



CARBOTECH™

ON FARM DEMONSTRATION - 2012

AVOCADOS, WESTFALIA FRUIT ESTATES, VARIOUS FARMS, TZANEEN, SOUTH AFRICA

TRIAL AIM

CARBOTECH is a liquid carbon product derived from plant extracts. CARBOTECH is useful in improving the efficiency of plant nutrient uptake.

The CARBOTECH mechanisms of action are as follows:

1. CARBOTECH will bind with nutrients and protect it from lock-out in the soil or from leaching and volatilization.
 - a. Cat-ions such as Ammonia, Potassium, Calcium and Magnesium binds with CARBOTECH to form larger molecules, aiding in reducing leaching through the soil.
 - b. Anions such as Phosphates binds with CARBOTECH in 'n proses called organic Phosphate clustering protecting it from Calcium / Phosphate lockout.
2. CARBOTECH will improve root growth by stimulating cell division and growth as well as having a positive effect on phosphate availability and mobility
3. The beneficial carbonaceous bacterial food source available in CARBOTECH promotes the bio-life in the soil to thrive and assist in the promotion of nutrient uptake, root development and root health to give natural defence against attacks on plant health

On bearing Avocados a strategy of a reduction in the application of fertilizer elements resulting in a financial saving on the fertilizer program cost could theoretically be achieved.

The aim in this case therefore was to see if the addition of CARBOTECH could affect a saving in costs, whilst an investigation of the leaf analyses in the following year would establish if the reduction in nutrients have adversely affected the tree reserves in the following year or not. A saving in costs with leaf analyses staying within norm after the season would therefore constitute a win.

FIELD TRIAL SETUP

Three orchards were selected at different Westfalia farms. Fowey Z10D is an old Hass orchard planted on Duke 7 rootstock, Goedgelegen AB5 and Quantock 9.5 are both Hass on Dusa. Reductions were made on the fertilizer applied on the trial vs. the control:

Table 1: Fertilizer Application: Kg Element / Ha / Season

Detail	NITROGEN			PHOSPHATES			POTASSIUM		
	Standard Chemical Program	Reduced value – CFT Program	% Reduction	Standard Chemical Program	Reduced value – CFT Program	% Reduction	Standard Chemical Program	Reduced value – CFT Program	% Reduction
Fowey Block - Z10D Hass (1990)	102	87	15.0%	21	11	50.0%	102	61	40.0%
Quantock Block - 9 Hass	95	80	15.0%	38	19	50.0%	90	54	40.0%
Goedgelegen Block - AB5 Hass (2005)	74	59	20.0%	-	-	0.0%	48	29	40.0%

In the case of Fowey and Quantock an **additional** 27Kg of N was taken out of the program and replaced with one application of TwinN nitrogen fixating bacteria which is commonly used in conjunction with

CARBOTECH. This brought the actual chemical N applied on the two farms down to 60Kg and 53Kg respectively.



It should be noted that Carbotech is normally applied according to varying norms based on the actual kg of element for each of the nutrients being applied through the normal chemical fertilizer program. In each case the Carbotech applied was calculated and applied at the following rates:

Table 2: Calculation and application of CARBOTECH

Block	L/Ha
Fowey - Block - Z10D Hass (1990)	11.4
Quantock - Block - 9 Hass	24.6
Goedgelegen - Block - AB5 Hass (2005)	14.6

Leaf analyses were taken at the appropriate time to evaluate the effect of the fertilizer reductions and the trees were evaluated according to the Ciba Geigy rating scale (Figure 3) in November 2011 and March 2011. Goedgelegen AB5 was harvested on the 20th of April 2012. The yield for each tree (114 treated, 133 control) was recorded.

SUMMARY OF RESULTS

An overall Cost saving of 4.3% on the overall fertilizer program cost on the three sites was achieved

The leaf analysis results indicate that the treatments generally improved the tree nutrition. The nitrogen concentration increased more than 25 at both Goedgelegen AB5 and Quantock 9.5. The results for Fowey Z10D are still outstanding.

The concentrations of Zinc and Boron both were higher in the treated trees. The Boron concentration at AB5 increased by 84%, and is far above the norm. Potassium, Calcium and Magnesium showed dissimilar trends between the blocks, probably because of different rates of fertiliser application.

