




APPENDIX 7: SAINSBURY'S PROJECT INDIVIDUAL CASE STUDY FARMER DRENCH RESISTANCE RESULTS – NEW ZEALAND

DRENCH SUMMARY CHART CODES

Availability Legend

-  Available for Use – this active has not demonstrated resistance at this point in time
-  Use Cautiously – this active may be developing resistance and should be used cautiously
-  Do Not Use – this active is not working effectively on this property and use should be discontinued

DAY 10 LARVAL CULTURE SPECIES RESISTANCE SUMMARY: EXPLANATION AND CODES

To identify resistance for each parasite species for each drench active, we use Larval Cultures and average faecal egg counts (FEC). Using the species proportion of the Day 1 Larval Culture and the FEC from the Day 1 mob sample, we extrapolate a Day 1 FEC for each parasite species and active combination. For example, if 100% of the species found in the Day 1 Larval Culture are *Trichostrongylus* and the Day 1 strongyle FEC in the Benzimidazole sample is 270epg then we would use a Day 1 FEC of 270epg for *Trichostrongylus* in the Benzimidazole sample.

We do the same for the Day 10 FEC for each parasite species, using the average Day 10 FEC for each active. For example, if 83% of the species found in the Day 10 Larval Culture for Benzimidazole were *Trichostrongylus*, and the average Day 10 strongyle FEC in the Benzimidazole sample was 218epg; then the Day 10 FEC for *Trichostrongylus* in the Benzimidazole sample is extrapolated as $83\% \times 218\text{epg} = 181\text{epg}$.

We then calculate the FEC reduction percentage (Reduc %) for *Trichostrongylus* in the Benzimidazole sample as $(270\text{epg} - 181\text{epg})/270\text{epg} = 33\%$.

Nematodirus eggs can be identified when processing FEC, so Nematodirus reduction percentages can be calculated directly from FEC counts.

Chart Codes

Reduction % Key:

- 99% and Above – Drench is effective against this species
- 95% - 98% (inclusive) – Resistance is developing
- 94% and below – Drench is NOT effective against this species as resistance has been confirmed

Test Validity:

- Y = Pre-test worm species present at more than 50epg
- N = Pre-test worm species present at less than 50epg

“Where a pre-test/pre-drench worm species is present at less than 50epg for that species – then no validity should be attributed to that result.” - Source www.wormwise.co.nz













Table Key

* Species of most significance. Please Note: The egg counts of each worm type are extrapolated from the larval culture results, this is an indicator of trends only, not an absolute result. Nematodirus is not included in the main data table as its susceptibility or resistance is evident from the FEC data.

DRENCH SUMMARY: CASE STUDY FARMER 1

Drench Active	Quick Drench Selection	Species	Starting FEC	Percentage Reduction	Combined Percentage Reduction	Resistance Status	Test Confidence
Benzimidazole	✘	Strongyle	840	88.6%	86.4%	Resistance Confirmed	High
	✘	Nematodirus	60	54.5%			Low
Levamisole	✘	Strongyle	1290	96.8%	97.2%	Resistance Suspected	High
	✔	Nematodirus	150	100.0%			Med
Combination (BZ & Lev)	✔	Strongyle	1800	99.5%	99.5%	No Resistance Detected	High
	✔	Nematodirus	330	99.2%			High
Abamectin	✔	Strongyle	1230	99.7%	99.7%	No Resistance Detected	High
	✔	Nematodirus	60	100.0%			Low
Moxidectin	✘	Strongyle	1050	95.8%	96.5%	Resistance Suspected	High
	✔	Nematodirus	180	100.0%			High
Combination (Lev & Aba)	✔	Strongyle	1770	99.5%	99.5%	No Resistance Detected	High
	✔	Nematodirus	150	100.0%			Med

DRENCH SUMMARY: CASE STUDY FARMER 2

Drench Active	Quick Drench Selection	Species	Starting FEC	Percentage Reduction	Combined Percentage Reduction	Resistance Status	Test Confidence
Levamisole		Strongyle	280	81.2%	71.9%	Resistance Confirmed	Med
		Nematodirus	0	0.0%			Low
Combination (BZ & Lev)		Strongyle	735	93.5%	93.6%	Resistance Confirmed	High
		Nematodirus	210	93.9%			High
Abamectin		Strongyle	665	99.5%	99.5%	No Resistance Detected	High
		Nematodirus	35	100.0%			Low
Moxidectin		Strongyle	525	92.8%	93.1%	Resistance Confirmed	High
		Nematodirus	105	94.4%			Med
Combination (Lev & Aba)		Strongyle	315	89.8%	93.5%	Resistance Confirmed	Med
		Nematodirus	175	100.0%			High
Combination (BZ, Lev, Aba)		Strongyle	1050	99.7%	99.4%	No Resistance Detected	High
		Nematodirus	70	95.5%			Low

DAY 10 LARVAL CULTURE SPECIES RESISTANCE SUMMARY: CASE STUDY FARMER 2

Parasite Species

	*Ostertagia/ Teladorsagia		*Trichostrongylus		*Haemonchus		Cooperia		Oesophagostomum / Chabertia		Other		*Nematodirus	
	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity
Levamisole	16.5%	N	83.6%	Y	N/A	N	100.0%	N	98.7%	Y	N/A	N	0.0%	N
Combination (BZ & Lev)	41.0%	Y	100.0%	Y	N/A	N	100.0%	N	100.0%	Y	N/A	N	93.9%	Y
Moxidectin	100.0%	Y	100.0%	Y	N/A	N	100.0%	N	100.0%	Y	N/A	N	94.4%	Y









