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Pre-Sowing Bioresonanse Treatment of *Simmondsia chinensis* Seeds: Effects on the Growth

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ABSTRACT

Magnetic water treatment (MWT) techniques have shown promising potentials in different areas especially agriculture. Safety, compatibility and simplicity, environmentally friendliness, low operating cost and not proven harmful effects are the main advantages of electromagnetic field (EMF) over conventional methods for water treatment. The effects of pre-sowing bioresonanse treatments on the growth, were studied under greenhouse conditions. Jojoba seeds were exposed either to three different frequencies: Stimulations of shoot grow, root general grow and plants growth acceleration. Non-treated seeds were used as controls. Nursery stage, the treatments led to a significant increase in root length, fresh and dry root weight, stem length, fresh and dry stem weight. Pre-sowing bioresonanse treatments would appear to enhance the growth of Jojoba seeds.

INTRODUCTION:

Jojoba can generally be cultivated in well-drained, coarse, desert soils, where the land is composed of sandy alluviums and mixtures of gravels and clays derived from such igneous materials as granitics and volcanicm. Jojoba is living in the bright desert sun and tolerates the extreme daily fluctuations of temperature which commonly range through -1° C during the morning to daily extremes of 46°C. In our work, an increase of temperature stimulated seed germination, shortened the time needed for the emergence of radical (Hassanein *et al*.2012).Consequently, jojoba has recently established as a crop in many arid and semi-arid regions of the world (Brown *et al*., 1996), especially around the Mediterranean basin (Hassanein *et al*.2012). This evergreen desert shrub is native to arid hills of Arizona, southern California and adjacent parts of Mexico. The leaves and young twigs are much-browsed by sheep, cattle, and goats. The seeds are edible for man and are used extensively by American Indians for food Jojoba yields a crop of seeds that contain mean 40-50 % oil that is unique (Bazaid *et al*. 2013). Jojoba was used as a medicine for cancer, stomach ache, kidney disorders, easing childbirth and intending wounds (Weiss, 1983). New industrial plant species can be grown successfully in saline soil. It is worth to mention that the total area of arable land is gradually decreasing due to the progressive salinization of the earth (Botti *et al*., 1998). Electromagnetic waves as tools in the field of agriculture have been used in many applications such greater growth and productivity or at the cellular level, a wide range of physiological effects can be observed. Magnetic fields have been reported to exert a positive effect on the germination of seeds (Alexander and Doijode, 1995), on plant growth and development (De Souza *et al*., 1999; Martínez *et al*., 2000), on tree growth (Ruzic *et al*., 1998), on the ripening of fruits and vegetables (Boe and Salunke, 1963) and on crop yield (Pietruszewski, 1993); some review papers also mention a number of controversial, early results (Findlay and Hope, 1976).The similar positive effect of magnetic treatment was recorded by (Hogan,2016), who found that the electrostatic field treatment of the potato seed has a positive impact on the evolution of the plant growing and the yield (especially the seed yield) by increasing the number and the quantity. Of the obtained seed tubers(Marks and Szecówka,2010), found that exposer of seed-potatoes with variable magnetic field caused a significant positive effect on the mass of aboveground parts of potato plants. The purpose of this study was to investigate the effects of pre-sowing by very low frequencies on the growth and germination of *Simmondsia chinensis*. For this purpose, the seed of the studied plant was

indirectly (using water) under the influence of the frequency of the names stimulations of shoot grow, root general grow and Plants growth acceleration.

MATERIAL AND METHOD:

All seeds were disinfected, and in each petri dish, 15 seeds were placed. All Petri dishes were identified from the beginning, and the seeds were watered entirely for two days. Then, in a petri dish, they were placed in a filter paper dish and filled them with 5 cc of water at a frequency each day. During the experiment, Petri dishes were completely closed, but the surface was clear to control germination and growth. During the test, the ambient temperature maintained at 25°C.

Plant material and germination experiment: Seeds of Jojoba were collected from Iran shahr, Iran. The seeds were divided to four groups and each group contains 15 seeds in 3 replications. Seeds in the first, second and third groups were passed through the different bioresonase frequency (T1,T2,T3) and then the seeds were placed in petri dishes (9 cm) containing Whatman No.1 filter paper soaked with normal distilled water (low-frequency water). Name of information are: Stimulations of shoot grow, Root general grow and Plants growth acceleration. Seeds in the final group were soaked in distilled water as a control (C) Seeds in four groups were left to germinate at room temperature (25±2°C) for 14 days to measure growth.

Bioresonanse exposure conditions

The pre-sowing low frequency treatments were administered using a low frequency device made by Health technology research institute, Amirkabir university of technology, Tehran, Iran. In this test, 200 ml bottles of mineral water produced in a commercial company were under the selected frequencies at 300 seconds. This mineral water was used during the experiment during one month.

Statistical analysis:

Data were analyzed by SPSS computer software program using ANOVA with the Least Significant Difference (LSD) at the 0.05 probability level.

