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IMFLUENCE OF POTASSIUM NITRATE ON THE GROWTH OF TRICHODERMA IN NUTRIENT SOLUTION

Experiment 1602.28

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SUMMARY

In 2000 research was performed on the Research Station for Floriculture and Glasshouse Vegetables in Naaldwijk on the influence of potassium nitrate on the growth of *Trichoderma atroviride* in nutrient solution.

In this research eight samples of potassium nitrate were tested in two replications. Each sample was tested in three concentrations: 0.1, 1 and 5 grams per litre tap water. *Trichoderma atroviride* was added to these nutrient solutions. After one, two and three weeks the nutrient solutions were plated out on Petri dishes with a selective medium for *Trichoderma*. After five days the colonies of *Trichoderma* were enumerated. For six weeks the nutrient solutions were assessed for mycelium growth.

Trichoderma proved to be most stable at the tested concentrations of 5 grams potassium nitrate per litre tap water in comparison with the tested concentrations of 0.1 and 1 gram per litre.

Trichoderma was most stable in potassium nitrate number 4 at a concentration of 5 grams per litre.

In all numbers of potassium nitrate and at all concentrations tested the vitality of *Trichoderma* was strongly reduced, with 46 - 87%, after an exposure time of three weeks. This reduction was not realized when potassium nitrate number 1 was applied at 0.1 gram per litre and number 4 at a concentration of 5 grams per litre.

No mycelium growth of *Trichoderma* was observed in all potassium nitrate solutions during six weeks.

1. INTRODUCTION

In agriculture and horticulture fertilizers on the basis of potassium nitrate are coated with anticaking agents to prevent precipitation. These anticaking agents may stimulate the growth of *Trichoderma*, a fungus frequently isolated from blocked drippers.

By order of Norsk Hydro ASA in Porsgrunn, Norway, research was performed in 2000, to assess in the influence of eight samples of potassium nitrate on the growth of *Trichoderma* in nutrient solution.

After several exposure times the vitality of *Trichoderma* in the nutrient solutions was assessed by enumerating the spores on a selective medium for *Trichoderma*. This report deals with the conditions and the results of the research performed.

2. MATERIALS AND METHODS

The trial started on June 28, 2000. The research was performed in the phytopathological laboratory with the fungus *Trichoderma atroviride*, further on indicated as *Trichoderma*. This fungus was isolated out of a blocked dripper from a commercial nursery.

Eight samples of potassium nitrate were added to tap water in three concentrations with 0.1, 1 and 5 grams per litre and in two replications. Data about the EC of the nutrient solutions are listed in Appendix 1. The pH was adjusted with 10% HNO₃ to 6.0 ± 0.1.

Each treatment contained 1 litre of nutrient solution, to which 0.1 ml spore suspension of *Trichoderma* was added.

After one (July 5), two (July 12) and three weeks (July 19) the nutrient solutions were plated out with a spiral plater on Petri dishes with a selective medium for *Trichoderma*: TSM. Per treatment two Petri dishes are used, which are cultured in an incubator at a temperature of approximately 25°C. Per Petri dish 50.030 µl was plated out.

After five days (July 10, 17 and 24) the number of colony forming units (cfu) was enumerated.

For six weeks the treatments were visually assessed for growth of mycelium of *Trichoderma*.

3. RESULTS AND DISCUSSION

The results of the trials are listed in the appendices 2 up to and including 9 and summarized in Table 1. From Table 1 can be concluded that *Trichoderma* is most stable in potassium nitrate number 4 at a concentration of 5 grams per litre. In all numbers of potassium nitrate at concentrations of 0.1 and 1 gram per litre the vitality of *Trichoderma* is strongly reduced, with 50% or more, after an exposure time of three weeks. Potassium nitrate number 1 however, does not show this effect at a concentration of 0.1 gram per litre.

