

Field Investigation Of The Effect Of Maxicrop Concentrate On Crown Rot And Establishment Of Young Cider Apple Trees

Crown rot [*Phytophthora cactorum/syringae*] is principally responsible for failure of young trees to establish on sites subject to winter wet or water-logging. The pathogen attacks the rootstock at the crown of the tree, developing a lesion which shows characteristic `tiger striping` when cut with a knife. Above ground symptoms are early flowering, yellowing leaves and premature leaf drop and eventual death of the tree, usually during the drier summer months. Trees are at most risk during the first 5 years of their life when losses can be considerable on high risk sites. The rootstock MM106 is particularly susceptible though widely used in bush cider orchards [1].

Standard prophylactic treatments are winter drenches of metalaxyl [Ridomil Plus] and/or foliar sprays of fosetyl-al [Aliette], both of which help to control disease development [3].

Seaweed extract is known to increase the natural plant defence mechanisms against disease attack, primarily by certain compounds acting as methyl donors and stimulating specific plant metabolic processes [4]. It is also known to increase growth and chlorophyll content of plants [3].

The objective of this trial was to assess the effect of regular drenches of seaweed extract [Maxicrop Concentrate] on the establishment of young cider apple trees on a wet site thought to be favourable to crown rot.

Method

The site, at Inch`s Cider Company`s orchard in central Devon, is on fine sandy-clay soil of the Neath Series, subject to water-logging and considerable surface run-off during the winter in this high rainfall area [>1000mm pa.].

Two sets of trees were used, Set A: variety Michelin planted April 1994, and Set B: variety Brown`s Apple planted April 1995. Both sets of trees on MM106 were planted by hand at a spacing of 5.5 x 3m [18 x 10`] into a bare herbicide strip running up/down the slope of approx 5%. All trees were healthy on planting and have received regular fungicide sprays to control apple scab.

As a precaution against crown rot, a drench of Ridomil was applied to all planted trees:- April 1994, Sept 1994, March 1995.

The trial design is 10 randomised replicate blocks of 3 treatments [Set A] or 2 treatments [Set B] to single trees. All treatments were applied as a drench to the base of the tree. Maxicrop Concentrate, 2% in water, or water was applied at the rate of 1 litre/tree in 1995, increased to 2 litres/tree from June 1996. Drenching was done during the first week of every month commencing May 1995 to October 1995, recommencing May 1996 and to be continued indefinitely. A further and final Ridomil drench was applied in September 1995 to all trees except those receiving the Maxicrop treatment [Table 1].

Trees were assessed in early May during `leafing out` and at intervals during the summer for

symptoms of crown rot. Tree girths at 45cm above the ground, and growth of the leader shoot were measured at the end of each year. Flower bud and fruit set were recorded during the second summer.

Results

No symptoms of crown rot and no differences in leaf colour or chlorophyll intensity were observed during the first two years of the trial which is still continuing.

Tree growth is summarised in Table 2. Although the Ridomil treated Michelin trees grew most, the differences between treatments were not significant. The Brown's Apple trees however, showed a positive growth response to Maxicrop drenching. Mean extension growth of the leader shoots was significantly greater than the water treated controls in both years [$P=0.1, 18df$], the trees being nearly 10% taller by the end of the second year. The mean girth increase during the two years [April 1995 - Sept 1996], was 50% more in the Maxicrop treated trees [$P=0.1, \text{ nearly } 0.05$]. Growth of the Maxicrop treated trees was greater than the untreated control trees, but not significantly so.

Estimates of early crops are summarised in Table 3. The effects of the treatments are similar in both sets of trees. A greater proportion of the Maxicrop treated trees were cropping in the second year of the trial. More of the Michelin trees were carrying more than 10 fruits per tree. The positive effect of the Maxicrop drench was most marked in the Brown's Apple trees, 80% of which were carrying fruit in their second year of growth. Maxicrop drenched trees formed more flower buds in the first year which subsequently set more fruit in the following year.

