BOOMTEELT PRAKTIJKONDERZOEK

PROEFSTATION VOOR DE BOOMKWEKERIJ
RESEARCH STATION FOR NURSERY STOCK

Commissioned by:

Fytogreen BV
Ambachtsweg 6
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The Netherlands

Project: 1333 **Research on the usage of FYTOCELL as a soil improving material.**

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Summary

In 1999 and 2000 Fytogreen commissioned research to be carried out with the product Fytocell. The requirements of products such as peat soil matter and other organic products are formulated by the 'Soil Supplement Regulations' (RAG) and by the 'Potting Soil Trade Regulation' (RHP). New products for which there are no product requirements available, must be investigated. Depending on the area of application, extra requirements maybe necessary. Positive effects are expected with the application of Fytocell as a soil improving material in mineral soil or in potting soil.
Fytocell was mixed with sandy soil at the Boot & Co. Research Station for Nursery Stock, Zundert. During the fertilization research it was determined that due to the application of Fytocell the availability of nutrients increased.
This is clearly measurable in the first year of mixing and in the second year there is a marginal effect. The availability of nitrogen and potassium was higher especially in the first year of application. In the second year there was a marginal effect measurable. There was an extra 7 kg mineral N per ha present in the soil per 10 vol. % Fytocell.
There was no influence to the pH level in this strongly buffered soil.
The compressive strength or resistance of the soil decreases due to the use of Fytocell.
An increase is evident in vol. % moisture of approximately 8% per 10 vol. % Fytocell.
The moist and dry bulk weight decrease with respectively 4 and 6-weight % per 10 vol. % Fytocell.

The *Amelanchier* plants were longer and the fresh and dry weight was higher. The root quality received a higher rating due to the use of Fytocell.
At the end of the second growing year, the plants with a dosage of 12.5 and 25 vol. % Fytocell received a higher quality valuation when compared to the control. An optimum was already achieved with a dose of 12.5 %.
A control on the *Pinus* crop was not carried out at the beginning of the trial; therefore it is not possible to make a comparison. The higher dosage of Fytocell in the last year gave measurable shorter plants and a shorter shoot growth. The plants root development was excellent.

1. Introduction

1.1 The Product Fytocell

In 1999 and 2000 Fytogreen commissioned research to commence with the product Fytocell. The aim of this research is to establish the user value or application possibilities of Fytocell both in mineral soil and in potting soil.
The requirements of products such as peat soil matter and other organic products are formulated by the 'Soil Supplement Regulation' (RAG) and by the 'Potting Soil Trade Regulations'(RHP). Standardization in product requirements is adapted for the connected companies, which fall under the control of this regulation.
New products for which there are no product requirements available, must be investigated. Depending on the area of application, extra requirements maybe necessary which have not yet been carried out in this standardized control system.
Positive effects are expected with the application of Fytocell as a soil improver in mineral soil or in potting soil.
Listed below are some of the qualities resulting from the use of the material:

- Increase in soil pore volume
- Increase/Decrease of soils moisture capacity
- Increase in buffer capacity and mineral capacity of the soil
- Increase in soil aeration

Products such as Fytocell have rarely been used for crops grown outside and in open space planning. Therefore it is necessary to carry out basic research.

1.2 Purpose of the research

To establish the changes in physical properties in the improved sandy soil as a result of the addition of Fytocell flakes, which were incorporated as an overall treatment. Which soil parameters are interesting and what are the achieved effects?

1.3 Execution of the research

To improve the cultivated soil, Fytocell was used with a sieve fraction of 2-15 mm.
Fytocell was applied to two mixture proportions to a depth of 30 cm, using sandy soil as cultivated soil. The trial location was at the Boot & Co. Nursery, Zundert. The area for each treatment was 250 m2.
The following treatments were handled in the trial:
1. Untreated (control).
2. 12.5 volume % Fytocell flakes, with a layer thickness of 3.75 cm.
3. 25 volume % Fytocell flakes, with a layer thickness of 7.5 cm.

The ground was ploughed twice to a depth of 30 cm in order to achieve a thorough mixture. The crops *Amelanchier lamarckii* and *Pinus nigra ssp. Nigra* were used in the trial. These plants are delivered with root after 2 or more growing seasons. The plant distance was 70 x 70 cm. The application of the trial was carried out by Boot & Co. Nursery on a dry sensitive field. The planting date was the end of April 1999 and the plants will remain in the field until at least November 2000.
The physical properties of the soil were established. The Research Station for Nursery Stock carried out the soil measurements and the crop observation.

1.4 Measurements

1. Texture and chemical composition of the soil was analysed;
2. 'Ring' samples were taken in week 20, 32 and 44 in 1999 and in week 26 and 42 in 2000 for physical research;
3. The compressive strength was measured with the 'penetrograph' in week 20 and 44 in 1999 and in week 42 in 2000;
4. Crop observation was carried out at the beginning of the cultivation in week 20, week 32 and week 44 in 1999 and in week 42 in 2000.

2. Results

2.1 Physical and chemical analysis

The results of the N-mineral, texture and fertilization research are detailed in appendix 1a and 1b. There is a slight increase noticed in the amount of nitrogen and potassium due to the addition of Fytocell. The level of nitrogen and potassium in the control carried out in 1999 was already very high. Additional fertilization in 1999 was not necessary. The pH level of the strongly buffered soil hardly changed due to the addition of Fytocell. The percentage of fine particles < 50 ppm remained the same by using Fytocell.
It was established in the fertilization research that the availability of nutrient elements increased by using Fytocell.
In the first year of mixing it is clearly measurable and in the second year the effect is marginal. The nitrogen mineral rating in the soil was measured on May 4, 2000. The amounts measured in the soil with Fytocell was respectively 10 and 16 kg N per ha higher than the control. The actual fertilization dosage was: Boot 1. 49 kg N, for Boot 2. with 12.5% Fytocell, 39 kg and Boot 3 with 25% Fytocell, 33 Kg N per ha.
The percentage of organic matter content increased by approximately 1 % due to the addition of Fytocell.

2.2 Physical measurements

The basic details of the volume % moisture, the bulk weight and the dry bulk weight are illustrated in appendix 2a – 2 e. The average figures calculated are shown in Table 1 – 5.

