	-0.50	607	★★★	-3.24
P9721	P9650	16	1.03	-1,289	★★	-1.82
P9721	P9978	102	1.46	-1,180	★★★	0.63
P9721	PAC249	101	0.24	1,347	★★★	-0.47
P9721	PAC295 (N39-Q1)	124	0.44	815	★★★	0.79
Waikato						
P9721	Obelix	23	-0.30	2,029	★★★	-0.25
P9721	P0021	179	0.56	-55	NS	-1.84
P9721	P92575	12	1.15	-347	NS	1.24
P9721	P9400	186	-0.68	294	★★	-3.35
P9721	P9650	8	1.44	-800	CA	-1.86
P9721	P9978	32	1.42	-1,122	★★★	0.50
P9721	PAC249	25	0.12	2,466	★★★	-0.85
P9721	PAC295 (N39-Q1)	55	0.36	1,213	★★★	0.87
Gisborne & Hawke's Bay						
P9721	P0021	80	0.46	35	NS	-1.47
P9721	P0200	16	1.04	-494	NS	-1.90
P9721	P9400	73	-0.56	964	★★★	-3.03
P9721	P9978	23	1.12	-1,153	★★★	0.52
Lower North Island						
P9721	P0021	240	0.98	-84	NS	-1.74
P9721	P92575	15	1.05	-1,245	★	0.87
P9721	P9400	282	-0.39	777	★★★	-3.45
P9721	P9650	7	0.63	-1,923	★	-1.72
P9721	P9978	39	1.76	-1,258	★★★	0.88
P9721	PAC249	70	0.27	951	★★★	-0.33
P9721	PAC295 (N39-Q1)	55	0.58	378	★	0.64

¹Positive harvest moisture differences indicate that the bolded Pioneer hybrid was drier at harvest, negative harvest moisture differences mean it was wetter. ²Positive yield and / or test weight differences indicate the bolded Pioneer hybrid had higher yield and / or grain test weight. ³For information on interpreting hybrid comparison data and statistical significance see page 3. Includes all data to the end of the 2023 harvest.

Recommended growing regions



Recommended established plant populations (000's/ha)

- Challenging yield environments **88**
- Medium yield environments **96**
- High yield environments **102**





VERY PRODUCTIVE. VERY STABLE. VERY DEFENSIVE.

CRM 99

Feature hybrid	Comparison hybrid	Number of trials	Harvest moisture difference (%) ¹	Yield advantage to P9978 (kg/ha) ²	Yield statistical significance ³	Test weight difference (kg/hl) ²
National						
P9978	P0021	201	-0.56	846	★★★★	-2.21
P9978	P0200	171	0.13	587	★★★★	-1.57
P9978	P0362	203	0.80	482	★★★★	-2.10
P9978	P9400	79	-2.01	1,825	★★★★	-4.17
P9978	P9650	25	-0.75	105	NS	-2.22
P9978	P9721	102	-1.46	1,180	★★★★	-0.63
P9978	PAC249	51	-1.04	2,647	★★★★	-1.99
P9978	PAC295 (N39-Q1)	58	-0.96	2,474	★★★★	0.16
P9978	PAC314	64	-0.40	1,167	★★★★	-3.69
P9978	PAC344	24	-0.04	864	★	-1.23
Northland						
P9978	P0021	24	-0.41	151	NS	-3.12
P9978	P0200	24	0.52	88	NS	-2.38
P9978	P0362	25	0.75	173	NS	-3.13
Waikato						
P9978	P0021	60	-0.64	959	★★★★	-1.97
P9978	P0200	55	0.27	450	★★	-0.92
P9978	P0362	64	0.91	397	★	-2.05
P9978	P9650	15	-0.55	-236	NS	-2.08
P9978	PAC249	14	-1.09	3,570	★★★★	-2.25
P9978	PAC295 (N39-Q1)	28	-0.94	2,403	★★★★	0.26
P9978	PAC314	17	-0.38	1,084	★	-4.95
P9978	PAC344	8	-0.68	835	★	-3.16
Bay of Plenty, Gisborne & Hawke's Bay						
P9978	P0021	46	-0.34	999	★★★★	-2.35
P9978	P0200	40	-0.01	593	★★	-2.36
P9978	P0362	46	0.66	690	★★	-2.33
P9978	P9400	16	-1.48	2,404	★★★★	-3.26
P9978	P9721	24	-1.07	1,168	★★★★	-0.47
P9978	PAC295 (N39-Q1)	10	-0.85	3,298	★★★★	0.69
P9978	PAC314	14	-0.10	1,189	★	-3.48
Lower North Island						
P9978	P0021	71	-0.70	886	★★★★	-2.01
P9978	P0200	52	-0.08	957	★★★★	-1.28
P9978	P0362	68	0.81	536	★★	-1.61
P9978	P9650	8	-1.10	1,104	★	-2.48
P9978	P9721	39	-1.76	1,258	★★★★	-0.88
P9978	PAC249	27	-1.18	2,892	★★★★	-2.06
P9978	PAC295 (N39-Q1)	20	-1.04	2,161	★★★★	-0.26
P9978	PAC314	26	-0.62	1,415	★★★★	-3.03
P9978	PAC344	10	-0.26	1,080	CA	-0.91