RESULT AND DISCUSSION

Electromagnetic fields (EMFs) have shown great potentials in medical, industrial and environmental applications. Using magnetic water (MW) for irrigation of squash increases the weight of squash. Bio-magnetic water is more solvent and has a lower surface tension; therefore, nutrients are absorbed greater in the water (Eitken, and Turan,2004). Data observed in Tables (1) showed that the irrigation of Jojoba plant with bioresonanse water increased significantly the growth parameters as compared to control which used distilled water. The bioresonanse had a significant effect ($p < 0.05$) on root length, which increased by 25% with the T1 treatment, by 20% with T2 and T3 treatment 3% compared to controls (Table 1). Stem length was also significantly affected by the bioresonanse ($p < 0.05$); T1 led to 11.4% increase while T2 led to 13.9% and T3 led to 33% increase over that of the controls (Table 1).

Table No. 1: Effect of pre-sowing bioresonanse treatments on growth of Jojoba in the nursery stage

Growth parameters	Stimulations of shoot grow (T1)	Root general grow (T2)	Plants growth acceleration (T3)	Control	C.V (%)
Root length (cm)	6.42 ± 0.12^{a}	5.30 ± 0.16^{a}	4.54 ± 0.19^{b}	4.38 ± 0.14^{b}	10.12
Root fresh weight (g)	0.510 ± 0.018^{a}	0.422 ± 0.015^{a}	0.350 ± 0.014^{b}	0.312 ± 0.017^{b}	15.18
Root dry weight (g)	0.0761 ± 0.0041^{a}	0.0694 ± 0.0048^{a}	0.0497 ± 0.0028^{b}	0.0372 ± 0.0021^{b}	12.16
Stem length (cm)	3.51 ± 0.24^{a}	3.75 ± 0.31^{a}	3.12 ± 0.21^{b}	2.34 ± 0.20^{b}	14.17
Stem fresh weight (g)	0.252 ± 0.032^{a}	0.240 ± 0.038^{a}	0.22 ± 0.011^{b}	0.15 ± 0.010^{b}	13.16
Stem dry weight (g)	0.0435 ± 0.0032^{a}	0.0342 ± 0.0024^{a}	0.0353 ± 0.0018^{b}	0.0241 ± 0.0015^{b}	15.11

The same letter within a row indicates the lack of a significant difference ($p < 0.05$) according to the Newman-Keuls test. CV: coefficient of variation.

The treatments also led to a significantly ($p < 0.05$) greater stem fresh and dry weights: T1 increased stem fresh weight by 5.6 %while T2 increased this by 6.4%; similarly, stem dry weight increased by 35.4% in T1 plants and by 29.4% in T2 plants (Table 3). Plants growth acceleration (T3) significantly affected on stem fresh and stem dry weight ($p < 0.05$) led to an increase 34.3 % and 17.35 respectively. Similarly, these treatments had a remarkable effect ($p < 0.05$) on root fresh and dry weight results: T1 treatment led to an increase in fresh weight of

26.4 % while T2 led to a 28.8% increase and T3 5% increase; root dry weight increased by 33.5% with T1 and by 31.5% with T2and 6.10% T3 (Table 1).

Exposing the Jojoba seeds to the bioresonanse led to a considerable improvement in the growth. The results show the bioresonanse treatments led to a notable increase in plant root and stem length as well as fresh and dry weight during the nursery period. The improvement induced by the magnetic treatment was consistent with the results of other studies (Amaya et al., 1999) which also report enhanced root and stem growth and fresh weight in other plants. Aladjadjıyan (2002) showed that exposure of seeds of Zea mays has a favorable effect on the development of shoots in the early stages. Nimmi and Madhu (2009) Significant increase in the length of germinated seedlings and in the germination velocity of *Capsicum frutescens* seeds. These results are in agreement with those obtained by other researchers; Hilal and Hilal they reported that magnetized water has more tripled seedling emergence of wheat than tap water. Renia, *et al*. found significance increase in the rate of water absorption accompanied with an increase in total mass of lettuce with the increase of magnetic force. Moreover, Samir,2008 found that chick pea plants irrigated with magnetized water were taller than plants irrigated with tap water Significant increases in pigment fractions were recorded in chickpea plants irrigated with magnetized water compared to control treatment. In agreement with our results, there are many reported that improved percent of germination rate in different plants when exposed to magnetic intensity because of improved of water uptake and biochemical changes of seed mixture and changes of enzymes involved in germination (Cakmak et al., 2010). They found acceleration of germination and early growth of wheat and bean seedlings grown under various magnetic field and osmotic conditions.

Marks and Szecówka, 2010, reported the stimulation of seed-potatoes with variable magnetic field was found to have a statistically significant positive effect on the germination, stem length and number and mass of stems and leaves of potato plants, also statistically significant effects, directly proportional to the magnetic induction and to the exposure doses, were shown for stimulating the germination, stem length and the number and mass of stems and leaves of potato plants.

The present findings have shown that irrigation with bioresonanse water could be employed as one of the most valuable modern technologies that can assist in saving irrigation water and growth plants. The usage of bioresonanse water in the agricultural production will enable intense and more quantities and qualitative production.

CONCLUSION

The current study has shown that using bioresonanse could be employed as one of the most valuable physical growth stimulation approaches that can assist in increasing the physical parameter of jojoba. Bioresonanse technologies are eco- friendly and non-polluting to the soil. In consequence, the usage of bioresonanse in agricultural production will enable intensely and increased production both in terms of quantity and quality. It can also be used for conserving irrigation water and increasing the efficiency of added fertilizers. In conclusion, magnetic technology is a promising physical growth stimulation approach. However, further field and laboratory experiments are needed to overcome the field challenges and to gain knowledge about the working mechanism of the bioresonanse treated water.

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