DRENCH SUMMARY: CASE STUDY FARMER 3

Drench Active	Quick Drench Selection	Species	Starting FEC	Percentage Reduction	Combined Percentage Reduction	Resistance Status	Test Confidence
Benzimidazole	?	Strongyle	1500	96.0%	96.0%	Resistance Suspected	High
	?	Nematodirus	60	95.5%			Low
Levamisole	?	Strongyle	2700	96.6%	96.6%	Resistance Suspected	High
	?	Nematodirus	120	97.9%			Med
Combination (BZ & Lev)	✓	Strongyle	1650	99.7%	99.7%	No Resistance Detected	High
	✓	Nematodirus	150	100.0%			High
Abamectin	✓	Strongyle	2280	98.7%	98.9%	No Resistance Detected	High
	✓	Nematodirus	360	100.0%			High
Moxidectin	✓	Strongyle	2760	98.1%	98.3%	No Resistance Detected	High
	✓	Nematodirus	240	100.0%			High
Combination (Lev & Aba)	✓	Strongyle	1740	100.0%	100.0%	No Resistance Detected	High
	✓	Nematodirus	180	100.0%			High
Combination (BZ, Lev, Aba)	✓	Strongyle	2400	99.9%	99.9%	No Resistance Detected	High
	✓	Nematodirus	120	100.0%			Med

DAY 10 LARVAL CULTURE SPECIES RESISTANCE SUMMARY: CASE STUDY FARMER 3

	Parasite Species													
	*Ostertagia/ Teladorsagia		*Trichostrongylus		*Haemonchus		Cooperia		Oesophagostomum / Chabertia		Other		*Nematodirus	
	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity
Benzimidazole	76.8%	Y	92.7%	Y	N/A	N/A	100.0%	Y	100.0%	Y	N/A	N/A	95.5%	Y
Levamisole	32.9%	Y	100.0%	Y	N/A	N/A	99.9%	Y	100.0%	Y	N/A	N/A	97.9%	Y















DRENCH SUMMARY: CASE STUDY FARMER 4

Drench Active	Quick Drench Selection	Species	Starting FEC	Percentage Reduction	Combined Percentage Reduction	Resistance Status	Test Confidence
Combination (BZ & Lev)		Strongyle	330	94.7%	95.50%	Resistance confirmed	Med
		Nematodirus	60	100.0%			Low
Moxidectin		Strongyle	180	95.8%	95.80%	Resistance confirmed	Low
		Nematodirus	0	100.0%			Low
Combination (Lev & Aba)		Strongyle	390	100.0%	100.00%	No resistance detected	Med
		Nematodirus	0	100.0%			Low
Combination (BZ, Lev, Aba)		Strongyle	300	98.3%	98.50%	No resistance detected	Med
		Nematodirus	30	100.0%			Low

DAY 10 LARVAL CULTURE SPECIES RESISTANCE SUMMARY: CASE STUDY FARMER 4

	Parasite Species													
	*Ostertagia/ Teladorsagia		*Trichostrongylus		*Haemonchus		Cooperia		Oesophagostomum / Chabertia		Other		*Nematodirus	
	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity
Combination (BZ & Lev)	100%	N	81.1%	Y	N/A	N	100%	Y	100%	N	N/A	N	100%	Y
Moxidectin	100%	N	100%	Y	N/A	N	92.6%	Y	100%	N	N/A	N	100%	N

DRENCH SUMMARY: CASE STUDY FARMER 5















Drench Active	Quick Drench Selection	Species	Starting FEC	Percentage Reduction	Combined Percentage Reduction	Resistance Status	Test Confidence
Benzimidazole		Strongyle	1710	58.8%	58.8%	Resistance Confirmed	High
		Nematodirus	3	60.0%			Low
Levamisole		Strongyle	1230	47.0%	46.1%	Resistance Confirmed	High
		Nematodirus	30	9.1%			Low
Combination (BZ & Lev)		Strongyle	990	40.7%	38.9%	Resistance Confirmed	High
		Nematodirus	0	0%			Low
Abamectin		Strongyle	1230	100.0%	100%	No Resistance Detected	High
		Nematodirus	30	100.0%			Low
Moxidectin		Strongyle	1560	99.8%	99.8%	No Resistance Detected	High
		Nematodirus	0	100.0%			Low
Combination (Lev & Aba)		Strongyle	1050	99.5%	99.5%	No Resistance Detected	High
		Nematodirus	30	100.0%			Low
Combination (BZ, Lev, Aba)		Strongyle	1380	99.1%	99%	No Resistance Detected	High
		Nematodirus	60	95.8%			Low

DAY 10 LARVAL CULTURE SPECIES RESISTANCE SUMMARY: CASE STUDY FARMER 5

Parasite Species

	*Ostertagia/ Teladorsagia		*Trichostrongylus		*Haemonchus		Cooperia		Oesophagostomum / Chabertia		Other		*Nematodirus	
	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity
Benzimidazole	45.0%	Y	51.7%	Y	N/A	N	N/A	N	100.0%	Y	N/A	N	60.0%	N
Levamisole	100.0%	N	27.6%	Y	N/A	N	N/A	N	100.0%	Y	N/A	N	0%	N
Combination (BZ & Lev)	100.0%	N	36.0%	Y	N/A	N	N/A	N	96.5%	Y	N/A	N	9.1%	N















DRENCH SUMMARY: CASE STUDY FARMER 6

Drench Active	Quick Drench Selection	Species	Starting FEC	Percentage Reduction	Combined Percentage Reduction	Resistance Status	Test Confidence
Benzimidazole		Strongyle	805	83.7%	84.0%	Resistance Confirmed	High
		Nematodirus	35	91.7%			Low
Levamisole		Strongyle	525	63.9%	63.9%	Resistance Confirmed	High
		Nematodirus	0	N/A			Low
Combination (BZ & Lev)		Strongyle	735	89.3%	89.3%	Resistance Confirmed	High
		Nematodirus	0	N/A			Low
Abamectin		Strongyle	1190	98.2%	98.3%	No Resistance Detected	High
		Nematodirus	70	100.0%			Low
Moxidectin		Strongyle	980	96.1%	96.3%	Resistance Suspected	High
		Nematodirus	35	100.0%			Low
Combination (Lev & Aba)		Strongyle	385	81.8%	81.8%	Resistance Confirmed	Med
		Nematodirus	0	N/A			Low
Combination (BZ, Lev, Aba)		Strongyle	700	97.0%	97.1%	Resistance Suspected	High
		Nematodirus	35	100.0%			Low