¹Positive harvest moisture differences indicate that the bolded Pioneer hybrid was drier at harvest, negative harvest moisture differences mean it was wetter. ²Positive yield and / or test weight differences indicate the bolded Pioneer hybrid had higher yield and / or grain test weight. ³For information on interpreting hybrid comparison data and statistical significance see page 3. Includes all data to the end of the 2023 harvest.

Recommended growing regions



Recommended established plant populations (000's/ha)

Challenging yield environments	85
Medium yield environments	95
High yield environments	105





HARD TO BEAT CONSISTENCY.

CRM 100

Feature hybrid	Comparison hybrid	Number of trials	Harvest moisture difference (%) ¹	Yield advantage to P0021 (kg/ha) ²	Yield statistical significance ³	Test weight difference (kg/hl) ²
National						
P0021	P0200	24	0.81	-148	NS	0.94
P0021	P0362	45	0.89	-327	CA	0.37
P0021	P9721	94	-0.69	285	★	2.03
P0021	P9978	24	0.41	-151	NS	3.13
Waikato						
P0021	P0200	58	0.88	-240	NS	0.70
P0021	P0362	85	1.60	-616	★★★	0.30
P0021	P9650	16	0.12	-140	NS	-1.31
P0021	P9978	60	0.64	-959	★★★	1.97
P0021	PAC249	22	-0.14	2,649	★★★	-0.46
P0021	PAC295 (N39-Q1)	80	-0.30	744	★★★	2.38
Bay of Plenty, Gisborne & Hawke's Bay						
P0021	P0200	39	0.35	-522	★	0.11
P0021	P0362	69	1.17	-310	CA	0.12
P0021	P9721	91	-0.47	138	NS	1.65
P0021	P9978	45	0.34	-999	★★★	2.35
Lower North Island						
P0021	P0200	50	0.46	115	NS	0.64
P0021	P0362	110	1.67	-491	★★★	0.50
P0021	P0547	204	0.38	-384	★★★	-0.17
P0021	P9721	240	-0.98	84	NS	1.74
P0021	P9978	71	0.70	-886	★★★	2.01
P0021	PAC249	43	-0.46	1,031	★★★	2.05
P0021	PAC295 (N39-Q1)	86	-0.24	331	★★	2.45

¹Positive harvest moisture differences indicate that the bolded Pioneer hybrid was drier at harvest, negative harvest moisture differences mean it was wetter. ²Positive yield and / or test weight differences indicate the bolded Pioneer hybrid had higher yield and / or grain test weight. ³For information on interpreting hybrid comparison data and statistical significance see page 3. Includes all data to the end of the 2023 harvest.

Recommended growing regions



Recommended established plant populations (000's/ha)

Challenging yield environments	85
Medium yield environments	95
High yield environments	100





PRESENTS PERFORMANCE AND RELIABILITY.

