Final Report

Optimal dosage rate of Mix 532 fertiliser for use in an Organic Substrate Product.

Somborne Valley Research Ltd

Customer: Swift Global Eco Solutions Ltd- Premiere Cocos

Report by: Tobias Lane *BSc (Hons)*

Experimental work by: Tobias Lane *BSc (Hons)*

Trial Site: Crops Environment Laboratory, University of Reading, Reading, UK

Trial Completion date: 14.6.2017

Report Date: 23.6.2017

OVERVIEW

This will build on a previous trial to find the optimum dosage rate for the development of an organic substrate product. One of the best preforming fertilisers from the previous trial and suitable for the desired end product will be used (Mix532). The best dosage rate will be based on optimal crop growth coupled with the amount of fertiliser added to the product.

Trial Aim: To find the optimum dosage rate of Mix 532 fertiliser when added to coco peat (70%) and coir chips (30%) mix. To be able to ascertain the best dosage rate for future addition to premiere coco products in terms of plant quality and economic viability, across a range of crops.

TRIAL DESIGN

Treatments were laid out in a randomised design, labelled with treatment code and replicate number.

Base substrate: 70% coco peat and 30% coir chips mix.

Fertiliser Used: Mix 532.

Dosage Rates: Varied dosage rates of 0g per litre 4g, 6g, 8g, 10g (or 0g, 52g, 78g, 104g, 130g per kilo of dry product).

Test Species: Cucumber 'Femspot F1', Sweet Pepper 'Snack bite mix', Petunia 'Priscilla'& Tomato 'Black Opal'.

Product Codes:

A- Control (70-30 peat and chips mix)

B– Mix532 – 4g per litre

C– Mix532 – 6g per litre

D– Mix532 – 8g per litre

E– Mix532 – 10g per litre

Replicates: 3 **Plants per pot:** 1 **Pot size:** 1 litre

Conditions: 20-25^{oc} Glasshouse, no feed and no supplementary lighting.

Set Up Date: 28.4.2017 Tomato and Pepper; 3.5.2017 Cucumber and Petunia.

Last Assessment Dates: 9.6.2017 Tomato and Pepper; 14.6.2017 Cucumber and Petunia.

SUBSTRATE COMPOSITION

NRM analysis

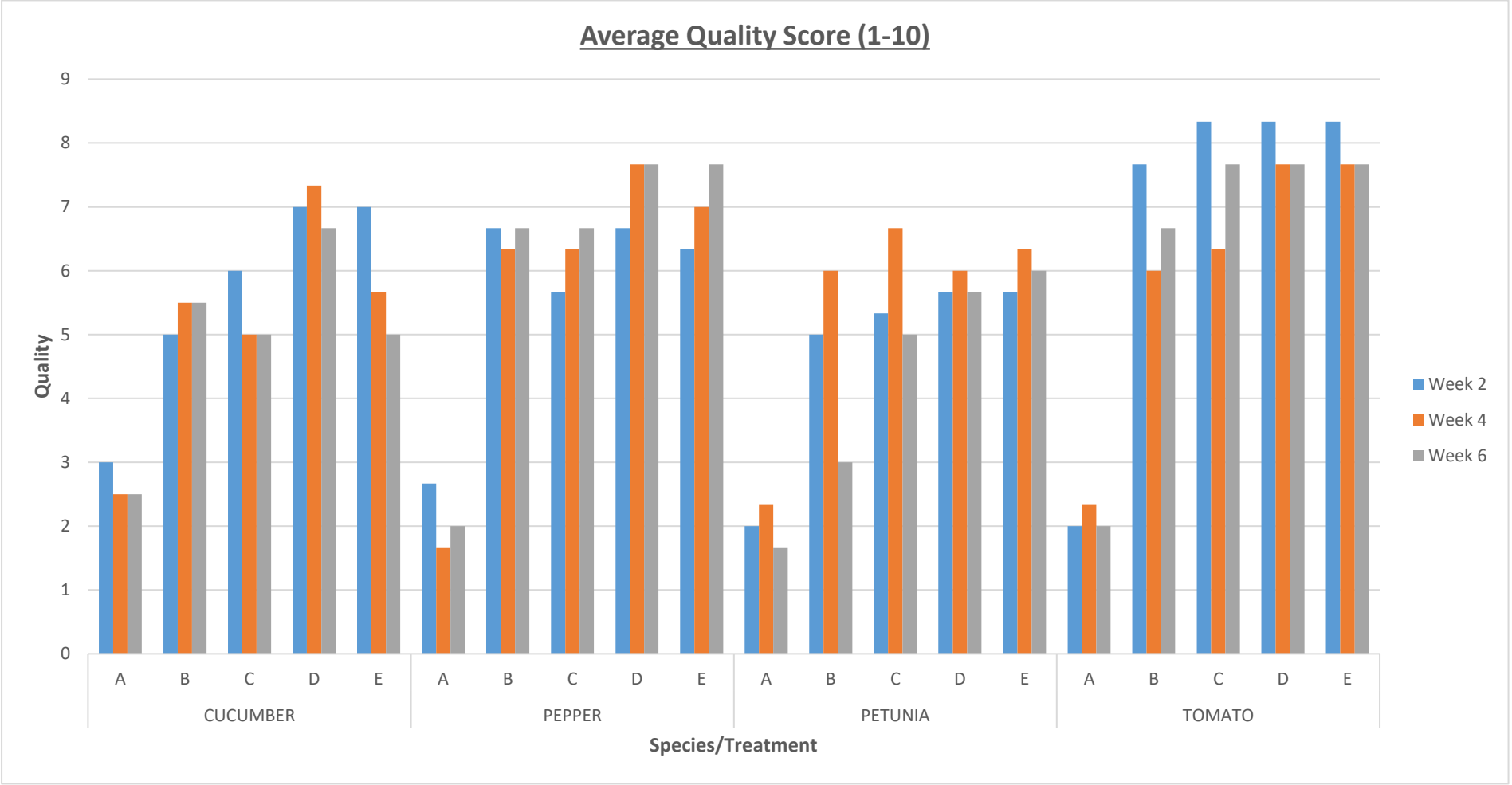
Treatment	PH	EC *u/s*	Chloride *mg/l*	Sodium *mg/l*	Calcium *mg/l*	Magnesium *mg/l*	Sulphate *mg/l*	Phosphorus *mg/l*	Potassium *mg/l*	Total Nitrogen *mg/l*
A	6.3	125	136.9	35.7	0.8	0.4	18.6	5	105.5	5.3
B	7.6	364	165.4	67.5	3.4	2	431.2	9.4	247.4	80.9
C	7.9	494	176.9	75.8	3.6	2	647.2	12.5	306.3	128.9
D	8.2	672	161.4	79.8	4	2.4	962.8	13.7	368.2	200.2
E	8.1	735	173.8	81.9	5.6	3.3	1067.5	16.9	393.5	225.1

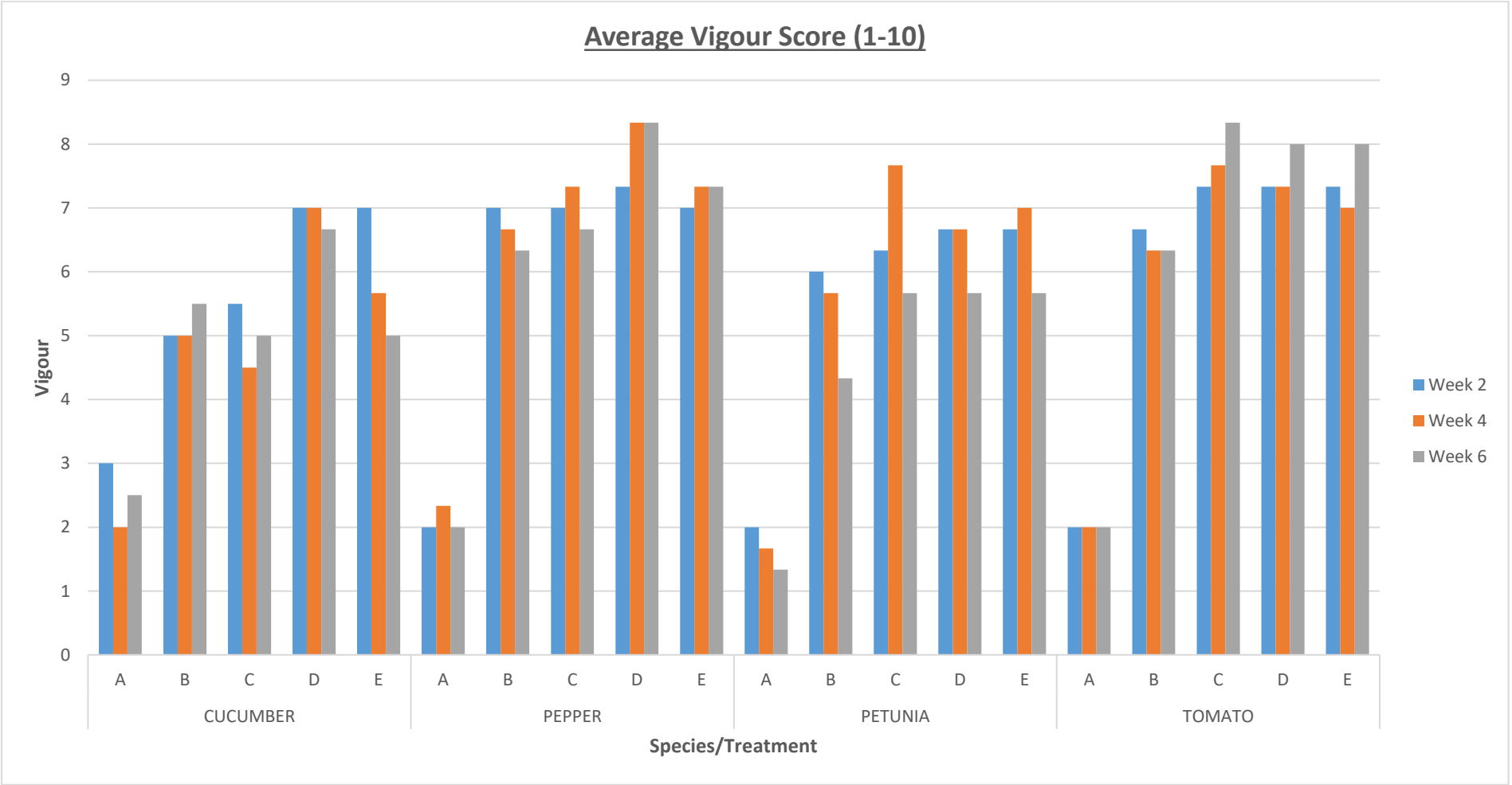
Additions from adding fertiliser compared to control substrate

