RESEARCH ON THE INFLUENCE OF HYDROGELS ZEBA SP AND TERRACOTTEM ON THE DEVELOPMENT OF SOME AROMATIC PLANT SPECIES

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Abstract: *Climate change in recent decades has increased the conditions of abiotic stress on plant growth, mainly by ariding large areas of land and reducing fresh water reserves.One of the solutions for increasing the efficiency of these lands and decreasing the irrigation rate by up to 50% - 70% is the incorporation in their structure of ecological and biodegradable hydrogels. Hydrogels are hightlyflexible, three –dimensional inflatable materials composed of polymers which have the property of absorbing and retaining a large amount of water, subsequently releasing the minto several absortion – release cycles. By their specific characteristics, they can lead to: Stimulating water retention capacity near seeds or roots, reducing the risk of waterloss by leaching or evaporation, increasing soil permeability, reducing soil degradation and inplicitly increasing quantitative and qualitative productivity. Due to these properties, hydrogels are finding a growing number of applications in both agriculture and horticulture. Being veryuseful in contioning and fertilizing soils, the first may have a stimulating effect : fast and uniform growth of fruit, physiological processes and development including aromatic and medicinal plants. On the basic of these observations, the influence of some hydrogels of Zeba SP and Terracotemtype oh the state of vegetation of aromatic and medicinal plants of the genus : Artemisia absinthium L., Artemisia lancea Vaniotand Artemisia lavandulaefolia DC wastested. The results of these research have shown that a better inflence and efficiencz of about 14%- 18% on the chosen plant sistreatedwithTerracotemcomparedtothat of Zeba SP.*

Key words:*Hydrogel, ZebaSP ,Teracottem, hydrophilic polymer, water retention.*

INTRODUCTION

The drought and related phenomena, such as aridization and desertification, represent, after pollution, the second major problem faced by mankind in the last half century. However, agriculture and horticulture are based on the existence of a sustainable and renewable resource base such as water and soil. For this purpose, new specialists develop new methods of irrigated land protection and the most efficient use of water resources. The relationship between plant genetics, water consumption, practices used and local environmental conditions is the quantitative and qualitative basis of production.

Thus, the use of hydro-absorbent hydrogel-like materials with three-dimensional structures, which have a high swelling capacity, has grown to a worldwide level in order to: stimulate water retention capacity near plants for many years, reduce the amount of water used, fertilization treatments applied by reducing leachate fertilizer losses, improving soil structure by reducing erosion or improving the physical properties of compact soils through good aeration, plant wastage delays, increased productivity on unstructured soil, and last but not least in order to protect the environment against drought and underground pollution. (BAKER J.P., HONG L.H.,ET AL., 1994, EL-HAG ALI A., SHAWKY H.A, 2 ET AL., 2003).

Applications of hydrogels are closely related to soil type, geographical area, and plant species.

It is worth noting that hydrogels based on biopolymers have the advantage of biodegradability, biocompatibility and low toxicity (GONZALES-SAIZ J.M., PIZARRO C., 2001). Thus, this paper aims to test two categories of polyacrylamide hydrogels such as Zeba SP and Terracottem to track the influence and their effectiveness on the state of vegetation in aromatic plants such as Artemisia *absinthium*L., Artemisia *lancea L.* and Artemisia *lavandulaefolia* L.

TerraCottem Complement (Figure1) has been specially formulated for applications in horticulture. This replenishes the soil components that have been consumed by the plants during the growing season. Due to its application the nutrient and water holding capacity of soils and growing media is kept in optimal conditions. The polymer functions in absorption-desorption cycles of water and nutrients.

In its composition are included the following components that stimulate the growth of plants:

In the early stages of plant growth, precursors of growth play a very important role. They activate the differentiation and elongation of cells in the root and can lead to leaf development and an increase in biomass production. Roots thus grow faster to larger and more developed depths.

• Acrylamide cross-linked polymers of acrylamide and acrylic acid neutralized by potassium and ammonium salts absorb and store water that is normally lost at evaporation, reducing the volume and frequency of irrigation need by up to 50% (TIRTHANKAR J., BIDHAN C.R., SUKUMAR M., 2001).