CRM 102

Feature hybrid	Comparison hybrid	Number of trials	Harvest moisture difference (%) ¹	Yield advantage to P0200 (kg/ha) ²	Yield statistical significance ³	Test weight difference (kg/hl) ²
National						
P0200	P0021	171	-0.62	188	CA	-0.58
P0200	P0362	169	0.72	-224	★	-0.35
P0200	P0547	52	-0.52	82	NS	-0.66
P0200	P0640	107	0.77	-627	★★★★	2.28
P0200	P9721	60	-1.38	489	★★★★	0.89
P0200	P9978	171	-0.13	-587	★★★★	1.57
P0200	PAC295 (N39-Q1)	56	-0.93	1,763	★★★★	0.67
P0200	PAC314	68	-0.51	448	★	-2.19
Northland						
P0200	P0021	24	-0.79	148	NS	-0.94
P0200	P0362	25	0.25	5	NS	-0.88
P0200	P0640	24	0.38	-363	NS	2.44
P0200	P9978	24	-0.52	-88	NS	2.38
Waikato						
P0200	P0021	58	-0.88	240	NS	-0.70
P0200	P0362	57	0.68	-237	NS	-0.62
P0200	P0640	40	1.16	-979	★★★★	1.81
P0200	P9978	55	-0.27	-450	★★	0.92
Bay of Plenty						
P0200	P0021	13	-0.29	705	NS	-0.41
P0200	P0362	12	0.75	-238	NS	0.18
P0200	P9978	12	-0.01	-298	NS	2.76
Gisborne & Hawke's Bay						
P0200	P0021	26	-0.38	430	CA	0.00
P0200	P0362	23	0.66	527	CA	0.28
P0200	P0640	24	0.89	-293	NS	2.47
P0200	P9978	28	-0.02	-719	★★	2.22
Lower North Island						
P0200	P0021	50	-0.45	-103	NS	-0.77
P0200	P0362	52	0.74	-618	★★★★	-0.16
P0200	P0547	47	-0.46	-11	NS	-0.97
P0200	P9978	52	-0.01	-965	★★★★	1.36

¹Positive harvest moisture differences indicate that the bolded Pioneer hybrid was drier at harvest, negative harvest moisture differences mean it was wetter. ²Positive yield and / or test weight differences indicate the bolded Pioneer hybrid had higher yield and / or grain test weight. ³For information on interpreting hybrid comparison data and statistical significance see page 3. Includes all data to the end of the 2023 harvest.

Recommended growing regions



Recommended established plant populations (000's/ha)

- Challenging yield environments **85**
- Medium yield environments **95**
- High yield environments **105**





ROBUST HYBRID WITH STANDABILITY, FOLIAR HEALTH AND “EYE APPEAL”.

CRM 103

Feature hybrid	Comparison hybrid	Number of trials	Harvest moisture difference (%) ¹	Yield advantage to P0362 (kg/ha) ²	Yield statistical significance ³	Test weight difference (kg/hl) ²
Northland						
P0362	P0021	45	-0.89	327	CA	-0.37
P0362	P0200	25	-0.29	-5	NS	0.88
P0362	P0640	57	0.18	-369	★	2.38
P0362	P0891	14	0.57	738	★	-2.49
P0362	P9978	25	-0.75	-173	NS	3.13
Waikato						
P0362	P0021	85	-1.60	616	★★★★	-0.30
P0362	P0200	57	-0.68	237	NS	0.62
P0362	P0640	94	0.33	-1,116	★	2.22
P0362	P9978	64	-0.91	-397	★	2.05
P0362	PAC295 (N39-Q1)	23	-1.49	2,575	★★★★	1.62
P0362	PAC314	24	-1.27	1,331	★★	-2.43
P0362	PAC344	14	-0.77	822	★	-0.18
Bay of Plenty, Gisborne & Hawke's Bay						
P0362	P0021	69	-1.17	310	CA	-0.12
P0362	P0200	35	-0.69	-234	NS	-0.22
P0362	P0547	51	-0.88	70	NS	-0.17
P0362	P0640	91	0.10	-304	★★	2.37
P0362	P9978	46	-0.66	-690	★	2.33
Lower North Island						
P0362	P0021	110	-1.67	491	★★★★	-0.50
P0362	P0200	52	-0.99	629	★★★★	0.20
P0362	P0547	113	-1.36	200	CA	-0.73
P0362	P0640	44	-0.13	-143	NS	2.21
P0362	P9978	68	-0.81	-536	★★	1.61
P0362	PAC314	24	-1.34	807	★★	-1.94

¹Positive harvest moisture differences indicate that the bolded Pioneer hybrid was drier at harvest, negative harvest moisture differences mean it was wetter. ²Positive yield and / or test weight differences indicate the bolded Pioneer hybrid had higher yield and / or grain test weight. ³For information on interpreting hybrid comparison data and statistical significance see page 3. Includes all data to the end of the 2023 harvest.