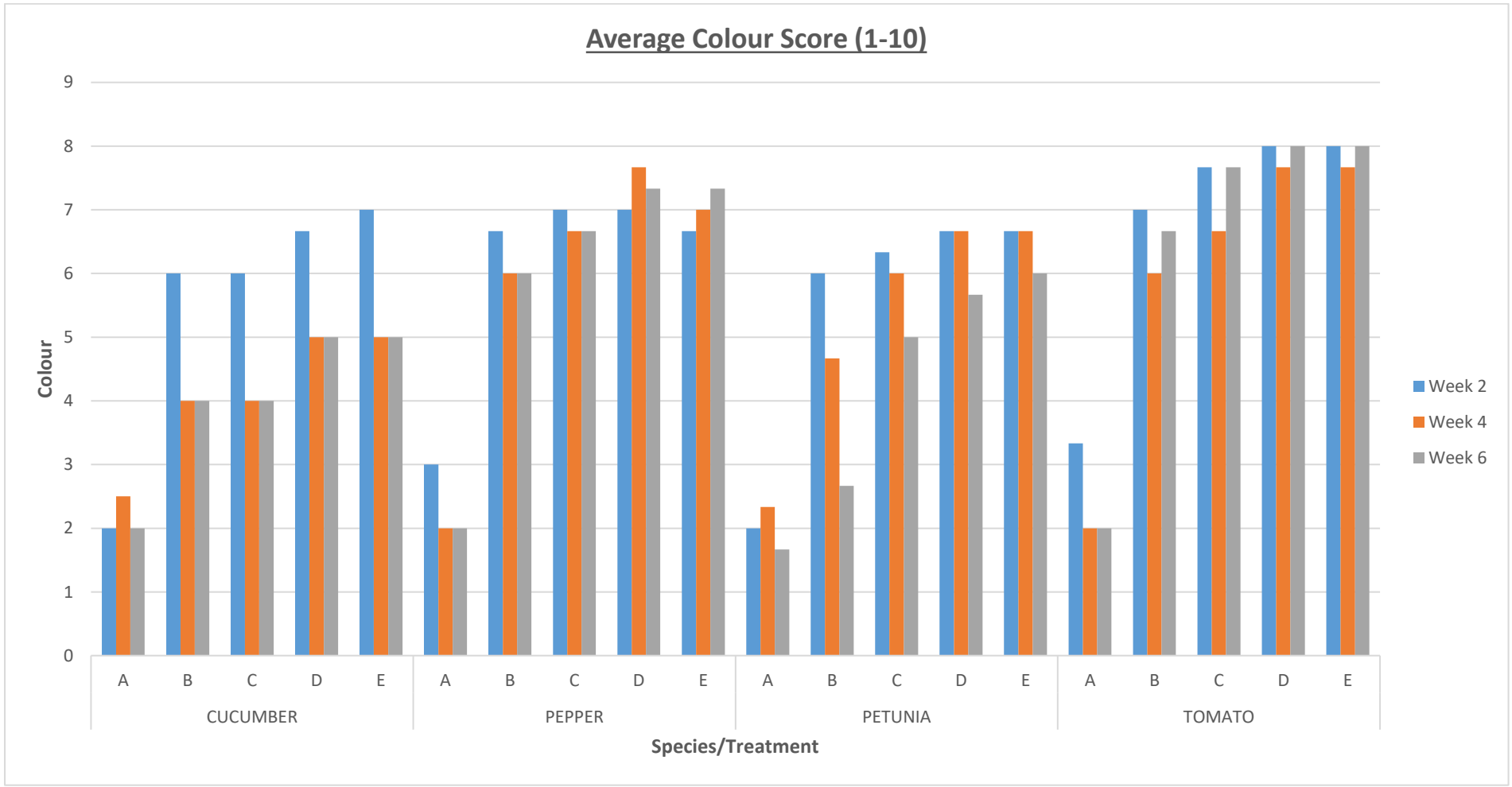
Treatment	PH	EC *u/s*	Chloride *mg/l*	Sodium *mg/l*	Calcium *mg/l*	Magnesium *mg/l*	Sulphate *mg/l*	Phosphorus *mg/l*	Potassium *mg/l*	Total Nitrogen *mg/l*
A	6.3	125	136.9	35.7	0.8	0.4	18.6	5	105.5	5.3
B	1.3	239	28.5	31.8	2.6	1.6	412.6	4.4	141.9	75.6
C	1.6	369	40	40.1	2.8	1.6	628.6	7.5	200.8	123.6
D	1.9	547	24.5	44.1	3.2	2	944.2	8.7	262.7	194.9
E	1.8	610	36.9	46.2	4.8	2.9	1048.9	11.9	288	219.8

***Composition will vary depending on the nutrient content of water used to hydrate substrate, see appendix for analysis of water used in this experiment.*

RESULTS


Average Quality Score (1-10)
Quality
9
8
7
6
5
4
3
2
1
0
A B C D E A B C D E A B C D E A B C D E
CUCUMBER
PEPPER
PETUNIA
TOMATO
Species/Treatment
Week 2
Week 4
Week 6


Average Vigour Score (1-10)
Vigour
9
8
7
6
5
4
3
2
1
0
A B C D E A B C D E A B C D E A B C D E
CUCUMBER
PEPPER
PETUNIA
TOMATO
Species/Treatment
Week 2
Week 4
Week 6


Average Colour Score (1-10)
Colour
9
8
7
6
5
4
3
2
1
0
A B C D E A B C D E A B C D E A B C D E
CUCUMBER
PEPPER
PETUNIA
TOMATO
Species/Treatment
Week 2
Week 4
Week 6

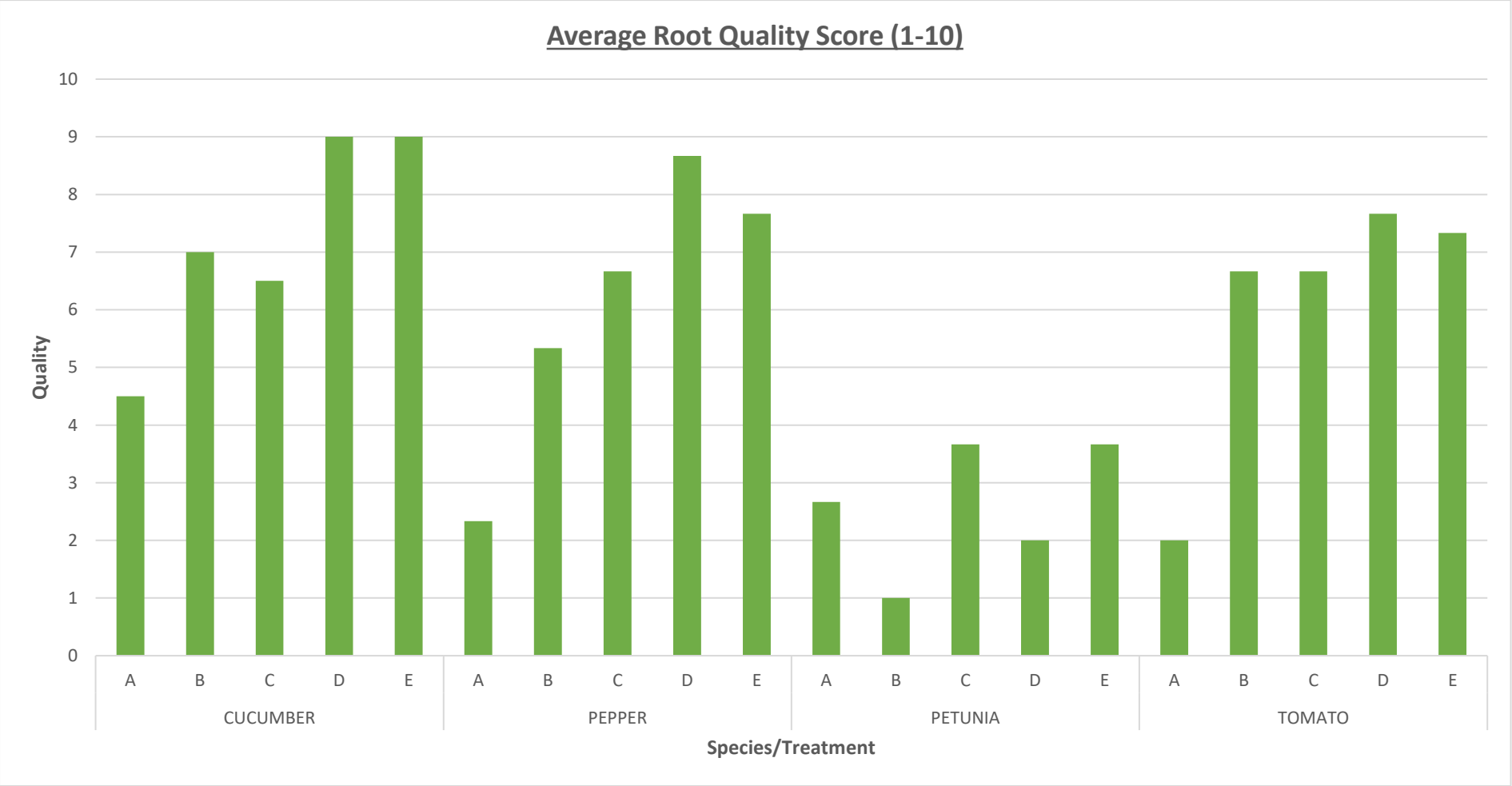
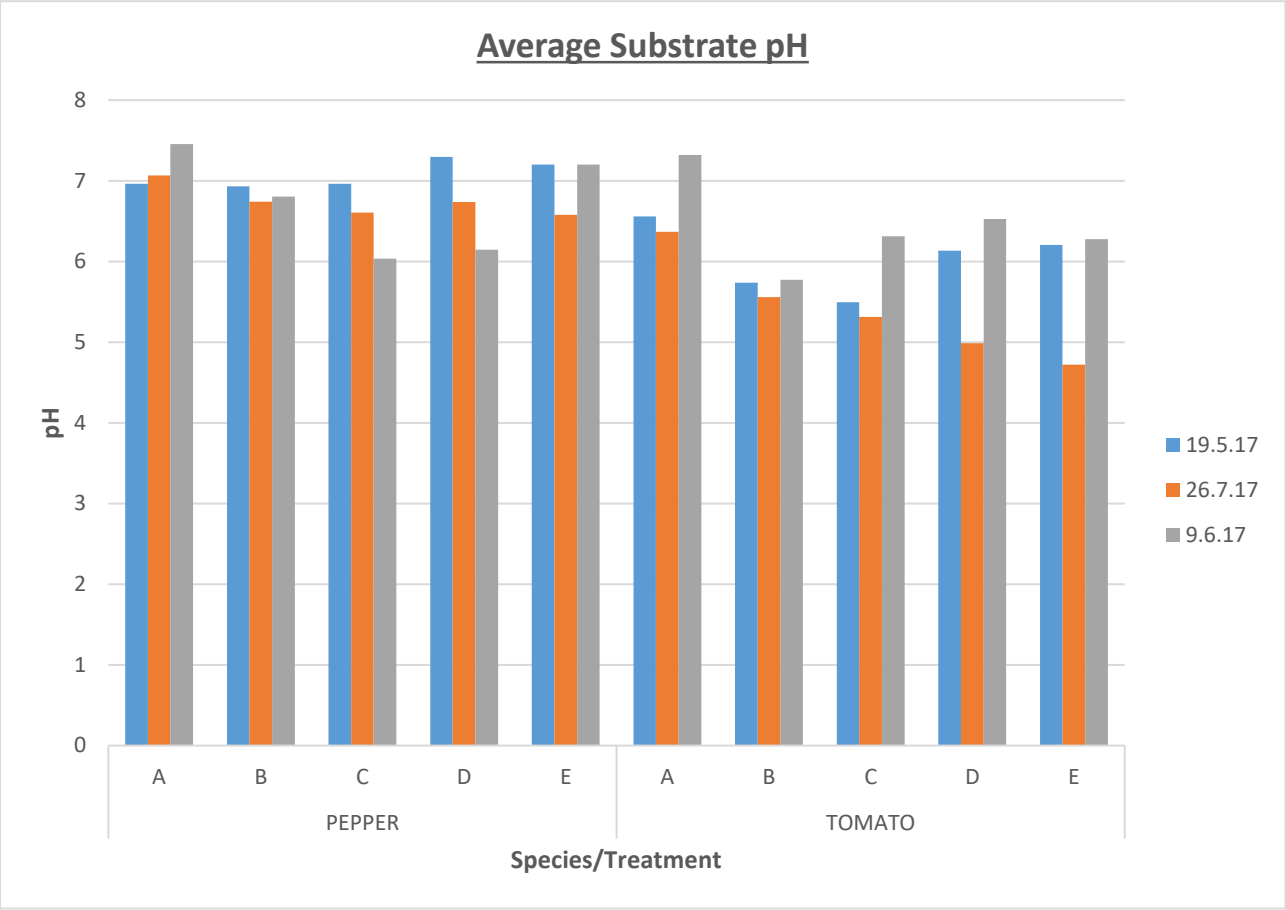