Table 1 Moisture Volume % in the cultivated soil at Boot & Co. in 1999

Treatment	Week 20	Week 32	Week 44	Week 44
Boot 1	26.1	20.1	23.4	100%
Boot 2	31.2	22.7	27.1	116%
Boot 3	31.2	29.3	29.0	124%

By applying Fytocell there is an increased availability of moisture.

Table 2 Moisture Volume % in the cultivated soil at Boot & Co. in 2000

Treatment	Week 26	Week 42	Week 26	Week 42
Boot 1	11.72	16.7	100%	100%
Boot 2	15.45	18.5	132%	111%
Boot 3	15.67	24.6	134%	147%

By applying Fytocell there is an increased availability of moisture.

Table 3 Moisture bulk weight in g/cm3 in the soil at Boot & Co. in 1999

Treatment	Week 20	Week 32	Week 44	Week 44
Boot 1	1.68	1.55	1.65	100%
Boot 2	1.54	1.49	1.49	90%
Boot 3	1.51	1.47	1.45	88%

By applying Fytocell the moisture bulk weight decreases.

Table 4 Dry bulk weight in g/cm3 in the soil at Boot & Co. in 1999

Treatment	Week 20	Week 32	Week 44	Week 44
Boot 1	1.42	1.35	1.42	100%
Boot 2	1.22	1.24	1.22	86%
Boot 3	1.20	1.19	1.16	82%

By applying Fytocell the dry bulk weight decreases.

Table 5 Moist and dry bulk weight in g/cm3 in the soil in 2000

	Moisture		Dry	
Treatment	Week 26	Week 42	Week 26	Week 42
Boot 1	149.8	1.58	132.26	1.32
Boot 2	140.44	1.43	118.78	1.17
Boot 3	141.68	1.54	119.5	1.14

By applying Fytocell the dry bulk weight decreases.

2.3 Compressive strength of the soil

The compressive strength or resistance measurements concerning the Fytocell, with the crop Amelanchier at Boot & Co. are mentioned in appendix 1d and 1e.
In week 20, 1999, three weeks after planting, there was a lowered resistance measured in the soil with Fytocell, compared to the soil with no Fytocell. The greatest difference occurs with 25% volume % Fytocell. The soil has more resistance in week 44 of 1999, than in week 20. In week 42 of 2000 the resistance in the soil is somewhat higher than in the previous year. Depending on the depth of the soil profile to 10 – 35 N/ cm 2, soil with Fytocell shows lower resistance compared to soil without Fytocell.
When a comparison is made with the limit values for the rooting of Nursery crops in general, all of the measured resistances are sufficiently low in the profile to a depth of approximately 50 cm. By adding Fytocell, the obvious lower resistance in the root zone can have a positive effect, because this limit value for sensitive crops for the bulk density of the soil are roughly estimated.

2.4 Crop observation

The crop observation at Boot & Co. of the soil objects treated with Fytocell is recorded in appendix 3a – 3d.
The lengths of the Amelanchier plants during the growing season are mentioned in table 6.

Table 6 The length of the Amelanchier in cm in the soil with Fytocell in1999

Treatment	Week 20	Week 34	Week 44	Week 44
Boot1-control	39.5	64.5	63.4	100%
Boot2 –12.5%	50.1	114.2	113.4	179%
Boot3-25%	54.4	115.0	114.1	180%

By applying Fytocell the length of the plants increased in 1999.

Table 7 The length of the Amelanchier in cm in the soil with Fytocell in 2000

Treatment	Week 42	Week 44	Grading size	
Boot1-control	106.5	100%	80-100 cm 100-125 cm	85% 15%
Boot2 –12.5%	149.3	140%	100-125 cm 125-150 cm	7% 93%
Boot3-25%	150.4	141%	100-125 cm 125-150 cm	5% 95%

By applying Fytocell the length of the plants increased. A higher % of the plants were in the higher grading size.

Table 8 Fresh and dry weight – Amelanchier in the field soil.
With and without Fytocell, Boot & Co., 1999

Treatment	Week 44 Fresh in g	Week 44 Fresh in %	Week 44 Dry in g	Week 44 Dry in %
Boot1-control	54.3	100%	31.2	100%
Boot2 –12.5%	126.9	184%	69.6	223%
Boot3-25%	183.5	338%	99.0	317%

By adding Fytocell the fresh and dry weight increased.

Table 9 Fresh and dry weight – Amelanchier in the field soil.
With and without Fytocell, Boot & Co., 2000

Treatment	Week 42 Fresh in g	Week 42 Fresh in %	Week 42 Dry in g	Week 42 Dry in %
Boot1-control	700	100%	417	100%
Boot2 –12.5%	1745.5	249%	1168	280%
Boot3-25%	1819	260%	1262	302%

By adding Fytocell the fresh and dry weight of the plants increased. With the application of the highest vol. % Fytocell there was a slight increase noticeable.

The total length of *Pinus* crop plants were measured and the length of 5 shoots that grew in the year that the measuring took place.
The results are shown in table 10 and 11.

Table 10 Growth in length in cm – *Pinus* in soil with Fytocell at Boot in 1999.

Treatment	Week 44 Total Plant	Week 44 Total Plant	Week 44 Young Shoot	Week 44 Young Shoot
Boot1-control	*	*	*	*
Boot2 –12.5%	82.1 cm	100%	15.6 cm	100%
Boot3-25%	82.2 cm	100.2%	17.05 cm	109%

*There was no control treatment present.
An even growth was determined with a mixture of 12.5 and 25 vol. % Fytocell in the soil.

Table 11 Growth in length in cm – *Pinus* in soil with Fytocell at Boot in 2000.

Treatment	Week 44 Total Plant	Week 44 Total Plant	Week 44 Young Shoot	Week 44 Young Shoot
Boot1-control	*	*	*	*
Boot2 –12.5%	115 cm	100%	29.7 cm	100%
Boot3-25%	106 cm	92.2%	24.7 cm	83.2%

*There was no control treatment present.
A decrease in the length and shoot growth was measured with the application of the highest Fytocell dosage.

