

The effect of dimethyl sulphoxide (DMSO) on carrot plants grown in the field

(with 1 figure)

R San Miguel-Chávez¹, P Aristeo-Cortés¹, A Larqué-Saavedra*

Abstract. Dymethyl sulphoxide (DMSO) was sprayed on carrot plants grown under field conditions on the leaves to determine its effects on fresh biomass accumulation. A 3.7×10^{-3} M solution was sprayed on two occasions during plant development. The results showed that root fresh weight was 28%, root length 10% and shoot fresh weight 41% higher in DMSO treated plants than in control plants.

Keys words: Dimethyl sulphoxide, DMSO, carrot, Plant growth

Dimethyl sulphoxide (DMSO) is widely studied in medicine for its cryoprotective action and its effectiveness as an analgesic and anti-inflammatory agent (11). In agriculture, it is used for its properties as a solvent for the application of chemicals. There are reports where DMSO has been used as solvent for oxytetracycline which decreased bacterial spots in peach fruits (1). A mixture of iron, water and DMSO sprayed citrus and grapefruit leaves that showed visible signs of iron deficiency, increased greening of the leaves (4). Fungicides, such as benomyl, thiabendazole, thiomersal, are normally dissolved in DMSO and applied to plants (10). Moreover, DMSO has been used as a mineral nutrient carrier in leaves (3, 8). These contributions, however, did not look for the effect of DMSO by itself.

There are few studies on the effect of DMSO alone. Rute & Butenko (7) reported that it increased the proportion of female flowers in cucumber

* Correspondence: Centro de Investigación Científica de Yucatán, A.C. Calle 43 No. 130, Chuburná de Hidalgo, Mérida, Yucatán, C.P. 97200, México Tel. (52)999-981-3919; fax (52)999-981-3900. E-mail: larque@cicy.mx

¹ Colegio de Postgraduados. Carretera México-Texcoco Km. 36.5, Montecillo, México. C.P. 56230, México

Authors acknowledge. *The financial by CONACYT project n° 33647-B. To Silvia Vergara Yoisura, for help with the preparation of the manuscript is appreciated

Received 11.VI.2002; accepted 12.VII.2002

and Lang (2) showed that it stimulated flowering and fructification in common beans. It increased cell division in protoplast cultures and growth of callus of *Hibiscus syriacus* L. and callus induction in rice (5, 9). In 1978 Prik'ko & Kushinski (6) reported that DMSO increases the yield of beet plants when applied at high concentrations (2.5-10%) on leaves. Since then no other reports have been found on other plant species.

The objective of the present study was to determine whether DMSO sprayed on leaves affects root growth of carrots.

MATERIALS & METHODS

The experiment was carried out with carrot (*Daucus carota* L. cv. Nantes) plants grown under field conditions, in the central plateau of México (19.5°N, 98.8° W, 2249 m above sea level). Fertilizers were applied to the soil as recommended for the region and irrigation applied every 10-15 days. To reduce weeds Sencor-480® (1 L ha⁻¹) was sprayed and against insects, Diazinon® (1 L ha⁻¹) was used.

Plots (three 5 m long beds) were laid out in a randomized complete-block design three replicates and two treatments were established: distilled water control, and DMSO (3.7X10⁻³ M) that had been previously proved to be effective. In the DMSO solution ten drops of Tween-20 as surfactant were added and pH adjusted to 5.5 with KOH potassium hydroxide (1.0 N). The solutions were sprayed on the shoots of 47 day-old plants early in the morning, when they had three well-developed leaves and the root began to differentiate. A second application was carried out when the plants showed four leaves (about 73 days-old).

Root length, and fresh weight, and shoot fresh weight were determined when plants were 52, 68, 86, 94, 110 and 128 days old by harvesting thirty plants from the inner rows of the central bed. Data were submitted to analysis of variance (ANOVA), and means were compared by Tukey's test at 5% level of significance.

RESULTS & DISCUSSION

Treatment with DMSO, increased growth, fresh weight and root length. Shoot growth also increased (Fig. 1). The effect of DMSO on root fresh weight differed significantly when the plants were 110 or 128 days old, when an increase of 28% over the control was found. At the same ages, root length was not affected as intensely as fresh weight, where a small but significant difference of around 10% was found.