DAY 10 LARVAL CULTURE SPECIES RESISTANCE SUMMARY: CASE STUDY FARMER 6

	Parasite Species													
	*Ostertagia/ Teladorsagia		*Trichostrongylus		*Haemonchus		Cooperia		Oesophagostomum / Chabertia		Other		*Nematodirus	
	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity
Benzimidazole	83.7%	Y	83.1%	Y	N/A	N	N/A	N	95.9%	N	N/A	N	91.7%	N
Levamisole	7.1%	N	71.6%	Y	N/A	N	N/A	N	0.0%	N	N/A	N	N/A	N
Combination (BZ & Lev)	87.8%	Y	88.9%	Y	N/A	N	N/A	N	100.0%	N	N/A	N	N/A	N
Moxidectin	86.2%	Y	97.1%	Y	N/A	N	0.0%	N	100.0%	N	N/A	N	100.0%	N
Combination (Lev & Aba)	84.4%	N	80.8%	Y	N/A	N	N/A	N	100.0%	N	N/A	N	N/A	N
Combination (BZ, Lev, Aba)	100.0%	N	96.6%	Y	N/A	N	N/A	N	100.0%	N	N/A	N	100.0%	N

DRENCH SUMMARY: CASE STUDY FARMER 7















Drench Active	Quick Drench Selection	Species	Starting FEC	Percentage Reduction	Combined Percentage Reduction	Resistance Status	Test Confidence
Benzimidazole		Strongyle	480	98.3%	98.60%	No resistance detected	Med
		Nematodirus	120	100.0%			Med
Levamisole		Strongyle	360	96.5%	96.80%	Resistance confirmed	Med
		Nematodirus	30	100.0%			Low
Combination (BZ & Lev)		Strongyle	870	99.1%	99.40%	No resistance detected	High
		Nematodirus	300	100.0%			High
Abamectin		Strongyle	480	100.0%	100.00%	No resistance detected	Med
		Nematodirus	90	100.0%			Med
Moxidectin		Strongyle	630	100.0%	100.00%	No resistance detected	High
		Nematodirus	60	100.0%			Low
Combination (Lev & Aba)		Strongyle	840	99.1%	99.30%	No resistance detected	High
		Nematodirus	210	100.0%			High
Combination (BZ, Lev, Aba)		Strongyle	630	98.8%	98.90%	No resistance detected	High
		Nematodirus	60	100.0%			Low

DAY 10 LARVAL CULTURE SPECIES RESISTANCE SUMMARY: CASE STUDY FARMER 7

Parasite Species

	*Ostertagia/ Teladorsagia		*Trichostrongylus		*Haemonchus		Cooperia		Oesophagostomum / Chabertia		Other		*Nematodirus	
	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity
Levamisole	N/A	N	96.6%	Y	N/A	N	N/A	N	N/A	N	N/A	N	100.0%	N

DRENCH SUMMARY: CASE STUDY FARMER 8















Drench Active	Quick Drench Selection	Species	Starting FEC	Percentage Reduction	Combined Percentage Reduction	Resistance Status	Test Confidence
Benzimidazole		Strongyle	1230	57.5%	60.0%	Resistance Confirmed	High
		Nematodirus	180	77.8%			High
Levamisole		Strongyle	2490	63.0%	63.5%	Resistance Confirmed	High
		Nematodirus	60	87.5%			Low
Combination (BZ & Lev)		Strongyle	1500	55.2%	56.0%	Resistance Confirmed	High
		Nematodirus	30	100.0%			Low
Abamectin		Strongyle	1890	99.6%	99.6%	No Resistance Detected	High
		Nematodirus	0	N/A			Low
Moxidectin		Strongyle	900	99.7%	99.7%	No Resistance Detected	High
		Nematodirus	30	100.0%			Low
Combination (Lev & Aba)		Strongyle	1440	98.1%	98.1%	No Resistance Detected	High
		Nematodirus	0	N/A			Low
Combination (BZ, Lev, Aba)		Strongyle	1410	91.0%	91.1%	Resistance Confirmed	High
		Nematodirus	30	100.0%			Low

DAY 10 LARVAL CULTURE SPECIES RESISTANCE SUMMARY: CASE STUDY FARMER 8

Parasite Species

	*Ostertagia/ Teladorsagia		*Trichostrongylus		*Haemonchus		Cooperia		Oesophagostomum / Chabertia		Other		*Nematodirus	
	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity
Benzimidazole	0.0%	N	58.8%	Y	N/A	N	14.9%	N	100.0%	N	N/A	N	77.8%	Y
Levamisole	0.0%	N	63.7%	Y	N/A	N	100.0%	N	25.9%	N	N/A	N	87.5%	Y
Combination (BZ & Lev)	10.3%	N	54.7%	Y	N/A	N	100.0%	N	100.0%	N	N/A	N	100.0%	N
Combination (BZ, Lev, Aba)	45.7%	N	91.2%	Y	N/A	N	100.0%	N	100.0%	N	N/A	N	100.0%	N

