PLOCHER®

Symbionature inc.

Scientific Trial

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Seed Treatment with Plocher® P for Carrots

Les Fermes R. R. et Fils inc., Eric Rémillard, Saint-Michel, Québec, Canada – 2010

This trial demonstrates in a statistically significant manner the beneficial action of Plocher® P on the development of carrot seedlings after seed treatment. The carrots which profited from 10 g/kg Plocher® P seed treatment show a decrease of 28.5% in the number of dead plants and were ahead in development when compared to the untreated group. This illustrates the better vitality of the treated seeds and gives inexpensive means to increase their resistance in the field.

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Introduction

Authorised for use in Organic agriculture, Plocher® natural products are also extensively used in conventional agriculture. They provide tools essential to a steady production of superior quality. To evaluate what farmers have been reporting for years, under scientific conditions, a trial was conducted on carrot seedlings at the Ferme R. R. et Fils inc. (Canada), vegetable farm of 200 acres cultivating black muck soil.

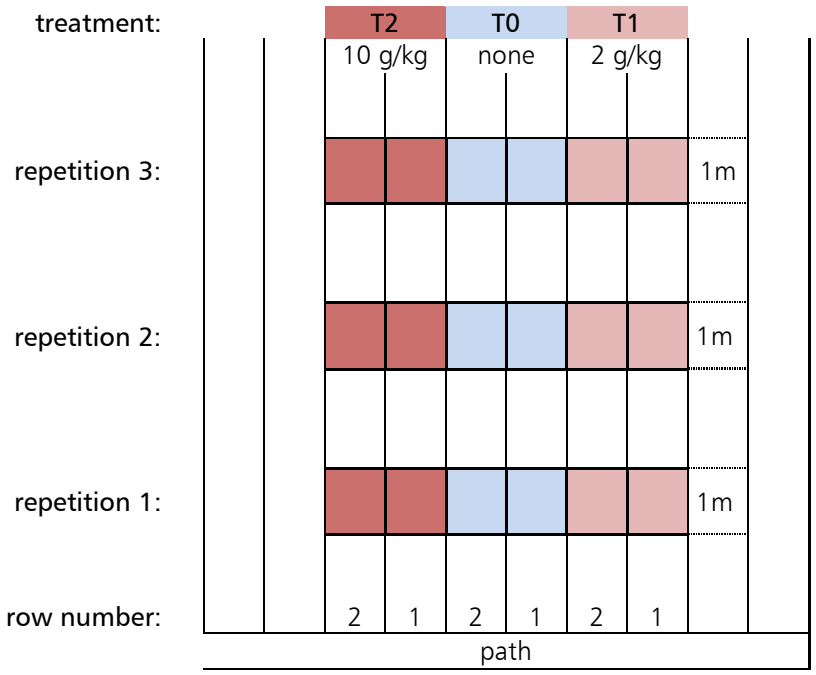
Trial

The trial was designed to determine the influence of seed treatment with Plocher® P (ap3051) on the growth and development of carrot seedlings. The seed treatment was carried out prior to drilling on June 28th 2010 into black soil at a rate of 3 million seeds per acre (= 741/m²). An application of the herbicide *Gesagard*® followed within 6 days. Untreated seeds were compared with two different treatment intensities of Plocher® P as seen in table 1:

Tab. 1: Seed treatments applied

Control (T0)	Plocher® P (T1)	Plocher® P (T2)
untreated	2 g/kg of Seeds	10 g/kg of Seeds

The carrot seeds were drilled according to schema 1. The samples were taken at three sites marked as repetitions 1-3:



Scheme 1: Trial layout in carrot field

This sample layout was chosen to integrate the trial as much as possible into the normal production process of the farm. In order to drill the rows without interruption, the seeds under same treatment are in one row and not altered as it would have been necessary to exclude a line effect which could interfere with statistics. The statistical evaluations are therefore only valid if the field is expected to be homogeneous as can be presumed in a flat black soil field.

When the seedlings reached their first leaf stage a plant count was performed in all of the sample areas. The seedlings were grouped according to the stages described in fig. 1-4 and the number of dead plants was determined as well. The detailed results of these counts may be found in the annex.