Recommended growing regions



Recommended established plant populations (000's/ha)

- Challenging yield environments **85**
- Medium yield environments **95**
- High yield environments **105**





LEAF DISEASE CHAMPION DELIVERING YIELD STABILITY.

CRM 106

Feature hybrid	Comparison hybrid	Number of trials	Harvest moisture difference (%) ¹	Yield advantage to P0640 (kg/ha) ²	Yield statistical significance ³	Test weight difference (kg/hl) ²
Northland						
P0640	P0200	24	-0.38	363	NS	-2.44
P0640	P0362	57	-0.18	369	★	-2.38
P0640	P0891	52	0.24	611	★★	-5.68
P0640	P0900	20	0.65	469	★★★	-1.02
P0640	P0937	34	0.61	-344	CA	-0.71
Waikato						
P0640	P0200	40	-1.16	979	★★★★	-1.81
P0640	P0362	94	-0.33	1,116	★★★★	-2.22
P0640	P0891	183	0.40	416	★★★★	-5.11
P0640	P0900	64	0.95	379	CA	-0.90
P0640	P0937	102	0.78	-279	CA	-0.32
P0640	PAC430	13	0.46	908	★	-2.15
P0640	PAC432	46	0.83	868	★★★★	0.21
Bay of Plenty, Gisborne & Hawke's Bay						
P0640	P0200	34	-0.66	222	NS	-3.01
P0640	P0362	91	-0.10	304	★	-2.37
P0640	P0891	214	0.43	329	★★★★	-6.01
P0640	P0900	71	1.04	-159	NS	-1.11
P0640	P0937	112	0.77	-635	★★★★	0.06
P0640	PAC314	14	-0.57	1,184	★★	-3.45

¹Positive harvest moisture differences indicate that the bolded Pioneer hybrid was drier at harvest, negative harvest moisture differences mean it was wetter. ²Positive yield and / or test weight differences indicate the bolded Pioneer hybrid had higher yield and / or grain test weight. ³For information on interpreting hybrid comparison data and statistical significance see page 3. Includes all data to the end of the 2023 harvest.

Recommended growing regions



Recommended established plant populations (000's/ha)

- Challenging yield environments **85**
- Medium yield environments **95**
- High yield environments **100**





HARD TO FAULT, STABLE, ALL-ROUND HYBRID.

CRM 109



Feature hybrid	Comparison hybrid	Number of trials	Harvest moisture difference (%) ¹	Yield advantage to P0900 (kg/ha) ²	Yield statistical significance ³	Test weight difference (kg/hl) ²
Northland						
P0900	P0640	20	-0.65	-469	★	1.02
P0900	P0891	16	-0.69	501	★	-4.39
P0900	P0937	20	-0.21	-400	CA	-0.21
Waikato						
P0900	P0640	64	-0.95	-379	CA	0.90
P0900	P0891	56	-0.59	233	NS	-3.22
P0900	P0937	74	-0.26	-543	★★	0.86
Bay of Plenty, Gisborne & Hawke's Bay						
P0900	P0640	71	-1.04	159	NS	1.11
P0900	P0891	68	-0.49	645	★★	-4.94
P0900	P0937	84	-0.24	-348	★	1.17
P0900	P1253	70	-0.24	370	★	-4.33

¹Positive harvest moisture differences indicate that the bolded Pioneer hybrid was drier at harvest, negative harvest moisture differences mean it was wetter. ²Positive yield and / or test weight differences indicate the bolded Pioneer hybrid had higher yield and / or grain test weight. ³For information on interpreting hybrid comparison data and statistical significance see page 3. Includes all data to the end of the 2023 harvest.

Recommended growing regions



Recommended established plant populations (000's/ha)

Challenging yield environments	80
Medium yield environments	90
High yield environments	110





SOLID HYBRID WITH NEXT GENERATION GRAIN YIELD.