DMSO's effect on shoot fresh weight appeared much earlier than on roots. As early as day 86 (13 days after the second DMSO application) shoot fresh weight was significantly higher (44% more) in DMSO

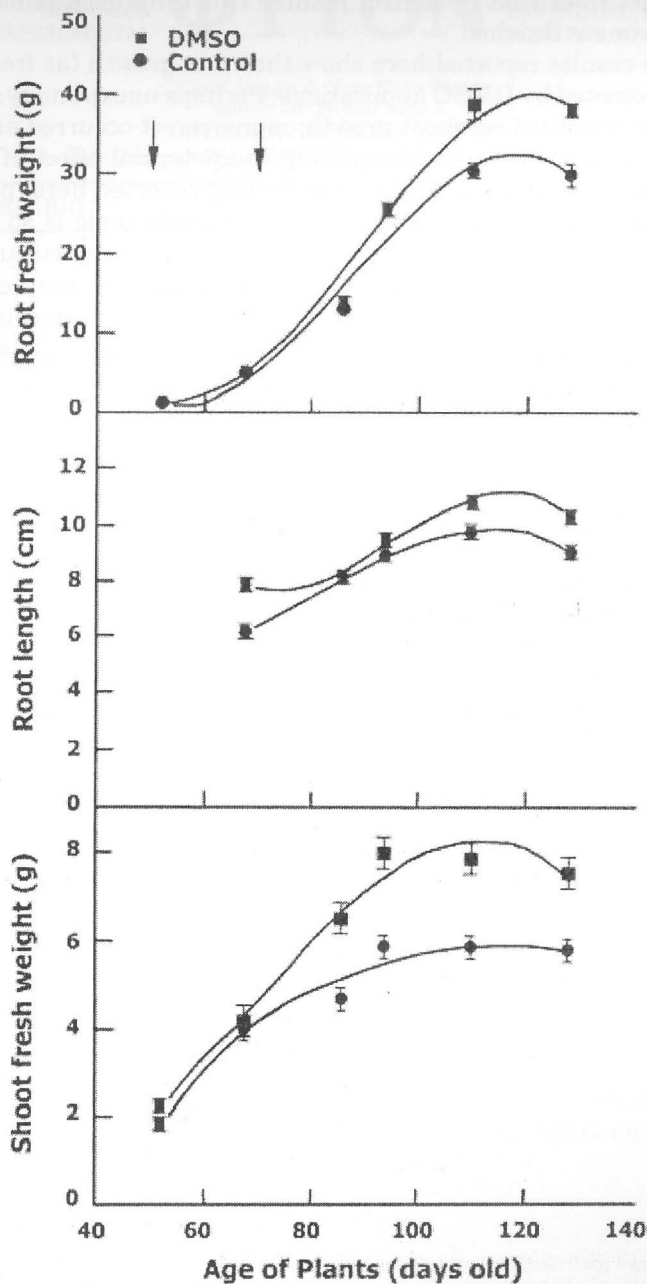


Fig. 1.— Effect of DMSO (3.7×10^{-3} M) on the growth of carrot plants cv. Nantes. The arrows indicate the times of DMSO applications. Each point is the mean of 30 plants readings \pm s.e.

treatments than that of control plants. This difference remained until the experiment finished.

The results reported here show that root growth (as fresh weight) can be promoted by DMSO applications. Perhaps unexpectedly, a stronger effect was observed on shoot growth; moreover, it occurred earlier than on roots. In this early work exploring the potential effect of DMSO on growth. It is not easy to explain the finding reported here, particularly when the literature published for plants on this topic is so scarce. Li-Rong and coworkers (5) and Song & Park (9) in tissue culture studies, have shown that DMSO promotes cell division; this may explain the growth effect reported here. Further work is needed to confirm these DMSO effects in other species and to suggest a mode of action of this chemical in plants.

LITERATURE CITED

1. Keil HL, *Ann NY Acad Sci* 141 (1967)131
2. Lang OFP, *Tesis de Maestría en Ciencias, Col de Postgraduados. Chapingo. México.* (1986)
3. Leake CD, *Ann NY Acad Sci* 141 (1967)1
4. Leonard CD, *Ann NY Acad Sci* 141 (1967)148
5. Li-Rong B, MP Pandey, GK Garg, SK Pandey, DK Dwivedi, *Euphytica* 104 (1998) 159
6. Prik'ko NV, MF Kushinski, *Khimiya u Sel'skom khozyaisture* 16 (1978) 68
7. Rute TN, RG Butenko, *Fiziologiya Rastenii* 28 (1981) 1190
8. Smale BC, NJ Lasate, BT Hunter, *Ann NY Acad Sci* 243 (1975) 228
9. Song K, HG Park, *J Korean Socty Hortic-Sci* 40:1 (1999) 93
10. Voutsinas G, FE Zarani, A Kappas, *Cell-Biol Intl* 21 (1997) 411
11. Walker M, *DMSO, Nature's healer. Avery Publishing Group Inc. New York.* (1993) 1