Fig. 1: cotyledon only (stage 1)

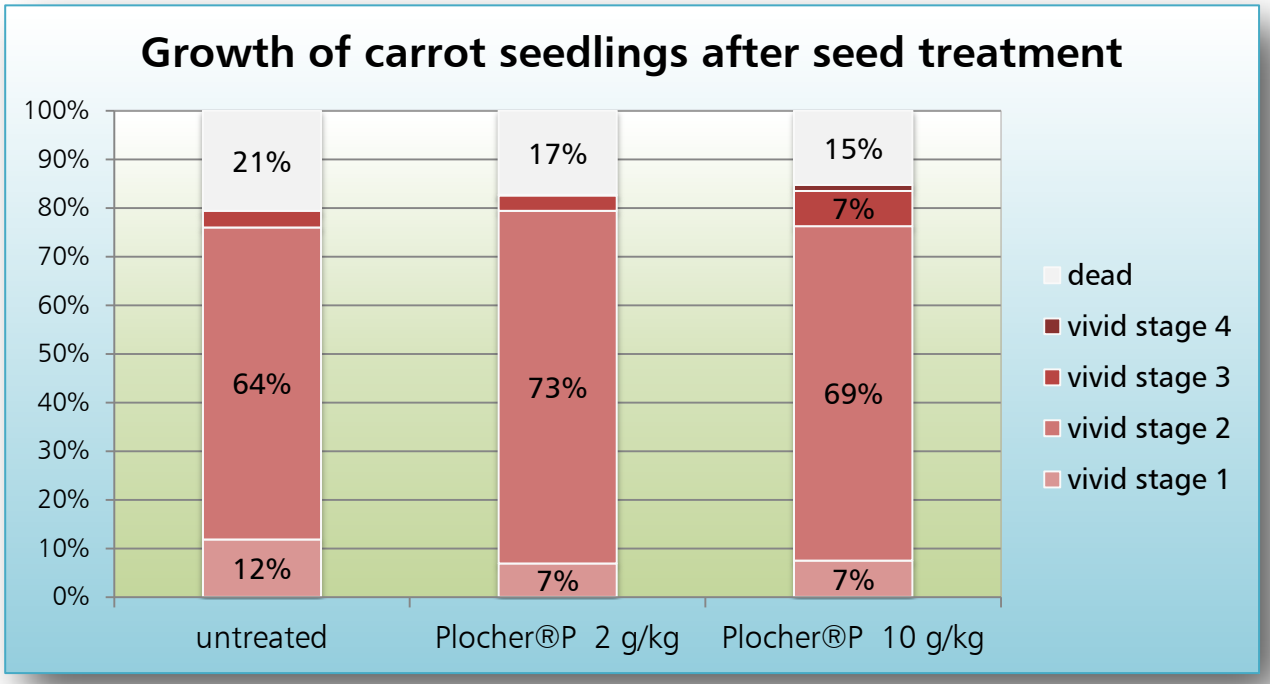
Fig 2: first leave not developed (stage 2)

Fig 3: first leave partly developed (stage 3)

Fig 4: first leave fully developed (stage 4)