MEASUREMENTS

1. Detailed leaf analyses

Table 3: Leaf analyses for Goedgelegen AB5 in 2012. Samples were taken at the end of March 2012. Norms are indicated in red. Trees were planted in 2005. The percentage difference between the treatments for each nutrient and yield in 2012 is given in the last row.

Treatment	Year	Norms						
		N (%)	P (%)	K (%)	Ca (%)	Mg (%)	Zn (mg/Kg)	B (mg/Kg)
-	2008							
-	2009	2.180	0.156	0.850	1.140	0.670	22.0	47.8
-	2010	3.050	0.169	0.870	1.820	0.588	27.0	30.7
-	2011	2.190	0.205	1.980	1.400	0.575	33.0	91.3
Control	2012	2.480	0.174	1.220	1.440	0.533	33.0	89.1
Carbotech	2012	3.120	0.228	1.340	1.100	0.536	38.0	163.8
% Difference		25.8%	31.0%	9.8%	-23.6%	0.6%	15.2%	83.8%

Table 4: Leaf analyses for Quantock 9.5 for 2012. Samples were taken at the end of March 2012. Norms are indicated in red. Trees were planted in 2001/2. The percentage difference between the treatments for each nutrient and yield in 2012 is given in the last row.

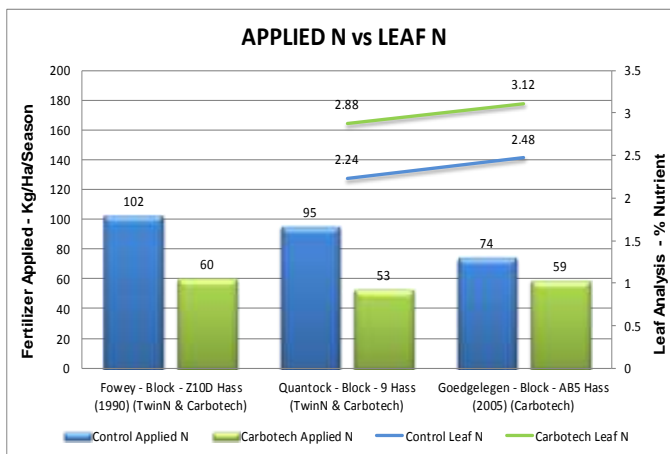
Treatment	Year	Norms						
		N (%)	P (%)	K (%)	Ca (%)	Mg (%)	Zn (mg/Kg)	B (mg/Kg)
-	2003	2.350	0.146	0.940	0.840	0.361	39.000	19.200
-	2004	2.780	0.148	0.750	0.920	0.448	22.0	51.4
-	2005	2.110	0.120	0.670	0.910	0.446	23.0	27.9
-	2006	2.860	0.156	0.930	0.940	0.472	24.0	25.6
-	2007	2.390	0.133	0.810	0.990	0.472	23.0	31.6
-	2008	2.560	0.129	0.660	1.270	0.597	22.000	25.800
-	2009	2.600	0.141	0.810	1.110	0.538	24.000	31.500
-	2010	2.110	0.143	0.770	0.430	0.379	22.000	28.200
-	2011	2.280	0.114	0.670	0.820	0.550	42.000	31.500
Control	2012	2.240	0.159	1.130	0.770	0.443	28.000	26.100
Carbotech & TwinN	2012	2.880	0.165	1.040	0.860	0.514	34.000	29.300
% Difference		28.6%	3.8%	-8.0%	11.7%	16.0%	21.4%	12.3%



2. Leaf Analyses in relation to nutrients applied

Nitrogen

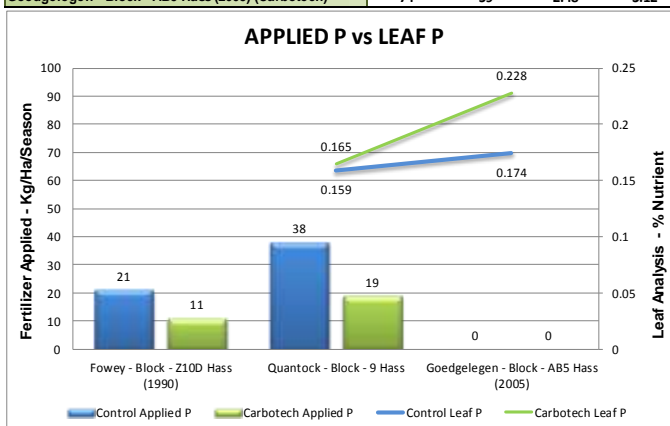
In general a 15% -20% reduction in N was made with the addition of Carbotech. On Fowey and Quantock an additional 27kg N was replaced with the addition of TwinN. This contributed to an overall 4% saving on total fertilizer program cost over the three sites. In spite of these reductions leaf analyses for N have improved by between 25.8% and 26.8% (Fowey leaf Analyses still outstanding)



