MAIZE SILAGE RESEARCH 2023

PIONEER®
BRAND · PRODUCTS

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INTRODUCTION

Welcome to the Pioneer Maize Silage Research update for 2023.

For many years we've produced Maize Silage 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 research which includes maize field establishment, tillage systems and using dedicated maize cropping blocks as a nitrogen leaching mitigation strategy.

An IMPACT™ small plot planter at Gordonton, Waikato. IMPACT is the acronym for "intensively managed product advancement and characterisation trials".

Long term breeding delivers higher yields

The annual rate of maize silage yield gain in New Zealand is estimated to have been over 300 kgDM/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, silage 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 silage 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 data gathered over several seasons from a wide range of locations within a growing region. An individual on-farm trial result should not be used to select a hybrid because in isolation, it is 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.

This publication provides a summary of the investment made to evaluate the silage yield performance of Pioneer® and other brands of maize silage hybrids in five defined growing regions;

1) Northland and north Auckland **2)** Waikato **3)** Bay of Plenty, Gisborne and northern Hawke's Bay **4)** Lower North Island and Taranaki **5)** South Island.

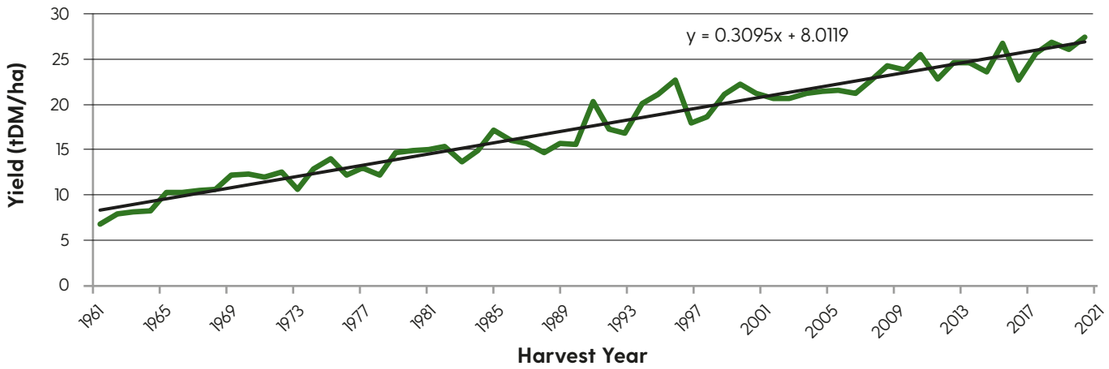
Summarised hybrid comparison data published in this book has been collected from field trials conducted over one or more growing seasons up to and including the 2022 harvest. The most recent regional Hybrid Performance Information (HPI) can be found at pioneer.nz.

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. 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 <0.10 which means there is a greater than 90% probability the 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 silage harvest maturity.**
- **only include comparisons where the harvest drymatter difference is +/- 4%. This is an objective measure and a more robust way to compare products. We also always publish the actual drymatter difference so growers can consider hybrid maturity as well as yield in their hybrid decision.**

Figure 1: New Zealand maize silage yield trend



Source: New Zealand Year Book (1961 to 1996) and Pioneer® brand products New Zealand Research Programme (1997 to 2021).

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 <u>can be claimed</u>.** 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	May be regarded as a commercially acceptable basis for a decision.
>0.10	<90.0%	NS	Not significant	NO	**Hybrid superiority for yield <u>cannot be claimed</u>.** 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. Key agronomic traits must always be considered.

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.

NEW

PIONEER® BRAND P8240

BULK AND ENERGY TO FILL THE VAT.

CRM 82

Feature hybrid	Comparison hybrid	Number of trials	Drymatter difference (%)[1]	Yield advantage to P8240 (kgDM/ha)[2]	Statistical significance[3]
National					
P8240	PAC007 (Booster)	15	0.66	3,405	★★★
P8240	PAC003 (Delitop)	16	-2.18	5,604	★★★
P8240	P8000	30	-3.95	2,702	★★★
P8240	P8333	41	-0.78	1,045	★
P8240	P8500	45	-0.32	209	NS
P8240	P8666	46	-0.22	-258	NS
P8240	Titus	15	-1.94	5,120	★★★
South Island					
P8240	P8000	12	-1.05	1,637	★
P8240	P8333	18	-0.19	486	NS
P8240	P8500	18	0.46	360	NS
P8240	P8666	19	0.64	-638	★
Lower North Island & Taranaki					
P8240	P8000	18	-5.89	3,412	★★★
P8240	P8333	15	-1.30	1,224	★
P8240	P8500	16	-1.56	-742	CA
P8240	P8666	18	-0.89	-390	NS

[1]Positive DM differences means the bolded hybrid was drier at harvest, negative DM differences mean it was wetter. [2]A positive yield advantage means the bolded hybrid produced more yield, a negative yield advantage means it produced less. [3]For information on interpreting hybrid comparison data and statistical significance see page 3.

Recommended growing regions

Recommended established plant populations (000's/ha)

Challenging yield environments	105
Medium yield environments	115
High yield environments	120

PIONEER® BRAND P8333

HIGHLY PRODUCTIVE MID-MATURITY OPTION.