Results

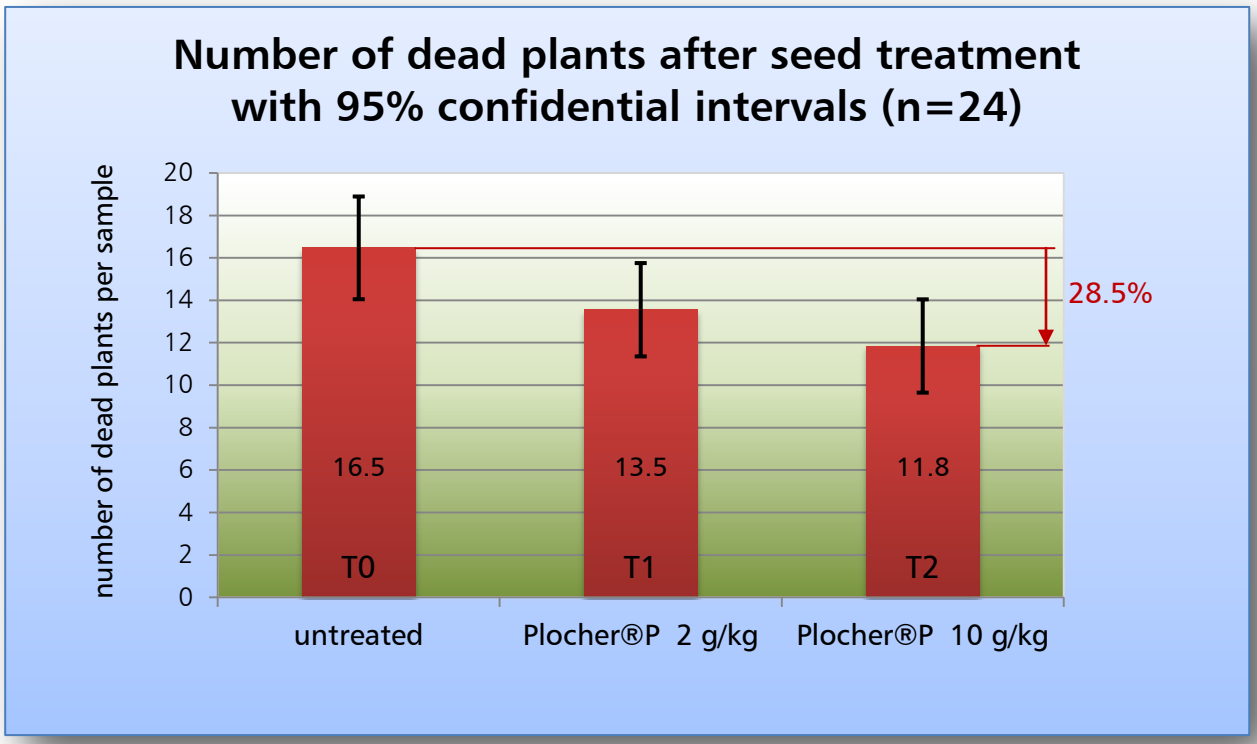
In diagram 1 the percentages of each stage are visualized for the three different treatment methods. There is only a slight difference between the control group and the seedlings treated with 2 g/kg of Plocher® P. There are 4% less dead and 5% fewer seedlings in cotyledon only stage. The seed treatment at a rate of 10 g/kg however leads to a clearly higher number of further developed plants (cf. diagram 3) and 6% less dead seedlings compared to the untreated.



Diag. 1: Percentage of dead and vivid seedlings in 4 different stages for 3 kinds of seed treatment. The percentage of further developed seedlings increases according to the seed treatment intensity whereas the number of dead seedlings decreases.

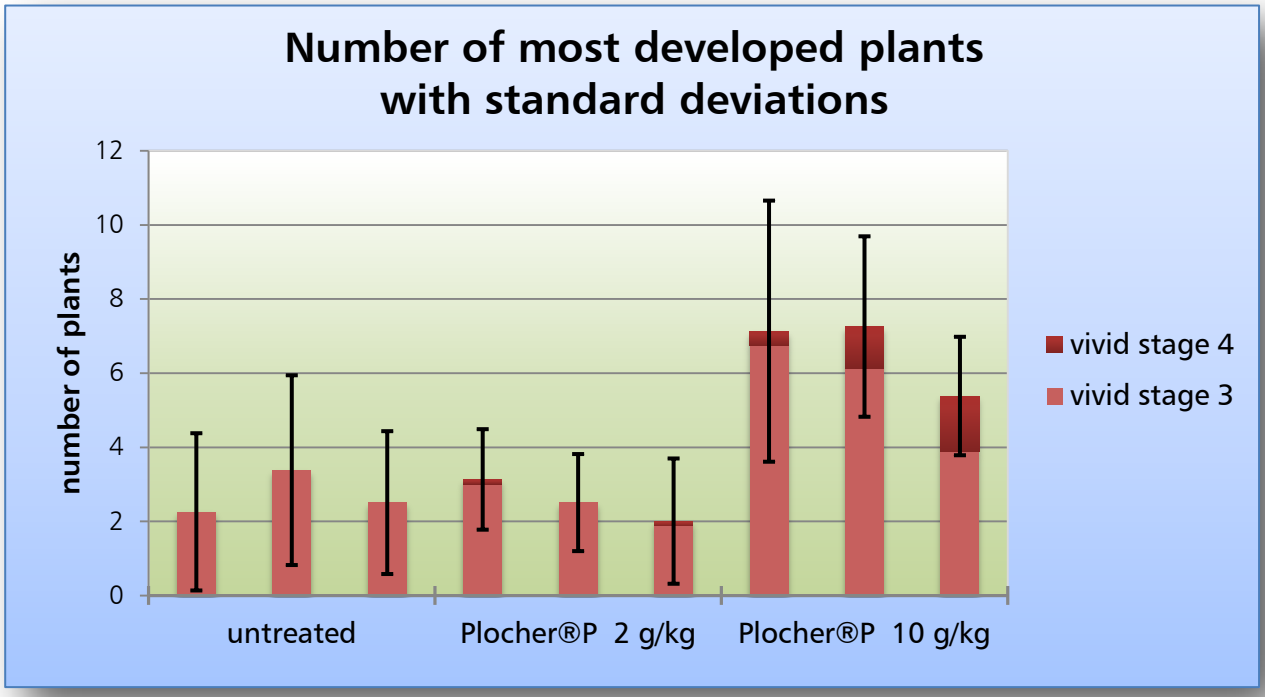
The statistical analysis of the number of dead plants in the different treatment categories is illustrated in diagram 2. All 24 samples (8 in each repetition area) have been collectively evaluated. The number of dead plants under Plocher® P seed treatment at a rate of 10 g/kg decreases by a highly significant 28.5% with $p<0.006$ (T-test)[1]. Using Plocher® P seed treatment at 2 g/kg however shows a tendency towards less dead plants but does not lead to significant results ($p<0.08$).