3. Conclusions

It was determined/established in the fertilization research that the availability of nutrients increased due to the addition of Fytocell.
In the first year of mixing the results are clearly measurable and in the second year there is a slighter effect. The amount of organic particles present increased by 1%.
An increase was recorded in moisture volume % of approximately 8% per 10-volume % Fytocell. The moist and dry bulk weight decreased with respectively 4% and 6% per 10-volume % Fytocell.
The compressive strength or resistance of the soil decreases in the layer with Fytocell incorporated. The *Amelanchier* plants were longer and the fresh and dry weight was higher. The root quality received a higher rating when Fytocell was applied.
At the end of the second growing year, the plants with an addition of 12.5% and 25 vol. % Fytocell received a higher quality valuation when compared to the control. An optimum was already achieved with a dose of 12.5 %.
A control on the *Pinus* crop was not carried out at the beginning of the trial. Therefore, it was not possible to make a comparison with the control. The higher –percentage of Fytocell in the last year gave measurable shorter plants and a shorter shoot growth. The plants root development was excellent.

Bijlage 1 Analyseresultaten

Bijlage 1a Resultaten van het 'Stikstof-plus'-onderzoek

Analysemethode: veldvochtige grond, volgens 1:2 v/v $CaCl_2$

		mg per liter extract			Beschikbare voorraad (kg/ha)	
Datum	behandeling	NH_4-N	NO_3-N	K	N	K_2O
27-5-1999	boot 1	< 0,5	12,3	213	74	1540
27-5-1999	boot 2	1	17,9	237	113	1714
27-5-1999	boot 3	5,9	11	209	101	1511
4-5-2000	boot 1	< 0,5	3,5	74,2	21	536
4-5-2000	boot 2	< 0,5	5,1	69,7	31	504
4-5-2000	boot 3	1	5,2	81,4	37	589
30-6-2000	boot 1	< 0,5	8,1	87,9	49	636
30-6-2000	boot 2	< 0,5	8,5	87,9	51	636
30-6-2000	boot 3	< 0,5	7,9	111,1	47	803

		Kg N per ha in de bodem	Gift in kg per ha	Kg kalk ammonsalpeter per ha
4-5-2000	boot 1	21	49	180
4-5-2000	boot 2	31	39	145
4-5-2000	boot 3	37	33	125

Bijlage 1b Resultaten van het granulair onderzoek

d.d. 27-5-1999

	Behandeling		
Analyse	boot1	boot2	boot3
pH-KCl	7	7	6,5
Vocht[1]	0,82	1,17	0,73
Organische stof[2]	3,1	4,9	3,7
$CaCO_3$[2]	0	0	0
Afslibbaar[2]	4,4	4,2	3,8
Totaal zand[2]	92,5	90,9	92,5
Granulair[3]			
0-2 µm	3	3,1	2,7
2-16 µm	1,6	1,3	1,2
16-50 µm	7,8	7,6	9
50-105 µm	18,9	19,1	18
105-150 µm	24	24	23,3
150-210 µm	25,1	24,7	25,5
210-300 µm	14,2	13,7	13,9
300-2000 µm	5,4	6,5	6,4

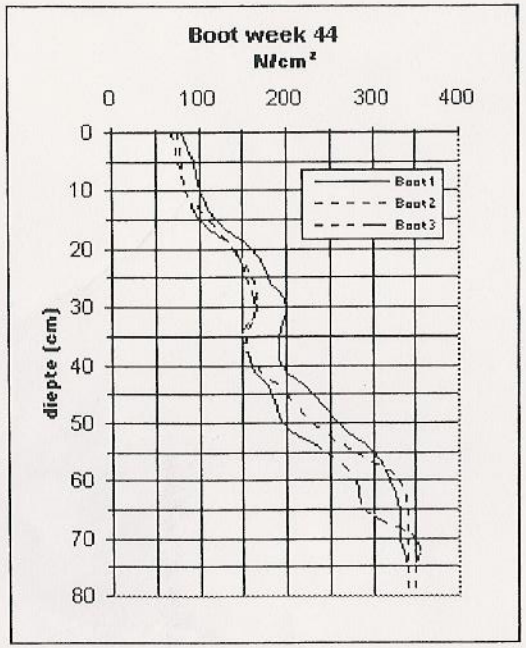
[1] gram / 100 gram luchtdroog
[2] gram / 100 gram droge stof
[3] % van de minerale delen

Bijlage 1c Resultaten van het chemisch onderzoek

		pH-KCl	Org. Stof	Fosfaat P-w	Fosfaat P-AL	Kali K-H(
27-5-1999	boot 1	6,1	3,4	70	66	62
27-5-1999	boot 2	6,7	4,9	95	103	77
27-5-1999	boot 3	6,4	4,2	104	87	69
4-5-2000	boot 1	6,5	3,2	66	80	30
4-5-2000	boot 2	6,7	4,8	76	106	37
4-5-2000	boot 3	6,8	4,6	77	116	33

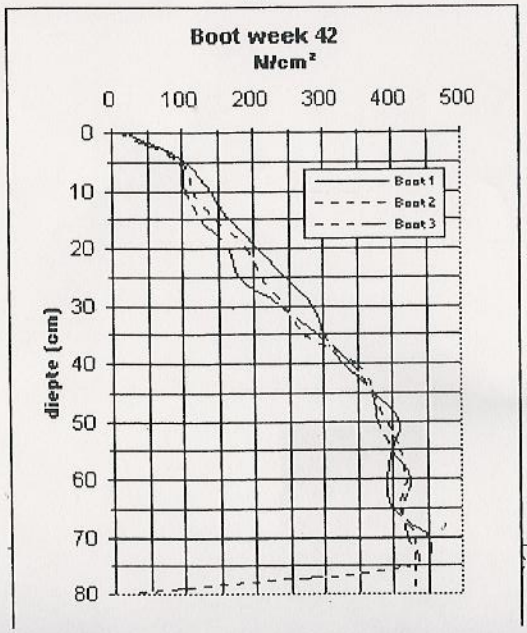
Bijlage 1d Draagkracht of weerstandsmetingen in N/cm^2 in 1999

diepte in cm	Boot 1 week 20	Boot 2 week 20	Boot 3 week 20	Boot 1 week 44	Boot 2 week 44	Boot 3 week 44
0	70	65	50	80	75	70
5	90	70	65	95	80	75
10	100	90	75	100	85	85
15	120	110	105	120	110	100
20	155	140	120	160	140	140
25	190	160	140	180	160	155
30	195	160	155	200	165	165
35	190	155	150	190	150	155
40	180	150	165	195	165	160
45	170	170	175	230	200	185
50	200	185	160	260	230	195
55	230	200	185	300	280	245
60	250	250	240	320	330	280
65	290	310	270	330	340	290
70	340	330	350	330	340	350
75	350	340	345	340	340	350
80	350	340	345	340	340	350