CRM 83

Feature hybrid	Comparison hybrid	Number of trials	Drymatter difference (%)[1]	Yield advantage to P8333 (kgDM/ha)[2]	Statistical significance[3]
National					
P8333	PAC007 (Booster)	25	1.30	1,543	★★
P8333	P8000	94	-2.52	1,899	★★★
P8333	P8240	41	0.78	-1,045	★
P8333	P8500	123	0.45	-417	★
P8333	P8666	97	1.02	-903	★★★
P8333	Titus	26	-0.80	4,707	★★★
South Island					
P8333	P8000	41	-1.43	1,842	★★★
P8333	P8240	18	0.19	-486	NS
P8333	P8500	42	0.85	474	NS
P8333	P8666	35	1.19	-496	NS
P8333	Titus	13	-1.90	4,508	★★★
Lower North Island & Taranaki					
P8333	P8000	52	-3.43	2,037	★★★
P8333	P8240	15	1.30	-1,224	★
P8333	P8500	61	-0.02	-846	★★
P8333	P8666	43	1.05	-1,120	★★
P8333	Titus	13	0.31	4,906	★★★

[1]Positive DM differences means the bolded hybrid was drier at harvest, negative DM differences mean it was wetter. [2]A positive yield advantage means the bolded hybrid produced more yield, a negative yield advantage means it produced less. [3]For information on interpreting hybrid comparison data and statistical significance see page 3.

Recommended growing regions

Recommended established plant populations (000's/ha)

Challenging yield environments	100
Medium yield environments	110
High yield environments	115

GROWS WELL, YIELDS VERY WELL AND FEEDS EVEN BETTER.

CRM 86

Feature hybrid	Comparison hybrid	Number of trials	Drymatter difference (%)[1]	Yield advantage to P8666 (kgDM/ha)[2]	Statistical significance[3]
National					
P8666	PAC007 (Booster)	38	0.46	2,472	★★★
P8666	PAC100 (Comet)	47	0.88	2,050	★★★
P8666	Obelix	20	0.06	3,158	★★★
P8666	P8240	46	0.22	258	NS
P8666	P8333	97	-1.02	903	★★★
P8666	P8500	144	-0.61	367	CA
P8666	P8711	45	2.34	215	NS
P8666	P9127	88	3.32	488	★
P8666	Titus	19	-2.46	5,874	★★★
Waikato					
P8666	PAC007 (Booster)	18	2.09	2,825	★★★
P8666	PAC100 (Comet)	30	0.56	2,401	★★★
P8666	P8333	19	-0.62	1,158	★
P8666	P8500	38	-0.31	742	CA
P8666	P8711	13	3.32	-2,195	★★
P8666	P9127	37	3.28	107	NS
Lower North Island and Taranaki					
P8666	PAC007 (Booster)	15	-0.55	2,493	★★
P8666	PAC100 (Comet)	17	1.45	1,430	CA
P8666	Obelix	10	-0.93	3,658	★
P8666	P8240	18	0.89	390	NS
P8666	P8333	43	-1.05	1,120	★★
P8666	P8500	59	-0.95	-127	NS
P8666	P8711	24	2.63	897	CA
South Island					
P8666	P8240	19	-0.64	638	NS
P8666	P8333	35	-1.19	496	NS
P8666	P8500	47	-0.43	684	CA
P8666	P8711	8	-0.13	2,088	CA
P8666	P9127	13	1.14	-240	NS

[1]Positive DM differences means the bolded hybrid was drier at harvest, negative DM differences mean it was wetter. [2]A positive yield advantage means the bolded hybrid produced more yield, a negative yield advantage means it produced less. [3]For information on interpreting hybrid comparison data and statistical significance see page 3.

Recommended growing regions

Recommended established plant populations (000's/ha)

Challenging yield environments	100
Medium yield environments	110
High yield environments	115

NEW

NEW LEVEL OF PERFORMANCE FOR NORTHERN REGIONS.

CRM 87

Feature hybrid	Comparison hybrid	Number of trials	Drymatter difference (%)[1]	Yield advantage to P8711 (kgDM/ha)[2]	Statistical significance[3]
Waikato					
P8711	P8500	16	-3.18	2,538	★★★
P8711	P8666	13	-3.32	2,195	★★
P8711	P9127	17	0.30	-247	NS
P8711	P9400	18	0.20	1,133	★
Lower North Island and Taranaki					
P8711	P8666	24	-2.63	-867	CA
P8711	P9127	15	1.27	485	NS
P8711	P9400	16	0.10	93	NS
South Island					
P8711	P8500	9	-1.57	-1,839	NS
P8711	P8666	8	0.13	-2,088	CA
P8711	P9127	9	0.67	280	NS

[1]Positive DM differences means the bolded hybrid was drier at harvest, negative DM differences mean it was wetter. [2]A positive yield advantage means the bolded hybrid produced more yield, a negative yield advantage means it produced less. [3]For information on interpreting hybrid comparison data and statistical significance see page 3.

Recommended growing regions

Recommended established plant populations (000's/ha)

Challenging yield environments	100
Medium yield environments	110
High yield environments	120

BRED TO DEFEND BUT YIELDS TO IMPRESS.

P9127

CRM 91

Optimum AQUAmax

Feature hybrid	Comparison hybrid	Number of trials	Drymatter difference (%)[1]	Yield advantage to P9127 (kgDM/ha)[2]	Statistical significance[3]
Waikato					
P9127	Obelix	14	-1.11	3,023	★★
P9127	P8666	37	-3.28	-107	NS
P9127	P9400	87	-0.06	452	★
P9127	P9721	34	2.80	-227	NS
P9127	PAC249	19	2.00	3,152	★★★
Lower North Island & Taranaki					
P9127	P8666	36	-3.91	-1,073	★★
P9127	P8711	15	-1.27	-485	NS
P9127	P9400	59	-0.88	594	CA
P9127	P9721	18	1.24	812	CA
P9127	PAC249	11	2.11	2,309	★★
South Island					
P9127	P8500	16	-3.05	8	NS
P9127	P8666	13	-1.14	240	NS
P9127	P8711	9	-0.67	-280	NS
P9127	P8805	23	-3.03	1,022	★
P9127	P9400	14	0.72	1,281	★

[1]Positive DM differences means the bolded hybrid was drier at harvest, negative DM differences mean it was wetter. [2]A positive yield advantage means the bolded hybrid produced more yield, a negative yield advantage means it produced less. [3]For information on interpreting hybrid comparison data and statistical significance see page 3.

