

Reducing the impact of *Armillaria* in kiwifruit orchards with applications of biological agents Terracin and Mycorrcin

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March 2010

Key words

Armillaria, Mycorrcin, Terracin, kiwifruit

After 12 years of trying different *Armillaria* treatments, Terracin followed by Mycorrcin provides the first reliable success – as well as improving vine productivity.

Background

Mark and Jenny Menefy purchased their 10 canopy hectare kiwifruit orchard in Waihi in April 1996. That winter they spent \$5,000 injecting trichodermia into vines sick with armillaria and using dowels. They also stripped fruitlets off sick plants and cut back to new growth. They spent \$3,000 on trichodermia and dowels in 1997 and again in 1998 without noticing much effect. Of their six home orchard blocks, the armillaria was worst in block 2. Armillaria kept coming up in new places. In 1999 they removed willow shelters around blocks 2 and 1 and tried ground aeration with trichodermia and worm castings.



Mark Menefy with one of the recovering vines.

In 2000 they gave up on trichodermia. During this time dead plants were replaced with two-year old vines and two handfuls trichodermia pellets were added to the planting holes. Over the next few years they tried stem shots, and sluicing around the roots of affected vines with some success. The toll of armillaria on this orchard is easy to see by the large number of slender trunks amongst the older vines which are now approaching 25 years of age.

In winter 2007 they followed the advice of Fruited Supplies Technical Manager, Richard Bawden, reduced the winter base fertiliser application and started using BioStart products. In mid-winter the Menefys broadcast sprayed Terracin in block 2 at a rate of 10 litres per hectare in 2,000 litres of water using a flood jet nozzle. Terracin is a broad-spectrum biocide. They followed this with Mycorrcin applied in the same way to blocks 1, 2 and 3 in early September at a rate of 5 litres in 2,000 litres on water per hectare. Mycorrcin activates beneficial soil microbes with specific biological signalling molecules and is necessary because Terracin inhibits good and bad soil microbes. The Menefys continued to strip fruit from armillaria-affected vines.

While fruit thinning in late January and February 2008, Jenny noticed that although there were still vines with armillaria symptoms, they weren't dying – except for one or two that were past the point of no return and had already died. Fruit on the affected vines was more yellow and smaller, but the leaves on these vines were healthy. "Normally the leaves would be unhealthy and yellowing, but these vines appeared to be trying to grow," said Jenny.

When the soil around the base of affected vines was dug, new root growth was revealed. This was especially encouraging because the hot, dry summer of 2007/08 summer had provided perfect conditions for armillaria.

Bud break in all three blocks treated with Mycorrcin was a week earlier than in the rest of the orchard and the canopy was healthy. When Mark and Jenny noticed the improved vigour in the three blocks treated with Mycorrcin, they started treating the whole 10 hectares.

The following winter of 2008 the Menefy's did not broadcast spray Terracin in block 2, but spot-treated affected vines, and neighbouring vines with 40 litres of a 10 litre in 2,000 solution of Terracin, marking each treated vine. The efficacy of this treatment is readily seen in block 2, where affected vines that were identified and treated have survived and thrived, whereas a couple of previously healthy vines immediately outside the circle of treated vines have clearly dropped dead halfway through fruit development.

Mark is very pleased with this result. "Normally we would get six to 10 healthy vines in this block drop dead without warning in a summer," he said.

Jenny is also pleased. "It is quite good to see results from something that you are using," she said. "BioStart products are the best we have used so far."

The Menefys continue to nurture the recovering vines by tying down fewer canes thus reducing the fruit burden and allowing the plants to rebuild. The overall crop from Block 2 for 2009 is still down about 20 per cent compared to the blocks on either side.

"This season we picked good-sized, export-quality fruit from many of the vines that we treated," Mark said.

The Menefys double-trunk girdled healthy vines in their home orchard for the first time in the 2008/9 season, and have been rewarded with their largest ever tray size of 32. Since double-trunk girdling can have a detrimental effect on vine roots they have broadcast sprayed Mycorrcin in March to support root development and also used a urea foliar spray of 50kg/2000l/ha.

