

EFFECT OF AUSTRALIAN TEA TREE (*MELALEUCA ALTERNIFOLIA* CH.) OIL ON THE ORGANIC CARROT (*DAUCUS CAROTA* L.) SEED QUALITY

Hołubowicz R., Bralewski T.W., Lucyna Kozera-Stochaj

Agricultural University of Poznań
Department of Horticultural Seed Science and Technology
Poland, twbseed@au.poznan.pl

Key words: Australian tea tree, *Melaleuca alternifolia*, organic seeds, carrot, *Daucus carota*, seed quality

Abstract. The experiments were carried out to find out the effect of Australian tea tree (*Melaleuca alternifolia* Ch.) oil on the quality of organic carrot (*Daucus carota* L.) 'Perfekcja TOR' seeds. The cultivar is late, high yielding, good for storage and useful for processing. Its flesh is juicy and very tasty. The organic seeds for experiments were taken from a Polish seed company "Torseed S.A.". The seeds were soaked for 15 minutes in 0,25 – 0,75% water and alcohol solutions of 2% and 5% extract of the oil. In other treatment, only alcohol in the same concentrations and only chemical dressing compound – Dithane 45 80 WP - were used. The check seeds were untreated. It was found out that the Australian tea tree oil could be used to improve quality of organic carrot seeds. When soaked in 0,75% alcohol solution of 5% oil and then rinsed with water for 30 seconds, the seed germination increased from 56% to 72%. However, at the same time, a big variability in the received results was found, so the results were only partly proved statistically. The improvement of the germination came mostly from lowering the number of dead seeds in the sample. The tested oil did not affect the seed vigour. The used chemical Dithane increased the number of contaminated and healthy ungerminated germs, at the same time, however, decreased the number of dead seeds.

INTRODUCTION

Organic food has been in the interest of at least 40% of the society [ADAMICKI, 2001]. They see it as a source of healthy and trendy diet. For this reason, breeders, seed growers and traders [HOŁUBOWICZ 1999, BRALEWSKI AND HOŁUBOWICZ 2004]. Garden carrot is in Poland a leading vegetable crop in commercial production standing for at least 20% of all grown vegetables [SMOLENSKI 2005]. In organic production, however, the production limits come from lack of licensed growers, suitable cultivars and limits in controlling diseases and pests [BRALEWSKI AND HOŁUBOWICZ, 2004]. Especially difficult is to biologically dress seeds [BRALEWSKI AND WILK 2004]. The Australian tea tree (*Melaleuca alternifolia* Ch.) oil has been successfully used to control vegetable and herbs diseases [ROUVENI *et al.* 2006].

The main purpose of these experiments was to find out if the oil extracted from the Australian tea tree could be used to improve seed quality of organic carrot (*Daucus carota* L.) seeds.

MATERIALS AND METHODS

The organic seeds of the garden carrot 'Perfekcja TOR' were received from a Polish seed company "Torseed S.A.". The cultivar has been used in organic production because it is late, high yielding, good for storage and useful for processing. Its flash is juicy and very tasty.

The seeds were produced as organic seeds. The extract of oil of the Australian tea tree (*Melaleuca alternifolia* Ch.) was bought from a company "POLLENA" located in Warsaw, Poland.

The seeds were soaked for 15 minutes in 0.25 – 0.75% water and alcohol solutions of 2% and 5% oil extracts. Then the seeds were or were not rinsed with water for 30 seconds. In other treatment, the seeds were soaked only in the alcohol (the some concentrations), only in water (the same concentrations) or treated with the chemical dressing compound – Dithane 45 80 WP – in the dose of 3 g / kg of seeds. The check seeds were untreated.