[1] T-test applied after verification of the normality of value distribution with the Chi-square test for discrete values.



Diag. 2: Number of dead plants under Plocher® P seed treatment in different intensities with 95% confidential intervals for the mean value. In the most intensive treatment group the number of dead plants decreased by 28.5% compared to the untreated. According to the T-test, the difference is statistically significant ($p<0.006$, $n = 24$).

It can thus be concluded that the Plocher® P seed treatment reduces significantly dead plants in the first leave stage but only if used at a rate of 10 g/kg. According to diagram 3 it is also given that only under the 10 g/kg seed treatment the number of plants with partly or fully developed first leaf is increased. In the other two categories (untreated and 2 g/kg) hardly any plants with fully developed first leave may be found at the time of the evaluation. This latter correlation is also highly significant.



Diag. 3: Mean value of the number of plants in the most developed categories stages 3+4 for all 3 repetitions with standard deviations. In the 3 repetitions under Plocher® P seed treatment at a rate of 10 g/kg figure significantly more plants with a partly or fully developed first leaf when compared to the untreated (T-test[2], $p<0.005$, $n = 3$).

The significant difference produced by the Plocher® P seed treatment consists of less dead and more further developed plants in the first leaf stage. This shows that the treated seeds are more vital and have more reserves for growth in the field as well as a higher potential of resistance against illnesses.

[2] T-test applied after verification of the normality of value distribution with the Chi-square test for discrete values.

Appendix

Measured Values

Treatment code	Treatment	Repetition	Row Nr.	Total stage 1	Dead stage 1	Total stage 2	Dead stage 2	Total stage 3	Dead stage 3	Total stage 4	Dead stage 4
T0	Control	1	1	22	4	58	2	0	0	0	0
T0	Control	1	1	12	6	59	15	6	0	0	0
T0	Control	1	1	19	12	53	4	3	0	0	0
T0	Control	1	1	23	15	50	0	4	0	0	0
T0	Control	1	2	43	23	112	9	3	0	0	0
T0	Control	1	2	26	16	45	6	1	0	0	0
T0	Control	1	2	29	17	24	2	2	1	0	0
T0	Control	1	2	21	16	46	8	0	0	0	0
T0	Control	2	1	20	12	53	9	7	0	0	0
T0	Control	2	1	19	11	65	4	7	0	0	0
T0	Control	2	1	21	12	60	11	3	0	0	0
T0	Control	2	1	28	10	55	7	4	0	0	0
T0	Control	2	2	26	12	54	7	0	0	0	0
T0	Control	2	2	21	4	47	5	1	0	0	0
T0	Control	2	2	24	9	49	4	2	0	0	0
T0	Control	2	2	23	11	56	6	3	0	0	0
T0	Control	3	1	9	7	72	7	3	0	0	0
T0	Control	3	1	9	3	60	8	2	0	0	0
T0	Control	3	1	9	3	56	13	0	0	0	0
T0	Control	3	1	9	5	67	5	5	0	0	0
T0	Control	3	2	7	4	80	11	5	0	0	0
T0	Control	3	2	9	2	60	7	2	0	0	0
T0	Control	3	2	11	5	57	11	3	0	0	0
T0	Control	3	2	10	5	60	9	0	0	0	0
T1	2 g/kg	1	1	17	7	59	4	6	0	0	0
T1	2 g/kg	1	1	16	5	57	2	2	0	0	0
T1	2 g/kg	1	1	18	7	54	0	3	0	0	0
T1	2 g/kg	1	1	14	6	63	6	2	0	0	0
T1	2 g/kg	1	2	18	9	73	7	4	0	0	0
T1	2 g/kg	1	2	18	14	54	15	2	0	0	0
T1	2 g/kg	1	2	15	8	61	5	3	0	0	0
T1	2 g/kg	1	2	9	8	75	7	2	0	1	0
T1	2 g/kg	2	1	17	9	53	5	2	0	0	0
T1	2 g/kg	2	1	9	8	59	5	2	0	0	0