The 2009 season has been especially good and especially early for the Menefy's home orchard. The fruit was cleared for harvest on April 4th which was the earliest of any of the Menefy's orchards.



Untreated



Treated vine



Roots from an untreated vine showing symptoms of Armillaria

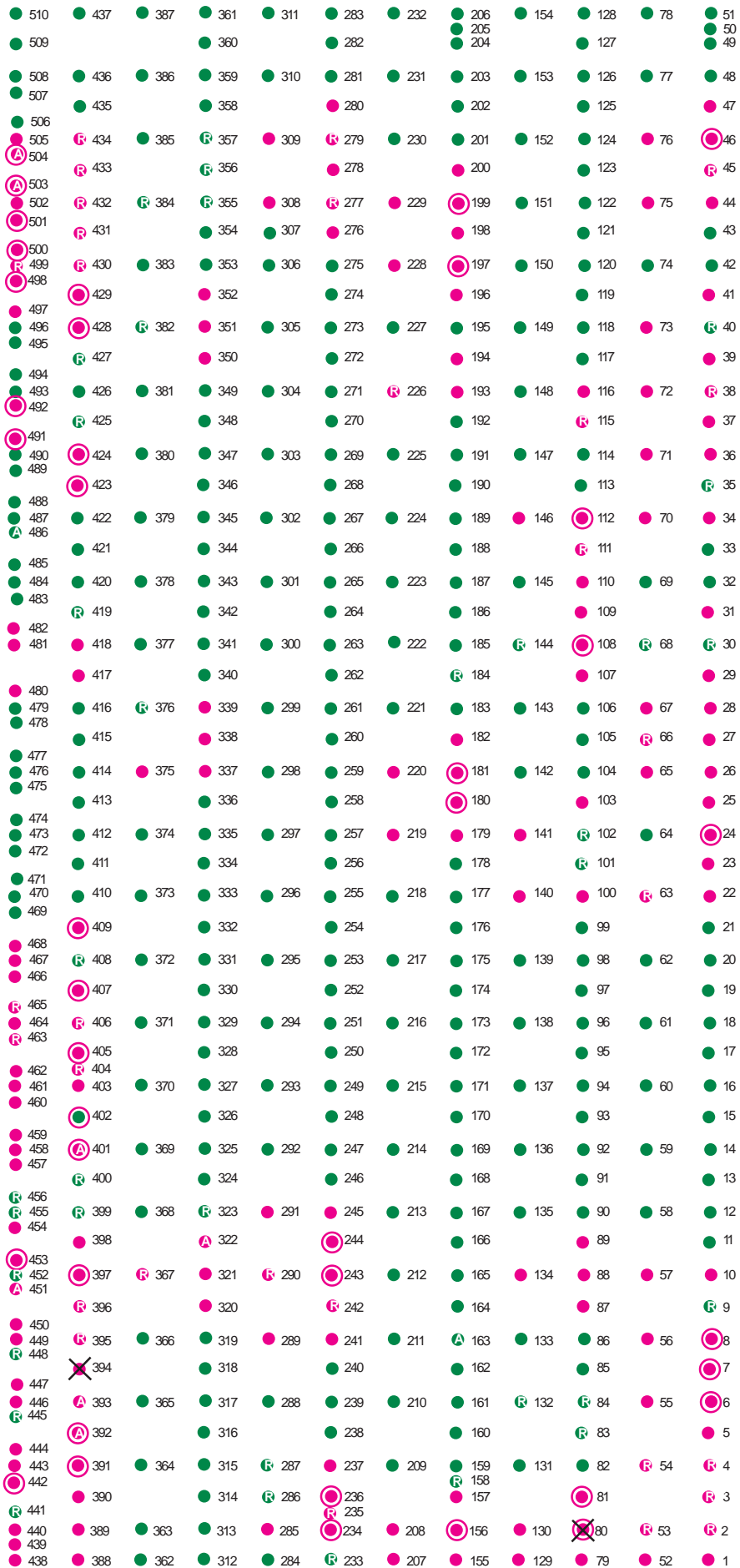


Roots from a treated vine

Blocks	Winter 07 August	Spring 07 At bud-break	Summer 07/08 Post-flowering	Autumn 08 Post-harvest	Winter 08	Spring 08 At bud-break	Summer 08/09 Post-flowering	Autumn 09 March	Winter 2009 Post-harvest
1		5l/ha Mycorrcin 2l/ha Digester 4l/ha Mobiliser	2l/ha Mycorrcin 4l/ha Mobiliser	5l/ha Mycorrcin		10l/ha Mycorrcin 2l/ha Mobiliser	4l/ha Mycorrcin 2l/ha Mobiliser	4l/ha Mycorrcin 2l/ha Mobiliser	4l/ha Digester 2l/ha Mobiliser
2: Bad Armillaria	Terracin 10l/2,000/ha broadcast, and 10l/2000 spot treatment at 40 litres per plant	Mycorrcin 5l/ha 2l/Digester 4l/ha Mobiliser	Renewed leaf and root growth on affected vines. Some deaths of badly affected plants. 