Boot week 44
N/cm²
0
100
200
300
400
0
10
20
30
40
50
60
70
80
diepte (cm)
Boot 1
Boot 2
Boot 3

Bijlage 1 e Draagkracht of weerstandsmetingen in N/cm^2 in 2000

diepte in cm	Boot 1 week 42	Boot 2 week 42	Boot 3 week 42
0	20	10	10
5	105	100	95
10	140	115	105
15	165	145	125
20	205	190	165
25	245	210	180
30	285	245	240
35	300	270	290
40	330	350	340
45	375	375	370
50	410	390	380
55	400	410	400
60	390	420	425
65	400	410	415
70	450	430	420
75	450	430	430
80	450	430	430



Bijlage 2a Analyse ringmonsters week 20, 1999

Monsternr.	ringnr.	massa ring	massa plastic zak	massa ring + plastic + vochtige grond	massa ring + droge grond	Vochtige grond (g/100 cm^3)	Droge grond (g/100 cm^3)	Volume% vocht	Volume% vocht gemidd.	Bulkgewicht vochtig (g/cm^3)	Bulkgewicht droog (g/cm^3)
1a1	23	90,41	3,15	271,53	242,64	177,97	152,23	25,74			
1a2	22	90,69	3,15	259,7	232,44	165,86	141,75	24,11			
1a3	6	90,57	3,15	258,63	226,98	164,91	136,41	28,5			
1a4	14	90,63	3,15	258,36	228,98	164,58	138,35	26,23			
1a5	44	90,43	3,15	259,83	230,65	166,25	140,22	26,03	26,1	1,68	1,42
2a1	31	90,32	3,15	255,9	221,83	162,43	131,51	30,92			
2a2	34	91,58	3,15	242,81	207,79	148,08	116,21	31,87			
2a3	29	90,97	3,15	238,64	200,62	144,52	109,65	34,87			
2a4	13	90,33	3,15	242,82	208,73	149,34	118,4	30,94			
2a5	18	91,32	3,15	258,15	227,44	163,68	136,12	27,56	31,2	1,54	1,22
3a1	11	90,6	3,15	250,21	217,63	156,46	127,03	29,43			
3a2	26	90,93	3,15	246,32	211,67	152,24	120,74	31,5			
3a3	33	91,13	3,15	244,67	208,61	150,39	117,48	32,91			
3a4	25	90,5	3,15	238,56	203,51	144,91	113,01	31,9			
3a5	40	91,49	3,15	246,73	213,23	152,09	121,74	30,35	31,2	1,51	1,20

NB: geen petrischaaltje gebruikt

Bijlage 2b Analyse ringmonsters week 32, 1999

Monsternr.	ringnr.	massa ring	massa plastic zak	massa ring + plastic + vochtige grond	massa ring + droge grond + petrischaal	massa petri-schaal	Vochtige grond (g/100 cm^3)	Droge grond (g/100 cm^3)	Volume% vocht	Volume% vocht gemidd.	Bulkgewicht vocht (g/cm^3)	Bulkgewicht droog (g/cm^3)
1a1	26	90,97	3,15	250,54	276,32	50,12	156,42	135,23	21,19			
1a2	42	90,36	3,15	246,43	270,19	45,73	152,92	134,1	18,82			
1a3	38	91,55	3,15	250	269,47	42,18	155,3	135,74	19,56			
1a4	37	91,62	3,15	255,1	281,43	49,13	160,33	140,68	19,65			
1a5	15	90,89	3,15	244,95	266,07	45,37	150,91	129,81	21,1	20,1	1,55	1,35
2a1	25	90,53	3,15	241,8	260,21	45,09	148,12	124,59	23,53			
2a2	17	90,51	3,15	240,83	269,96	54,95	147,17	124,5	22,67			
2a3	28	91,52	3,15	244,68	267,9	49,23	150,01	127,15	22,86			
2a4	33	91,19	3,15	246,77	273,95	52,29	152,43	130,47	21,96			
2a5	34	91,63	3,15	231,77	258	51,75	136,99	114,62	22,37	22,7	1,47	1,24
3a1	44	90,46	3,15	243,68	252,94	44,09	150,07	118,39	31,68			
3a2	6	90,57	3,15	241,94	254,67	44,04	148,22	120,06	28,16			
3a3	29	91	3,15	243,96	262,28	49,97	149,81	121,31	28,5			
3a4	33	91,19	3,15	240,94	253,55	45,31	146,6	117,05	29,55			
3a5	21	90,19	3,15	241,95	260,75	50,32	148,61	120,24	28,37	29,3	1,49	1,19

Bijlage 2c Analyse ringmonsters week 44, 1999

Monsternr.	ringnr.	massa ring	massa plastic zak	massa ring + plastic + vochtige grond	massa ring + droge grond + petrischaal	massa petri-schaal	Vochtige grond (g/100 cm^3)	Droge grond (g/100 cm^3)	Volume% vocht	Volume% vocht gemid.	Bulkgewicht vocht (g/cm^3)	Bulkgewicht droog (g/cm^3)
1a1	2	91,2	3,15	261,82	278,67	44,7	167,47	142,77	24,7			
1a2	6	90,57	3,15	267,4	283,15	41,02	173,68	151,56	22,12			
1a3	46	90,79	3,15	259,22	285,1	52,31	165,28	142	23,28			
1a4	30	90,98	3,15	252,92	275,86	49,52	158,79	135,36	23,43			
1a5	14	90,65	3,15	254,85	275,16	46,96	161,05	137,55	23,5	23,4	1,65	1,42
2a1	48	91,06	3,15	235,96	255,51	48,14	141,75	116,31	25,44			
2a2	45	90,85	3,15	248,26	264,82	46,01	154,26	127,96	26,3			
2a3	28	91,52	3,15	245,78	257,75	43,39	151,11	122,84	28,27			
2a4	27	91,24	3,15	244,24	261,25	48,8	149,85	121,21	28,64			
2a5	50	91,27	3,15	241,63	260,29	48,5	147,21	120,52	26,69	27,1	1,49	1,22
3a1	29	91	3,15	235,57	238,56	36,77	141,42	110,79	30,63			
3a2	20	90,38	3,15	244,57	258,19	45,75	151,04	122,06	28,98			
3a3	49	90,91	3,15	234,1	246,4	42,91	140,04	112,58	27,46			
3a4	47	91,8	3,15	247,9	264,14	48,83	152,95	123,51	29,44			
3a5	42	90,36	3,15	232,96	254,7	53,2	139,45	111,14	28,31	29,0	1,45	1,16