- C – Check,
- D – chemically dressed with Dithane 45 80 WP,
- W – distilled water, 0,25 W -0,25% water solution of the oil,
- 0,25 WR – 0,25% water solution of the oil, then rinsed with distilled water,
- 0,5 W – 0,5% water solution of the oil,
- 0,5 WR – 0,5% water solution of the oil, then rinsed with distilled water,
- 0,75 W – 0,75% water solution of the oil,
- 0,75 WR – 0,75% water solution of the oil, then rinsed with distilled water,
- A2 – 2% alcohol solution, A2R – 2% alcohol solution, then rinsed with water,
- A5 – 5% alcohol solution,
- A5R – 5% alcohol solution, then rinsed with water,
- 0,25 A2 - 0,25% alcohol solution of 2% oil extract,
- 0,25 A2R – 0,25% alcohol solution of 2% oil extract, then rinsed with water,
- 0,5 A2 – 0,5% alcohol solution of 2% oil extract,
- 0,5A2R – 0,5% alcohol solution of 2% oil extract, then rinsed with water,
- 0,75 A2 – 0,75% alcohol solution of 2% oil extract,
- 0,75 A2R – 0,75% alcohol solution of 2% oil extract, then rinsed with water,
- 0,25 A5 – 0,25% alcohol solution of 5% oil extract,
- 0,25 A5R – 0,25% solution of 5% oil extract, then rinsed with water,
- 0,5 A5 – 0,5% alcohol solution of 5% oil extract,
- 0,5 A5R – 0,5% solution of 5% oil extract, then rinsed with water,
- 0,75 A5 – 0,75% alcohol solution of 5% oil extract,
- 0,75 A5R – 0,75% solution of 5% oil extract, then rinsed with water.

For all seeds their germination was evaluated based on the routine ISTA rules. The 6 samples of 50 seeds each were placed on blotting paper in the Petri dishes. Their energy and capacity of germination were evaluated 7 and 14 days after keeping them in the darkness at 20°C, respectively. The numbers of normal, abnormal, contaminated with diseases, dead and healthy ungerminated seeds were counted.

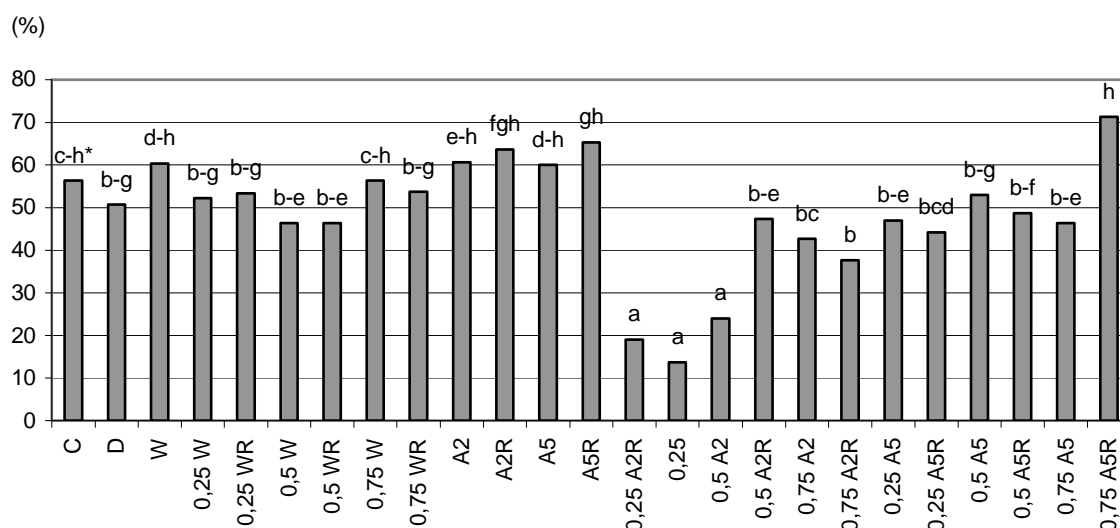
The vigour test was run on 300 seeds for each treatment. They were germinated in the darkness at 20°C. Every day, for 2 weeks, the number of germinating seeds was counted. For germinated seeds were considered those, which germs were at least 1 mm long. Then, using the programme SeedCalculator 2.1 the T_1 , T_{25} , T_{75} , U_{75-25} and mean germination times (MGT) values were calculated. T_1 – time needed for germinating 1% of all the seeds, T_{25} – 25% of all the seeds, T_{75} – 75% of all the seeds and U_{75-25} – time needed for germination from 25% to 75% of all the seeds.

The received data was analyzed stastically. The variance was calculated and significant differences were calculated based on the Duncan's test at $\alpha = 0.05$.