Recommended growing regions

Recommended established plant populations (000's/ha)

Challenging yield environments	95
Medium yield environments	108
High yield environments	115

TOP YIELDING, DROUGHT BUSTER.

P9911

CRM 99

Optimum AQUAmax

Feature hybrid	Comparison hybrid	Number of trials	Drymatter difference (%)[1]	Yield advantage to P9911 (kgDM/ha)[2]	Statistical significance[3]
Waikato					
P9911	PAC355 (G49-T9)	66	0.05	2,420	★★★
P9911	PAC300 (N51-N4)	10	0.20	1,127	CA
P9911	P0021	117	-1.30	1,440	★★★
P9911	P0362	69	1.34	402	CA
P9911	P9721	110	-1.18	1,574	★★★
P9911	P9978	37	-1.48	-157	NS
P9911	PAC249	33	-1.99	4,266	★★★
P9911	PAC314	18	0.69	1,519	★
Lower North Island & Taranaki					
P9911	PAC200 (Afinity)	29	-2.55	2,215	★★★
P9911	PAC355 (G49-T9)	23	-1.33	2,151	★★
P9911	P0021	131	-2.17	961	★★★
P9911	P9721	128	-2.35	1,345	★★★
P9911	P9978	32	-1.36	-694	NS
P9911	PAC249	38	-1.69	3,082	★★★
P9911	PAC314	14	0.32	2,304	★

[1]Positive DM differences means the bolded hybrid was drier at harvest, negative DM differences mean it was wetter. [2]A positive yield advantage means the bolded hybrid produced more yield, a negative yield advantage means it produced less. [3]For information on interpreting hybrid comparison data and statistical significance see page 3.

Recommended growing regions

Recommended established plant populations (000's/ha)

Challenging yield environments	100
Medium yield environments	108
High yield environments	115

VERY PRODUCTIVE. VERY STABLE. VERY DEFENSIVE.

CRM 99

Feature hybrid	Comparison hybrid	Number of trials	Drymatter difference (%)[1]	Yield advantage to P9978 (kgDM/ha)[2]	Statistical significance[3]
National					
P9978	PAC200 (Afinity)	29	-1.15	2,242	★★★
P9978	PAC295 (N39-Q1)	42	-1.04	1,798	★★★
P9978	P0362	58	2.79	0	NS
P9978	P9400	59	-2.34	2,138	★★★
P9978	P9721	46	-0.52	1,858	★★★
P9978	P9911	79	1.56	511	★
P9978	PAC249	36	-0.47	2,211	★★★
P9978	PAC314	31	1.70	1,920	★★★
Northland					
P9978	P9911	10	2.52	1,231	★
Waikato					
P9978	PAC200 (Afinity)	17	-1.07	1,911	★
P9978	PAC295 (N39-Q1)	23	-0.31	2,047	★★
P9978	P9400	31	-1.74	2,016	★★★
P9978	P9721	25	-0.23	1,106	★
P9978	P9911	37	1.48	157	NS
P9978	PAC249	15	-1.24	2,371	★★★
P9978	PAC314	17	2.19	1,085	★
Lower North Island and Taranaki					
P9978	PAC200 (Afinity)	12	-1.27	2,711	★★
P9978	PAC295 (N39-Q1)	19	-1.92	1,496	★
P9978	P0021	12	-0.24	1,867	★
P9978	P9721	21	-0.86	2,752	★★★
P9978	P9911	32	1.36	694	NS
P9978	PAC249	18	-0.45	2,203	★★
P9978	PAC314	13	0.96	3,038	★★★

[1]Positive DM differences means the bolded hybrid was drier at harvest, negative DM differences mean it was wetter. [2]A positive yield advantage means the bolded hybrid produced more yield, a negative yield advantage means it produced less. [3]For information on interpreting hybrid comparison data and statistical significance see page 3.

Recommended growing regions

Recommended established plant populations (000's/ha)

Challenging yield environments	95
Medium yield environments	110
High yield environments	120

ROBUST HYBRID DELIVERING YIELD AND ENERGY.

CRM 103

Feature hybrid	Comparison hybrid	Number of trials	Drymatter difference (%)[1]	Yield advantage to P0362 (kgDM/ha)[2]	Statistical significance[3]
National					
P0362	Brutus	19	1.41	2,162	★★★
P0362	PAC355 (G49-T9)	49	-1.12	2,029	★★★
P0362	Maximus	13	-0.03	1,977	★★★
P0362	P0021	74	-2.43	1,274	★★★
P0362	P0640	50	1.21	-712	★
P0362	P0891	35	-0.35	204	NS
P0362	P9911	124	-1.03	-223	NS
P0362	P9978	58	-2.79	0	NS
P0362	PAC314	30	-0.92	2,157	★★★
P0362	PAC344	15	1.09	2,018	★
Waikato					
P0362	Brutus	19	1.41	2,162	★★★
P0362	PAC355 (G49-T9)	43	-1.12	1,918	★★★
P0362	Maximus	12	-0.13	1,844	★★
P0362	P0021	44	-2.38	1,318	★★★
P0362	P0640	36	0.91	-1,254	★★★
P0362	P0891	33	-0.35	258	NS
P0362	P9911	69	-1.34	-402	CA
P0362	P9978	29	-2.98	289	NS
P0362	PAC314	17	-0.57	1,848	★★
P0362	PAC344	13	1.40	2,124	★
Lower North Island and Taranaki					
P0362	P0021	28	-2.58	1,046	★
P0362	P9911	43	-0.64	-119	NS
P0362	P9978	24	-2.23	-282	NS
P0362	PAC314	13	-1.37	2,562	★★

[1]Positive DM differences means the bolded hybrid was drier at harvest, negative DM differences mean it was wetter. [2]A positive yield advantage means the bolded hybrid produced more yield, a negative yield advantage means it produced less. [3]For information on interpreting hybrid comparison data and statistical significance see page 3.