DRENCH SUMMARY: CASE STUDY FARMER 9















Drench Active	Quick Drench Selection	Species	Starting FEC	Percentage Reduction	Combined Percentage Reduction	Resistance Status	Test Confidence
Benzimidazole		Strongyle	245	85.7%	67.7%	Resistance Confirmed	Med
		Nematodirus	35	0.0%			Low
Levamisole		Strongyle	1295	92.8%	92.6%	Resistance Confirmed	High
		Nematodirus	0	N/A			Low
Combination (BZ & Lev)		Strongyle	280	91.2%	91.2%	Resistance Confirmed	Med
		Nematodirus	0	N/A			Low
Abamectin		Strongyle	595	99.5%	99.6%	No Resistance Detected	High
		Nematodirus	175	100.0%			High
Moxidectin		Strongyle	1155	99.7%	99.5%	No Resistance Detected	High
		Nematodirus	70	95.5%			Low
Combination (Lev & Aba)		Strongyle	735	100.0%	100.0%	No Resistance Detected	High
		Nematodirus	0	N/A			Low
Combination (BZ, Lev, Aba)		Strongyle	630	99.4%	99.0%	No Resistance Detected	High
		Nematodirus	70	95.0%			Low

DAY 10 LARVAL CULTURE SPECIES RESISTANCE SUMMARY: CASE STUDY FARMER 9

Parasite Species

	*Ostertagia/ Teladorsagia		*Trichostrongylus		*Haemonchus		Cooperia		Oesophagostomum / Chabertia		Other		*Nematodirus	
	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity
Benzimidazole	0.0%	N	96.9%	Y	N/A	N	100.0%	N	100.0%	Y	N/A	N	0.0%	N
Levamisole	0.0%	Y	96.3%	Y	N/A	N	100.0%	N	100.0%	Y	N/A	N	0.0%	N
Combination (BZ & Lev)	0.0%	N	94.8%	Y	N/A	N	100.0%	N	100.0%	Y	N/A	N	N/A	N















DRENCH SUMMARY: CASE STUDY FARMER 10

Drench Active	Quick Drench Selection	Species	Starting FEC	Percentage Reduction	Combined Percentage Reduction	Resistance Status	Test Confidence
Benzimidazole		Strongyle	270	19.4%	17.6%	Resistance Confirmed	Med
		Nematodirus	0	0.0%			Low
Levamisole		Strongyle	270	84.3%	84.3%	Resistance Confirmed	Med
		Nematodirus	0	N/A			Low
Combination (BZ & Lev)		Strongyle	390	94.2%	96.3%	Resistance Suspected	Med
		Nematodirus	210	100.0%			High
Abamectin		Strongyle	630	96.0%	96.5%	Resistance Suspected	High
		Nematodirus	90	100.0%			Med
Moxidectin		Strongyle	420	98.2%	98.5%	No Resistance Detected	High
		Nematodirus	90	100.0%			Med
Combination (Lev & Aba)		Strongyle	630	99.2%	98.9%	No Resistance Detected	High
		Nematodirus	30	91.7%			Low
Combination (BZ, Lev, Aba)		Strongyle	210	97.6%	97.9%	Resistance Suspected	Med
		Nematodirus	30	100.0%			Low

DAY 10 LARVAL CULTURE SPECIES RESISTANCE SUMMARY: CASE STUDY FARMER 10

	Parasite Species													
	*Ostertagia/ Teladorsagia		*Trichostrongylus		*Haemonchus		Cooperia		Oesophagostomum / Chabertia		Other		*Nematodirus	
	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity
Benzimidazole	0%	N	33%	Y	0%	N	0%	N	N/A	N	N/A	N	0%	N
Levamisole	0%	N	89%	Y	N/A	N	N/A	N	N/A	N	N/A	N	N/A	N
Combination (BZ & Lev)	0%	N	95%	Y	N/A	N	N/A	N	N/A	N	N/A	N	100%	Y
Abamectin	N/A	N	N/A	N	N/A	N	N/A	N	N/A	N	N/A	N	100%	Y











DRENCH SUMMARY: CASE STUDY FARMER 11

Drench Active	Quick Drench Selection	Species	Starting FEC	Percentage Reduction	Combined Percentage Reduction	Resistance Status	Test Confidence
Benzimidazole		Strongyle	1500	92.9%	93.2%	Resistance Confirmed	High
		Nematodirus	60	100.0%			Low
Levamisole		Strongyle	1470	87.2%	87.5%	Resistance Confirmed	High
		Nematodirus	30	100.0%			Low
Combination (BZ & Lev)		Strongyle	1170	95.1%	95.7%	Resistance Suspected	High
		Nematodirus	150	100.0%			High
Abamectin		Strongyle	930	98.4%	98.4%	No Resistance Detected	High
		Nematodirus	0	N/A			Low
Moxidectin		Strongyle	1110	99.5%	99.4%	No Resistance Detected	High
		Nematodirus	90	97.2%			Med
Combination (Lev & Aba)		Strongyle	870	98.0%	98.2%	No Resistance Detected	High
		Nematodirus	90	100.0%			Med
Combination (BZ, Lev, Aba)		Strongyle	1440	98.8%	98.9%	No Resistance Detected	High
		Nematodirus	90	100.0%			Med

DAY 10 LARVAL CULTURE SPECIES RESISTANCE SUMMARY: CASE STUDY FARMER 11

	Parasite Species													
	*Ostertagia/ Teladorsagia		*Trichostrongylus		*Haemonchus		Cooperia		Oesophagostomum / Chabertia		Other		*Nematodirus	
	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity
Benzimidazole	0.0%	Y	99.3%	Y	N/A	N/A	100.0%	Y	100.0%	Y	N/A	N/A	100.0%	Y
Levamisole	0.0%	Y	96.9%	Y	N/A	N/A	98.3%	Y	100.0%	Y	N/A	N/A	100.0%	N

