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Technical Report

Evaluation of a range of post-emergent herbicides on weed control efficacy and crop safety in a commercial onion planting in Waiuku, New Zealand

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Summary

A field trial was conducted during winter 2025 to assess the efficacy of a range of post-emergent herbicides at varying rates and tank mixes. The results indicate that tank mixes containing Iotril in combination with Tribunil and either Ethomate or Baron were the most effective in achieving high levels of weed control (88–93%) and major reductions in weed density. However, these same combinations also caused significant crop injury (up to 80%), indicating a potential trade-off between efficacy and crop safety.

Iotril alone provided moderate control (65–67%) with acceptable crop safety, while Ethomate (500 mL) gave low phytotoxicity but limited weed suppression. Tribunil alone showed poor overall performance and should not be relied upon under high weed pressure.

While Iotril + Tribunil + Ethomate and Iotril + Tribunil + Baron mixes demonstrated the greatest weed control, their crop safety concerns would need to be addressed before recommending for field use.

Materials and Method

Experimental site and application details

An experimental area was established within a commercial onion planting of the cv. Pinotage in a known high pressure weed block in Waiuku. The crop was seeded on the 15th of September. The experiment was laid out in a randomised complete block design (RCBD) with four treatment replicates. A total of 9 treatments were included in the experiment (including an untreated control) (Table 1). Plots were one bed (1.72m) wide and 7m in length. Herbicide applications were made on the 1st of August and were applied using a CO2 powered plot sprayer using 11002 AITTJ60 teejet nozzles spaced at 30cm. The sprayer was calibrated to apply a water volume equivalent to 400L/Ha. No other herbicides were made to the experimental area, all other growing practices were conducted as per the commercial crop.

Herbicide efficacy (% weed control/plot) was assessed on the 7th, 11th and 15th of August. Weed and onion counts were recorded on August 28th using a 1 m² quadrat placed within a representative area of each plot. Weed control efficiency was calculated based on the number of weeds present and was calculated using the formula below:

$$WCE(\%) = (WDc - WDt)/WDc \times 100$$

WCE = Weed control efficiency
WDc = Weed population of the untreated control
WDt = Weed population of the treated plot

Statistical analysis

Data was analysed using a 95% confidence interval. Analyses of variance (ANOVA) were computed using the statistical software ARM. Treatment means were separated using Tukeys test. As the LSD is computed using transformed data, comparisons of means should rely on the letters of separation, rather than the LSD value.

Table 1: Herbicide treatment details

Treatment	Product name	Active Ingredient
1	Untreated Check	-
2	Iotril (400ml)	Ioxynil
3	Tribunil (250g)	Methabenzthiazuron
4	Tribunil (500g)	Methabenzthiazuron
5	Tribunil (1kg)	Methabenzthiazuron
6	Ethomate (500ml)	Ethofumesate
7	Iotril (400ml) + Tribunil (250g) + Ethomate (500ml)	Ioxynil + Methabenzthiazuron + Ethofumesate
8	Iotril (400ml) + Tribunil (250g) + Baron (50g)	Ioxynil + Methabenzthiazuron + Oxyfluorfen
9	Iotril (400ml) + Tribunil (250g) + Baron (100g)	Ioxynil + Methabenzthiazuron + Oxyfluorfen

Results and Discussion

Crop Safety (Phytotoxicity)

Crop injury in the untreated control remained minimal throughout the trial, averaging less than 3% across all assessment dates. Early phytotoxicity ratings (7 August) were generally low across treatments, though some combinations exhibited moderate visible effects (10–26%). The highest initial injury was recorded in the Iotril + Tribunil + Baron (50 g) treatment, reaching 26%, followed by Iotril + Tribunil + Ethomate (11%) and Iotril alone (13%).

By the mid-assessment (11 August), differences between treatments became more evident. Tank mixes containing Baron (50–100 g) or Ethomate resulted in the highest injury (45–55%), significantly above the control. The Iotril + Tribunil + Ethomate and Iotril + Tribunil + Baron combinations produced moderate to high levels of crop damage across all ratings (45–81%), indicating some crop sensitivity to these mixtures.

At the final crop damage assessment (25 August), several treatments exhibited substantial crop damage, with injury ranging from 54% to over 80%. The Iotril + Tribunil + Baron (100 g) and Iotril + Tribunil + Ethomate treatments caused the greatest visible damage (74–81%), whereas single-product applications Tribunil (up to 1 kg) and Ethomate (500 mL) maintained very low crop injury (≤10%). Overall, treatments containing Iotril combined with Tribunil and either Baron or Ethomate showed a clear trend of increased phytotoxicity relative to single or lower-rate treatments.