Farms	Control Applied N	Carbotech Applied N	Control Leaf N	Carbotech Leaf N
Fowey - Block - Z10D Hass (1990) (TwinN & Carbotech)	102	60	2.24	2.88
Quantock - Block - 9 Hass (TwinN & Carbotech)	95	53	2.48	2.88
Goedgelegen - Block - AB5 Hass (2005) (Carbotech)	74	59	2.48	3.12

Phosphates

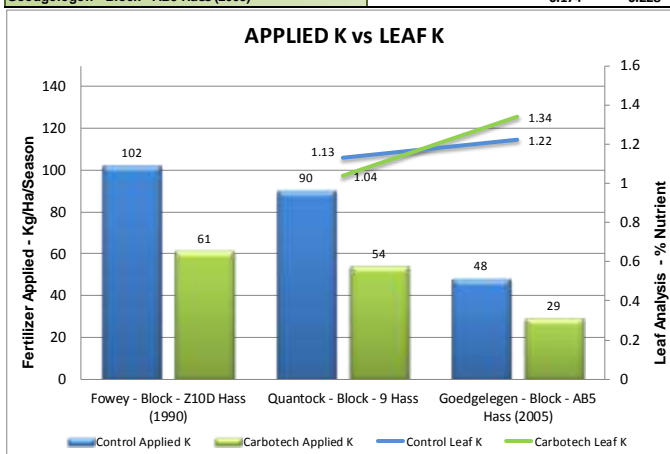
In general a 50% reduction in P was made with the addition of Carbotech. This contributed to an overall 4% saving on total fertilizer program cost over the three sites. In spite of these reductions leaf analyses for P have improved by between 3.8% and 31.0% (Fowey leaf Analyses still outstanding)



Farms	Control Applied P	Carbotech Applied P	Control Leaf P	Carbotech Leaf P
Fowey - Block - Z10D Hass (1990)	21	11	0.159	0.165
Quantock - Block - 9 Hass	38	19	0.159	0.165
Goedgelegen - Block - AB5 Hass (2005)	-	-	0.174	0.228

Potassium

In general a 40% reduction in K was made with the addition of Carbotech. This contributed to an overall 4% saving on total fertilizer program cost over the three sites. These reductions have resulted in a reduction in leaf analyses for K on Quantock by 7.9% and an improvement in leaf analyses for K on Goedgelegen by 9.8% (Fowey leaf Analyses still outstanding)



Farms	Control Applied K	Carbotech Applied K	Control Leaf K	Carbotech Leaf K
Fowey - Block - Z10D Hass (1990)	102	61	1.13	1.04
Quantock - Block - 9 Hass	90	54	1.13	1.04
Goedgelegen - Block - AB5 Hass (2005)	48	29	1.22	1.34