Discussion

Since no symptoms of crown rot have been observed, it is too early to evaluate the effects, if any, of the treatments on development of the disease.

The objective of a bush cider orchard is to achieve rapid commencement of cropping and quick financial returns from fruit production. This has to be gained by careful balance of vegetative growth; rapid production of tree framework; with flower bud production and fruit set; neither at the expense of the other.

In this trial, trees in all treatments grew satisfactorily in both years. The slight but positive gain in tree size of the Maxicrop treated Brown's Apple trees was useful since this variety is often slow to grow away after planting.

The application of a drench itself clearly had a suppressant effect on tree growth, especially the young Brown's Apple. The summer rainfall in both 1995 and 1996 was lower than average. In 1995 many newly planted trees in and around the trial area showed drought stress symptoms. Under these conditions, limited quantities of water applied at infrequent intervals would be expected to be detrimental to developing root systems, through alternate wetting and drying out. However the addition of Maxicrop seems to have overcome the deleterious effects to a large extent.

Flower bud in apple is produced towards the end of the previous year [August - October]. Maxicrop drench increased flower bud by 11 and 23% respectively for Michelin and Brown's Apple. Also, a higher proportion of trees carried flower bud. Brown's Apple, not normally

precocious, began cropping earlier than usual with the advantage of 80% of trees with flower bud and fruit in the second year, compared to only 40% for the water and Ridomil controls. These increases were achieved without detriment to, and in spite of, increased tree growth, indicating an enhanced level of assimilate production in year 1.

Fruit set is a function of blossom strength, factors relating mostly to the year of bud production, and tree strength and partitioning of assimilates in the current year. Maxicrop treated trees set more fruit in the second year of the trial, but again, not at the expense of vegetative growth, indicating an increase in total assimilates in year 2 also.

Maxicrop contains only small quantities of plant nutrients, mostly micronutrients. Any effects resulting from application of Maxicrop cannot be attributed to the addition of plant nutrients. However, this seaweed extract does contain significant levels of betaines, compounds which are accredited with increasing chlorophyll activity in plants [4]. Increases in growth and cropping of Maxicrop treated trees in this trial, is consistent with this theory, and also has desirable implications for rapid achievement of the growth and economic objectives of a bush cider orchard.

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References

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Table 1: Summary of the Ridomil treatments.

Tree set	A			B		
	Maxicrop conc	Water + Ridomil	Ridomil alone	Maxicrop conc	Water + Ridomil	Control
Drench						
Timing	March 94	March 94	March 94			
	Sept 94	Sept 94	Sept 94			
	March 95	March 95	March 95	March 95	March 95	
	-	Sept 95	Sept 95		Sept 95	

Table 2: Effect of treatments on tree height and girth [cm].**Mean height increase**

Year 1	71.0	74.9	73.2	28.4a	14.3b	27.0a
Year 2	58.8	58.6	60.9	73.4	66.9	67.2
Year 1+2	129.8	133.5	134.1	101.8	81.2	94.2

Mean tree height after 2 yrs

Year 1+2	236.2	232.7	242.9	194.2	173.6	180.7
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Mean girth increase

Year 1	2.8	3.1	3.4	1.3	1.0	
Year 2	3.4	3.2	3.3	3.7a	2.7b*	
Year 1+2	6.2	6.3	6.7	5.3a	3.7b*	

Mean girth after 2 years

Year 1+2	11.3	11.2	11.7	9.4a	8.1b	9.6a
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Figures in this table are not significantly different unless marked a or b. * P = 0.01 + P = 0.1

Table 3: Effect of treatments on early crop [Year 2, 1996].

Treatment	Maxicrop conc	Water + Ridomil	Ridomil alone	Maxicrop conc	Water + Ridomil	Control
Clusters	44.2	34.6	38.1	6.5	5.3	-
Fruit/tree	18.2	13.3	14.6	3.6	2.4	1.8
Fruit/cluste	0.34	0.38	0.30	0.70	0.27	-
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% trees cropping	60*	60*	40*	80	40	40

* Percentage of trees carrying more than 10 fruits