DRENCH SUMMARY: CASE STUDY FARMER 12













Drench Active	Quick Drench Selection	Species	Starting FEC	Percentage Reduction	Combined Percentage Reduction	Resistance Status	Test Confidence
Benzimidazole		Strongyle	720	98.6%	98.60%	No Resistance Detected	High
	N/A	Nematodirus	0	100.0%			Low
Levamisole		Strongyle	1260	95.7%	95.90%	Resistance Suspected	High
		Nematodirus	60	100.0%			Low
Combination (BZ & Lev)		Strongyle	1020	99.5%	99.20%	No Resistance Detected	High
	N/A	Nematodirus	0	0.0%			Low
Moxidectin		Strongyle	1320	99.8%	99.80%	No Resistance Detected	High
		Nematodirus	60	100.0%			Low
Combination (Lev & Aba)		Strongyle	870	99.7%	99.70%	No Resistance Detected	High
		Nematodirus	60	100.0%			Low
Combination (BZ, Lev, Aba)		Strongyle	1710	99.9%	99.90%	No Resistance Detected	High
		Nematodirus	30	100.0%			Low

DAY 10 LARVAL CULTURE SPECIES RESISTANCE SUMMARY: CASE STUDY FARMER 12

Parasite Species

	*Ostertagia/ Teladorsagia		*Trichostrongylus		*Haemonchus		Cooperia		Oesophagostomum / Chabertia		Other		*Nematodirus	
	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity
Levamisole	0.0%	N	99.8%	Y	N/A	N	100.0%	Y	N/A	N	N/A	N	100.0%	Y

DRENCH SUMMARY: CASE STUDY FARMER 13











Drench Active	Quick Drench Selection	Species	Starting FEC	Percentage Reduction	Combined Percentage Reduction	Resistance Status	Test Confidence
Benzimidazole		Strongyle	1080	11.6%	11.6%	Resistance Confirmed	High
		Nematodirus	0	N/A			Low
Levamisole		Strongyle	1170	44.4%	45.8%	Resistance Confirmed	High
		Nematodirus	30	100.0%			Low
Combination (BZ & Lev)		Strongyle	1560	80.4%	80.4%	Resistance Confirmed	High
		Nematodirus	0	N/A			Low
Abamectin		Strongyle	1440	99.8%	99.8%	No Resistance Detected	High
		Nematodirus	0	N/A			Low
Moxidectin		Strongyle	990	99.7%	99.7%	No Resistance Detected	High
		Nematodirus	0	N/A			Low
Combination (Lev & Aba)		Strongyle	1290	99.8%	99.8%	No Resistance Detected	High
		Nematodirus	0	N/A			Low

DAY 10 LARVAL CULTURE SPECIES RESISTANCE SUMMARY: CASE STUDY FARMER 13

Parasite Species

	*Ostertagia/ Teladorsagia		*Trichostrongylus		*Haemonchus		Cooperia		Oesophagostomum / Chabertia		Other		*Nematodirus	
	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity
Benzimidazole	100.0%	N	0.0%	Y	N/A	N	100.0%	Y	100.0%	Y	N/A	N	N/A	N
Levamisole	58.3%	N	35.1%	Y	N/A	N	100.0%	Y	100.0%	Y	N/A	N	100.0%	N
Combination (BZ & Lev)	100.0%	Y	76.4%	Y	N/A	N	100.0%	Y	100.0%	Y	N/A	N	N/A	N

DRENCH SUMMARY: CASE STUDY FARMER 14















Drench Active	Quick Drench Selection	Species	Starting FEC	Percentage Reduction	Combined Percentage Reduction	Resistance Status	Test Confidence
Combination (BZ & Lev)		Strongyle	2100	64.4%	74.7%	Resistance Confirmed	High
		Nematodirus	875	99.3%			High
Abamectin		Strongyle	1470	99.6%	99.7%	No Resistance Detected	High
		Nematodirus	525	100.0%			High
Moxidectin		Strongyle	525	98.9%	99.2%	No Resistance Detected	High
		Nematodirus	245	100.0%			High
Combination (Lev & Aba)		Strongyle	630	97.2%	97.8%	Resistance Suspected	High
		Nematodirus	175	100.0%			High
Combination (BZ, Lev, Aba)		Strongyle	1330	94.5%	95.1%	Resistance Suspected	High
		Nematodirus	280	97.9%			High

DAY 10 LARVAL CULTURE SPECIES RESISTANCE SUMMARY: CASE STUDY FARMER 14













Parasite Species

	*Ostertagia/ Teladorsagia		*Trichostrongylus		*Haemonchus		Cooperia		Oesophagostomum / Chabertia		Other		*Nematodirus	
	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity
Combination (BZ & Lev)	75.1%	Y	63.6%	Y	N/A	N/A	0.0	N	100.0%	N	N/A	N/A	99.3%	Y
Combination (Lev & Aba)	No worms seen in the Day 10 Larval Culture												100.0%	Y
Combination (BZ, Lev, Aba)	90.1%	Y	94.9%	Y	N/A	N/A	N/A	N/A	100.0%	N	N/A	N/A	97.9%	Y

DRENCH SUMMARY: CASE STUDY FARMER 15

Drench Active	Quick Drench Selection	Species	Starting FEC	Percentage Reduction	Combined Percentage Reduction	Resistance Status	Test Confidence
Benzimidazole		Strongyle	805	100.0%	100.0%	No Resistance Detected	High
		Nematodirus	35	100.0%			Low
Levamisole		Strongyle	525	98.9%	99.2%	No Resistance Detected	High
		Nematodirus	175	100.0%			High
Combination (BZ & Lev)		Strongyle	910	100.0%	100.0%	No Resistance Detected	High
		Nematodirus	70	100.0%			Low
Abamectin		Strongyle	840	99.0%	99.1%	No Resistance Detected	High
		Nematodirus	105	100.0%			Med
Moxidectin		Strongyle	315	100.0%	100.0%	No Resistance Detected	Med
		Nematodirus	35	100.0%			Low
Combination (Lev & Aba)		Strongyle	805	100.0%	100.0%	No Resistance Detected	High
		Nematodirus	105	100.0%			Med
Combination (BZ, Lev, Aba)		Strongyle	280	99.0%	99.0%	No Resistance Detected	Med
		Nematodirus	0	N/A			Low