RESULTS AND DISCUSSION

The carried out experiments proved that soaking organic carrot seeds in the solution of the Australian tea tree oil only partly affected their germination. Out of the tested treatments, soaking the seeds for 15 minutes in the 0,75% alcohol solution of 5% extract of the oil increased their germination from 56% to 72% (Fig. 1). However, at the same time, the received results varied much so the received difference was only partly proved statistically. The received improvement of the germination did not come from lowering the amount of abnormal, contaminated germs or healthy ungerminated seeds (data not shown), but came from the lowering of dead seeds (Fig. 2). Seeds in the best treatment had only about 6 times less dead seeds than the check seeds.

The used oil did not improve the seeds and seedlings vigour measured by the speed of germination. On the opposite, there was a delay in germination in some cases (Fig. 3). The same was observed for the MGT, in some cases, the treatment of the seeds with oil slowed down their germination by increasing their MGT (Fig. 4).

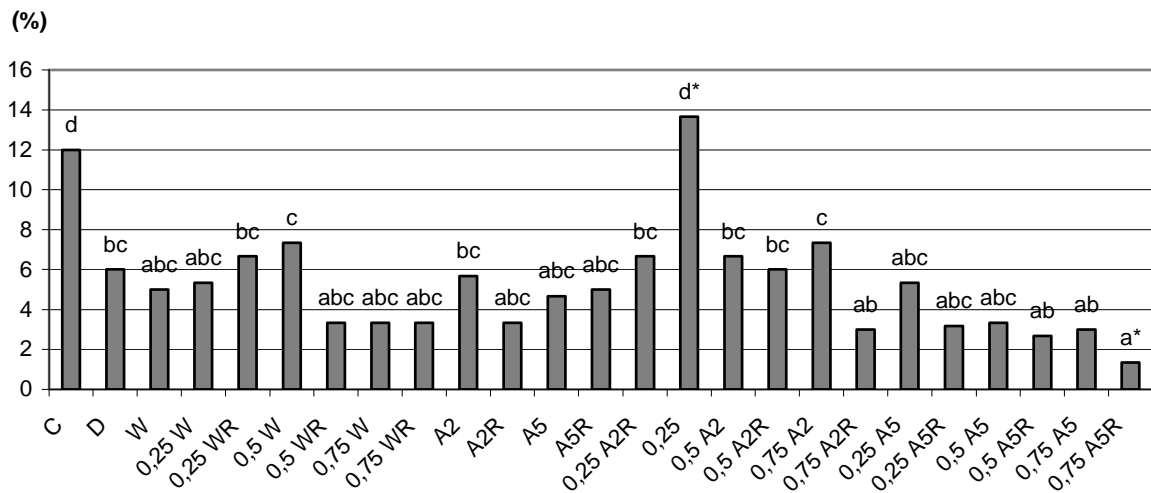


Explanations:

* means followed by the same letter are not significantly different according to the Duncan's test at $\alpha = 0,05$

** explanation – see the “Material and method”

Fig. 1 Effect of treating the organic carrot ‘Perfekcja TOR’ seeds with oil from the Australian tea tree on their germination capacity (%)

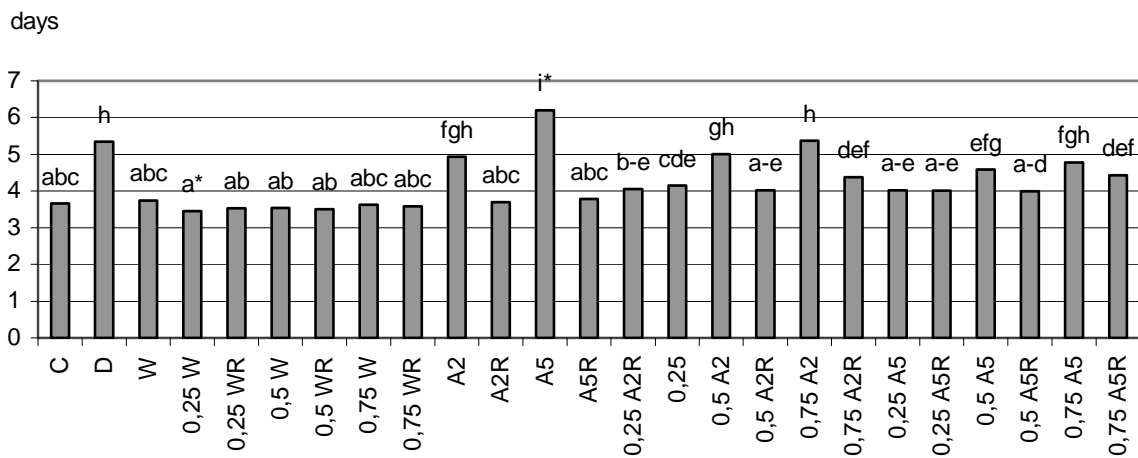


Explanations:

* means followed by the same letter are not significantly different according to the Duncan's test at $\alpha = 0,05$

** explanation – see the “Material and method”

Fig. 2. Effect of treating the organic carrot 'Perfekcja TOR' seeds with oil from the Australian tea tree on dead seeds

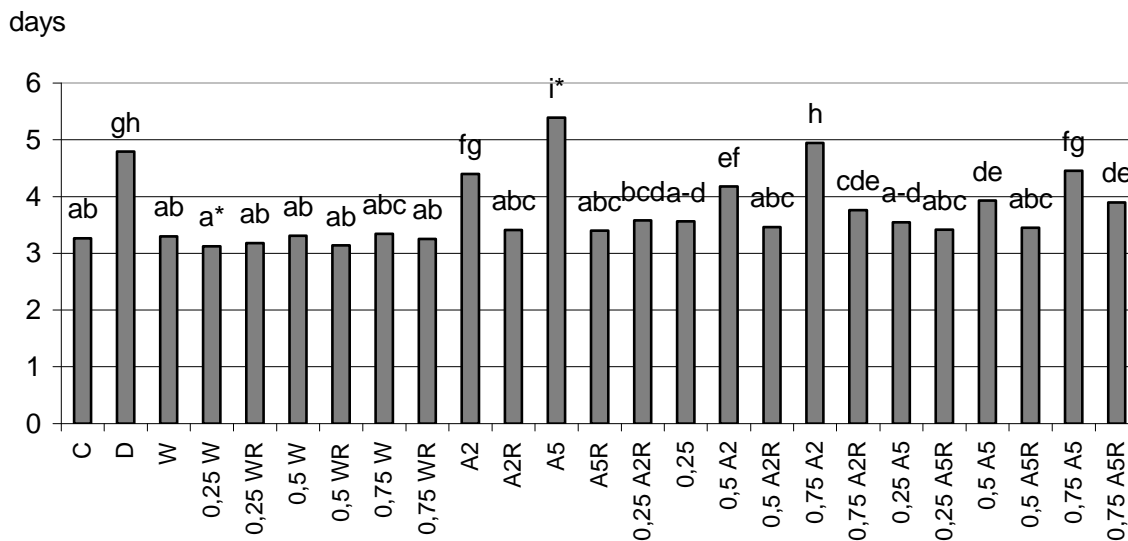


Explanations:

* means followed by the same letter are not significantly different according to the Duncan's test at $\alpha = 0,05$

** explanation – see the “Material and method”

Fig. 3. Effect of treating the organic carrot 'Perfekcja TOR' seeds with oil from the Australian tea tree on their vigour measured by the speed of germination expressed by T_{75}



Explanations:

* means followed by the same letter are not significantly different according to the Duncan's test at $\alpha = 0,05$

** explanation – see the “Material and method”

Fig. 4. Effect of treating the organic carrot ‘Perfekcja TOR’ seeds with oil from the Australian tea tree - on their vigour expressed by the mean germination time

The carried out experiments partly proved that the Australian tea tree oil could be used to improve germination of the organic carrot seeds. This result, although only partly proved statistically, has a certain practical value. No reports on this matter has been found in the available literature.

The recorded improvement was a result of the number of dead seeds in the tested samples. This observation is in agreement of finding of KLIMACH *et al.* (1996) and ROUVENI *et al.* (2006) who reported the ethereal oil to control diseases in vegetable and herb crops. Also KĘDZIA *et al.* (2004) reported that such as (*Trichophyton mentagrophytes*, *T. rubrum*, *Microsporum cansis*, *M. gypseum* as well as *Aspergillus niger* and *A. flavus*). The method thus has some future to be used to biologically conditioned organic seeds.

The usefulness of the oil to improve seed vigour of the sample was not proved. It could come from specific response to a given crop or even cultivar. Further research in this area is needed.

CONCLUSION

The Australian tea tree oil could be used to improve germination of the organic carrot seeds.

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