Average Root Quality Score (1-10)
10
9
8
7
6
5
4
3
2
1
0
Quality
A
B
C
D
E
CUCUMBER
PEPPER
PETUNIA
TOMATO
Species/Treatment

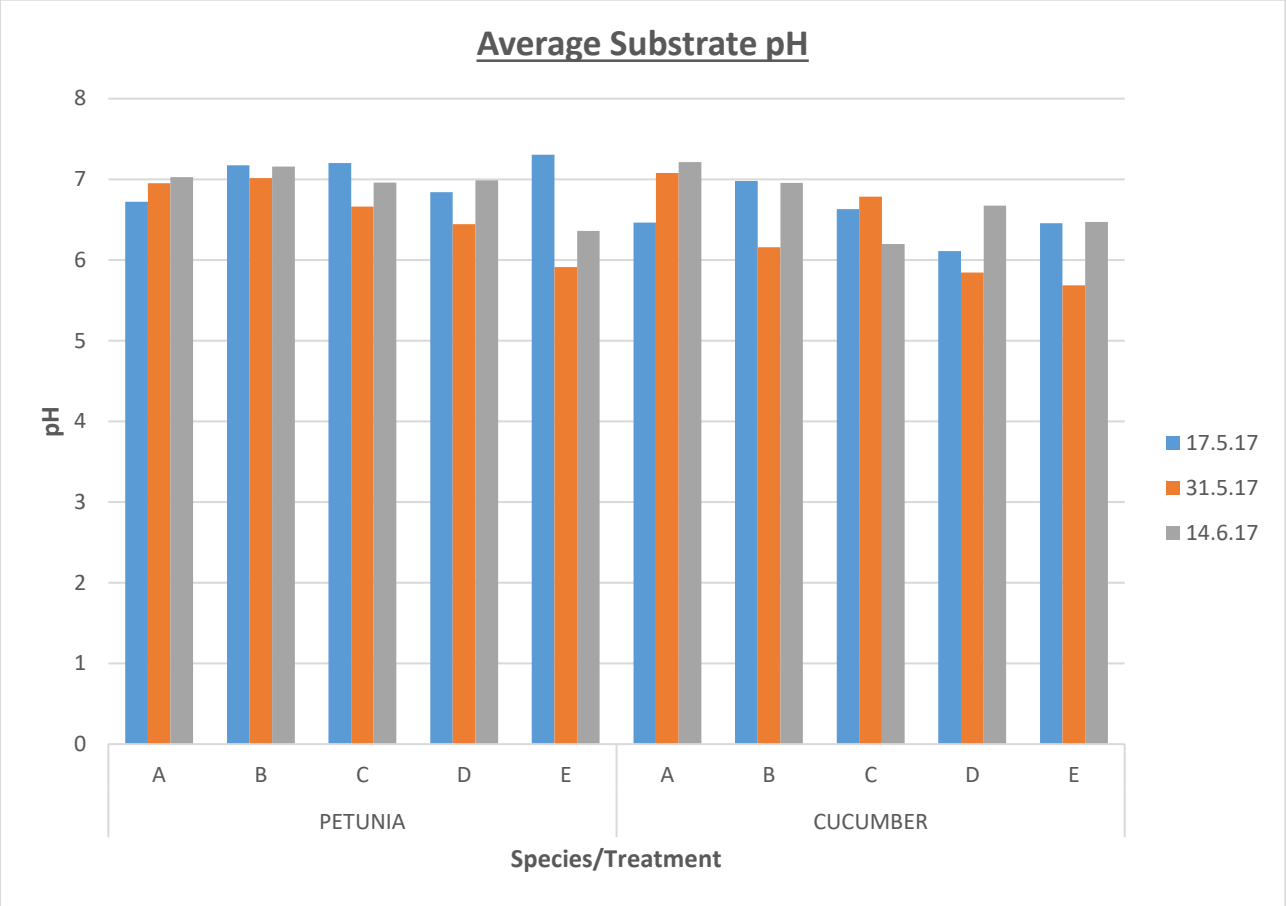
Table of Averages

	Date:	Week 2			Week 4			Week 6			
Species	**Treatment**	**Quality**	**Vigour**	**Colour**	**Quality**	**Vigour**	**Colour**	**Quality**	**Vigour**	**Colour**	**Root Score**
CUCUMBER	A	3	3	2	2.5	2	2.5	2.5	2.5	2	4.5
	B	5	5	6	5.5	5	4	5.5	5.5	4	7
	C	6	5.5	6	5	4.5	4	5	5	4	6.5
	D	7	7	6.666667	7.333333	7	5	6.666667	6.666667	5	9
	E	7	7	7	5.666667	5.666667	5	5	5	5	9
PEPPER	A	2.666667	2	3	1.666667	2.333333	2	2	2	2	2.333333333
	B	6.666667	7	6.666667	6.333333	6.666667	6	6.666667	6.333333	6	5.333333333
	C	5.666667	7	7	6.333333	7.333333	6.666667	6.666667	6.666667	6.666667	6.666666667
	D	6.666667	7.333333	7	7.666667	8.333333	7.666667	7.666667	8.333333	7.333333	8.666666667
	E	6.333333	7	6.666667	7	7.333333	7	7.666667	7.333333	7.333333	7.666666667
PETUNIA	A	2	2	2	2.333333	1.666667	2.333333	1.666667	1.333333	1.666667	2.666666667
	B	5	6	6	6	5.666667	4.666667	3	4.333333	2.666667	1
	C	5.333333	6.333333	6.333333	6.666667	7.666667	6	5	5.666667	5	3.666666667
	D	5.666667	6.666667	6.666667	6	6.666667	6.666667	5.666667	5.666667	5.666667	2
	E	5.666667	6.666667	6.666667	6.333333	7	6.666667	6	5.666667	6	3.666666667
TOMATO	A	2	2	3.333333	2.333333	2	2	2	2	2	2
	B	7.666667	6.666667	7	6	6.333333	6	6.666667	6.333333	6.666667	6.666666667
	C	8.333333	7.333333	7.666667	6.333333	7.666667	6.666667	7.666667	8.333333	7.666667	6.666666667
	D	8.333333	7.333333	8	7.666667	7.333333	7.666667	7.666667	8	8	7.666666667
	E	8.333333	7.333333	8	7.666667	7	7.666667	7.666667	8	8	7.333333333

***Crop losses were observed during the trial, these were not due to any treatment effects and were removed from the trial.*



	Date:	19.5.17	26.7.17	9.6.17
Species	**Treatment**	**pH**	**pH**	**pH**
PEPPER	A	6.963333	7.066667	7.453333
	B	6.9325	6.74	6.805
	C	6.963333	6.606667	6.036667
	D	7.296667	6.736667	6.146667
	E	7.2	6.58	7.2
TOMATO	A	6.556667	6.366667	7.32
	B	5.736667	5.56	5.773333
	C	5.493333	5.313333	6.313333
	D	6.133333	4.986667	6.526667
	E	6.205	4.72	6.275



	Date:	17.5.17	31.5.17	14.6.17
Species	Treatment	pH	pH	pH
PETUNIA	A	6.723333	6.95	7.026667
	B	7.173333	7.016667	7.156667
	C	7.2	6.663333	6.96
	D	6.84	6.443333	6.986667
	E	7.303333	5.913333	6.36
CUCUMBER	A	6.465	7.08	7.215
	B	6.98	6.16	6.955
	C	6.63	6.785	6.2
	D	6.11	5.843333	6.673333
	E	6.456667	5.686667	6.47

PHOTOGRAPHS

Week 2

CUCUMBER – Week 2 Scoring 17.5.2017 – showing each treatment and the average from each treatment compared to the control (A).