Bijlage 2d Analyse ringmonsters week 42, 2000

Monsternr.	ringnr.	massa ring	massa ring + vochtige grond	massa petri-schaal	massa ring + droge grond + petrischaal	Vochtige grond (g/100 cm^3)	Droge grond (g/100 cm^3)	Volume% vocht	Volume% vocht gemid.	Bulkgewicht vocht (g/cm^3)	Bulkgewicht droog (g/cm^3)
1a1	42	89,9	244,6	49,5	267,5	154,7	128,1	17,19			
1a2	48	90,7	253,5	47,2	274,7	162,8	136,8	15,97			
1a3	3	90,2	245	38,8	257,1	154,8	128,1	17,25			
1a4	24	89,7	242,5	40,6	258,9	152,8	128,6	15,84			
1a5	26	90,5	256	44,4	271,9	165,5	137	17,22	16,7	1,58	1,32
2a1	11	90,3	228,3	48,5	250,8	138	112	18,84			
2a2	13	90	245,3	50	267,9	155,3	127,9	17,64			
2a3	22	90,3	234,3	44,9	250,3	144	115,1	20,07			
2a4	9	89,9	225,8	45,8	245,3	135,9	109,6	19,35			
2a5	36	91,6	234,2	47,1	257,8	142,6	119,1	16,48	18,5	1,43	1,17
3a1	27	91	249,8	46,1	264,3	158,8	127,2	19,90			
3a2	2	90,9	237,8	49,7	254,4	146,9	113,8	22,53			
3a3	31	90,1	277,3	47,5	243	187,2	105,4	43,70			
3a4	12	90,7	232,8	42,3	247,3	142,1	114,3	19,56			
3a5	4	90,1	223,9	53,1	253,7	133,8	110,5	17,41	24,6	1,54	1,14

Bijlage 2e

Project 1405 Onderzoek naar Fytocell als bodemverbeterend materiaal

Proeflocatie Boot en Co Zundert
Week 26 2000

Monsternr.	ringnr.	massa ring	massa ring + vochtige grond	massa petri-schaal	massa ring + droge grond + petrischaal	Vochtige grond (g/100 cm^3)	Droge grond (g/100 cm^3)	Volume% vocht	Volume% vocht gemidd.	Bulkgw.vochtig g/cm^3	Bulk gew. Droog g/cm^3
1a1	22	90,7	246,6	65,6	295,6	155,9	139,3	10,65			
1a2	17	90,4	250,6	64,4	296	160,2	141,2	11,86			
1a3	9	90,2	236	65,2	282,7	145,8	127,3	12,69			
1a4	4	90,1	232,7	39,1	254,7	142,6	125,5	11,99			
1a5	21	90,1	234,6	65,5	283,6	144,5	128	11,42	11,72	149,8	132,26
2a1	42	90,3	226,2	45,9	250,8	135,9	114,6	15,67			
2a2	13	90,3	227,6	37,2	241,7	137,3	114,2	16,82			
2a3	31	90,3	243,1	46,8	268	152,8	130,9	14,33			
2a4	27	91,2	227	49,4	255,3	135,8	114,7	15,54			
2a5	36	91,7	232,1	49,2	260,4	140,4	119,5	14,89	15,45	140,44	118,78
3a1	48	91	223,3	44,1	245,4	132,3	110,3	16,63			
3a2	38	91,5	246,7	36,4	258,2	155,2	130,3	16,04			
3a3	11	90,6	233,3	64,5	277,1	142,7	122	14,51			
3a4	7	91	227,3	57,2	261,7	136,3	113,5	16,73			
3a5	2	91,2	233,1	65,6	278,2	141,9	121,4	14,45	15,67	141,68	119,5

Bijlage 2e

Project 1405 Onderzoek naar Fytocell als bodemverbeterend materiaal

Proeflocatie Boot en Co Zundert
Week 42 2000

Monsternr.	ringnr.	massa ring	massa ring + vochtige grond	massa petri schaal	massa ring + droge grond + petrischaal	Vochtige grond (g/100 cm^3)	Droge grond (g/100 cm^3)	Volume% vocht	Volume% vocht gemidddeld	Bulkgewicht vocht (g/100 cm3)	Bulkgewicht droog (g/100 cm3)
1a1	42	89,9	244,6	49,5	267,5	154,7	128,1	17,19			
1a2	48	90,7	253,5	47,2	274,7	162,8	136,8	15,97			
1a3	3	90,2	245	38,8	257,1	154,8	128,1	17,25			
1a4	24	89,7	242,5	40,6	258,9	152,8	128,6	15,84			
1a5	26	90,5	256	44,4	271,9	165,5	137	17,22	16,69		
2a1	11	90,3	228,3	48,5	250,8	138	112	18,84			
2a2	13	90	245,3	50	267,9	155,3	127,9	17,64			
2a3	22	90,3	234,3	44,9	250,3	144	115,1	20,07			
2a4	9	89,9	225,8	45,8	245,3	135,9	109,6	19,35			
2a5	36	91,6	234,2	47,1	257,8	142,6	119,1	16,48	18,48		
3a1	27	91	249,8	46,1	264,3	158,8	127,2	19,90			
3a2	2	90,9	237,8	49,7	254,4	146,9	113,8	22,53			
3a3	31	90,1	277,3	47,5	243	187,2	105,4	43,70			
3a4	12	90,7	232,8	42,3	247,3	142,1	114,3	19,56			
3a5	4	90,1	223,9	53,1	253,7	133,8	110,5	17,41	24,62		

Bijlage 3 c **Bodemverbeterende Fytocell op zandgrond**

projekt 1333 Boot en Co

Behandelingen Vol% Fytocel	Amelanchier Versgewicht in gram			week 44 1999
0%	51,7			
0%	56,9			
0%	54,2 Gemidd.	54,3 g	100%	
12,50%	166,9			
12,50%	103,2			
12,50%	110,6 Gemidd.	126,9 g	184%	
25%	223,6			
25%	128,6			
25%	198,2 Gemidd.	183,5 g	338%	