Weed Density (Plant Counts)

Weed density in the untreated plots was high, averaging over 75 plants per m² by the end of the trial. Nearly all herbicide treatments significantly reduced weed numbers compared with the control. The most effective suppression occurred in tank mixes of Iotril + Tribunil + Ethomate and Iotril + Tribunil + Baron (100 g), with counts as low as 4–5 plants per m².

Iotril alone, achieved moderate reductions (9 plants/m²), while Tribunil treatments were less consistent, showing 22–57 plants/m² depending on rate. Ethomate alone, achieved low reductions in weed numbers, with an average count of 78 plants/m². This indicates that Ethomate has poor residual control when used as a stand-alone product compared to the other treatments. These results indicate that Iotril-based mixtures provided the strongest reduction in weed populations, particularly when combined with Ethomate or Baron.

Percent Weed Control (Visual Ratings)

Weed control ratings reflected the same patterns observed in the count data. Early control (7 August) was variable, with Iotril alone and the Iotril + Tribunil + Baron (50 g) mix showing moderate to high suppression (26-43%). By 11 August, control improved substantially in the tank-mix treatments, exceeding 60% for combinations containing Iotril + Tribunil + Ethomate or Baron.

Final control ratings (25 August) were highest for Iotril + Tribunil + Ethomate (93%) and Iotril + Tribunil + Baron (100 g) (90%), both statistically different to most other treatments. These treatments provided strong and sustained knockdown of broadleaf and grass weeds. In contrast, Tribunil applied alone, even at the highest rate (1 kg/ha), achieved only 28% control by the final assessment, confirming limited standalone efficacy.

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Table 2: The average percentage of crop damage per treatment

Treatment No.	Name	7th August	11th August	25th August
1	Untreated Check	2.5 b	0.0 c	17.5 c
2	Iotril (400ml)	12.5 ab	26.3 abc	10.0 c
3	Iotril (400ml) + Tribunil (250g)	2.5 b	2.5 c	5.0 c
4	Iotril (400ml) + Tribunil (500g)	2.5 b	5.0 c	30.0 bc
5	Iotril (400ml) + Bladex (50g)	0.0 b	12.5 bc	22.5 c
6	Iotril (400ml) + Bladex (100g)	0.0 b	0.0 c	10.0 c
7	Iotril (400ml) + Ethomate (500ml)	11.3 ab	45.0 ab	73.8 ab
8	Iotril (400ml) + Baron (50g)	26.3 a	55.0 a	53.8 abc
9	Iotril (400ml) + Baron (100g)	15.0 ab	55.0 a	81.3 a
Tukey's HSD P=.05		19.63	38.92	50.68
Standard Deviation		8.17	16.19	21.09
CV		101.4	72.42	62.48
Grand Mean		8.06	22.36	33.75
Levene's F^		1.044	2.596*	0.836
Levene's Prob(F)		0.429	0.03*	0.579
Replicate F		1.679	0.094	1.039
Replicate Prob(F)		0.1981	0.9624	0.3933
Treatment F		4.733	8.486	7.440
Treatment Prob(F)		0.0014	0.0001	0.0001

Means followed by same letter or symbol do not significantly differ (P=.05, Tukey's HSD).
Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.
Due to missing data, larger Tukey's HSD values (col. 7: >=30.43 and <=43.92) are used for mean comparisons of treatment pairs with missing data. * Adjusted means ^Calculated from residual.

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Table 3: Weed and onion counts were recorded (last assessment) on August 28th using a 1 m² quadrat placed within a representative area of each plot.

Treatment No.	Name	Weed Count: 28th August	Onion Count: 28th August	WCE (Total) (%)
1	Untreated Check	75.3 a	47.4 ab	-
2	Iotril (400ml)	8.8 c	47.8 a	88.31
3	Iotril (400ml) + Tribunil (250g)	57.0 ab	46.0 ab	24.30
4	Iotril (400ml) + Tribunil (500g)	33.3 bc	46.8 ab	55.78
5	Iotril (400ml) + Bladex (50g)	22.4 bc	37.5 bcd	70.25
6	Iotril (400ml) + Bladex (100g)	77.8 a	47.8 a	-3.32
7	Iotril (400ml) + Ethomate (500ml)	4.0 c	28.5 d	94.69
8	Iotril (400ml) + Baron (50g)	4.8 c	38.8 abc	93.63
9	Iotril (400ml) + Baron (100g)	4.5 c	30.5 cd	94.02
Tukey's HSD P=.05		30.43	9.30	
Standard Deviation		12.56	3.85	
CV		38.6	9.41	
Grand Mean		32.53	40.97	
Levene's F^		1.177	0.707	
Levene's Prob(F)		0.351	0.683	
Replicate F		1.368	3.074	
Replicate Prob(F)		0.2787	0.0478	
Treatment F		23.648	15.385	
Treatment Prob(F)		0.0001	0.0001	

Means followed by same letter or symbol do not significantly differ (P=.05, Tukey's HSD).
Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.
Due to missing data, larger Tukey's HSD values (col. 7: >=30.43 and <=43.92) are used for mean comparisons of treatment pairs with missing data. * Adjusted means ^Calculated from residual.