3. Tree health

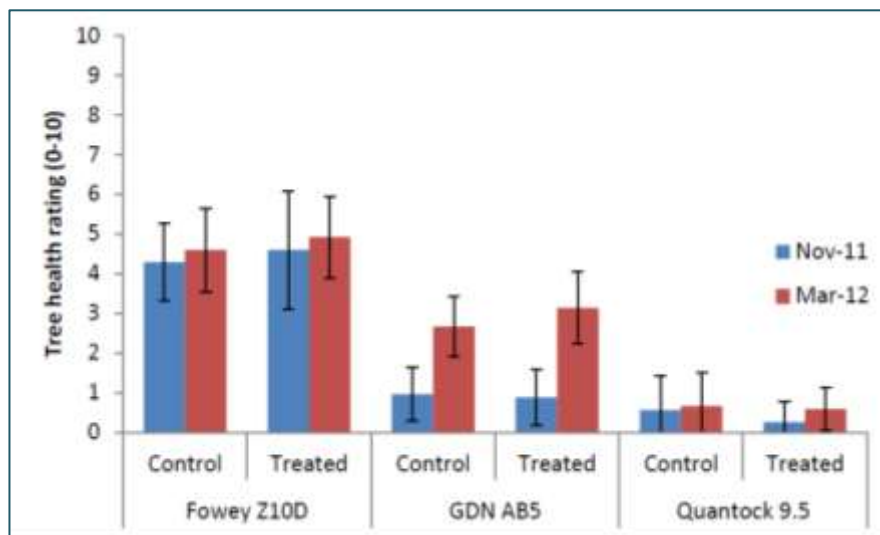


Figure 1: Tree health rating of Hass avocado trees in November 2011 and March 2012, from Fowey Z10D, Goedgelegen AB5, and Quantock 9.5. A rating of 0 = healthy, 10 = dead. Vertical bars indicate standard deviation.

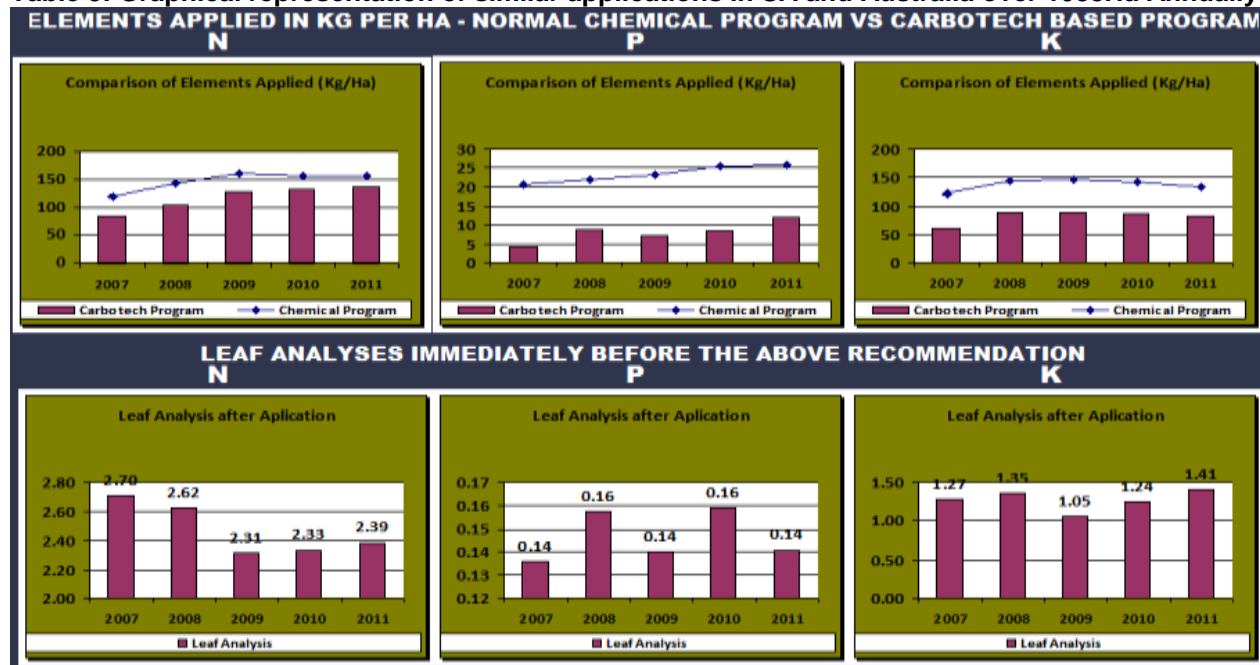
Due to the wide standard deviation on this subjective measurement, the results are deemed statistically the same from one measurement to the next

CONCLUSION

From the results obtained, it is apparent that CARBOTECH in conjunction with TwinN is useful for the reduction of fertilizer program costs in Avocado production, whilst not adversely affecting tree reserves as evidenced by subsequent leaf analyses. This result corroborates findings on other tree crops like citrus on various other farms country wide over a number of years, where similar results were found. The graphs below represent results over more than a 1000 Ha measured annually in various places in South Africa and Australia



Table 5: Graphical representation of similar applications in SA and Australia over 1088Ha Annually



ACKNOWLEDGEMENTS

We would like to thank Mr. Lucas McClean for affording us the opportunity to run these trials and the Westfalia Technical Services Department, and in particular Mr Rob Blakey for the meticulous measurements and control that allowed for the recording of these results.