Behandelingen Vol% Fytocel	Amelanchier Drooggewicht in gram			
0%	28,1			
0%	31,6			
	33,8 Gemidd.	31,2 g	100%	
12,50%	93,8			
12,50%	55,8			
12,50%	59,3 Gemidd.	69,6 g	223%	
25%	117,7			
25%	68,7			
25%	110,6 Gemidd.	99 g	317%	

week 42 2000

Behandelingen Vol% Fytocel	Amelanchier Versgewicht in gram			
0%	763			
0%	637 Gemidd.	700	100%	
12,50%	1854			
12,50%	1637 Gemidd.	1745,5	249%	
25%	2024			
25%	1614 Gemidd.	1819	260%	

Behandelingen Vol% Fytocel	Amelanchier Drooggewicht in gram			
0%	432,2			
0%	402,3 Gemidd.	417,25	100%	
12,50%	1293,3			
12,50%	1042,4 Gemidd.	1167,85	280%	
25%	1402,5			
25%	1121,7 Gemidd.	1262,1	302%	

Project 1405 Onderzoek naar Fytocell als bodemverbeterend materiaal

Proeflocatie Boot en Co Zundert
Week 42 2000

Lengte van de planten in cm
Gewas: *Pinus nigra ssp nigra*

plantnr.	Behandeling 2; 12,5%	Behandeling 3; 25%
1	108	120
2	104	108
3	115	112
4	123	120
5	104	100
6	112	94
7	108	102
8	100	99
9	102	125
10	126	90
11	162	118
12	110	86
13	120	110
Gemiddeld	114,92	106,46

Project 1405 Onderzoek naar Fytocell als bodemverbeterend materiaal

Proeflocatie Boot en Co Zundert
Week 42 2000

Lengte van de planten in cm
Gewas: *Amelanchier lamarckii*

	Behandeling 1; 0%			Behandeling 2; 12,5%			Behandeling 3; 25%		
plantnr.	1a	1b	1c	2a	2b	2c	3a	3b	3c
1	117	103	133	150	170	145	145	140	160
2	117	95	105	152	165	125	146	155	160
3	124	90	115	136	155	145	146	140	165
4	137	109	95	150	155	140	145	155	170
5	128	93	105	150	170	140	155	160	155
6	138	81	107	137	155	155	130	155	160
7	127	122	116	152	160	150	155	155	165
8	90	113	100	143	165	150	160	160	160
9	123	108	105	134	150	145	139	150	170
10	121	100	83	148	155	145	152	160	155
11	134	107	88	138	150	140	158	160	150
12	99	102	114	150	145	148	134	170	150
13	87	104	102	150	140	155	160	150	138
14	125	108	96	152	155	150	135	160	152
15	114	97	120	154	150	150	146	120	154
16	88	97	115	143	140	155	144	160	143
17	108	103	107	140	145	150	160	155	165
18	99	105	117	152	145	150	142	165	152
19	110	102	110	155	150	150	148	155	140
20	118	102	108	155	140	135	143	145	155
21	102	103	115	153	150	140	160	155	152
22	107	98	99	155	150	155	170	148	140
23	108	101	108	155	144	145	155	148	150
24	105	102	83	150	150	145	146	150	130
25	97	109	92	155	150	140	155	140	135
26	105	108	97	160	145	155	155	147	130
27	105	122	114	150	140	160	130	155	155
28	118	110	95	155	145	150	147	135	145
29	100	93	108	160	135	160	153	144	152
30	117	80	98	160	145	160	145	124	150
Gemiddeld	112,27	102,23	105,00	149,80	150,47	147,77	148,63	150,53	151,93
in %		100		140,7	141,3	138,7	139,6	141,3	142,7

Project 1405 Onderzoek naar Fytocell als bodemverbeterend materiaal

Proeflocatie Boot en Co Zundert
Week 42 2000

Lengte van het nieuwe schot in cm
Gewas: *Pinus nigra ssp nigra*

	Behandeling 2; 12,5%						Behandeling 3; 25%					
plantnr.	**1**	**2**	**3**	**4**	**5**	**Gem.**	**1**	**2**	**3**	**4**	**5**	**Gem.**
1	24	18	21	20	16	19,80	30	26	23	19	19	23,4
2	27	26	22	21	19	23,00	27	33	25	29	29	28,6
3	34	32	30	31	30	31,40	40	24	27	27	28	29,2
4	35	30	40	32	33	34,00	33	25	23	20	22	24,6
5	24	27	26	27	25	25,80	24	19	22	23	24	22,4
6	24	25	27	26	26	25,60	25	25	22	16	15	20,6
7	23	30	25	22	24	24,80	26	28	27	25	22	25,6
8	26	27	27	23	26	25,80	16	20	22	22	24	20,8
9	33	32	30	27	27	29,80	38	31	29	26	30	30,8
10	42	27	28	31	30	31,60	30	23	21	22	24	24
11	80	52	45	32	42	50,20	38	32	30	35	28	32,6
12	38	32	33	27	28	31,60	14	16	16	14	15	15
13	33	35	32	33	31	32,80	35	22	19	18	22	23,2
			Gemiddelde behandeling 2			29,71			Gemiddelde behandeling 3			24,68

Bijlage Fytocell als bodemverbeterend materiaal op zandgrond

projekt plantlengte Boot en Co week 42 2000,0

Plant Amelanchier

nummer	Amel.	Amel.	Amel.	Amel.	Amel.	Amel.	Amel.	Amel.	Amel.	Pinus	Pinus
	0%	0%	0%	12,50%	12,50%	12,50%	25%	25%	25%	12,50%	25%
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											
21											
22											
23											
24											
25											
26											
27											
28											
29											
30											
	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Gemiddelde lengte											
In %		100%									