2l/ha Mycorrcin 4l/ha Mobiliser	5l/ha Mycorrcin		10l/ha Mycorrcin 2l/ha Mobiliser	4l/ha Mycorrcin 2l/ha Mobiliser	4l/ha Mycorrcin 2l/ha Mobiliser	4l/ha Digester 2l/ha Mobiliser
3		Mycorrcin 5l/ha 2l/Digester 4l/ha Mobiliser	2l/ha Mycorrcin 4l/ha Mobiliser	5l/ha Mycorrcin		10l/ha Mycorrcin 2l/ha Mobiliser	4l/ha Mycorrcin 2l/ha Mobiliser	4l/ha Mycorrcin 2l/ha Mobiliser	4l/ha Digester 2l/ha Mobiliser
4						6l/ha Mycorrcin 2l/ha Mobiliser	4l/ha Mycorrcin 2l/ha Mobiliser	4l/ha Mycorrcin 2l/ha Mobiliser	4l/ha Digester 2l/ha Mobiliser
5						6l/ha Mycorrcin 2l/ha Mobiliser	4l/ha Mycorrcin 2l/ha Mobiliser	4l/ha Mycorrcin 2l/ha Mobiliser	4l/ha Digester 2l/ha Mobiliser
6						6l/ha Mycorrcin 2l/ha Mobiliser	4l/ha Mycorrcin 2l/ha Mobiliser	4l/ha Mycorrcin 2l/ha Mobiliser	4l/ha Digester 2l/ha Mobiliser

Orchard Map Feb 2007

● Healthy
● Showing signs of Armillaria
A Infected with Armillaria
R Replant
 Sluced
X Died



Orchard Map Feb 2010

● Healthy A Infected with Armillaria ○ Sluced
● Showing signs of Armillaria R Replant X Died