CRM 109

Feature hybrid	Comparison hybrid	Number of trials	Harvest moisture difference (%) ¹	Yield advantage to P0937 (kg/ha) ²	Yield statistical significance ³	Test weight difference (kg/hl) ²
National						
P0937	P0640	254	-0.78	456	★★★	0.18
P0937	P0891	221	-0.51	1,216	★★★	-5.34
P0937	P0900	181	0.23	427	★★★	-0.94
P0937	PI253	203	-0.08	907	★★★	-5.10
P0937	PAC430	41	-0.44	487	CA	-2.90
P0937	PAC432	67	-0.11	653	★★	-0.33
Northland						
P0937	P0640	34	-0.61	344	CA	0.71
P0937	P0891	24	-0.46	1,386	★★★	-4.32
P0937	P0900	20	0.21	400	CA	-0.20
Waikato						
P0937	P0640	102	-0.78	279	CA	0.32
P0937	P0891	84	-0.62	1,035	★★★	-4.69
P0937	P0900	74	0.26	543	★★	-0.86
P0937	PAC432	43	-0.10	994	★★	0.44
Bay of Plenty, Gisborne & Hawke's Bay						
P0937	P0640	112	-0.77	635	★★★	-0.06
P0937	P0891	112	-0.44	1,320	★★★	-6.05
P0937	P0900	84	0.24	348	★	-1.17
P0937	PI253	106	-0.05	968	★★★	-5.62
P0937	PAC430	18	-0.42	834	CA	-3.08

¹Positive harvest moisture differences indicate that the bolded Pioneer hybrid was drier at harvest, negative harvest moisture differences mean it was wetter. ²Positive yield and / or test weight differences indicate the bolded Pioneer hybrid had higher yield and / or grain test weight. ³For information on interpreting hybrid comparison data and statistical significance see page 3. Includes all data to the end of the 2023 harvest.

Recommended growing regions



Recommended established plant populations (000's/ha)

Challenging yield environments	85
Medium yield environments	95
High yield environments	110





PACK YOUR PADDOCK FOR TOP GRAIN QUALITY.

CRM 109

Feature hybrid	Comparison hybrid	Number of trials	Harvest moisture difference (%) ¹	Yield advantage to P1253 (kg/ha) ²	Yield statistical significance ³	Test weight difference (kg/hl) ²
Waikato						
P1253	P0640	154	-0.99	-17	NS	4.79
P1253	P0891	235	-0.59	235	★★★	-0.31
P1253	P0900	50	-0.03	213	NS	3.31
P1253	P0937	72	0.11	-700	★★★	4.46
P1253	PAC432	37	-0.02	649	★	5.17
Bay of Plenty, Gisborne & Hawke's Bay						
P1253	P0640	200	-0.59	288	NS	5.48
P1253	P0891	348	-0.27	582	★★	-0.40
P1253	P0900	70	0.17	-370	NS	4.33
P1253	P0937	106	0.20	-968	★★★	5.62

¹Positive harvest moisture differences indicate that the bolded Pioneer hybrid was drier at harvest, negative harvest moisture differences mean it was wetter. ²Positive yield and / or test weight differences indicate the bolded Pioneer hybrid had higher yield and / or grain test weight. ³For information on interpreting hybrid comparison data and statistical significance see page 3. Includes all data to the end of the 2023 harvest.

Recommended growing regions



Recommended established plant populations (000's/ha)

Challenging yield environments	88
Medium yield environments	94
High yield environments	100



OPTIMISING NITROGEN APPLICATION FOR MAIZE PRODUCTION

Introduction

An ideal fertiliser management strategy should optimise profit while reducing the environmental impact of maize cropping. Excessive and inefficient nitrogen (N) fertiliser use can damage the environment and reduce profitability whereas applying less fertiliser than crop demand reduces crop production and potentially depletes soil organic matter (OM) levels over time.

To maximise efficiency of N fertiliser application, crop nutrient demand and uptake, as well as the amount of N supplied by the soil should be considered before deciding on the amount and timing of N fertiliser application. Accurately predicting the right amount of N to meet crop demand and achieving synchrony between N supply and crop demand are prerequisites to optimising production and protecting the environment. Even though most New Zealand soils generally have high OM levels which allows them to mineralise a significant amount of N, it is often difficult to accurately predict when this N will become available to the crop. The unpredictability of weather makes the decision-making process even more complicated.