PEPPER – Week 2 Scoring 13.5.2017 – showing each treatment and the average from each treatment compared to the control (A).

PETUNIA – Week 2 Scoring 17.5.2017 – showing each treatment and the average from each treatment compared to the control (A).

TOMATO – Week 2 Scoring 13.5.2017 – showing each treatment and the average from each treatment compared to the control (A).

Week 4

CUCUMBER – Week 4 Scoring 31.5.2017 – showing each treatment and the average from each treatment compared to the control (A).

PEPPER – Week 4 Scoring 26.5.2017 – showing each treatment and the average from each treatment compared to the control (A).

PETUNIA – Week 4 Scoring 31.5.2017 – showing each treatment and the average from each treatment compared to the control (A).

TOMATO – Week 4 Scoring 26.5.2017 – showing each treatment and the average from each treatment compared to the control (A).

Week 6

CUCUMBER – Week 6 Scoring 14.6.2017 – showing each treatment and the average from each treatment compared to the control (A).

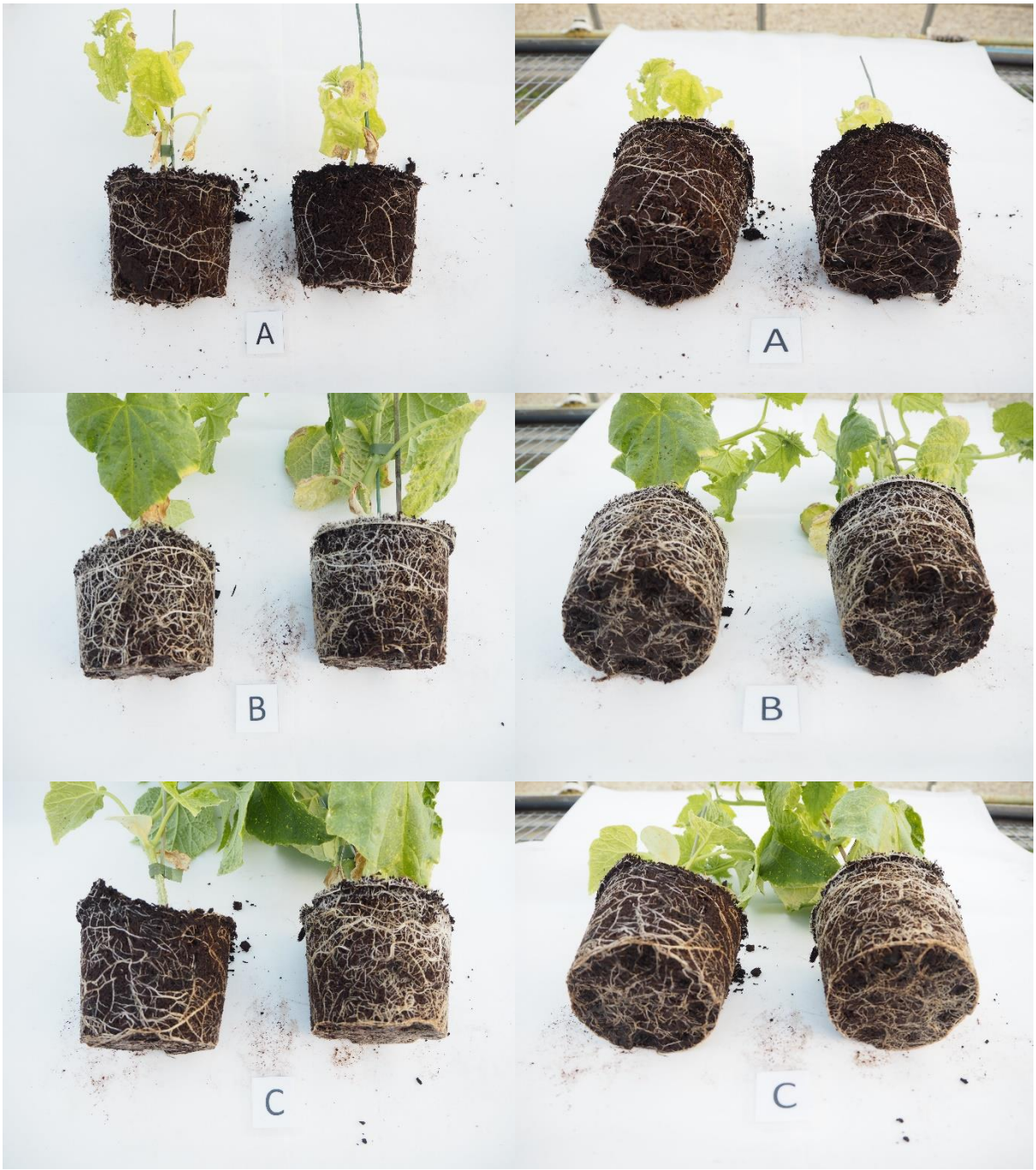
PEPPER – Week 6 Scoring 9.6.2017 – showing each treatment and the average from each treatment compared to the control (A).

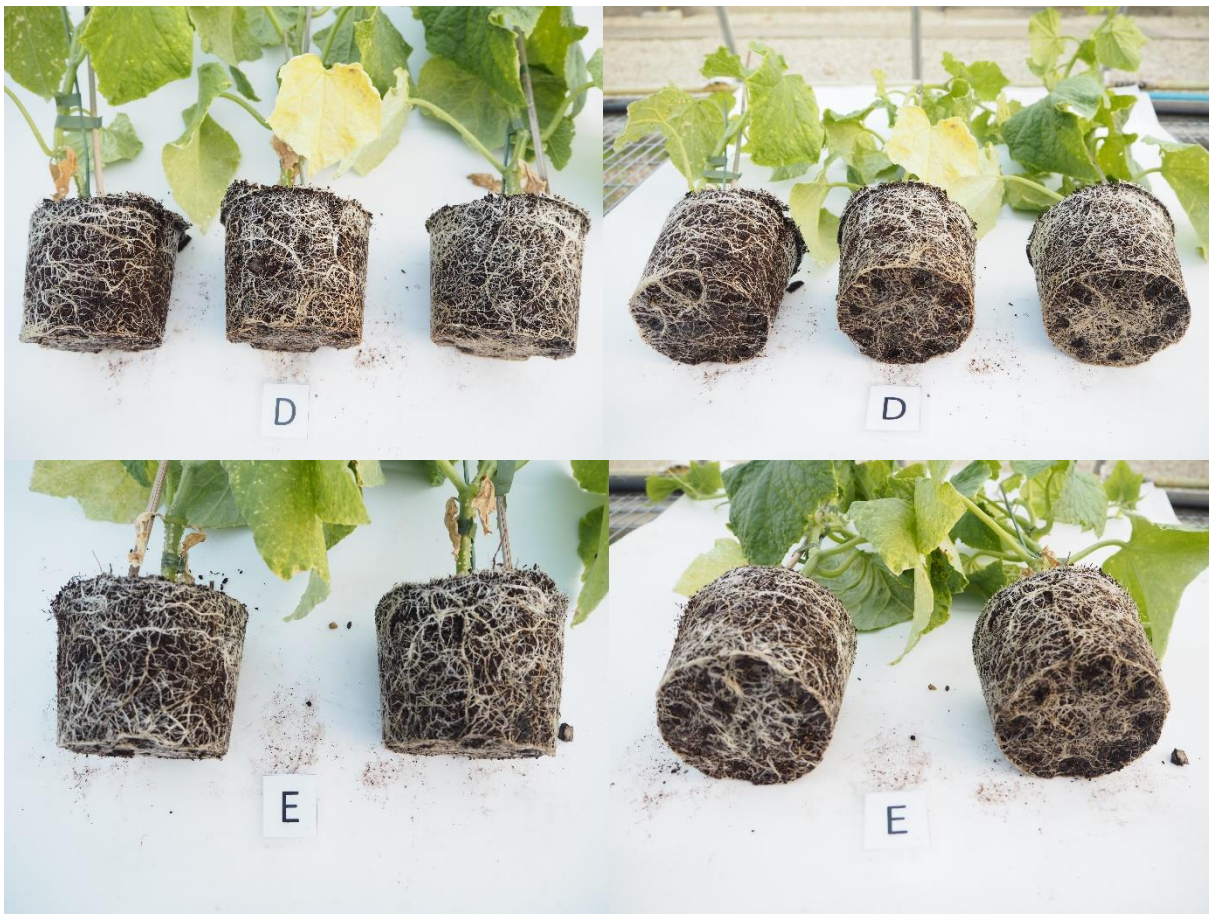
PETUNIA – Week 6 Scoring 14.6.2017 – showing each treatment and the average from each treatment compared to the control (A).

TOMATO – Week 6 Scoring 9.6.2017 – showing each treatment and the average from each treatment compared to the control (A).