Table 1 – Mean number of *Trichoderma* colonies per ml potassium nitrate solution (n = 2)

Potassium nitrate number	Concentration (gram/litre)		
	0.1	1	5
1			
after one week	1809	2074	2224
after two weeks	1774	1234	1499
after three weeks	1449	1045	720
2			
after one week	1594	1354	1869
after two weeks	670	615	845
after three weeks	360	370	975
3			
after one week	2808	3593	1969
after two weeks	375	1089	1774
after three weeks	465	700	1059
4			
after one week	2009	2309	3113
after two weeks	465	795	3798
after three weeks	300	315	2679
5			
after one week	1395	1799	1709
after two weeks	390	985	970
after three weeks	255	445	785
7			
after one week	2079	1654	1884
after two weeks	570	625	1165
after three weeks	370	465	795
9			
after one week	1759	1959	2679
after two weeks	590	585	1479
after three weeks	310	250	855
10			
after one week	1574	1874	3093
after two weeks	565	700	1574
after three weeks	375	380	775

During six weeks all potassium nitrate solutions were assessed for mycelium growth of *Trichoderma*. No mycelium growth was observed during that period in all treatments.

These results correspond with the poor survival of the *Trichoderma* spores in most potassium nitrate solutions.

4. CONCLUSION

- *Trichoderma* is most stable at the tested concentrations of 5 grams potassium nitrate per litre in comparison with the tested concentrations of 0.1 and 1 gram per litre.
- *Trichoderma* is most stable in potassium nitrate number 4 at a concentration of 5 grams per litre.
- In all numbers of potassium nitrate and at all concentrations tested the vitality of *Trichoderma* is strongly reduced, with 46 - 87%, after an exposure time of three weeks. This reduction was not realized when potassium nitrate number 1 was applied at 0.1 gram per litre and number 4 at a concentration of 5 grams per litre.
- No mycelium growth of *Trichoderma* was observed in all potassium nitrate solutions during six weeks.

Appendix 1. EC of the nutrient solutions

Potassium nitrate	Concentration (Gram/litre)	EC (mS/cm)
1	0.1	0.7 - 0.8
1	1	2.0
1	5	7.4
2	0.1	0.7
2	1	2.0
2	5	7.5
3	0.1	0.6 - 0.7
3	1	2.0
3	5	7.5 - 7.6
4	0.1	0.7
4	1	2.0
4	5	7.5 - 7.6
5	0.1	0.6 - 0.7
5	1	2.0
5	5	7.5
7	0.1	0.6 - 0.7
7	1	2.0
7	5	7.5 - 7.6
9	0.1	0.7
9	1	2.0
9	5	7.4 - 7.5
10	0.1	0.6 - 0.7
10	1	2.0
10	5	7.5 - 7.6

Appendix 2. Number of *Trichoderma* colonies in potassium nitrate solution no. 1

KNO ₃ concentration (gram/litre)	Replication 1			Replication 2		
	plate 1	plate 2	cfu/ml	plate 1	plate 2	cfu/ml
0.1						
Exposure time						
one week	69	79	1479	109	105	2139
two weeks	72	77	1489	111	95	2059
three weeks	65	57	1219	93	75	1679
1						
one week	84	85	1689	119	127	2459
two weeks	60	78	1379	56	53	1089
three weeks	37	39	760	66	67	1329
5						
one week	79	92	1709	150	124	2738
two weeks	52	56	1079	109	83	1919
three weeks	32	25	570	49	38	869

Appendix 3. Number of *Trichoderma* colonies in potassium nitrate solution no. 2

KNO ₃ concentration (gram/litre)	Replication 1			Replication 2		
	plate 1	plate 2	cfu/ml	plate 1	Plate 2	cfu/ml
0.1						
Exposure time						
one week	74	74	1479	83	88	1709
two weeks	30	38	680	30	36	660
three weeks	12	18	300	23	19	420
1						
one week	63	57	1199	70	81	1509
two weeks	29	40	690	25	29	540
three weeks	19	24	430	16	15	310
5						
one week	98	108	2059	92	76	1679
two weeks	47	36	830	45	41	859
three weeks	68	77	1449	23	27	500