Treatment code	Treatment	Repetition	Row Nr.	Total stage 1	Dead stage 1	Total stage 2	Dead stage 2	Total stage 3	Dead stage 3	Total stage 4	Dead stage 4
T1	2 g/kg	2	1	10	6	49	8	3	0	0	0
T1	2 g/kg	2	1	12	9	61	5	2	0	0	0
T1	2 g/kg	2	2	11	3	74	3	4	0	0	0
T1	2 g/kg	2	2	12	3	75	15	0	0	0	0
T1	2 g/kg	2	2	10	4	64	13	3	0	0	0
T1	2 g/kg	2	2	9	7	70	8	4	0	0	0
T1	2 g/kg	3	1	8	3	59	3	0	0	0	0
T1	2 g/kg	3	1	6	1	68	12	2	0	0	0
T1	2 g/kg	3	1	10	4	60	5	2	0	0	0
T1	2 g/kg	3	1	5	3	69	7	2	0	1	0
T1	2 g/kg	3	2	5	2	81	8	5	0	0	0
T1	2 g/kg	3	2	10	9	67	12	3	0	0	0
T1	2 g/kg	3	2	6	3	71	14	0	0	0	0
T1	2 g/kg	3	2	10	8	63	10	1	0	0	0
T2	10 g/kg	1	1	26	12	44	4	9	0	0	0
T2	10 g/kg	1	1	26	5	45	2	5	0	0	0
T2	10 g/kg	1	1	32	18	42	1	1	0	0	0
T2	10 g/kg	1	1	27	9	52	2	5	0	0	0
T2	10 g/kg	1	2	9	0	60	3	8	0	1	0
T2	10 g/kg	1	2	4	1	54	0	5	0	1	0
T2	10 g/kg	1	2	11	5	56	8	12	0	0	0
T2	10 g/kg	1	2	9	4	63	1	9	0	1	0
T2	10 g/kg	2	1	9	5	72	11	7	0	1	0
T2	10 g/kg	2	1	3	3	54	9	7	0	3	0
T2	10 g/kg	2	1	4	4	73	16	6	1	0	0
T2	10 g/kg	2	1	3	1	78	14	9	0	1	0
T2	10 g/kg	2	2	4	2	76	8	4	0	2	0
T2	10 g/kg	2	2	6	4	73	6	7	0	1	0
T2	10 g/kg	2	2	8	5	64	13	8	0	0	0
T2	10 g/kg	2	2	13	8	64	8	2	0	1	0
T2	10 g/kg	3	1	11	6	52	10	6	0	0	0
T2	10 g/kg	3	1	9	4	59	11	4	1	2	0
T2	10 g/kg	3	1	8	2	60	8	4	0	4	0
T2	10 g/kg	3	1	3	2	68	3	3	0	2	0
T2	10 g/kg	3	2	5	3	66	7	7	1	1	0
T2	10 g/kg	3	2	12	6	51	9	1	0	2	0
T2	10 g/kg	3	2	3	2	70	6	4	0	0	0
T2	10 g/kg	3	2	11	6	49	4	4	0	1	0