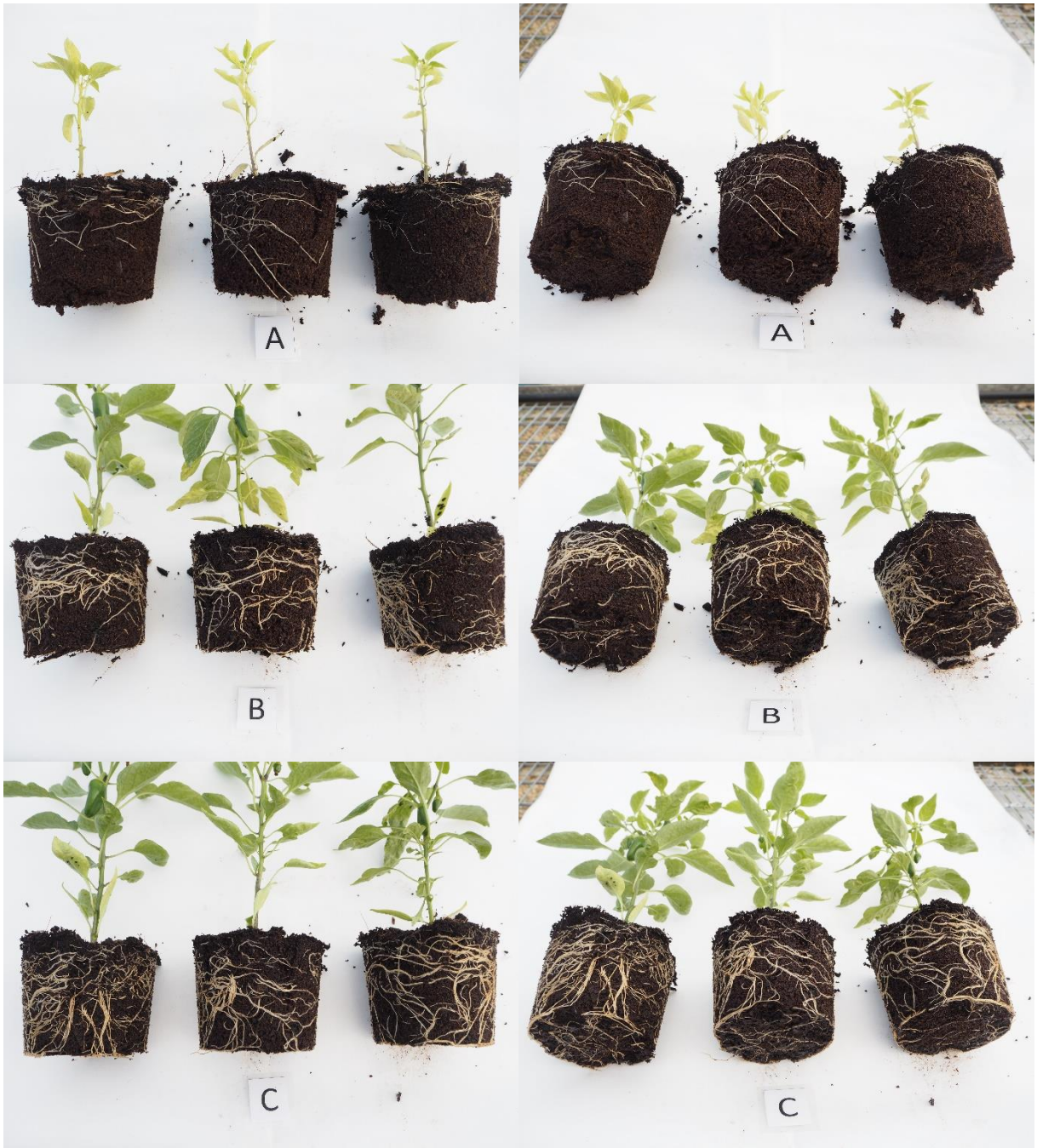
Root Score

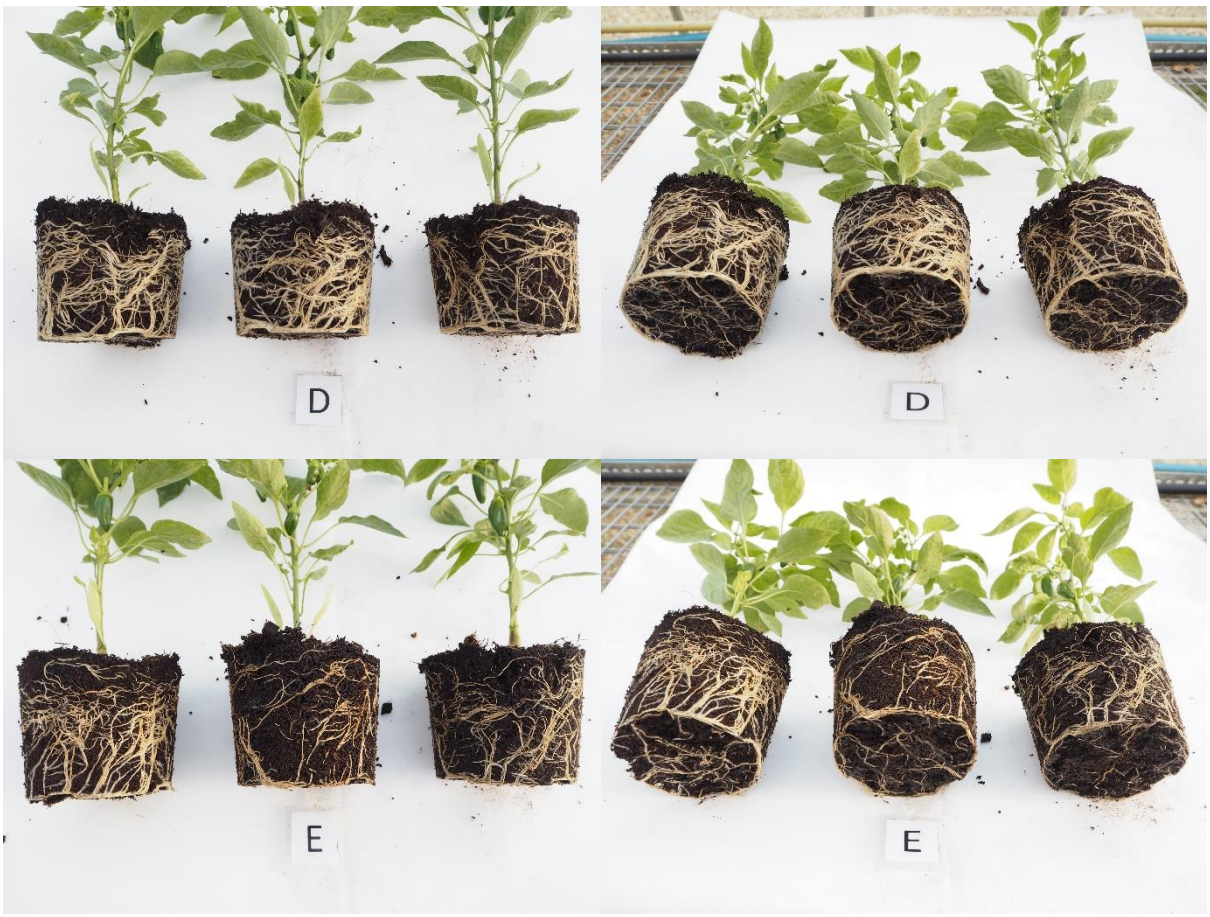
CUCUMBER – Week 6 Root Scoring 14.6.2017 – showing each treatment.



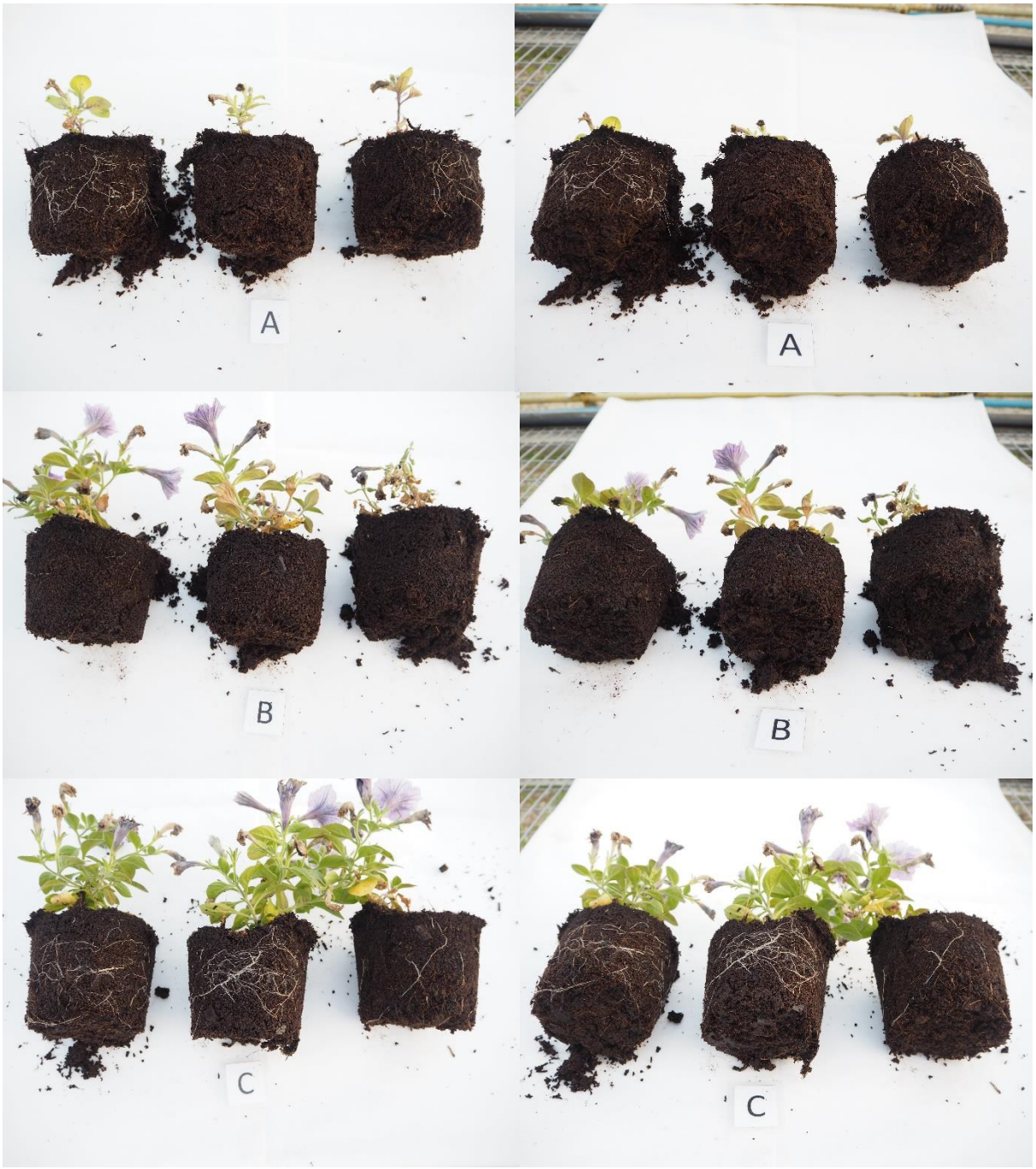

D
D
E
E

PEPPER – Week 6 Root Scoring 9.6.2017 – showing each treatment.