Recommended growing regions

Recommended established plant populations (000's/ha)

Challenging yield environments	95
Medium yield environments	105
High yield environments	115

LEAF DISEASE CHAMPION DELIVERING SILAGE YIELD STABILITY.

CRM 106

Feature hybrid	Comparison hybrid	Number of trials	Drymatter difference (%)[1]	Yield advantage to P0640 (kgDM/ha)[2]	Statistical significance[3]
National					
P0640	Brutus	19	0.47	3,640	★★★
P0640	PAC355 (G49-T9)	71	-2.16	2,699	★★★
P0640	Maximus	27	-1.09	2,328	★★★
P0640	P0362	50	-1.21	712	★
P0640	P0725	150	1.01	-911	★★★
P0640	P0900	31	0.81	378	NS
P0640	P0937	49	1.39	660	CA
P0640	P9911	96	-1.79	-106	NS
P0640	PAC430	14	2.27	1,649	CA
P0640	PAC432	50	0.59	833	★
P0640	PAC400 (Plenitude)	42	1.15	1,049	★
Northland and South Auckland					
P0640	P0891	28	-2.78	-377	NS
P0640	P0900	5	-1.06	-1,294	NS
P0640	P0937	8	0.48	331	NS
P0640	P9911	16	-3.01	892	NS
Waikato					
P0640	Brutus	19	0.47	3,640	★★★
P0640	PAC355 (G49-T9)	60	-1.97	2,919	★★★
P0640	Maximus	24	-0.96	2,320	★★★
P0640	P0362	36	-0.91	1,254	★★★
P0640	P0725	107	1.22	-856	★★
P0640	P0900	24	1.07	663	NS
P0640	P0937	38	1.53	821	CA
P0640	P9911	52	-1.63	314	NS
P0640	PAC430	12	2.66	1,867	CA
P0640	PAC432	48	0.60	875	★
P0640	PAC400 (Plenitude)	37	1.25	1,353	★★

[1]Positive DM differences means the bolded hybrid was drier at harvest, negative DM differences mean it was wetter. [2]A positive yield advantage means the bolded hybrid produced more yield, a negative yield advantage means it produced less. [3]For information on interpreting hybrid comparison data and statistical significance see page 3.

Recommended growing regions

Recommended established plant populations (000's/ha)

Challenging yield environments	95
Medium yield environments	105
High yield environments	110

SUPERIOR PERFORMANCE WITH EXTRAORDINARY CONSISTENCY.

CRM 107

Optimum AQUAmax

Feature hybrid	Comparison hybrid	Number of trials	Drymatter difference (%)[1]	Yield advantage to P0725 (kgDM/ha)[2]	Statistical significance[3]
National					
P0725	Brutus	18	-0.95	4,093	★★★
P0725	PAC355 (G49-T9)	67	-3.01	3,461	★★★
P0725	Maximus	37	-1.66	2,490	★★★
P0725	P0362	35	-1.97	1,473	★★★
P0725	P0640	150	-1.01	911	★★★
P0725	P0891	260	-2.22	385	★
P0725	P0900	35	-0.99	407	NS
P0725	P0937	59	0.73	970	★
P0725	P1636	72	2.49	-611	CA
P0725	PAC430	12	0.39	2,932	★★
P0725	PAC432	52	-0.87	1,327	★★
P0725	PAC456	62	1.15	613	CA
P0725	PAC400 (Plenitude)	40	-0.48	2,063	★★★
Waikato					
P0725	Brutus	18	-0.95	4,093	★★★
P0725	PAC355 (G49-T9)	61	-3.01	3,395	★★★
P0725	Maximus	35	-1.78	2,375	★★★
P0725	P0362	32	-1.88	1,586	★★★
P0725	P0640	107	-1.22	856	★★
P0725	P0891	175	-2.18	752	★★★
P0725	P0900	24	-1.02	792	★
P0725	P0937	43	0.51	1,266	★★
P0725	P1636	55	2.39	-833	★
P0725	PAC430	12	0.39	2,932	★★
P0725	PAC432	50	-0.88	1,398	★★
P0725	PAC456	56	1.12	725	CA
P0725	PAC400 (Plenitude)	36	-0.47	2,091	★★★
Bay of Plenty					
P0725	P0900	6	-1.34	-670	NS
P0725	P1636	10	2.31	348	NS

[1]Positive DM differences means the bolded hybrid was drier at harvest, negative DM differences mean it was wetter. [2]A positive yield advantage means the bolded hybrid produced more yield, a negative yield advantage means it produced less. [3]For information on interpreting hybrid comparison data and statistical significance see page 3.

Recommended growing regions

Recommended established plant populations (000's/ha)

Challenging yield environments	95
Medium yield environments	104
High yield environments	108

RELIABLE VETERAN.