● 510	● 437	● 387	● 361	● 311	● 283	● 232	● 206	● 154	● 128	● 78	● 51
● 509			● 360		● 282		● 205				● 50
							● 204		● 127		● 49
● 508	● 436	● 386	● 359	● 310	● 281	● 231	● 203	● 153	● 126	● 77	● 48
● 507			● 358		● 280		● 202		● 125		● 47
● 506											
● 505	● 434	● 385	● 357	● 309	● 279	● 230	● 201	● 152	● 124	● 76	● 46
● 504			● 356		● 278		● 200		● 123		● 45
	● 433										
● 503											
● 502	● 432	● 384	● 355	● 308	● 277	● 229	● 199	● 151	● 122	● 75	● 44
● 501			● 354	● 307	● 276		● 198		● 121		● 43
	● 431										
● 500											
● 499	● 430	● 383	● 353	● 306	● 275	● 228	R 197	● 150	● 120	● 74	● 42
● 498			● 352		● 274		● 196		● 119		● 41
	● 429										
● 497											
● 496	● 428	● 382	● 351	● 305	● 273	● 227	● 195	● 149	● 118	● 73	● 40
● 495			● 350		● 272		● 194		● 117		● 39
	● 427										
● 494											
● 493	● 426	● 381	● 349	● 304	● 271	R 226	● 193	● 148	● 116	● 72	● 38
● 492			● 348		● 270		● 192		● 115		● 37
	● 425										
● 491											
● 490	● 424	● 380	● 347	● 303	● 269	● 225	● 191	● 147	● 114	● 71	● 36
● 489			● 346		● 268		● 190		● 113		● 35
	A 423										
● 488											
● 487	● 422	● 379	● 345	● 302	● 267	● 224	● 189	● 146	R 112	● 70	● 34
● 486			● 344		● 266		● 188		● 111		● 33
	● 421										
● 485											
● 484	● 420	● 378	● 343	● 301	● 265	● 223	● 187	● 145	● 110	● 69	● 32
● 483			● 342		● 264		● 186		● 109		● 31
	● 419										
● 482											
● 481	● 418	● 377	● 341	● 300	● 263	● 222	● 185	R 144	● 108	● 68	● 30
			● 340		● 262		● 184		● 107		● 29
	● 417										
● 480											
● 479	● 416	● 376	● 339	● 299	● 261	● 221	● 183	● 143	● 106	● 67	● 28
● 478			● 338		● 260		● 182		● 105	● 66	● 27
	● 415										
● 477											
● 476	● 414	● 375	● 337	● 298	● 259	● 220	● 181	● 142	● 104	A 65	● 26
● 475			● 336		● 258		R 180		● 103		● 25
	● 413										
● 474											
● 473	● 412	● 374	● 335	● 297	● 257	● 219	● 179	● 141	● 102	R 64	● 24
● 472			● 334		● 256		● 178		● 101		● 23
	● 411										
● 471											
● 470	● 410	● 373	● 333	● 296	● 255	● 218	● 177	● 140	A 100	● 63	● 22
● 469			● 332		● 254		● 176		● 99		● 21
	● 409										
● 468											
● 467	● 408	● 372	● 331	● 295	● 253	● 217	● 175	● 139	● 98	● 62	● 20
● 466			● 330		● 252		● 174		● 97		● 19
	● 407										
● 465											
● 464	● 406	● 371	● 329	● 294	● 251	● 216	● 173	● 138	● 96	● 61	● 18
● 463			● 328		● 250		● 172		● 95		● 17
	A 405										
● 462	● 404										
● 461	● 403	● 370	● 327	● 293	● 249	● 215	● 171	● 137	● 94	● 60	● 16
● 460			● 326		● 248		● 170		● 93		● 15
	R 402										
● 459											
● 458	R 401	● 369	● 325	● 292	● 247	● 214	● 169	● 136	● 92	● 59	● 14
● 457			● 324		R 246		● 168		● 91		● 13
	● 400										
R 456											
● 455	● 399	● 368	● 323	● 291	● 245	● 213	● 167	● 135	● 90	● 58	● 12
● 454			● 322		● 244		● 166		● 89		● 11
	● 398										
R 453											
● 452	● 397	● 367	● 321	● 290	● 243	● 212	● 165	● 134	R 88	● 57	● 10
R 451			● 320		● 242		● 164		● 87		● 9
	● 396										
● 450											
● 449	● 395	● 366	● 319	● 289	● 241	● 211	A 163	● 133	● 86	● 56	● 8
● 448			● 318		● 240		● 162		● 85		● 7
	R 394										
● 447											
● 446	● 393	● 365	● 317	● 288	● 239	● 210	● 161	● 132	● 84	● 55	● 6
● 445			● 316		● 238		● 160		● 83		● 5
	A 392										
R 444											
● 443	R 391	● 364	● 315	● 287	● 237	● 209	● 159	● 131	● 82	● 54	● 4
R 442			● 314	● 286	● 236		● 158				● 3
	● 390				● 235		● 157		R 81		
● 441					● 234	● 208	● 156	● 130	● 80	● 53	● 2
● 440	● 389	● 363	● 313	● 285	● 233	● 207	● 155	A 129	● 79	X 52	X 1
● 439											
● 438	● 388	● 362	● 312	● 284	● 233	● 207	● 155	A 129	● 79	X 52	X 1