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Table 4: The percentage of weed control achieved per treatment over three assessment dates.

Treatment No.	Name	7th August	11th August	25th August
1	Untreated Check	10.0 ab	0.0 b	0.0 c
2	Iotril (400ml)	26.3 ab	52.5 a	70.0 a
3	Iotril (400ml) + Tribunil (250g)	5.0 ab	6.3 b	15.0 bc
4	Iotril (400ml) + Tribunil (500g)	11.3 ab	5.0 b	10.0 bc
5	Iotril (400ml) + Bladex (50g)	1.3 b	8.8 b	27.5 b
6	Iotril (400ml) + Bladex (100g)	0.0 b	0.0 b	3.8 c
7	Iotril (400ml) + Ethomate (500ml)	30.0 ab	58.8 a	9.0 a
8	Iotril (400ml) + Baron (50g)	42.5 a	60.0 a	86.3 a
9	Iotril (400ml) + Baron (100g)	28.8 ab	62.5 a	90.0 a
Tukey's HSD P=.05		38.79	29.23	23.69
Standard Deviation		16.14	12.16	9.86
CV		93.7	43.13	22.6
Grand Mean		17.22	28.19	43.61
Levene's F^		1.923	0.569	0.916
Levene's Prob(F)		0.098	0.794	0.519
Replicate F		0.704	1.595	0.276
Replicate Prob(F)		0.5590	0.2166	0.8419
Treatment F		3.467	22.658	64.412
Treatment Prob(F)		0.0085	0.0001	0.0001

Means followed by same letter or symbol do not significantly differ (P=.05, Tukey's HSD).
Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.
Due to missing data, larger Tukey's HSD values (col. 7: >=30.43 and <=43.92) are used for mean comparisons of treatment pairs with missing data. * Adjusted means ^Calculated from residual.

Appendix

Appendix i: Weather Data

Date	Max Air Temp. (°C)	Min Air Temp. (°C)	Mean Air Temp. (°C)	Rainfall (mm)
Fri, Aug 1, 2025	15.4	2	8.7	0
Sat, Aug 2, 2025	14.6	4.2	9.4	0.9
Sun, Aug 3, 2025	15.3	4.2	9.7	0
Mon, Aug 4, 2025	12.7	6.3	9.5	0
Tue, Aug 5, 2025	14.2	8.4	11.3	0
Wed, Aug 6, 2025	13.1	8	10.5	0
Thu, Aug 7, 2025	15.9	10.8	13.4	5.3
Fri, Aug 8, 2025	15.8	8.2	12	8.3
Sat, Aug 9, 2025	14	3.1	8.5	0.4
Sun, Aug 10, 2025	12.3	1.5	6.9	0
Mon, Aug 11, 2025	15.1	3.8	9.4	0
Tue, Aug 12, 2025	15.2	3.2	9.2	0
Wed, Aug 13, 2025	16.6	3	9.8	0
Thu, Aug 14, 2025	16.7	2.7	9.7	0
Fri, Aug 15, 2025	17.8	5.4	11.6	0
Sat, Aug 16, 2025	14.2	8.1	11.2	14.3
Sun, Aug 17, 2025	17.7	7	12.3	1.1
Mon, Aug 18, 2025	15	7.5	11.3	9.8
Tue, Aug 19, 2025	12.4	3.3	7.8	10.3
Wed, Aug 20, 2025	13.6	2.5	8.1	0
Thu, Aug 21, 2025	15.6	4.8	10.2	0
Fri, Aug 22, 2025	15.8	5	10.4	0
Sat, Aug 23, 2025	14.8	5.7	10.2	0
Sun, Aug 24, 2025	16.5	8.6	12.5	4
Mon, Aug 25, 2025	18.1	9	13.6	0
Tue, Aug 26, 2025	17.8	8.5	13.2	0
Wed, Aug 27, 2025	15.6	5.6	10.6	0
Thu, Aug 28, 2025	19.1	10.8	14.9	3.6