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		X		

Indicate (X) client(s) to whom this final report is submitted. Replace any of these with other relevant clients if required.

FINAL REPORT 2013

Programme & Project Leader Information

	Research Organisation Programme leader	Project leader
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Project Information

Project number	EL Soil 1		
Project title	Quantifying the effect of inorganic and organic mulches of 2 soil types on nutrient uptake and fruit quality of Cripps' Pink apples		
Fruit kind(s)	Apples		
Start date (mm/yyyy)	01 October 2009	End date (mm/yyyy)	30 Sept 2012
Project keywords	Mulches, nutrients, fruit quality		

Approved by Research Organisation Programme leader (tick box)

X

THIS REPORT MUST INCLUDE INFORMATION FROM THE **ENTIRE** PROJECT

Executive Summary

The project was an addition to an established project and comprises bearing, 'Cripps' Pink' trees on M793 on a light, sandy and heavier, silt soil on Lourensford. A clean, cultivated control was compared to a geotextile fabric, compost, wood chips and vermi-casting/wood chips mulch. Irrigation and fertilizer practises were applied according to commercial recommendations and noted. During the last 2 of the 4 season, irrigation was reduced by changing nozzle delivery. Nevertheless, over irrigation was indicated and masked possible positive contributions of the mulches. Results differed between the first and subsequent two seasons of the trial and coincided with the reduction in irrigation volumes. After the first 2 seasons, no significant nutritional trends could be identified (Kotze 2012). After 4 seasons, woodchips improved leaf P, K and Ca levels in the heavy soil. Compost had a more pronounced effect on fruit nutrient levels and improved the levels of P, K and Mg in the heavy soil. In contrast, the vermi-castings resulted in more changes in nutrient levels at the sandy soil, with a positive effect on fruit P, K and Mg. The same trend was observed in the leaf nutrient levels. The geotextile mulch did not improve any nutrient levels, either the leaves or the fruit, compared to the organic mulches, but showed higher nutrient levels for most nutrients in the tree compared to the control, in both sites. Mineral analyses of vermi-castings indicated the highest nutrient levels of all organic mulches at application, as well as after a growing season, but did not result in a higher leaf or fruit nutrient status. The woodchips mulch showed higher yield efficiency and lower shoot growth compared to the control at both sites. The negative effect of compost on yield could not be explained. None of the treatments had a negative effect on fruit quality.

Problem identification and objectives

In spite of the numerous soil health projects that are running at present, all questions regarding the effect of mulches are not sufficiently answered yet. We would like to extend an existing trial on the effect of different mulches on sunburn to quantify the effect of the treatments on mineral analysis via organic material, soil temperatures and soil moisture and possibly on fruit quality after storage.

Workplan (materials and methods)

The randomised complete block design was laid out at Lourensford Estate, Somerset West. Plots of four, bearing Cripps' Pink trees on M793 were used on a sandy and heavier soil type, with 6 replicates and 5 treatments, and buffer trees between treatments. A clean, cultivated control was compared to a geotextile fabric, compost, wood chips and vermi-casting/wood chip mulch during 4 consecutive seasons. Nutrient status of the mulches, leaves and fruit were compared. Shoot growth, stem circumference and yield were also recorded for analyses. The nutrient status of the soil at the beginning and end of the trial was also analysed. Irrigation and fertiliser practices on the farm was noted – but not managed according to the mulches. Fruit quality was evaluated at harvest, and again after 2 months' storage at -0.5°C according to standard practices. Nematode samples were taken for analyses annually, as was michorrhizae colonization.

Results and discussion

This is a summary of the MScAgric thesis that is available on demand.

Limited research is available on the effect of mulches on established orchards. Most of the information available stems from research conducted in newly planted orchards or on annual crops such as green peppers and strawberries under greenhouse conditions. To increase the current knowledge on the effect of mulches in established orchards, two field trials were conducted on 14 year old 'Cripps' Pink' orchards. The one trial concentrated on the influence of mulches on the root environment and the other trial on the effect of mulches on growth, yield and fruit quality.

Both trials were conducted at Lourensford Estate near Somerset West, but the sites differed between sandy (Tukulu) and heavy (Clovelly) soil. Four different mulches were used viz. compost, wood chips, vermi-castings (topped with thin layer of woodchips) and a woven geotextile fabric. These four treatments were compared to an un-mulched control, managed according to industry norms.

After reducing irrigation volume in the 2010/2011 season, with a further reduction in the 2011/2012 season, more significant differences were obtained in nutrient levels of fruit and leaves compared to the 2008/2009 and 2009/2010 seasons of the trial. Leaf and fruit nutrients showed significant differences in both sites, but the differences were more pronounced on the sandy soil. At the heavy soil site, the vermi-castings, woodchips and compost treatments increased fruit phosphorus (P) during 2010/11 and the control treatment increased fruit boron (B) during 2011/12. Only leaf magnesium (Mg) was increased by woodchips and vermi-castings in 2011/12 at this site.