DRENCH SUMMARY: CASE STUDY FARMER 16















Drench Active	Quick Drench Selection	Species	Starting FEC	Percentage Reduction	Combined Percentage Reduction	Resistance Status	Test Confidence
Levamisole		Strongyle	1260	98.8%	98.8%	No Resistance Detected	High
		Nematodirus	0	N/A			Low
Combination (BZ & Lev)		Strongyle	1890	99.2%	99.2%	No Resistance Detected	High
		Nematodirus	0	N/A			Low
Abamectin		Strongyle	700	96.7%	96.2%	Resistance Suspected	High
		Nematodirus	0	0.0%			Low
Moxidectin		Strongyle	1155	98.2%	98.0%	No Resistance Detected	High
		Nematodirus	0	0.0%			Low
Combination (Lev & Aba)		Strongyle	1015	98.3%	98.3%	No Resistance Detected	High
		Nematodirus	35	100.0%			Low
Combination (BZ, Lev, Aba)		Strongyle	490	93.5%	93.5%	Resistance Confirmed	High
		Nematodirus	0	N/A			Low

DAY 10 LARVAL CULTURE SPECIES RESISTANCE SUMMARY: CASE STUDY FARMER 16

Parasite Species

	*Ostertagia/ Teladorsagia		*Trichostrongylus		*Haemonchus		Cooperia		Oesophagostomum / Chabertia		Other		*Nematodirus	
	Comp %	Validity	Comp %	Validity	Comp %	Validity	Comp %	Validity	Comp %	Validity	Comp %	Validity	Comp %	Validity
Pre-test (Day 1)	N/A	N	N/A	N	N/A	N	N/A	N	N/A	N	N/A	N	N/A	N
Abamectin	3%	N	N/A	N	N/A	N	97%	N	N/A	N	N/A	N	N/A	N
Combination (BZ, Lev, Aba)	N/A	N	N/A	N	N/A	N	N/A	N	N/A	N	N/A	N	N/A	N

DRENCH SUMMARY: CASE STUDY FARMER 17













Drench Active	Quick Drench Selection	Species	Starting FEC	Percentage Reduction	Combined Percentage Reduction	Resistance Status	Test Confidence
Benzimidazole		Strongyle	490	93.5%	94.3%	Resistance Confirmed	High
		Nematodirus	70	100.0%			Low
Levamisole		Strongyle	630	95.8%	96.4%	Resistance Suspected	High
		Nematodirus	105	100.0%			Med
Combination (BZ & Lev)		Strongyle	420	97.9%	98.2%	Resistance Suspected	High
		Nematodirus	70	100.0%			Low
Abamectin		Strongyle	630	99.4%	99.6%	No Resistance Detected	High
		Nematodirus	210	100.0%			High
Moxidectin		Strongyle	490	100.0%	100.0%	No Resistance Detected	High
		Nematodirus	35	100.0%			Low
Combination (Lev & Aba)		Strongyle	420	100.0%	100.0%	No Resistance Detected	High
		Nematodirus	35	100.0%			Low
Combination (BZ, Lev, Aba)		Strongyle	595	98.9%	99.0%	No Resistance Detected	High
		Nematodirus	70	100.0%			Low

DAY 10 LARVAL CULTURE SPECIES RESISTANCE SUMMARY: CASE STUDY FARMER 17

Parasite Species

	*Ostertagia/ Teladorsagia		*Trichostrongylus		*Haemonchus		Cooperia		Oesophagostomum / Chabertia		Other		*Nematodirus	
	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity
Benzimidazole	84.2%	N	90.0%	Y	N/A	N	100.0%	Y	100.0%	N	N/A	N	100.0%	Y
Levamisole	98.8%	N	92.5%	Y	N/A	N	100.0%	Y	99.5%	Y	N/A	N	100.0%	Y

DRENCH SUMMARY: CASE STUDY FARMER 18















Drench Active	Quick Drench Selection	Species	Starting FEC	Percentage Reduction	Combined Percentage Reduction	Resistance Status	Test Confidence
Benzimidazole		Strongyle	4935	71.6%	69.7%	Resistance Confirmed	Med
		Nematodirus	140	0.0%			Low
Combination (BZ & Lev)		Strongyle	3535	98.7%	98.4%	No Resistance Detected	High
		Nematodirus	140	90.9%			Med
Abamectin		Strongyle	2380	99.3%	99.3%	No Resistance Detected	High
		Nematodirus	35	100.0%			Low
Moxidectin		Strongyle	5075	99.9%	99.8%	No Resistance Detected	High
		Nematodirus	105	97.0%			Med
Combination (Lev & Aba)		Strongyle	3465	99.1%	99.1%	No Resistance Detected	High
		Nematodirus	70	96.4%			Low
Combination (BZ, Lev, Aba)		Strongyle	4445	99.9%	99.9%	No Resistance Detected	High
		Nematodirus	70	100.0%			Low

DAY 10 LARVAL CULTURE SPECIES RESISTANCE SUMMARY: CASE STUDY FARMER 18

Parasite Species

	*Ostertagia/ Teladorsagia		*Trichostrongylus		*Haemonchus		Cooperia		Oesophagostomum / Chabertia		Other		*Nematodirus	
	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity
Combination (BZ & Lev)	81.4%	Y	98.2%	Y	100.0%	Y	100.0%	Y	100.0%	Y	N/A	N/A	90.9%	Y