Nitrogen management studies

An ongoing N management study was initiated in the spring of 2021 at the Pioneer Rukuhia Research Station (Waikato) on a long-term cropped allophanic soil. The objective of the research was to help us understand how different rates of N fertiliser influences maize silage yield, soil fertility and N losses. A range of N fertiliser treatments – nil fertiliser (0 kg N/ha), low (160 kg N/ha), standard (250 kg N/ha) and high (320 kg N/ha) – were applied to different maize plots at the V5 stage of maize growth, resulting in soil N levels ranging from about 90–400 kg N/ha. The measured N reported in this article refers to soil N that was in the mineral form and ready for plant uptake, rather than potentially available N as reported in standard soil tests. Even though the study measured maize silage yields, the general principle also applies for maize grain production systems. While all figures and tables are reported as maize silage yields, we have discussed the implications for grain yield and converted numbers where possible.

Maize yields and soil N balance

During the first two years of the study, initial N measurements conducted just prior to fertiliser N application (V4 maize stage) averaged about 90 kg N/ha. These rates do not include any potential soil-N supply (mineralisation) after V4. Based on the estimated N content of maize silage, without

additional soil-N supply, the 0 kg N/ha N fertiliser plots would be expected to yield approximately 8 t/ha. However, mean yields for maize that received no N fertiliser averaged an equivalent of almost 11 t/ha maize grain yield during the first two years of the study. Figure 1 shows the average maize silage yields observed in the study.

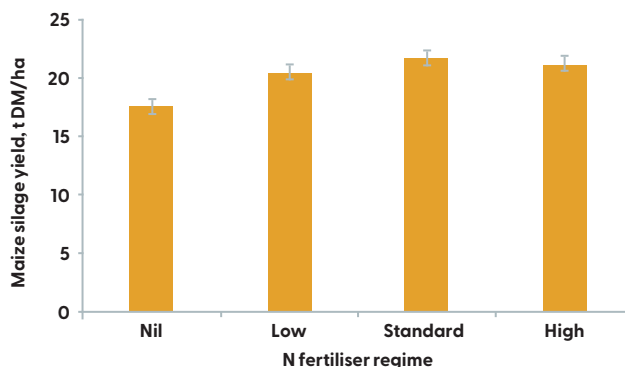


Figure 1: Mean maize DM silage yields on a Waikato ash soil during the 2021–22 and 2022–23 maize seasons.

These yields were slightly lower than the 21–22 t DM/ha (which equates to approximately 13 t/ha maize grain yield) obtained when fertiliser N was applied. Despite the 2 t/ha maize grain yield reduction in the nil N fertiliser plots, 87 kg N/ha was measured in the soil immediately after maize harvest (Table 1). This suggests that there was sufficient soil-N supply to achieve the paddock yield potential and that the lower yield was likely due to poor synchronisation between maize crop N demand and soil-N supply.

N treatment	Total N (fertiliser + soil N)	Soil N after maize	Estimated soil-N supply (mineralisation)
	kg N/ha		
Nil	90	87	177
Low	250	128	66
Standard	330	162	42
High	410	229	24
SE*	5.72	26.0	31.1

Table 1: Soil N dynamics on a Waikato ash soil during the 2021–22 and 2022–23 maize growing seasons. *SE refers to the standard error of the mean.

The key observation in the first two years of this study was that in N deficient situations, the soil mineralised significantly more N than normal. The mean estimated soil-N supply was 177 kg N/ha compared to only 42 kg N/ha for the standard N rates. These results are consistent with previous studies that concluded that N fertilisation decreased OM decomposition and under low soil N levels, microbes meet their N demand by decomposing OM. The question this study intends to answer eventually is how this “N mining” will influence soil OM in the long term.