CRM 107

Feature hybrid	Comparison hybrid	Number of trials	Drymatter difference (%)[1]	Yield advantage to P0891 (kgDM/ha)[2]	Statistical significance[3]
National					
P0891	Brutus	19	0.76	2,135	★★★
P0891	PAC355 (G49-T9)	94	-1.03	2,201	★★★
P0891	Maximus	85	1.17	2,137	★★★
P0891	PAC300 (N51-N4)	51	-1.67	1,203	★★★
P0891	P0362	35	0.35	-204	NS
P0891	P0640	132	1.48	2	NS
P0891	P0725	260	2.22	-385	★
P0891	P0900	70	2.10	-700	★
Northland					
P0891	P0640	28	2.78	377	NS
P0891	P0725	36	2.38	645	NS
Waikato					
P0891	Brutus	19	0.76	2,135	★★★
P0891	PAC355 (G49-T9)	75	-0.97	2,148	★★★
P0891	Maximus	68	1.14	2,263	★★★
P0891	PAC300 (N51-N4)	46	-1.66	1,282	★★★
P0891	P0362	33	0.35	-258	NS
P0891	P0640	97	1.13	-259	NS
P0891	P0725	175	2.18	-752	★★★
P0891	P0900	48	2.13	-1,199	★★
P0891	P0937	67	2.77	-505	CA
Bay of Plenty					
P0891	P0725	49	2.25	172	NS
P0891	P1253	55	1.79	-285	NS

[1]Positive DM differences means the bolded hybrid was drier at harvest, negative DM differences mean it was wetter. [2]A positive yield advantage means the bolded hybrid produced more yield, a negative yield advantage means it produced less. [3]For information on interpreting hybrid comparison data and statistical significance see page 3.

Recommended growing regions

Recommended established plant populations (000's/ha)

Challenging yield environments	95
Medium yield environments	105
High yield environments	110

HARD TO FAULT, STABLE, ALL-ROUND HYBRID.

CRM 109

Optimum AQUAmax

Feature hybrid	Comparison hybrid	Number of trials	Drymatter difference (%)[1]	Yield advantage to P0900 (kgDM/ha)[2]	Statistical significance[3]
National					
P0900	P0725	35	0.99	-407	NS
P0900	P0891	70	-2.10	700	★
P0900	P0937	78	0.93	306	NS
P0900	P1096	16	0.18	536	NS
P0900	P1253	44	-0.11	878	★
P0900	PAC430	25	1.54	2,079	★★
P0900	PAC456	33	1.99	721	CA
P0900	PAC445 (Pelota)	23	0.00	1,202	★
P0900	PAC400 (Plenitude)	17	0.62	982	★
Northland					
P0900	P0937	12	1.25	305	NS
Waikato					
P0900	P0725	24	1.02	-792	★
P0900	P0891	48	-2.13	1,199	★★
P0900	P0937	55	0.48	475	NS
P0900	P1096	12	0.32	360	NS
P0900	P1253	44	-0.11	878	★
P0900	P1636	25	2.32	-723	NS
P0900	PAC430	23	1.54	2,227	★★
P0900	PAC455 (Pelota)	23	0.00	1,202	★
P0900	PAC400 (Plenitude)	17	0.62	982	★★
Bay of Plenty					
P0900	P0725	6	1.34	670	NS
P0900	P0937	11	2.85	-538	NS

[1]Positive DM differences means the bolded hybrid was drier at harvest, negative DM differences mean it was wetter. [2]A positive yield advantage means the bolded hybrid produced more yield, a negative yield advantage means it produced less. [3]For information on interpreting hybrid comparison data and statistical significance see page 3.

Recommended growing regions

Recommended established plant populations (000's/ha)

Challenging yield environments	85
Medium yield environments	95
High yield environments	115

ENJOY THE AGRONOMICS OF THIS TOP YIELDING HYBRID.

CRM 112

Feature hybrid	Comparison hybrid	Number of trials	Drymatter difference (%)[1]	Yield advantage to P1636 (kgDM/ha)[2]	Statistical significance[3]
National					
P1636	P0725	72	-2.49	611	CA
P1636	P0900	26	-2.25	492	NS
P1636	P0937	41	-0.92	1,376	★
P1636	P1477W	129	0.94	-410	NS
P1636	P1613	100	-0.07	136	NS
P1636	P1837	20	0.82	147	NS
P1636	PAC430	12	-0.72	2,309	CA
P1636	PAC456	52	-1.03	1,112	★★
P1636	PAC624	72	3.39	1,078	★
P1636	PAC500 (Z71-F1)	96	0.36	1,450	★★★
Northland and South Auckland					
P1636	P1477W	32	0.19	-978	CA
P1636	P1613	26	-0.40	-898	NS
Waikato					
P1636	P0725	55	-2.39	833	★
P1636	P0937	33	-1.25	978	CA
P1636	P1477W	61	1.35	-32	NS
P1636	P1613	47	0.42	1,004	★
P1636	P1837	11	1.45	177	NS
P1636	PAC430	12	-0.72	2,309	CA
P1636	PAC456	50	-1.01	1,094	★★
P1636	PAC624	54	3.78	940	CA
P1636	PAC500 (Z71-F1)	73	0.73	1,574	★★★
Bay of Plenty, Gisborne and Hawke's Bay					
P1636	P0725	10	-2.31	-348	NS
P1636	P1253	36	-1.92	121	NS
P1636	P1477W	36	0.91	-546	NS

[1]Positive DM differences means the bolded hybrid was drier at harvest, negative DM differences mean it was wetter. [2]A positive yield advantage means the bolded hybrid produced more yield, a negative yield advantage means it produced less. [3]For information on interpreting hybrid comparison data and statistical significance see page 3.