Bijlage 12 Fytocel als bodemverbeterend materiaal op zandgrond

projekt 1333 plantlengte Boot en Co week 20 1999,0

Plant nummer	Amelanchier Amel. 0%	Amel. 0%	Amel. 0%	Amel. 12,50%	Amel. 12,50%	Amel. 12,50%	Amel. 25%	Amel. 25%	Amel. 25%	Pinus 12,50%	Pinus 25%
1	43,0	30,0	50,0	48,0	40,0	50,0	50,0	53,0	56,0	75,0	70,0
2	47,0	28,0	40,0	50,0	43,0	52,0	43,0	55,0	60,0	75,0	77,0
3	45,0	30,0	40,0	50,0	44,0	54,0	52,0	56,0	60,0	76,0	90,0
4	47,0	38,0	38,0	45,0	48,0	53,0	52,0	48,0	58,0	84,0	78,0
5	45,0	34,0	34,0	43,0	40,0	50,0	53,0	55,0	54,0	73,0	78,0
6	42,0	40,0	36,0	43,0	44,0	48,0	54,0	53,0	70,0	70,0	85,0
7	45,0	36,0	36,0	42,0	45,0	54,0	48,0	55,0	65,0	78,0	85,0
8	40,0	38,0	36,0	43,0	48,0	53,0	45,0	50,0	55,0	75,0	75,0
9	38,0	30,0	34,0	52,0	48,0	50,0	43,0	54,0	62,0	78,0	80,0
10	42,0	34,0	28,0	54,0	47,0	52,0	60,0	52,0	54,0	80,0	76,0
11	47,0	30,0	28,0	58,0	46,0	52,0	60,0	48,0	60,0	70,0	84,0
12	48,0	45,0	30,0	54,0	50,0	50,0	60,0	53,0	55,0	70,0	68,0
13	52,0	48,0	30,0	52,0	53,0	51,0	60,0	58,0	54,0	80,0	80,0
14	50,0	44,0	32,0	54,0	52,0	54,0	61,0	60,0	50,0	72,0	76,0
15	50,0	40,0	35,0	48,0	48,0	55,0	43,0	55,0	50,0	74,0	76,0
16	45,0	48,0	34,0	52,0	48,0	54,0	50,0	55,0	45,0	80,0	70,0
17	48,0	44,0	40,0	52,0	50,0	48,0	50,0	60,0	55,0	77,0	80,0
18	59,0	40,0	38,0	54,0	54,0	52,0	50,0	60,0	55,0	90,0	82,0
19	40,0	40,0	42,0	50,0	50,0	50,0	52,0	54,0	58,0	85,0	70,0
20	38,0	30,0	34,0	50,0	53,0	53,0	52,0	60,0	54,0	84,0	70,0
21	34,0	38,0	32,0	54,0	51,0		53,0	60,0	58,0	70,0	83,0
22	33,0	38,0	34,0	53,0	52,0		51,0	52,0	55,0	72,0	82,0
23	38,0	48,0	36,0	50,0	48,0		54,0	58,0	56,0	75,0	86,0
24	40,0	40,0	35,0	53,0	50,0		48,0	63,0	55,0	76,0	78,0
25	43,0	42,0	34,0	53,0	55,0		52,0	70,0	58,0	74,0	84,0
26	36,0	45,0	34,0	45,0	48,0		50,0	63,0	45,0	78,0	77,0
27	40,0	44,0	38,0	50,0	53,0		55,0	62,0	48,0	78,0	82,0
28	43,0	42,0	33,0	44,0	52,0		48,0	54,0	50,0	85,0	80,0
29	48,0	40,0	35,0	48,0	48,0		52,0	50,0	54,0	70,0	76,0
30	48,0	42,0	45,0	55,0	47,0		54,0	50,0	52,0	75,0	73,0
	1314,0	1166,0	1071,0	1499,0	1455,0	1035,0	1555,0	1676,0	1661,0	2299,0	2351,0
	43,8	38,9	35,7	50,0	48,5	51,8	51,8	55,9	55,4	76,6	78,4
Gemiddelde lengte		39,51 cm			50,1 cm		53,15 cm			76,63 cm	78,37 cm
In %		100%			128%		135%			100%	102%

Onderzoek aan FYTOCEL als bodemverbeterend materiaal

Bijlage 13 Fytocel als bodemverbeterend materiaal in zandgrond

projekt 1333 plantlengte Boot en Co week 32 1999

	Amelanchie	Amel.	Amel.	Amel.	Amel.	Amel.	Amel.	Amel.	Amel.	Pinus	Pinus
	0%	0%	0%	12,5%	12,5%	12,5%	25%	25%	25%	12,5%	25%
1	83	61	87	112	106	123	107	95	114	81	95
2	84	78	82	94	105	120	112	118	116	80	79
3	86	74	72	113	104	120	125	120	117	75	79
4	76	72	66	103	97	85	109	118	119	88	92
5	69	75	64	91	118	118	124	107	110	80	87
6	84	81	52	109	120	110	112	115	115	71	77
7	94	63	65	95	120	120	108	120	140	82	79
8	50	54	54	110	94	117	103	123	118	77	81
9	85	50	69	115	105	111	117	125	120	85	89
10	77	68	51	106	113	112	126	115	120	85	65
11	95	63	52	116	121	118	114	106	98	74	86
12	66	63	57	120	110	104	124	116	115	79	75
13	66	64	63	99	125	115	104	125	120	84	91
14	72	65	47	93	124	120	112	120	106	73	82
15	67	55	60	116	120	118	115	124	111	79	85
16	63	62	74	105	116	120	112	107	110	78	82
17	71	70	59	110	130	130	130	114	120	73	77
18	72	55	63	115	115	123	115	125	105	95	78
19	63	63	58	110	120	123	100	140	94	83	90
20	67	69	59	108	110	124	110	130	105	85	90
21	49	52	57	113	108		103	125	120	73	83
22	62	59	55	120	120		115	125	106	75	82
23	52	72	59	119	130		119	123	123	78	86
24	53	71	52	127	120		105	125	120	76	84
25	45	65	51	120	125		102	124	99	79	85
26	43	62	52	112	120		106	122	104	83	79
27	62	74	58	120	122		107	110	117	79	84
28	82	50	66	117	115		113	130	106	86	75
29	64	52	49	109	124		119	117	88	72	85
30	64	65	60	123	107		125	108	106	79	84
	2066	1927	1813	3320	3464	2331	3393	3572	3362	2387	2486
	68,87	64,23	60,43	110,67	115,47	116,55	113,1	119,07	112,07	79,57	82,87
Gemiddeld in cm		64,51			115,04			114,75		79,57	82,87
In %		100%			178,32%			177,89%		100%	104,10%