During the 2023–24 growing season, the average soil N at V4 averaged 100 kg N/ha. The “nil” fertiliser treatment

achieved significantly lower yields than the previous two seasons (Figure 2). Nitrogen stress was observed as early as silking time (Figure 3). Maize silage yields for the low fertiliser were significantly lower than for the standard fertiliser N rates. This illustrates the importance of customising N management for conditions. In high OM soils or those coming out of long term pasture, fertiliser N can be reduced or omitted depending on fertility levels whereas to avoid OM degradation in continuous cropping situations, growers should not skimp on fertiliser N. The dramatic impact of N stress on the crop during the 2023-24 season, may have been due to a significant decrease in soil fertility. This is not likely to have occurred as rapidly in maize grain production where about 40% of the total above ground maize N uptake is likely to be returned back in the soil through stover. It is also important for the maize stover to be finely chopped and evenly spread to minimise potential N immobilisation, especially in high yield situation where stover yields are high.

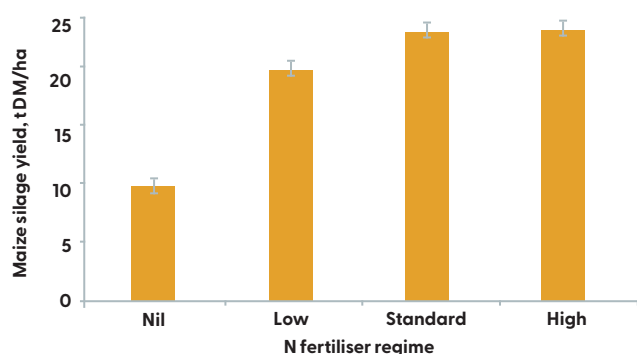


Figure 2: Mean maize DM silage yields on a Waikato ash soil during the 2023-24 maize season.



Figure 3: Maize plants from an ash soil with an initial soil mineral N level of 100 kg N/ha at V4, followed by nil (left) or 160 kg N/ha (right) sidedressing fertiliser N during the 2023-24 season.

Figure 3 shows maize plants (right) that received 160kg N/ha as fertiliser N during early grain fill. Unlike previous seasons, the plants showed some mild N stress, suggesting possible temporary N deficiency. In the previous two seasons yields were similar to the standard N rate, but in the 2023-24 season these plots yielded 21 t DM/ha (which equates to around 12.5 t/ha maize grain yield), 15% less than the standard fertiliser treatment. The high N plots did not yield any greater than the standard fertiliser treatment, further emphasising the importance of prudent N use to

minimise the environmental impact of maize cropping. Even though soil N fertilisation could potentially conserve soil organic matter in low OM situations, applying excessive N could result in an increased environmental impact through leaching especially in higher OM paddocks. Fertiliser N rates should hence be consistent with plant demand and soil organic matter status.

Nitrogen management

Maize uses less than 10% of its total N requirement between emergence and the V6 growth stage. The amount supplied through starter fertiliser is usually sufficient to meet crop requirements to this stage. Nitrogen leaching risk is usually greatest prior to V6. At this stage roots are shallow and soils are usually wetter, increasing the potential for leaching following heavy rainfall events. Pioneer research conducted on a Waikato soil and Canterbury stony loam soil indicated that leaching losses after late spring, which coincides with commencement of the rapid vegetative growth phase of maize (V6 stage), were marginal, contributing less than 10% of the total annual N leaching losses from maize-based systems.

Summary

This study suggests that to achieve optimum yields, it is best to apply the appropriate amount of fertiliser N, which is consistent with yield potential, accounting for paddock history and soil fertility. While applying less than the recommended N fertiliser and relying on soil supplied N may appear economical, our research indicates there could be a long-term yield and environmental penalty. Mineralisation is influenced by a range of factors such as moisture and rainfall, making it difficult to get the synchronisation between soil N release and plant N demand. This can result in nutrient deficiencies due to timing even when there is theoretically enough N available.

It is almost impossible to predict soil N supply in time and space and yet either skimping or excessive fertiliser N use in maize cropping is not an option. Our recommendation is to:

- Measure soil N supply by collecting representative soil samples.
- Use your knowledge of the paddock and hybrid yield potential to calculate crop N demand using a realistic potential yield.
- Where nitrogen is required, apply standard levels of starter fertiliser (around 30 kg N/ha) and sidedress the remainder of the crop's N requirements around V5-V6 when the risk of leaching is lower.
- Establish a cover crop immediately after maize harvest. Any potential excess soil N can be "mopped up" by the catch crop during the winter period, minimising potential leaching losses.



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