Recommended growing regions

Recommended established plant populations (000's/ha)

Challenging yield environments	95
Medium yield environments	105
High yield environments	110

NEW DEFENSIVE FULL-SEASON GIANT.

CRM 115

Feature hybrid	Comparison hybrid	Number of trials	Drymatter difference (%)[1]	Yield advantage to P1837 (kgDM/ha)[2]	Statistical significance[3]
National					
P1837	P0937	8	-2.12	534	NS
P1837	P1477W	21	-0.18	-441	NS
P1837	P1636	20	-0.82	-147	NS

[1]Positive DM differences means the bolded hybrid was drier at harvest, negative DM differences mean it was wetter. [2]A positive yield advantage means the bolded hybrid produced more yield, a negative yield advantage means it produced less. [3]For information on interpreting hybrid comparison data and statistical significance see page 3.

Recommended growing regions

Recommended established plant populations (000's/ha)

Challenging yield environments	80
Medium yield environments	90
High yield environments	100

DEDICATED CROPPING BLOCKS WITHIN DAIRY FARMS

Introduction

A number of studies have shown that:

- growing maize silage followed by a winter catch crop can significantly reduce the amount of nitrogen (N) leached.
- reducing dietary N intake can significantly reduce urinary N, one of the key sources of N-leaching on dairy farms.
- standing cows off paddocks and feeding them, enables the capture and storage of effluent which can be spread when the risk of N-leaching is low.

However, there has been no research to quantify the effect on N-leaching if all three on-farm mitigation strategies were combined. DairyNZ modellers Dr Pierre Beukes and Tai Chikazhe recently worked with Pioneer Farm Systems Specialist Ian Williams to conduct a modelling study to investigate the effectiveness of such a system from a profit and N loss perspective.[1]

Method

A Waikato farm with a dedicated maize block was simulated and compared with the two Waikato P21 farmlets from a previous trial using DairyNZ's Whole Farm Model (WFM), APSIM and the Urine Patch Framework (UPF) over five consecutive seasons (2013/14 to 2017/18). The three simulated farms represented **1)** the P21 Current Farm (CF) with a stocking rate of 3.2 cows/ha, applying 125 kg N/ha fertiliser on pasture, harvesting grass silage for use during periods of feed deficits, **2)** the P21 Future Farm (FF) with a stocking rate of 2.6 cows/ha, applying 85 kg N/ha fertiliser, high genetic merit cows, imported maize grain as low-N feed, with a standoff pad, and **3)** the maize silage-block farm (Future Farm Plus = FFP) with a stocking rate of 3.2 cows/ha, high genetic merit cows, applying 85 kg N/ha fertiliser on pasture, feedpad, maize silage followed by annual ryegrass grown on a dedicated block occupying 15% of the effective farm area. The annual ryegrass was harvested as silage and also fed on the feedpad. The model used a conservative 20 tDM/ha maize silage yield and a 6 tDM/ha annual ryegrass yield.

Results

A summary of the results can be seen in Table 1.

Table 1. Predicted results (average ± SD) for five consecutive seasons from 2013/14 to 2017/18 for Waikato dairy systems.

	Current Farm (CF)	Future Farm (FF)	Future Farm Plus maize (FFP)
Pasture yield (tDM/ha)	16.6±0.5	14.8±0.8	15.5±0.9
Milk production per cow (kg MS/cow)	392±4	433±2	435±2
Milk production per hectare (kg MS/ha)	1,266±13	1,132±6	1,407±7
N-leaching weighted average (kg N/ha)	70±37	49±27	52±29
N-leaching reduction from CF (%)	-	31±4	26±3
N use efficiency (kg MS/kg N leached)	23±13	31±18	36±21
Profit/ha ($/ha)	3,049±2,123	2,721±2,071	2,918±2,220
Profit reduction from CF/ha ($/ha)	-	11±23	4±24

[1]Beukes, P.; Chikazhe, T.; Williams, N. 2022. A dedicated maize block as a nitrogen leaching mitigation strategy for Waikato farms. Proceedings of the Australasian Dairy Science Symposium 2022.

Discussion

The N efficiency (kg MS/kg N leached) of the FFP system shows that a dedicated crop block with maize silage followed by a catch crop, can recycle more N within the farm system, with more N exported as product per unit of N lost to the environment. While the FFP had higher N losses compared to the FF, there was still a 26% reduction in N lost compared to the CF. The extra feed generated from the cropping block meant that the FFP had the highest milk production both on a per hectare and a per cow basis. However, the extra costs associated with growing a crop and feeding it on a feedpad resulted in a very slight reduction (4%) in profit for the FFP when compared to the CF.

Conclusion

The results from the modelling exercise shows that a farmer setting aside 15% of their farm as a dedicated cropping block can have some significant environmental benefits with minimal impact on profitability. Caveats are that the crop block should not be migrated across the farm to reduce the risk of N mineralisation, the maize should be followed by a catch crop (e.g. annual ryegrass), a feedpad is required to reduce feed-out wastage and capture effluent for recycling as a fertiliser source, and the homegrown crops are used to reduce imported feed-N.

FACTORS IMPACTING MAIZE FIELD ESTABLISHMENT IN NEW ZEALAND

Introduction

The aim of this field study was to quantify maize establishment under commercial growing conditions and to determine key factors influencing field establishment of maize in NZ.