Onderzoek aan FYTOCEL als bodemverbeterend materiaal

Bijlage 14 Bodemverbeterende FytocelL op zandgrond

projekt 1333 plantlengte in cm Boot en Co week 44 1999

	Amelanchie	Amel.	Amel.	Amel.	Amel.	Amel.	Amel.	Amel.	Amel.	Pinus	Pinus
	0%	0%	0%	12,5%	12,5%	12,5%	25%	25%	25%	12,5%	25%
1	81	59	85	105	104	123	115	125	104	80	78
2	84	77	65	110	105	119	104	93	114	82	98
3	85	75	71	92	106	123	115	120	113	78	78
4	75	72	64	113	103	81	125	115	115	90	81
5	65	74	62	103	98	118	107	116	108	80	93
6	82	78	48	89	118	108	122	106	103	71	87
7	92	63	62	109	120	123	116	116	119	85	77
8	67	55	54	93	118	115	111	124	120	82	82
9	83	50	67	108	93	111	100	121	111	85	81
10	75	67	47	111	104	106	116	125	118	86	88
11	95	61	48	106	113	120	130	115	118	83	65
12	61	68	56	112	119	105	114	110	97	80	87
13	65	66	65	118	105	107	129	116	114	88	76
14	73	65	46	99	130	123	99	128	120	78	93
15	68	53	70	95	118	119	113	120	106	82	80
16	56	62	71	116	121	130	114	123	107	83	82
17	74	75	57	100	114	130	115	104	108	73	74
18	71	51	63	110	137	124	124	113	119	97	72
19	62	60	59	117	114	127	111	120	110	85	88
20	64	64	60	107	118	125	99	140	97	88	89
21	49	51	59	101	107		109	130	104	71	84
22	59	56	54	111	111		98	125	121	77	82
23	50	70	60	110	121		115	129	106	83	86
24	51	69	51	119	126		120	124	120	80	82
25	43	60	47	123	123		105	124	120	82	83
26	45	61	56	117	125		103	125	98	88	81
27	56	75	57	109	120		103	122	100	82	83
28	83	45	65	118	126		103	110	116	90	72
29	65	50	40	117	123		112	130	103	72	84
30	61	65	63	106	126		118	118	88	82	81
	2040	1897	1772	3244	3466	2337	3365	3587	3297	2463	2467
	68,00	63,23	59,07	108,13	115,53	116,85	112,17	119,57	109,90	82,10	82,23
Gemiddeld in cm		63,43 cm			113,4 cm			114,11		82,1	82,23
In %		100%			178,80%			179,90%		100%	104,10%

Onderzoek aan FYTOCELL als bodenverbeterend materiaal

Bijlage 16 Bodemverbeterende Fytocell op zandgrond

	projekt 1333	Boot en Co		week 44 1999			week 42 2000			
Behandelingen	Amelanchier					Behandelingen	Amelanchier			
Vol% Fytocel	Versgewicht in gram					Vol% Fytocel	Versgewicht in gram			
0%	51,7									
0%	56,9					0%	763			
0%	54,2	Gemidd.	54,3 g	100%		0%	637	Gemidd.	700	100%
12,50%	166,9									
12,50%	103,2					12,50%	1854			
12,50%	110,6	Gemidd.	126,9 g	184%		12,50%	1637	Gemidd.	1745,5	249%
25%	223,6									
25%	128,6					25%	2024			
25%	198,2	Gemidd.	183,5 g	338%		25%	1614	Gemidd.	1819	260%
Behandelingen	Amelanchier					Behandelingen	Amelanchier			
Vol% Fytocel	Drooggewicht in gram					Vol% Fytocel	Drooggewicht in gram			
0%	28,1									
0%	31,6					0%	432,2			
	33,8	Gemidd.	31,2 g	100%		0%	402,3	Gemidd.	417,25	100%
12,50%	93,8									
12,50%	55,8					12,50%	1293,3			
12,50%	59,3	Gemidd.	69,6 g	223%		12,50%	1042,4	Gemidd.	1167,85	280%
25%	117,7									
25%	68,7					25%	1402,5			
25%	110,6	Gemidd.	99 g	317%		25%	1121,7	Gemidd.	1262,1	302%

Bijlage 15 Project 1333 Bodemverbetering van zandgrond

Lengte nieuwe schot van Pinus Boot en Co week 44 1999

plantnr.	12,5% Fytocel					Gemidd. Scheutl.cm	25% Fytocel						
1	18	17	18	17	21	18,2	17	19	19	18	19	18,4	
2	21	19	20	21	17	19,6	17	22	22	20	19	20	
3	16	16	16	17	14	15,8	17	18	18	17	19	17,8	
4	17	16	16	17	14	16	17	14	15	21	18	17	
5	16	16	17	12	16	15,4	17	22	22	19	19	19,8	
6	10	12	11	13	11	11,4	17	18	17	17	17	17,2	
7	12	14	14	14	12	13,2	17	18	17	17	17	17,2	
8	17	15	13	14	14	14,6	17	19	17	18	19	18	
9	15	16	16	18	14	15,8	17	15	17	16	17	16,4	
10	16	16	16	17	17	16,4	17	20	24	22	19	20,4	
11	12	13	12	13	13	12,6	17	14	17	18	18	16,8	
12	17	15	16	19	15	16,4	17	21	22	20	20	20	
13	16	14	13	18	15	15,2	17	15	13	13	13	14,2	
14	14	14	13	15	12	13,6	17	14	15	17	16	15,8	
15	17	13	14	17	17	15,6	17	15	17	16	15	16	
16	16	15	13	16	16	15,2	17	15	16	15	12	15	
17	13	10	11	11	12	11,4	0	0	0	0	0	0	kop stuk
18	14	13	15	16	15	14,6	17	17	19	20	19	18,4	
19	15	14	15	17	17	15,6	17	20	23	20	19	19,8	
20	17	16	15	18	18	16,8	17	19	18	17	18	17,8	
21	12	12	12	12	13	12,2	17	15	15	16	16	15,8	
22	14	15	14	15	15	14,6	17	14	13	14	15	14,6	
23	12	15	14	13	13	13,4	17	17	15	10	14	14,6	
24	14	16	15	12	16	14,6	17	15	16	18	18	16,8	
25	17	17	18	17	12	16,2	17	19	18	0	0	10,8	
26	21	25	24	24	23	23,4	17	16	15	17	17	16,4	
27	16	13	17	16	15	15,4	17	17	21	19	18	18,4	
28	17	18	17	18	18	17,6	17	14	14	15	11	14,2	
29	20	18	23	18	18	19,4	17	22	20	20	18	19,4	
30	18	16	15	16	17	16,4	17	16	19	20	15	17,4	
						466,6						494,4	
											29 planten		
				Gem.		15,55						17,048	

Scheutlengte toename van 12,5 tot 25%Fyt 8,79%

)nderzoek aan FYTOCEL als bodemverbeterend materiaal