In the sandy soil, the control treatment had the highest fruit B levels in 2010/11 while the vermi-castings and the woodchips treatments had the highest fruit P levels in 2011/12. For the same site, vermi-casting and compost treatments improved leaf potassium (K) uptake in 2010/11 and 2011/12, whereas woodchips and geotextile improved leaf copper (Cu) uptake in 2010/11 significantly compared to the control.

To determine if applied nutrients were trapped in the organic mulches over time, leading to a deficiency in the soil and eventually the tree, a mineral analysis was conducted on the organic mulches at the end of each season. Results of the two seasons indicated that vermi-castings contained higher total nutrient levels than the other two organic mulches, but the difference in nutrient levels were shown not to be directly related to the fertilisers applied during each season. In the case of vermi-castings, nutrient quantities in the original material applied at the beginning of each season were higher than those of the other organic mulches. The higher nutrient levels in organic in comparison to inorganic mulches were however not reflected in the fruit and leaf mineral analysis of these treatments. The overall treatment effect in terms of changes in nutrient levels in the tree became less significant when trees were over irrigated. This became evident as the differences between mulching treatments increased as the irrigation was reduced during the season, indicating the masking effect of irrigation on mulching.

Evaluating the effect of mulches on growth, yield and fruit quality showed significant differences only at the heavy silt loam site. The vermi-casting and woodchips treatments had significantly higher yield efficiencies than the control for the 2011/2012 season. Compost had the lowest yield efficiency at both sites, also during the previous two seasons (Kotze 2012). In 2011/12, the compost treatment also showed significantly higher shoot growth than the control. Compost therefore could increase vegetative growth in established orchards on a heavy silt loam soil after application for four seasons. Taking the cost of mulching into account, wood chips are the only treatment that can be recommended without compromising fruit quality. Wood chips will sustain or even improve yield efficiency in an established orchard on especially heavy silt loam soil.

Complete the following table

Milestone	Target Date	Extension Date	Date Completed	Achievement
1. complete study	2010	2012	2012	MSc Agric of WP Kotze
2. complete study	2012		2012	MSc Agric of P vd Merwe

3.				
4.				
5. Journal publication/s – final milestone			<u>2012</u>	<u>Presentation and publication in Acta Hort</u>

Accumulated outputs

MScAgric students were trained and data presented locally and internationally during the four years of the trial.

Conclusions

This study added some valuable information regarding medium term results after mulching. It emphasised the importance of irrigation when mulching and the different benefits of mulching in different soil types. At least one more scientific publication and one popular article will be submitted during 2013 to discuss results in more detail.

Technology development, products and patents
None

Suggestions for technology transfer

A mini-symposium with additional information from similar projects to present the information in a practical form – similar to the field day at Graymead.

Human resources development/training

Indicate the number and level (eg. MSc, PhD, post doc) of students/support personnel that were trained as well as their cost to industry through this project. Add in more lines if necessary.

Student level (BSc, MSc, PhD, Post doc)	Cost to Project
1. MScAgric	
2. MScAgric	
3.	
4.	
5.	

Publications (popular, press releases, semi-scientific, scientific)

Lötze, E. & Kotze, W.P., 2013. The effect of organic and inorganic mulches on soil environment, root development and nutrient uptake of mature apple trees. Act Hort (in press)

Presentations/papers delivered

Lötze, E. & Kotze, W.P., 2010. Pre-harvest management of fruit quality with emphasis on efficient nutrient uptake and distribution to the fruit. Integrated approaches to fruit production and post harvest management in arid climates. Workshop organized by Oman- South Africa Scientific & Technical bilateral cooperation program 29-31 May 2010.

Lötze, E. & Kotze, W.P., 2011. The effect of organic and inorganic mulches on soil environment, root development and nutrient uptake of mature apple trees. International Symposium on Organic Matter Management & Compost Use in Horticulture 4 - 7 April 2011, Adelaide, Australia.

Lötze, E., Kotze, WP, 2011. Pre-harvest management of fruit quality (emphasis on efficient nutrient uptake and distribution to the fruit) Fieldmen's meeting 5th Aug 2011, Stellenbosch.

Lötze, E., Kotze, WP, Nicholson, A, Van der Merwe, DJP, 2011. Pre-harvest management of fruit quality after application of mulches. Kromco technical information day 29th Nov 2011, Elgin.

Lötze, E., Kotze, WP, Nicholson, A, Van der Merwe, DJP, 2012. Choosing mulches: Horses for courses. Fruitgro Science Technical Symposium 2012, 6th June, Spier, Stellenbosch.

Total cost summary of the project

TOTAL COST IN REAL TERMS	COST	CFPA	DFTS	Deciduous	SATI	Winetech	THRIP	OTHER	TOTAL
YEAR 1	2009			150000					150000
YEAR 2	2010			160000					160000
YEAR 3	2011			170000					170000
YEAR 4	2012			160000					160000
YEAR 5									
TOTAL				640000					640000