DRENCH SUMMARY: CASE STUDY FARMER 19













Drench Active	Quick Drench Selection	Species	Starting FEC	Percentage Reduction	Combined Percentage Reduction	Resistance Status	Test Confidence
Benzimidazole		Strongyle	1925	67.6%	64.6%	Resistance Confirmed	High
		Nematodirus	70	0.0%			Low
Levamisole		Strongyle	1645	85.1%	83.0%	Resistance Confirmed	High
		Nematodirus	35	0.0%			Low
Combination (BZ & Lev)		Strongyle	2345	94.2%	92.8%	Resistance Confirmed	High
		Nematodirus	140	70.8%			Med
Abamectin		Strongyle	1470	98.8%	98.9%	No Resistance Detected	High
		Nematodirus	70	100.0%			Low
Moxidectin		Strongyle	1085	99.5%	99.5%	No Resistance Detected	High
		Nematodirus	70	100.0%			Low
Combination (Lev & Aba)		Strongyle	875	98.7%	98.7%	No Resistance Detected	High
		Nematodirus	0	N/A			Low
Combination (BZ, Lev, Aba)		Strongyle	910	98.7%	97.0%	Resistance Suspected	High
		Nematodirus	70	75.0%			Low

DAY 10 LARVAL CULTURE SPECIES RESISTANCE SUMMARY: CASE STUDY FARMER 19

Parasite Species

	*Ostertagia/ Teladorsagia		*Trichostrongylus		*Haemonchus		Cooperia		Oesophagostomum / Chabertia		Other		*Nematodirus	
	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity
Benzimidazole	54.1%	Y	68.7%	Y	N/A	N	100.0%	N	N/A	N	N/A	N	0.0%	Y
Levamisole	88.8%	Y	84.4%	Y	N/A	N	92.6%	N	N/A	N	N/A	N	0.0%	N
Combination (BZ & Lev)	100.0%	Y	93.2%	Y	N/A	N	100.0%	N	N/A	N	N/A	N	70.8%	Y
Combination (BZ, Lev, Aba)	89.3%	Y	100.0%	Y	N/A	N	100.0%	N	N/A	N	N/A	N	75.0%	Y















DRENCH SUMMARY: CASE STUDY FARMER 20

Drench Active	Quick Drench Selection	Species	Starting FEC	Percentage Reduction	Combined Percentage Reduction	Resistance Status	Test Confidence
Benzimidazole		Strongyle	600	52.5%	57.80%	Resistance Confirmed	High
		Nematodirus	90	93.3%			Med
Levamisole		Strongyle	360	50.0%	58.20%	Resistance Confirmed	Med
		Nematodirus	90	90.9%			Med
Combination (BZ & Lev)		Strongyle	420	31.0%	30.20%	Resistance Confirmed	Med
		Nematodirus	60	25.0%			Low
Abamectin		Strongyle	780	98.3%	98.50%	No Resistance Detected	High
		Nematodirus	120	100.0%			Med
Moxidectin		Strongyle	780	99.0%	99.00%	No Resistance Detected	High
		Nematodirus	0	N/A			Low
Combination (Lev & Aba)		Strongyle	1230	99.3%	99.00%	No Resistance Detected	High
		Nematodirus	30	90.0%			Low

DAY 10 LARVAL CULTURE SPECIES RESISTANCE SUMMARY: CASE STUDY FARMER 20

	Parasite Species													
	*Ostertagia/ Teladorsagia		*Trichostrongylus		*Haemonchus		Cooperia		Oesophagostomum / Chabertia		Other		*Nematodirus	
	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity
Benzimidazole	88.10%	N	29.80%	Y	N/A	N	100.00%	Y	100.00%	Y	N/A	N	93.30%	Y
Levamisole	100.00%	N	25.40%	Y	N/A	N	100.00%	N	100.00%	Y	N/A	N	90.90%	Y
Combination (BZ & Lev)	48.20%	N	0.00%	Y	N/A	N	100.00%	N	100.00%	Y	N/A	N	25.00%	Y















DRENCH SUMMARY: CASE STUDY FARMER 21

Drench Active	Quick Drench Selection	Species	Starting FEC	Percentage Reduction	Combined Percentage Reduction	Resistance Status	Test Confidence
Benzimidazole		Strongyle	1085	46.2%	47.1%	Resistance Confirmed	High
		Nematodirus	70	61.5%			Low
Levamisole		Strongyle	1680	54.5%	55.3%	Resistance Confirmed	High
		Nematodirus	35	90.9%			Low
Combination (BZ & Lev)		Strongyle	1260	60.6%	60.6%	Resistance Confirmed	High
		Nematodirus	0	N/A			Low
Abamectin		Strongyle	1400	89.0%	90.0%	Resistance Confirmed	High
		Nematodirus	140	100.0%			Med
Moxidectin		Strongyle	700	40.8%	48.2%	Resistance Confirmed	High
		Nematodirus	105	97.2%			Med
Combination (Lev & Aba)		Strongyle	1540	61.4%	62.2%	Resistance Confirmed	High
		Nematodirus	35	100.0%			Low
Combination (BZ, Lev, Aba)		Strongyle	1225	64.0%	64.4%	Resistance Confirmed	High
		Nematodirus	0	0.0%			Low

DAY 10 LARVAL CULTURE SPECIES RESISTANCE SUMMARY: CASE STUDY FARMER 21

	Parasite Species													
	*Ostertagia/ Teladorsagia		*Trichostrongylus		*Haemonchus		Cooperia		Oesophagostomum / Chabertia		Other		*Nematodirus	
	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity
Benzimidazole	100.0%	N	38.8%	Y	N/A	N/A	100.0%	Y	100.0%	N	N/A	N/A	61.5%	Y
Levamisole	100.0%	N	49.4%	Y	N/A	N/A	100.0%	Y	77.3%	Y	N/A	N/A	90.9%	N
Combination (BZ & Lev)	100.0%	N	55.3%	Y	N/A	N/A	100.0%	Y	100.0%	Y	N/A	N/A	N/A	N/A
Abamectin	100.0%	N	87.8%	Y	N/A	N/A	95.3%	Y	100.0%	Y	N/A	N/A	100.0%	Y
Moxidectin	100.0%	N	38.1%	Y	N/A	N/A	32.4%	N	100.0%	N	N/A	N/A	97.2%	Y
Combination (Lev & Aba)	100.0%	N	57.0%	Y	N/A	N/A	100.0%	Y	80.7%	Y	N/A	N/A	100.0%	N
Combination (BZ, Lev, Aba)	28.1%	N	60.0%	Y	N/A	N/A	100.0%	Y	100.0%	N	N/A	N/A	0.0%	N