Method

The study was conducted in spring 2021 and 2022 (n=156) and included commercial Pioneer® brand maize silage and grain crops from Northland to Canterbury. Pioneer field representatives estimated the actual planted and established populations using the methods described below:

Actual planted population per hectare

An even, flat (where possible) part of the paddock with no obvious gaps between plants was selected within the headland. Plants were counted in a 5.3 m section of a single row. This was repeated in different areas of the paddock to obtain three replicates.

Established population per hectare

A random starting point was selected outside the crop headland. Plants were counted in a 5.3 m section of a single row. This was repeated in different areas of the paddock until there were ten replicates.

Other information collected in this study included soil type, prior crop (or fallow), planting date, crop establishment method (conventional cultivation, strip till or no-till/direct drill), hybrid, amount of trash on the ground and seed bed preparation.

The assessment criteria for seed bed preparation are shown in Table 1.

Table 1: Assessment criteria for seed bed preparation.

Seed bed preparation	Description
Excellent	Small crumb size which is friable in hand, no clods or previous crop residue, no cracks
Acceptable	Medium crumb size which has minimal impact on emergence, small number of clods, low level or previous crop residue, small cracks
Poor	Large crumb size severely impacting crop emergence, lots of clods or previous crop residue, big cracks

Establishment percentage was calculated by dividing the established population by the planted population. Collected data was statistically analysed to determine trends.

Results

Maize establishment ranged from 76-100%. The median establishment percentage was 97% in both growing seasons. Maize that was planted using no-till or direct drill (n=4) had a lower establishment percentage than crops which were established using strip till (n=12) or conventional cultivation (n=140) (Table 2).

Table 2: Impact of crop establishment method on maize establishment.

Method of crop establishment	Establishment (%)*
Conventional cultivation	97[a]
Strip till	98[a]
No-till/direct drill	91[b]

*Means with different superscripts are statistically significant (P<0.05).

Crops which were established into excellent (n=98) or acceptable (n=50) seed beds, had a higher average establishment percentage than crops which were established into poor (n=8) seed beds (Table 3).

Table 3: Impact of seed bed preparation on maize establishment.

Method of crop establishment	Establishment (%)*
Excellent	97[a]
Acceptable	97[a]
Poor	91[b]

*Means with different superscripts are statistically significant (P<0.01).

Some paddocks were fallow over the winter prior to planting and there were a range of previous crops (annual ryegrass, perennial ryegrass, winter crop). The field study included a total of 24 different Pioneer® brand maize hybrids planted for silage and grain. Previous crop (including fallow) and hybrid had no impact on maize establishment.

Conclusions

Pioneer® brand maize seed is extensively tested for germination and cold vigour throughout the production process. The results of this survey show that field establishment is typically in the 90-100% range with only five paddocks (3%) having a field emergence less than 90%.

The two factors which resulted in the biggest impact on emergence and field establishment were the method of crop establishment or tillage type and the quality of seed bed preparation.

No-till or direct drill paddocks tend to be cooler, wetter and there is a higher incidence of slugs and snails than for conventionally cultivated paddocks. These factors can negatively impact seedling emergence and establishment.

Seed bed preparation impacts seed to soil contact and insect and weed pressure. This survey showed that there was no difference in the field establishment of high quality maize seed planted into excellent or acceptable seed beds. Poor seed bed preparation with large clods or cracks and/or a large amount of residue resulted in lower field establishment.

The current recommendations to plant 5% more seeds than the desired final plant population appears to be adequate for crops being established into well prepared seed beds using conventional cultivation or strip till. Where the seed bed preparation is poor, or the crop is being established via direct drill or no-till, growers should consider increasing the seeding rate.

THE IMPACT OF TILLAGE SYSTEMS ON MAIZE GROWTH AND THE ENVIRONMENT

Introduction

Tillage is the physical manipulation of soil to create a favourable environment for uniform seedling emergence and growth.

Tillage also helps aerate, warm and dry the soil, incorporate plant residues and fertilisers, control weeds, insects and disease organisms, improve nutrient availability by enhancing mineralisation and improve physical soil condition, e.g., reduce compaction. While the plough or disc continue to be the most popular equipment in crop production, a range of other tillage systems and variants exists.

Reduced tillage systems have a potential to reduce soil susceptibility to wind and water erosion and mitigate climate change through carbon sequestration. Besides the environmental benefits, increased soil carbon also results in improved soil fertility, water holding capacity and microbial activity and low bulk density.

Research conducted by Pioneer® brand seeds, Foundation for Arable Research, Plant and Food Research and other partners working on a Sustainable Farming Fund project concluded that in New Zealand, 89%, 9% and 2% of the maize is grown under conventional, strip and no-till systems respectively.

Since spring 2018, the Pioneer Research Team has been conducting a long-term tillage trial at the Rukuhia Research Station in the Waikato. This is a challenging maize growing environment with an ash soil. The trial involves growing maize silage under three tillage practices. The maize is then followed by an annual ryegrass option after harvesting in autumn. The research aims to help us better understand how these tillage practices influence crop growth, soil physical, chemical and biological conditions.

Tillage systems

The three tillage practices being tested are:

Conventional tillage – a three pass system using a standard disc followed by a power harrow and a precision seeding planter to plant the maize seed.

No-till (or direct drill) – a one pass system whereby a maize planter cuts a narrow slot of only sufficient width and depth and places the maize seed in the slot (Figure 1).

Strip tillage – a two pass system that combines no-till and full tillage by incorporating crop residues in a narrow zone, injecting fertiliser into the strip, while keeping residues between tilled strips undisturbed. The planter places maize seed directly into the strips. Strips can be created in autumn or in spring, but timing of stripping will depend on rotation, slope and soil type.