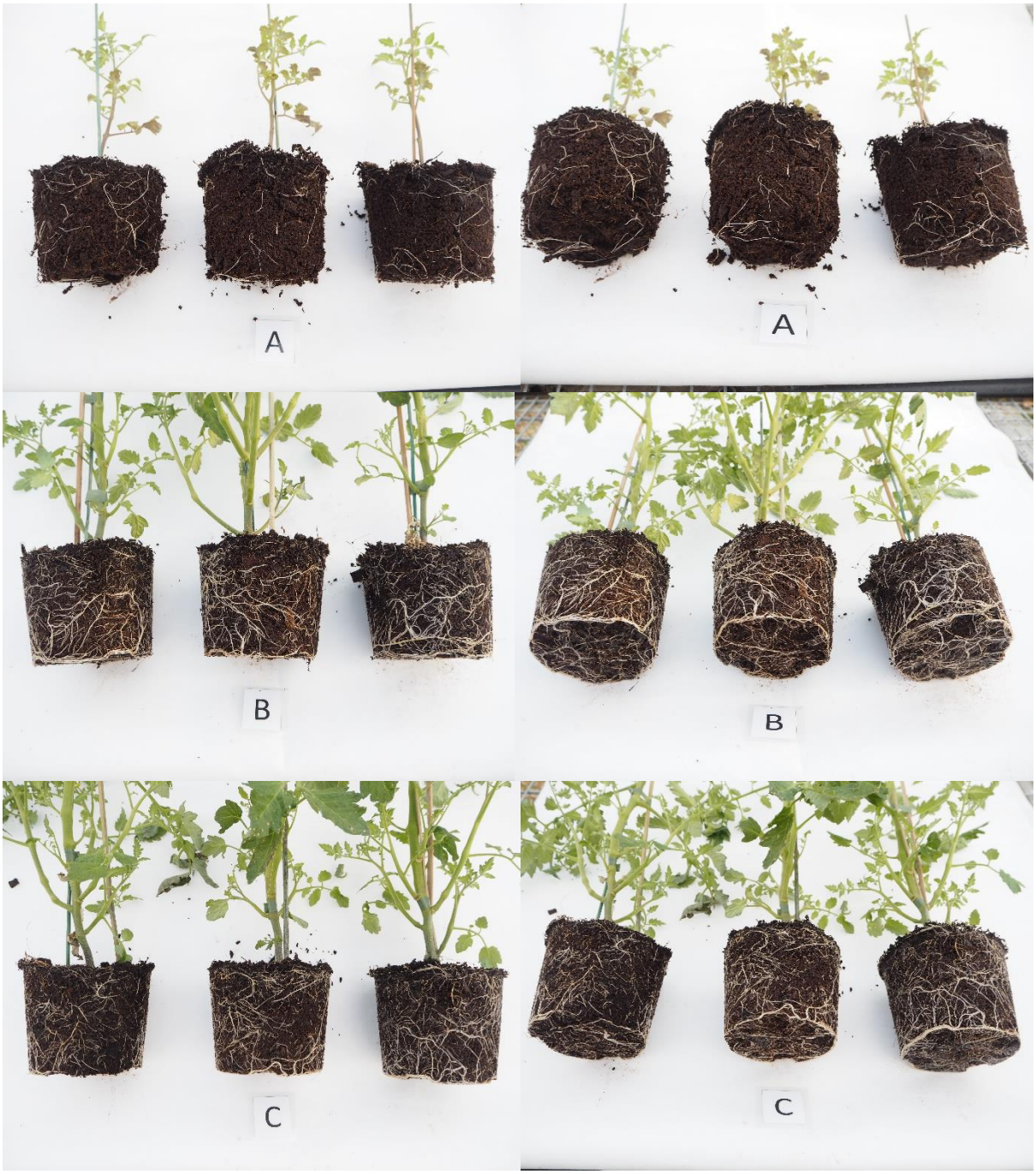

D
D
E
E

PETUNIA – Week 6 Root Scoring 14.6.2017 – showing each treatment.




D
D
E
E

TOMATO – Week 6 Root Scoring 9.6.2017 – showing each treatment.




D
D
E
E

CONCLUSIONS

In this experiment it can be seen that the control treatment (A) was the worst performing across species in terms of quality, vigour and colour. The significantly low scores will have been due to the small amount of naturally occurring nutrients in the coco peat substrate mix being used up by the plant rapidly. Although the control had the lowest root score in the cucumber, pepper and tomato, it did not with the petunia. This suggests that the petunia roots may not grow well in high nutrient mediums.

In terms of quality it can be seen that in the tomato crop as the amount of fertiliser added is increased it increases the plant quality, reaching a plateau after 8g per litre (D) is applied. In the cucumber and pepper crops however an increase in plant quality was seen on average until 10g per litre (E) of fertiliser was added to the substrate. At which point a small decline in plant quality was observed, indicating possible phytotoxic effects. This is more noticeable with the cucumber plants but is still present in the pepper also. In the petunia crop a linear response to the increased fertiliser applications was observed, with quality increasing as more fertiliser was applied.

The vigour of the different crops varied but similar effects to ones observed in plant quality appear apparent. The tomato plants showed an increase in vigour as more fertiliser was applied. After 6g per litre (C) was applied there seemed to be a decline in vigour. Similarly as before the vigour of the cucumber and pepper plants were positively affected by the increase fertiliser rates. However a decline in vigour was observed after 10g per litre (E) of fertiliser was applied, indicating possible phytotoxic effects. In the petunia crop a linear response to the increased fertiliser applications was observed, with vigour increasing as more fertiliser was applied.

The colouration of the petunia and cucumber plants increased linearly as more fertiliser was applied, with the significance of the effects reducing at the higher rates. Colouration of the tomato plants also increased linearly with the increasing fertiliser rates, however a plateau was observed at 10g per litre (E). A possible phytotoxic effect was observed as before in the pepper crop. The colouration score increased linearly as greater amounts of fertiliser were applied, with a small decline in the colour score at the 10g per litre (E) application.

The root quality of the cucumber plants increased linearly with increased fertiliser application. The same increase was observed in the pepper and tomato crops. However as before a decline was observed at the 10g per litre (E) rate, indicating possible phytotoxic effects. The root quality in the petunia crop showed no clear trend with increased fertiliser rates, with 6g (C) and 10g (E) per litre preforming best.

Generally across the different measures it can be seen that the average scores vary from week to week. It appears the initial scoring suggests that the plants have become established and are rapidly using up the nutrients. The optimal period was week 4 with on average the highest scores across crops, leading to a decline in week 6. This may be due to insufficient nutrients levels after fertiliser break down and consumption by the plants to sustain any more growth and some deficiencies were observed. An indication of this ‘running out’ of nutrients can be seen in the pH data collected, where in week 6 the pH of the substrate becomes more alkaline suggesting the fertiliser store has been exhausted.

A general trend can be seen across the species that the pH of the substrate becomes more acidic as the fertiliser breaks down. This can give an indication of how much fertiliser is being used by the crop and how quickly it breaks down. However results can be affected by the substrate saturation levels and will vary depending on the composition of water used to irrigate the crops. This can be seen with the tomato crop, due to its vigorous growth habit it uses water more readily, which can cause a lowered substrate ph.

Analysing all the scoring data across all the species it can be suggested that the optimal dosage rate would be 8g (D) of the Mix532 fertiliser per litre of the substrate mix. It seems to be the level at which no phytotoxic effects are observed and is the most commercially viable, with the lowest rate of fertiliser application required to achieve a high level of plant quality and overall growth.

APPENDIX

Raw Data

		Date:	13.5.17			26.5.17			9.6.17			9.6.17
Species	Treatment	Replicate	Quality	Vigour	Colour	Quality	Vigour	Colour	Quality	Vigour	Colour	Root Score
PEPPER	A	1	3	2	3	2	3	2	2	2	2	2
PEPPER	A	2	3	2	3	2	2	2	2	2	2	3
PEPPER	A	3	2	2	3	1	2	2	2	2	2	2
PEPPER	B	1	7	7	7	7	7	6	7	6	6	5
PEPPER	B	2	6	6	6	6	6	6	6	6	6	5
PEPPER	B	3	7	8	7	6	7	6	7	7	6	6
PEPPER	C	1	6	8	7	7	8	7	8	8	7	7
PEPPER	C	2	6	7	7	7	8	6	7	7	6	6
PEPPER	C	3	5	6	7	5	6	7	5	5	7	7
PEPPER	D	1	7	7	7	8	9	8	8	8	7	9
PEPPER	D	2	7	7	7	7	8	7	7	8	7	9
PEPPER	D	3	6	8	7	8	8	8	8	9	8	8
PEPPER	E	1	6	7	7	7	8	7	8	7	8	8
PEPPER	E	2	7	7	7	7	7	7	8	7	7	7
PEPPER	E	3	6	7	6	7	7	7	7	8	7	8
TOMATO	A	1	2	2	3	2	2	2	2	2	2	2
TOMATO	A	2	2	2	3	3	2	2	2	2	2	2
TOMATO	A	3	2	2	4	2	2	2	2	2	2	2
TOMATO	B	1	8	7	7	6	7	6	7	7	7	7
TOMATO	B	2	7	6	7	6	5	6	6	5	6	6
TOMATO	B	3	8	7	7	6	7	6	7	7	7	7

