

DRY LAND MAIZE TRIAL 2008/9

Introduction

Soil productivity is determined by its physical, chemical and biological properties. Many South African agricultural soils are depleted of organic matter, soil biology and vital minerals and thus have very low fertility. Farmers have applied lost minerals and are beginning to appreciate the importance of organic matter, but have scant regard for the importance of soil biology. Soil microbe diversity is extremely important for a healthy soil eco-system. A healthy soil will be more productive and will require fewer inputs like fertiliser and pesticides compared to dead soil. Compost tea can be used to re-introduce lost soil biology. It can be described as a water extract of compost containing nutrients and a diversity of bacteria, fungi, protozoa and nematodes. It is the purpose of this trial to ascertain whether the introduction of beneficial soil microbes by means of compost tea will lead to higher yields and will improve fertiliser uptake and thereby lower the demand for fertiliser.

A statistical trial was designed and planted in the Kroonstad area on 10 December 2008. The plot selected was planted with sunflowers the previous year and the trial was done with the white maize cultivar PHI 30B95. Due to the vast areas planted per day and the capacity constraints of the compost tea system, relatively small amounts of compost tea can be applied per hectare. A food source was applied with the compost tea in order to enhance the beneficial effect of the inoculated organisms. This will enable the microbes to multiply in the soil. Five litres of Apex (a microbial food additive from Ecosoil) was applied with 100 litres of Ecosoil Compost Tea. The compost tea was made in a compost tea system supplied by Ecosoil and the brewing period was 24 hours. Harvest date was 29 July 2009.

Statistical Procedures

The experimental design was a randomised complete block with 8 treatment combinations replicated in 4 blocks. The treatment design was a 2x4 factorial with 2 compost tea treatments (with and without compost tea) and 4 fertilizer treatments (230 kg 5:4:0(21), 200 kg 5:4:0(21), 220 kg 3:1:0(30), 180 kg 3:1:0(30))

Unvaried analysis of variance was performed on all variables accessed using GLM (General Linear Models) Procedure of SAS statistical software version 9.1 (SAS Institute Inc., Cary, NC, USA)). The Shapiro-Wilk test was performed to test for normality (Shapiro, 1965). Student's least significant difference was calculated at the 5% level to compare treatment means (Ott, 1998). A probability level of 5% was considered significant for all significance tests.

Treatments

The eight treatment combinations of fertilisers and Ecosoil Compost Tea and Apex were applied to experimental plots according to the design of the experiment.

Ecosoil Compost Tea and Apex were applied at a rate of 100L Compost Tea and 5L Apex per hectare. A minimum till planter was equipped with a tank that contained the Compost Tea-Apex mixture and this was sprayed on the seed with a pump as the seeds were planted.

Fertiliser from 2 companies (A and B) was used at a higher (100% of recommended) and lower ($\pm 80\%$ of recommended) rate to see what the effect on production will be. It was planned to apply a top dressing at some later stage, but this was not done. The fertiliser that was applied at planting can be seen in table 1.

Table 1: Fertiliser quantities applied

Treatment Number	Treatments	applied per treatment		
		N	P	K
1,2	220kg 3:1:0(30) Comp. A	49.5	16.5	0
3,4	180kg 3:1:0(30) Comp. A	40.5	13.5	0
5,6	230kg 5:4:0(21) Comp. B	26.9	21.4	0
7,8	200kg 5:4:0(21) Comp. B	23.4	18.6	0

It is standard practice on the farm to aim for 4.5 tons of maize per hectare and to fertilise 40 kg nitrogen (N) and 15 kg phosphor (P) at planting with a further 35 kg N as a top dressing later. From the table above it can be seen that the fertiliser selected from company B had less N, but more P than that of company A.

Table 2: Summary of treatments

Compost Tea Treatments	Fertiliser Treatments			
	Manufacturer A		Manufacturer B	
	220kg 3:1:0(30)	180kg 3:1:0(30)	230kg 5:4:0(21)	200kg 5:4:0(21)
Without Compost Tea and Apex	1	3	5	7
With Compost Tea and Apex	2	4	6	8

Each treatment site was 600 m² and the total area was ± 2 hectares.

Results and discussion

Table 3: Compost tea treatment main effect – with or without Compost Tea and Apex over all fertiliser treatments

Treatments	ton/ha	% change	Mois- ture	Hecto- litre mass	Protein content	Oil content	Milling index
Without Compost Tea and Apex	4.05 a		11.15 a	76.14 a	6.91 a	3.68 a	82.69 a
With Compost Tea and Apex	4.31 b	6%	11.30 a	76.35 a	7.00 a	3.64 a	82.06 a
Least Significant Difference (LSD)	0.23		0.24	0.58	0.28	0.25	2.59

The addition of Ecosoil Compost Tea and Apex increased production of dry land maize with 260 kg on average over all fertiliser treatments. This is a statistically significant difference and amounts to a 6% increase in production. The cost of this treatment was R110 per hectare and the potential increase in income at a maize price of R1500 per ton is R390 per hectare. This amounts to a net profit increase of R280 per hectare. There were no statistical differences with the other parameters that were tested.