Figure 1: Maize establishment under a no-till system

Results

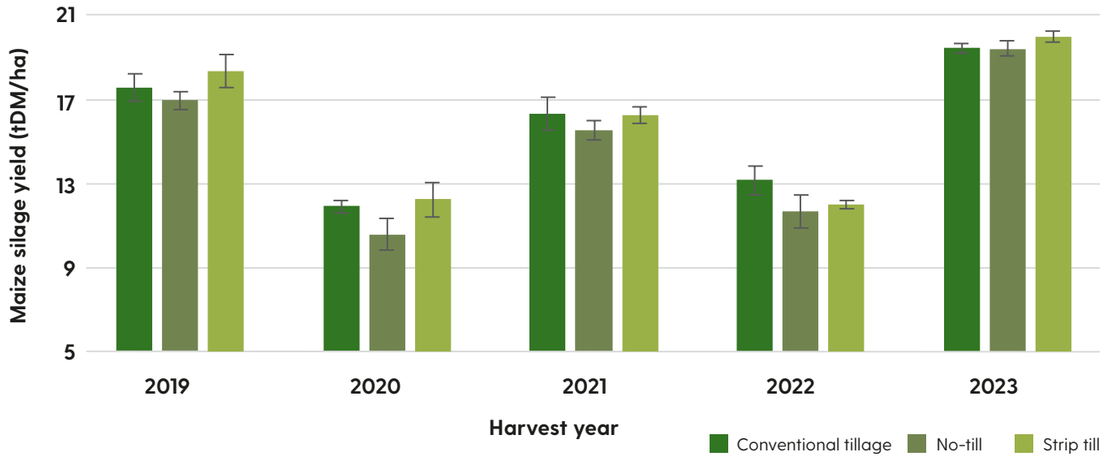
Below is a five-year summary of the key observations from our research:

Crop establishment and yields

On average, 95% plant establishment was achieved with strip till and conventional till, compared to 88% for no-till. Good seed to soil contact is critical to achieving high and uniform emergence. Our general observation has been that while appropriate soil conditions (e.g., moisture) are important for all planting systems, the impact of less favourable conditions has been greatest for no-till. Spring soil temperatures were lower in no-till than strip and conventional tillage, resulting in slower and less uniform emergence. This can be largely attributed to surface residue within the seed furrow and lack of tillage to aerate, warm and dry the soil.

Yield performance was more influenced by the season than the tillage system (Figure 2). This corroborates overseas research which indicates that tillage method success is influenced by the environment. Deciding on a tillage system should therefore be based on its suitability to the environment, and not yield.

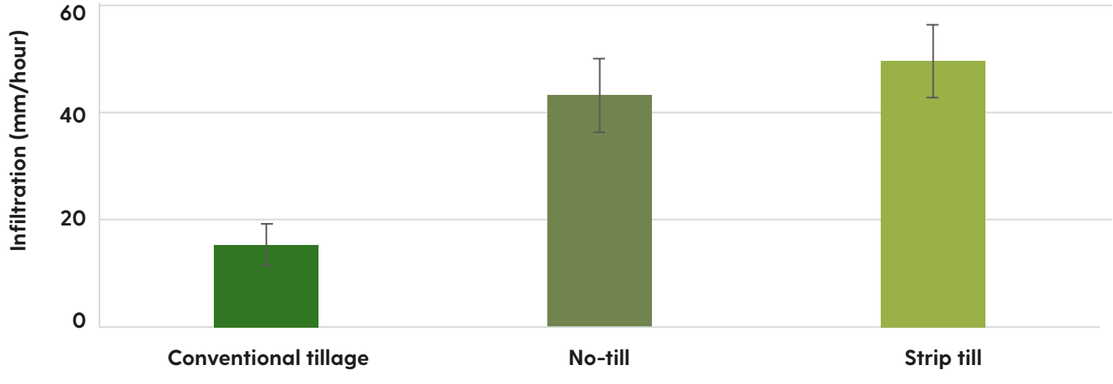
Figure 2: Maize silage drymatter yield at Rukuhia Research Station (2019-2023)



Water Infiltration

Water infiltration (measured in October 2022) was significantly greater under no-till and strip till than conventional tillage. Greater infiltration helps reduce soil water evaporation and surface runoff. Greater infiltration rates help soil absorb more water during heavy rain events, resulting in greater storage. This can have significant advantages during hot and dry summers.

Figure 3: Water infiltration rates between three tillage practices at Rukuhia Research Station



Organic matter (OM)

While soil OM levels measured at Year 5 are not statistically different, there has been a trend towards greater soil OM loss under conventional than reduced or no-till. Tilling the soil elevates soil temperature and aeration, increasing microbial activity which enhances mineralisation.

Summary

The best tillage option is the one capable of providing the best physical environment to achieve uniform plant emergence and growth. It should also provide the soil physical, chemical, and biological attributes necessary to achieve both environmental and crop yield benefits.

Both no-till and strip till showed a general trend towards better soil physical and biological conditions compared to conventional tillage. Despite the soil health benefits, under wet, compacted or heavy soil conditions, no-till will likely result in higher nitrous oxide losses.

Tillage helps to control weeds and buries crop residues which can harbour slugs and other pests and diseases. When shifting to reduced till an increase in chemical weed and slug control costs may need to be accounted for.

In high residue situations typical of no-till maize systems, more seed may be required to compensate for potentially lower seedling emergence and establishment.

Based on our Waikato trial, strip tillage appears to provide a balance between the environmental benefits of no-till and the positive attributes of conventional tillage.

THANK YOU TO THE 2021-2022 SILAGE TRIAL CO-OPERATORS

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