TOMATO	C	1	8	8	7	7	8	7	7	8	7	6
TOMATO	C	2	8	7	8	6	8	6	8	9	8	7
TOMATO	C	3	9	7	8	6	7	7	8	8	8	7
TOMATO	D	1	8	7	8	7	6	7	7	7	8	9
TOMATO	D	2	8	8	8	8	8	8	8	9	8	7
TOMATO	D	3	9	7	8	8	8	8	8	8	8	7
TOMATO	E	1	8	8	8	8	6	8	7	7	8	8
TOMATO	E	2	9	7	8	8	7	8	8	9	8	7
TOMATO	E	3	8	7	8	7	8	7	8	8	8	7
		Date:	**17.5.17**			**31.5.17**						**14.6.17**
Species	**Treatment**	**Replicate**	**Quality**	**Vigour**	**Colour**	**Quality**	**Vigour**	**Colour**	**Quality**	**Vigour**	**Colour**	**Root Score**
PETUNIA	A	1	2	2	2	3	2	3	2	2	2	4
PETUNIA	A	2	2	2	2	2	2	2	2	1	2	3
PETUNIA	A	3	2	2	2	2	1	2	1	1	1	1
PETUNIA	B	1	6	7	7	7	8	5	4	7	4	1
PETUNIA	B	2	5	6	6	6	6	5	4	5	3	1
PETUNIA	B	3	4	5	5	5	3	4	1	1	1	1
PETUNIA	C	1	6	7	7	7	8	6	5	6	5	4
PETUNIA	C	2	6	7	7	7	8	6	5	6	5	5
PETUNIA	C	3	4	5	5	6	7	6	5	5	5	2
PETUNIA	D	1	6	7	7	7	9	7	6	6	6	4
PETUNIA	D	2	5	6	6	5	4	7	5	5	6	1
PETUNIA	D	3	6	7	7	6	7	6	6	6	5	1
PETUNIA	E	1	6	7	7	6	7	7	6	5	6	5
PETUNIA	E	2	6	7	7	7	7	7	6	6	6	2
PETUNIA	E	3	5	6	6	6	7	6	6	6	6	4
CUCUMBER	A	1	-	-	-	-	-	-	-	-	-	-
CUCUMBER	A	2	3	3	2	2	2	2	3	3	2	5

CUCUMBER	A	3	3	3	2	3	2	3	2	2	2	4
CUCUMBER	B	1	-	-	-	-	-	-	-	-	-	-
CUCUMBER	B	2	5	5	6	5	5	4	5	5	4	7
CUCUMBER	B	3	5	5	6	6	5	4	6	6	4	7
CUCUMBER	C	1	4	4	5	4	3	4	4	4	4	6
CUCUMBER	C	2	-	-	-	-	-	-	-	-	-	-
CUCUMBER	C	3	8	7	7	6	6	4	6	6	4	7
CUCUMBER	D	1	5	5	6	6	5	5	6	6	5	8
CUCUMBER	D	2	8	8	7	8	8	5	7	7	5	9
CUCUMBER	D	3	8	8	7	8	8	5	7	7	5	10
CUCUMBER	E	1	5	5	7	1	1	5	1	1	5	-
CUCUMBER	E	2	8	8	7	8	8	5	7	7	5	9
CUCUMBER	E	3	8	8	7	8	8	5	7	7	5	9

pH Raw data

		Date:	19.5.17	26.7.17	9.6.17
Species	Treatment	Replicate	pH	pH	pH
PEPPER	A	1	6.91	6.95	7.47
PEPPER	A	2	7.2	7.32	7.41
PEPPER	A	3	6.78	6.93	7.48
PEPPER	B	1	6.96	6.62	7.19
PEPPER	B	2	6.92	6.48	7.08
PEPPER	B	3	6.71	7.08	7.43
PEPPER	C	1	7.14	6.78	5.52
PEPPER	C	2	7.19	6.49	6.7
PEPPER	C	3	6.94	6.94	6.3
PEPPER	D	1	6.76	6.39	5.11
PEPPER	D	2	7.25	6.65	6.58
PEPPER	D	3	7.22	6.85	5.75
PEPPER	E	1	7.42	6.71	6.11
PEPPER	E	2	7.38	6.56	6.91
PEPPER	E	3	7.22	6.27	7.16
TOMATO	A	1	7	6.91	7.53
TOMATO	A	2	7	7.51	7.54
TOMATO	A	3	6.5	6.63	7.48
TOMATO	B	1	6.17	4.96	6.94
TOMATO	B	2	5.35	5.38	6.55
TOMATO	B	3	5.64	5.7	5.52
TOMATO	C	1	6.22	5.6	5.25
TOMATO	C	2	5.7	5.18	5.07
TOMATO	C	3	4.82	4.87	6.68
TOMATO	D	1	5.96	5.89	7.19

		Date:	19.5.17	31.5.17	14.6.17
Species	Treatment	Replicate	pH	pH	pH
PETUNIA	A	1	6.74	6.71	6.41
PETUNIA	A	2	6.81	7.05	7.55
PETUNIA	A	3	6.62	7.09	7.12
PETUNIA	B	1	7.27	7.32	7.28
PETUNIA	B	2	7.04	7.21	7.34
PETUNIA	B	3	7.21	6.52	6.85
PETUNIA	C	1	7.04	6.16	7.13
PETUNIA	C	2	7.35	6.8	6.65
PETUNIA	C	3	7.21	7.03	7.1
PETUNIA	D	1	6.47	6.5	6.82
PETUNIA	D	2	7.11	6.24	7.08
PETUNIA	D	3	6.94	6.59	7.06
PETUNIA	E	1	7.3	5.97	5.72
PETUNIA	E	2	7.46	5.85	6.74
PETUNIA	E	3	7.15	5.92	6.62
CUCUMBER	A	1	-	-	-
CUCUMBER	A	2	6.56	6.96	7
CUCUMBER	A	3	6.37	7.2	7.43
CUCUMBER	B	1	-	-	-
CUCUMBER	B	2	7.12	6.58	7.01
CUCUMBER	B	3	6.84	5.74	6.9
CUCUMBER	C	1	6.89	6.82	6.83
CUCUMBER	C	2	-	-	-
CUCUMBER	C	3	6.37	6.75	5.57
CUCUMBER	D	1	6.96	6.31	6.65

TOMATO	D	2	6.04	4.2	6.12
TOMATO	D	3	5.65	4.8	6.82
TOMATO	E	1	6.71	5.96	6.64
TOMATO	E	2	5.7	4.48	6.33
TOMATO	E	3	6.71	4.96	6.22

CUCUMBER	D	2	5.39	5.7	6.69
CUCUMBER	D	3	5.98	5.52	6.68
CUCUMBER	E	1	7.42	6.14	7.28
CUCUMBER	E	2	5.81	5.02	5.42
CUCUMBER	E	3	6.14	5.9	6.71

**Raw substrate analysis (NRM) data can be supplied on request.*

Water Analysis Raw data

Farm No: Somborne Valley Research Ltd,

Date Sampled: 19/05/2017

Lab No.	Plot	pH	Cond. (µS/cm @ 25°C):	Bicarb. as $CaCO_3$	Mineral Nitrogen	Comprising		mg/L											
						Nitrate as N	Ammonia as N	Phos	K	Ca	Mag	Sulphur	Iron	Man	Cu	Zinc	B	Sodium	Chloride
8971	1702 WATER	6.2	560	203.0	4.60	4.59	0.01	0.061	2.83	103	2.326	7.97	0.001	0.003	0.866	0.035	0.019	14.9	36

Analysis conducted by Natural Resources Management Ltd:

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Please quote above code for all enquiries

RAM THANANCHAYAN

1702 SUR

COMPOST ANALYSIS RESULTS

Sample Reference :

1702 A

Sample Matrix : COMPOST

Laboratory References	
Report Number	58654
Sample Number	106291

Date Received	08-MAY-2017
Date Reported	10-MAY-2017

The sample submitted was of adequate size to complete all analysis requested.
The sample will be kept at ambient temperature for at least 3 weeks.

ANALYTICAL RESULTS *on 'as received' basis.*

Determinand	Value	Units	Determinand	Value	Units
pH	6.3		Cond. at 20 C	125	uS/cm
Density	467	kg/m3	Ammonia-N	5.3	mg/l
Dry Matter	14.4	%	Nitrate-N	<0.6	mg/l
Dry Density	67.2	kg/m3	Total Soluble N	5.3	mg/l
Chloride	136.9	mg/l	Sulphate	18.6	mg/l
Phosphorus	5.0	mg/l	Boron	0.12	mg/l
Potassium	105.5	mg/l	Copper	<0.01	mg/l
Magnesium	0.4	mg/l	Manganese	<0.01	mg/l
Calcium	0.8	mg/l	Zinc	<0.02	mg/l
Sodium	35.7	mg/l	Iron	1.42	mg/l

The extraction is performed by adding a weight of sample equivalent to 60mls volume to 300mls of deionised water (ref BSEN 13652:2001). Samples submitted under 1 litre will necessitate the use of scaled down equipment for density pH and Conductivity measurements are made at 20°C. I.S. = Insufficient Sample.

Released by P G Taylor Date 10/05/17

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1744

RAM THANANCHAYAN

1702 SUR

Please quote above code for all enquiries

COMPOST ANALYSIS RESULTS

Sample Reference :

1702 B

Laboratory References	
Report Number	58654
Sample Number	106292

Sample Matrix : COMPOST

Date Received	08-MAY-2017
Date Reported	10-MAY-2017

The sample submitted was of adequate size to complete all analysis requested.

The sample will be kept at ambient temperature for at least 3 weeks.

ANALYTICAL RESULTS *on 'as received' basis.*

Determinand	Value	Units	Determinand	Value	Units
pH	7.6		Cond. at 20 C	364	uS/cm
Density	489	kg/m3	Ammonia-N	67.9	mg/l
Dry Matter	14.8	%	Nitrate-N	13.0	mg/l

Dry Density	72.4	kg/m3	Total Soluble N	80.9	mg/l
Chloride	165.4	mg/l	Sulphate	431.2	mg/l
Phosphorus	9.4	mg/l	Boron	<0.05	mg/l
Potassium	247.4	mg/l	Copper	0.02	mg/l
Magnesium	2.0	mg/l	Manganese	0.03	mg/l
Calcium	3.4	mg/l	Zinc	0.03	mg/l
Sodium	67.5	mg/l	Iron	2.26	mg/l

The extraction is performed by adding a weight of sample equivalent to 60mls volume to 300mls of deionised water (ref BSEN 13652:2001). Samples submitted under 1 litre will necessitate the use of scaled down equipment for density pH and Conductivity measurements are made at 20˚C. I.S. = Insufficient Sample.

Released by *P G Taylor* Date *10/05/17*

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1702 SUR

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COMPOST ANALYSIS RESULTS

Sample Reference :

1702 C

Laboratory References	
Report Number	58654
Sample Number	106293

Sample Matrix : COMPOST

Date Received	08-MAY-2017
Date Reported	10-MAY-2017

The sample submitted was of adequate size to complete all analysis requested.

The sample will be kept at ambient temperature for at least 3 weeks.