DRENCH SUMMARY: CASE STUDY FARMER 22















Drench Active	Quick Drench Selection	Species	Starting FEC	Percentage Reduction	Combined Percentage Reduction	Resistance Status	Test Confidence
Benzimidazole		Strongyle	1225	94.8%	90.0%	Resistance Confirmed	High
		Nematodirus	175	56.7%			High
Levamisole		Strongyle	630	94.9%	95.2%	Resistance Suspected	High
		Nematodirus	35	100.0%			Low
Combination (BZ & Lev)		Strongyle	1225	100.0%	100.0%	No Resistance Detected	High
		Nematodirus	70	100.0%			Low
Abamectin		Strongyle	525	98.9%	99.0%	No Resistance Detected	High
		Nematodirus	35	100.0%			Low
Moxidectin		Strongyle	420	100.0%	100.0%	No Resistance Detected	High
		Nematodirus	35	100.0%			Low
Combination (Lev & Aba)		Strongyle	1225	99.8%	99.8%	No Resistance Detected	High
		Nematodirus	0	N/A			Low
Combination (BZ, Lev, Aba)		Strongyle	910	98.8%	98.8%	No Resistance Detected	High
		Nematodirus	0	N/A			Low

DAY 10 LARVAL CULTURE SPECIES RESISTANCE SUMMARY: CASE STUDY FARMER 22

Parasite Species

	*Ostertagia/ Teladorsagia		*Trichostrongylus		*Haemonchus		Cooperia		Oesophagostomum / Chabertia		Other		*Nematodirus	
	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity
Benzimidazole	N/A	N	92.5%	Y	100.0%	Y	100.0%	Y	100.0%	N	N/A	N	56.7%	Y
Levamisole	N/A	N	94.2%	Y	100.0%	Y	88.7%	Y	100.0%	N	N/A	N	100.0%	N

DRENCH SUMMARY: CASE STUDY FARMER 23













Drench Active	Quick Drench Selection	Species	Starting FEC	Percentage Reduction	Combined Percentage Reduction	Resistance Status	Test Confidence
Benzimidazole		Strongyle	690	5.9%	7.6%	Resistance Confirmed	High
		Nematodirus	30	45.5%			Low
Levamisole		Strongyle	360	0.0%	0.0%	Resistance Confirmed	Med
		Nematodirus	0	N/A			Low
Combination (BZ & Lev)		Strongyle	450	0.0%	0.0%	Resistance Confirmed	High
		Nematodirus	30	100.0%			Low
Abamectin		Strongyle	450	98.9%	99.0%	No Resistance Detected	High
		Nematodirus	30	100.0%			Low
Moxidectin		Strongyle	810	98.8%	98.8%	No Resistance Detected	High
		Nematodirus	30	100.0%			Low
Combination (Lev & Aba)		Strongyle	450	98.9%	99.0%	No Resistance Detected	High
		Nematodirus	30	100.0%			Low
Combination (BZ, Lev, Aba)		Strongyle	420	96.1%	96.1%	Resistance Suspected	High
		Nematodirus	0	N/A			Low

DAY 10 LARVAL CULTURE SPECIES RESISTANCE SUMMARY: CASE STUDY FARMER 23

Parasite Species

	*Ostertagia/ Teladorsagia		*Trichostrongylus		*Haemonchus		Cooperia		Oesophagostomum / Chabertia		Other		*Nematodirus	
	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity
Benzimidazole	100.0%	N	4.0%	Y	N/A	N	N/A	N	N/A	N	N/A	N	46.0%	N
Levamisole	100.0%	N	0.0%	Y	N/A	N	N/A	N	N/A	N	N/A	N	N/A	N
Combination (BZ & Lev)	100.0%	N	0.0%	Y	N/A	N	N/A	N	N/A	N	N/A	N	100.0%	N
Combination (BZ, Lev, Aba)	100.0%	N	96.0%	Y	N/A	N	N/A	N	N/A	N	N/A	N	N/A	N

DRENCH SUMMARY: CASE STUDY FARMER 24

Drench Active	Quick Drench Selection	Species	Starting FEC	Percentage Reduction	Combined Percentage Reduction	Resistance Status	Test Confidence
Benzimidazole		Strongyle	2170	98.9%	98.9%	No Resistance Detected	High
		Nematodirus	35	100.0%			Low
Levamisole		Strongyle	1400	93.2%	93.2%	Resistance Confirmed	High
		Nematodirus	0	N/A			Low
Combination (BZ & Lev)		Strongyle	1610	98.8%	98.8%	No Resistance Detected	High
		Nematodirus	0	N/A			Low
Abamectin		Strongyle	1400	99.3%	99.3%	No Resistance Detected	High
		Nematodirus	0	N/A			Low
Moxidectin		Strongyle	1785	99.5%	99.5%	No Resistance Detected	High
		Nematodirus	35	100.0%			Low
Combination (Lev & Aba)		Strongyle	1715	97.4%	97.4%	Resistance Suspected	High
		Nematodirus	0	N/A			Low

DAY 10 LARVAL CULTURE SPECIES RESISTANCE SUMMARY: CASE STUDY FARMER 24

Parasite Species

	*Ostertagia/ Teladorsagia		*Trichostrongylus		*Haemonchus		Cooperia		Oesophagostomum / Chabertia		Other		*Nematodirus	
	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity	Reduc %	Validity
Levamisole	47.7%	Y	99.2%	Y	N/A	N	100.0%	Y	100.0%	Y	N/A	N	N/A	N
Combination (Lev & Aba)	81.4%	Y	99.5%	Y	N/A	N	100.0%	Y	100.0%	Y	N/A	N	N/A	N