Appendix 4. Number of *Trichoderma* colonies in potassium nitrate solution no. 3

KNO ₃ concentration (gram/litre)	Replication 1			Replication 2		
	plate 1	plate 2	cfu/ml	plate 1	plate 2	cfu/ml
0.1						
Exposure time						
one week	140	138	2778	141	143	2838
two weeks	23	19	420	18	15	330
three weeks	18	12	600	16	17	330
1						
one week	151	152	3028	196	220	4158
two weeks	49	51	999	52	66	1179
three weeks	28	28	560	38	46	839
5						
one week	69	73	1419	123	129	2518
two weeks	71	71	1419	91	122	2129
three weeks	53	42	949	66	51	1169

Appendix 5. Number of *Trichoderma* colonies in potassium nitrate solution no. 4

KNO ₃ concentration (gram/litre)	Replication 1			Replication 2		
	plate 1	plate 2	cfu/ml	plate 1	plate 2	cfu/ml
0.1						
Exposure time						
one week	57	64	1209	135	146	2808
two weeks	21	20	410	29	23	520
three weeks	18	19	370	11	12	230
1						
one week	100	103	2029	129	130	2588
two weeks	29	27	560	53	50	1029
three weeks	18	12	300	14	21	330
5						
one week	148	152	2998	163	160	3228
two weeks	159	130	2888	227	244	4707
three weeks	114	110	2239	156	156	3118

Appendix 6. Number of *Trichoderma* colonies in potassium nitrate solution no. 5

KNO ₃ Concentration (gram/litre)	Replication 1			Replication 2		
	plate 1	plate 2	cfu/ml	plate 1	plate 2	cfu/ml
0.1						
Exposure time						
one week	39	43	820	99	98	1969
two weeks	22	17	390	20	19	390
three weeks	17	12	290	15	7	220
1						
one week	59	60	1189	119	122	2409
two weeks	29	32	610	69	67	1359
three weeks	19	15	340	21	34	550
5						
one week	55	74	1289	101	112	2129
two weeks	66	59	1249	75	94	1690
three weeks	27	40	670	45	45	899

Appendix 7. Number of *Trichoderma* colonies in potassium nitrate solution no. 7

KNO ₃ Concentration (gram/litre)	Replication 1			Replication 2		
	plate 1	plate 2	cfu/ml	plate 1	plate 2	cfu/ml
0.1						
Exposure time						
one week	121	93	2139	101	101	2019
two weeks	15	28	430	44	27	710
three weeks	8	6	140	21	9	600
1						
one week	48	52	999	109	122	2309
two weeks	17	24	410	36	48	839
three weeks	12	14	260	40	27	670
5						
one week	80	74	1539	113	110	2229
two weeks	27	38	650	80	88	1679
three weeks	33	46	790	43	37	800

Appendix 8. Number of *Trichoderma* colonies in potassium nitrate solution no. 9

KNO ₃ Concentration (gram/litre)	Replication 1			Replication 2		
	plate 1	plate 2	cfu/ml	plate 1	plate 2	cfu/ml
0.1						
Exposure time						
one week	77	78	1549	103	94	1969
two weeks	31	16	470	35	36	710
three weeks	19	15	340	18	10	280
1						
one week	81	81	1619	107	123	2299
two weeks	18	25	430	32	42	740
three weeks	11	14	250	19	6	250
5						
one week	134	112	2459	144	146	2898
two weeks	66	50	1159	91	89	1799
three weeks	23	26	490	31	29	1219

Appendix 9. Number of *Trichoderma* colonies in potassium nitrate solution no. 10

KNO ₃ Concentration (gram/litre)	Replication 1			Replication 2		
	plate 1	plate 2	cfu/ml	plate 1	plate 2	cfu/ml
0.1						
Exposure time						
one week	68	57	1249	96	94	1899
two weeks	23	25	480	35	30	650
three weeks	25	26	510	13	11	240
1						
one week	53	76	1289	122	124	2459
two weeks	37	35	720	36	32	680
three weeks	17	18	350	25	18	410
5						
one week	165	182	3468	137	135	2718
two weeks	52	68	1199	94	101	1949
three weeks	44	36	800	33	42	750