ANALYTICAL RESULTS *on 'as received' basis.*

Determinand	Value	Units	Determinand	Value	Units
pH	7.9		Cond. at 20 C	494	uS/cm
Density	496	kg/m3	Ammonia-N	118.0	mg/l
Dry Matter	14.1	%	Nitrate-N	10.9	mg/l

Dry Density	69.9	kg/m3	Total Soluble N	128.9	mg/l
Chloride	176.9	mg/l	Sulphate	674.2	mg/l
Phosphorus	12.5	mg/l	Boron	<0.05	mg/l
Potassium	306.3	mg/l	Copper	0.02	mg/l
Magnesium	2.0	mg/l	Manganese	0.03	mg/l
Calcium	3.6	mg/l	Zinc	0.03	mg/l
Sodium	75.8	mg/l	Iron	2.17	mg/l

The extraction is performed by adding a weight of sample equivalent to 60mls volume to 300mls of deionised water (ref BSEN 13652:2001). Samples submitted under 1 litre will necessitate the use of scaled down equipment for density pH and Conductivity measurements are made at 20˚C. I.S. = Insufficient Sample.

Released by *P G Taylor* Date *10/05/17*

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RAM THANANCHAYAN

1702 SUR

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COMPOST ANALYSIS RESULTS

Sample Reference :

1702 D

Laboratory References	
Report Number	58654
Sample Number	106294

Sample Matrix : COMPOST

Date Received	08-MAY-2017
Date Reported	10-MAY-2017

The sample submitted was of adequate size to complete all analysis requested.

The sample will be kept at ambient temperature for at least 3 weeks.

ANALYTICAL RESULTS *on 'as received' basis.*

Determinand	Value	Units	Determinand	Value	Units
pH	8.2		Cond. at 20 C	672	uS/cm
Density	522	kg/m3	Ammonia-N	200.2	mg/l
Dry Matter	13.7	%	Nitrate-N	<0.6	mg/l

Dry Density	71.5	kg/m3	Total Soluble N	200.2	mg/l
Chloride	161.4	mg/l	Sulphate	962.8	mg/l
Phosphorus	13.7	mg/l	Boron	<0.05	mg/l
Potassium	368.2	mg/l	Copper	0.02	mg/l
Magnesium	2.4	mg/l	Manganese	0.02	mg/l
Calcium	4.0	mg/l	Zinc	<0.02	mg/l
Sodium	79.8	mg/l	Iron	2.51	mg/l

The extraction is performed by adding a weight of sample equivalent to 60mls volume to 300mls of deionised water (ref BSEN 13652:2001). Samples submitted under 1 litre will necessitate the use of scaled down equipment for density pH and Conductivity measurements are made at 20˚C. I.S. = Insufficient Sample.

Released by *P G Taylor* Date *10/05/17*

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RAM THANANCHAYAN

1702 SUR

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COMPOST ANALYSIS RESULTS

Sample Reference :

1702 E

Laboratory References	
Report Number	58654
Sample Number	106295

Sample Matrix : COMPOST

Date Received	08-MAY-2017
Date Reported	10-MAY-2017

The sample submitted was of adequate size to complete all analysis requested.

The sample will be kept at ambient temperature for at least 3 weeks.

ANALYTICAL RESULTS *on 'as received' basis.*

Determinand	Value	Units	Determinand	Value	Units
pH	8.1		Cond. at 20 C	735	uS/cm
Density	527	kg/m3	Ammonia-N	225.1	mg/l
Dry Matter	13.6	%	Nitrate-N	<0.6	mg/l

Dry Density	71.7	kg/m3	Total Soluble N	225.1	mg/l
Chloride	173.8	mg/l	Sulphate	1067.5	mg/l
Phosphorus	16.9	mg/l	Boron	<0.05	mg/l
Potassium	393.5	mg/l	Copper	0.07	mg/l
Magnesium	3.3	mg/l	Manganese	0.04	mg/l
Calcium	5.6	mg/l	Zinc	0.06	mg/l
Sodium	81.9	mg/l	Iron	3.00	mg/l

The extraction is performed by adding a weight of sample equivalent to 60mls volume to 300mls of deionised water (ref BSEN 13652:2001). Samples submitted under 1 litre will necessitate the use of scaled down equipment for density pH and Conductivity measurements are made at 20˚C. I.S. = Insufficient Sample.

Released by *P G Taylor* Date *10/05/17*

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Descriptions of compost analysis conducted by Natural Resources Management Ltd:

Technical Information

nrm laboratories

MANURE AND SLUDGE ANALYSIS - DETERMINATION OF AMMONIUM NITROGEN, NITRATE NITROGEN AND NITRITE NITROGEN

Matrix: Sample as received from which a suitable aqueous suspension is prepared

Introduction

Most water contains ammonium salts and free ammonia in equilibrium with each other:

$NH_4^+ + H_2O \rightleftharpoons NH_3 + H_3O^+$

This equilibrium is extremely dependant on pH, with high pH favouring the formation of free ammonia, and to a lesser extent, on temperature, pressure and salinity of the water.

The total concentration of the two species is more usually termed the "ammoniacal nitrogen" or "total ammonia". In reporting ammonia concentrations, the customary UK practice is to refer to the concentration in terms of the element, N.

Principle

The determination of Nitrate-N and Nitrite-N is based on the formation of a diazo compound between nitrite and sulphanilamide. This compound is then coupled with N-1-Napthylethylenediamine dihydrochloride to give a red azo dye. The colour is measured at 540nm. In channel one, nitrate is reduced quantitatively to nitrite by cadmium metal in the form of an open tubular cadmium reactor (OTCR). The nitrite and reduced nitrate are therefore both measured as total oxidised nitrogen.

In channel two, nitrite is measured. Nitrate-N is therefore determined by deducting the nitrite figure from the TON.

In channel three, ammonium reacts with alkaline hypochlorite and phenol to form indophenol blue. Sodium nitroprusside acts as a catalyst in formation of indophenol blue which is measured at 640nm. Precipitation of calcium and magnesium hydroxides is eliminated by the addition of a combined potassium sodium tartrate/sodium citrate complexing reagent.

References

- Methods for Chemical Analysis of Water and Wastes, March 1984, EPA-600/4-79-020. Method 350.1 Colorimetric Automated Phenate.
- Patton, C.J. and Crouch, S.R (1977) Anaytical Chemistry 49(3), pp 464-469
- Standard Methods for the Examination of Water and Wastewater. 14th edition, 1976, American Public Health Association, Washington pp 424-425, 434

Standard Operating Procedure

- JAS-082

For further information on all analyses and services available from NRM Laboratories contact us on:
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Part of the Cawood Scientific Group

cawood

Technical Information

DETERMINATION OF OVEN DRY MATTER

Principle

As-received samples are homogenised and a representative sub-sample taken in a suitable tray. The weight is accurately recorded before and after drying in an oven at 105°C +/- 5 to determine the 'Oven Dry Matter' as a % weight loss. The drying time is at least 12 hours and samples are checked to ensure they are completely dry.

References

- The Feeding Stuffs (Sampling and Analysis) Regulations 1982 No1144 AGRICULTURE Statutory Instrument.
- The Analysis of Agricultural Materials, MAFF Reference Book RB427, ISBN 0 11 242762 6
- BS12880:2000 Characterisation of Sludges – Determination of dry residue and water content

Standard Operating Procedures

- JAS-034

Technical Information

COMPOST AND GROWING MEDIA ANALYSIS - EXTRACTION OF WATER SOLUBLE NUTRIENTS

METHOD PRINCIPLES 4.5

Matrix: Sample as received

Principle

The sample of peat is visually inspected for slow releasing fertiliser prills or 'osmacote'. The presence of these granules will give variable, unrepresentative results for the sample so are removed. Water soluble nutrients are extracted using a weight equivalent to 60ml of the sample volume determined by measuring the bulk density of the sample. This is then extracted in 300ml of Deionised water and shaken at 250rpm for 1 hour at 22 °C ± 3 °C.

The pH and conductivity are measured on the shaken suspension. All other nutrients are measured on a filtered extract.

Analysis of Prepared Extract

- Cl, SO4-S, NO3-N FI - Determined by Ion Chromatography
- NH4-N - Determined by Colorimetric Analysis
- P, K, Mg, Ca, Na, B, Cu, Fe, Mn, Mo, Zn - ICP-OES - (Inductively Coupled Plasma - Optical Emission Spectroscopy)

References

- British Standards Institution BS EN 13040:2000

Standard Operating Procedures

- JAS-226

Technical Information

COMPOST AND GROWING MEDIA ANALYSIS - DETERMINATION OF pH

METHOD PRINCIPLES 4.9

Matrix: Aqueous extract of fresh sample

Principle

A test portion is extracted with water under controlled conditions in an extraction of 1+5 (v/v) . The pH is measured potentiometrically under controlled conditions.

References

- British Standards Institution Document BS EN 13037:2000

Standard Operating Procedures

- JAS-226
- JAS-010

Technical Information

COMPOST AND GROWING MEDIA ANALYSIS
DETERMINATION OF ELECTRICAL CONDUCTIVITY

METHOD PRINCIPLES 4.6

Matrix: Aqueous extract of fresh sample

Principle

The conductance of a solution is defined as the reciprocal of its resistance. It is based upon the movement of ions when the solution is placed in an electrical field. Conductivity is measured in Siemens, or more commonly, Microsiemens (uS).
A test portion is extracted with water under controlled conditions in an extraction of 1+5 (v/v) to dissolve the electrolytes. The specific conductivity is measured using an EC meter and the result adjusted to a measurement temperature of 25C.

References

- British Standards Institute BS EN 13038:2000

Standard Operating Procedures

- JAS-035
- JAS-231

Technical Information

COMPOST AND GROWING MEDIA ANALYSIS – DETERMINATION OF COMPACTED BULK DENSITY

METHOD PRINCIPLES 4.8

Matrix: Sample as received passing 20mm screen

Principle

The compacted bulk density of soil improvers and growing media is determined in the laboratory using a 1 litre cylinder +/- 30ml fitted with an extension collar, screen and funnel. Note that when there is insufficient sample to use the 1 Litre weight tester the 1/3 or 1/10 Litre Weight tester (whichever is deemed the most appropriate) will be utilised. The cylinder is filled with the material and a static compaction applied for 3 minutes +/- 10 seconds. The cylinder is then struck off at the collar point and the contents weighed to the nearest 1g. The result is expressed as compacted bulk density in grams per litre.

References

- British Standards Institution BS EN 13040:2000

Standard Operating Procedures

- JAS-226