Table 4: Fertiliser treatment main effect

Treatment Number	Treatments	ton/ha	Mois-ture	Hecto-litre mass	Protein content	Oil content	Milling index
1,2	220kg 3:1:0(30) Comp. A	4.58 a	11.41 a	76.31 a	7.05 a	3.44 c	82.51 a
3,4	180kg 3:1:0(30) Comp. A	4.43 ab	11.32 ab	76.50 a	6.82 a	3.5 bc	81.50 a
5,6	230kg 5:4:0(21) Comp. B	4.14 b	11.07 b	76.20 a	6.98 a	3.8 ab	84.11 a
7,8	200kg 5:4:0(21) Comp. B	3.57 c	11.08 ab	75.98 a	6.98 a	3.89 a	81.38 a
	Least Significant Difference (LSD)	0.32	0.33	0.81	0.4	0.36	3.67

There was no statistical difference in tons of maize per hectare between the two different fertiliser treatments of company A. The 230 kg 5:4:0(21) resulted in significantly lower tons of maize per hectare than the 220kg 3:1:0(30) treatment, but did not differ significantly from the 180 kg 3:1:0(30) treatment. The 200 kg 5:4:0(21) treatment had a significantly lower production than all three other treatments. No statistical differences were found with the hectolitre mass, the protein content and the milling index between the 4 treatments. Fertiliser from company B had higher oil content with the 200 kg 5:4:0(21) treatment being statistically higher than the 220 kg 3:1:0(30) treatment.

Table 5: Interaction effect – fertiliser with or without Compost Tea and Apex

Treatment Number	Treatments	ton/ha	% change	Mois-ture	Hecto-litre mass	Protein content	Oil content	Milling index
1	220kg 3:1:0(30)	4.45 ab		11.40 a	76.25 a	6.88 a	3.40 b	82.28 a
2	220kg 3:1:0(30)+ 100L CTea + 5L Apex	4.71 a	6%	11.43 a	76.37 a	7.23 a	3.48 b	82.75 a
3	180kg 3:1:0(30)	4.35 ab		11.32 ab	76.52 a	6.75 a	3.40 b	81.83 a
4	180kg 3:1:0(30) + 100L CTea + 5L Apex	4.51 a	4%	11.32 ab	76.48 a	6.90 a	3.60 ab	81.18 a
5	230kg 5:4:0(21)	3.99 bc		10.90 b	75.98 a	6.90 a	3.90 ab	84.45 a
6	230kg 5:4:0(21) + 100L CTea + 5L Apex	4.29 ab	8%	11.25 ab	76.43 a	7.05 a	3.70 ab	83.78 a
7	200kg 5:4:0(21)	3.42 d		10.98 ab	75.82 a	7.13 a	4.00 a	82.20 a
8	200kg 5:4:0(21) + 100L CTea + 5L Apex	3.73 cd	9%	11.20 ab	76.15 a	6.83 a	3.78 ab	80.55 a
	LSD	0.46		0.47	1.15	0.56	0.50	5.19

From table 5 it can be seen that the addition of Ecosoil Compost Tea and Apex increased production with all 4 fertiliser treatments between 4 and 9%, with an average of 6% (Table 3). Treatment 4 (the addition of Compost Tea to the lower fertiliser amount) had a similar production as treatment 1 (the higher fertiliser amount without the compost tea). The same can be said with treatments 8 and 5. This amounts to a saving of 18% in fertiliser with treatment 4 and 13% with treatment 8. It is also notable that treatment 2 where 40.5 kg N and 13.5 kg P was applied attained a production of 4.7 tons/ha which under standard farm practice would have required an additional 30 kg N as a top dressing. The data suggests that the addition of Ecosoil Compost Tea and Apex would lead to better utilisation of applied fertiliser which in turn will lead to higher production. The data also suggests (although this was not proven statistically) that the addition of Ecosoil Compost Tea and Apex will enable the farmer to save 10% on fertilisers with no loss in production. These results will be researched further in the following season.

Conclusion

The use of Ecosoil's Compost Tea and Apex on dry land maize will lead to higher production and could increase nett farm income by as much as R280 per hectare.

Trial design: Ecosoil

Statistical trial lay out and analysis of data: ARC Stellenbosch

Trial planted and harvested by farm owner: Flip van der Merwe

Production data collected by farmer and assisted by Ecosoil

Quality analysis by Senwes Kroonstad

Reference

Ott, R.L. (1998) An Introduction to Statistical methods and data analysis. Belmont, California:Duxbury Press: pp 807-837 (pp 1-1051)

SAS, 2000. SAS/STAT Users Guide, Version 8, First Edition, Volume 2. SAS Institute Inc., Cary, NC, USA

Shapiro, S.S. and Wilk, M.B. (1965); An analysis of Variance Test for Normality (complete samples), Biometrika 52, 591-611.
ed at further.