This water is kept in order to be accessible to the plant that uses the accumulated water as needed from the roots, then keeping the water in the root area for a longer time Particularly selected fertilizers can guarantee a balanced plant nutrition based on micro and macro elements.

TerraCottem support materials allow homogeneous distribution of all components. In its composition are included the following components that stimulate the growth of plants. Growth precursors play a very important role in the initial growth phase of the plant. They activate root cell elongation and differentiation, and promote leaf development and biomass production. In addition, roots are encouraged to grow more quickly to depths where more water is present.

The cross-linked hydroabsorbent polymers - absorb and store water that is normally lost to evaporation and leaching, reducing the volume and frequency of necessary irrigation by up to 50%. This water is then kept at the disposal of the plant, which accesses the stored water on demand through its root hairs, keeping the water in the root zone for a longer period of time. The specially selected fertilizers provide balanced nutrition to the plants based on macro and microelements.

TerraCottem's carrier materials are selected for their chemo-physical properties (CEC, WRC, etc.) and their characteristics which allow homogeneous distribution of all components.

The Zeba SP (Figure 2) is a biodegradable superabsorbent that has the role of maintaining a constant amount of moisture in the soil available to seeds, seedlings and germ plants throughout the growing season. This hydrogel made from natural corn starch swells by absorbing more than 400 times its original weight in water, and then releases it on demand from plants. Zeba also binds and releases water-soluble nutrients, preserving fertilizers in the root area for a long time, creating a healthy micro-environment. Over time, Zebra is decomposed and consumed by the microorganisms that live in the soil.

Zeba is a superabsorbent biodegradable, which is the role of maintaining in the soil a constant amount of moisture in enhancement designed to maintain a constant supply of moisture to germinating seed, seedlings, and plants throughout the growing season. Each Zeba granule is made from corn starch and can function as a sponge that absorbs over 400 times the initial weight in water, then forms hydrogels that slowly release moisture back to the plants as it is needed. Zeba granules bind and remove water-soluble nutrients and then store more fertilizers in the root area where they can be used by plants to create a healthier micro environment.

Zeba is broken down and consumed by naturally occurring microorganisms in the soil, leaving no residue behind.


Figure1. Structure ofTerraCottemFigure 2. Structure of hydrogelZeba SP

MATERIAL AND METODS

The experiments were carried out in greenhouse conditions on 4 experimental plots with 1 m^2 each.

Inflation of hydrogels was followed using facilities designed on the principle of operation of the Dogatkin apparatus. The burial of the hydrogels in the soil was made at a depth of 20 cm. The soil used had an average organic content of 72.5% and nutrients (values reported relative to the dry substance): N-NO_3 = 4,5•10^{-3} %, N-NH_4 = 1,7•10^{-3} %, P_2O_5 = 1,35•10^{-3} %, K_2O = 33.8•10^{-3} %, CaO = 116•10^{-3} %, MgO = 41,5•10^{-3} %. After the burial of the hydrogels (well known and morphostructural and swelling behavioral), aromatic plants such as Artemisia absinthium L., Artemisia lanceaVaniot and Artemisia lavandulaefolia DC were found.

The vegetation state of plants grown in the soil-hydrogel mix compared to the control sample (plants grown on the same soil type but without a hydrogel) was observed over a period of time ranging from 1 to 8 months. After this time, the plants were removed and then measured and weighed.

Throughout the observations the plants in the 4 experimental lots were watered at equal time intervals with equal watering standards.

RESULTS AND DISCUSSION

Plant growth observations were made throughout their vegetation period between April and September 2016. It was found that plants placed on the hydrogel-embedded lots developed better than the control plants on the non-hydrogel plot. There were differences in height, number of branches, leaves and flowers, differences due to a better nutrition regime for plants tested on hydrogel lots. Although water quantities and watering ranges were the same for all plants, the presence of hydrogels in the soil determined that retained water, at a higher proportion and longer intervals, would help to improve the growth of plants on these lots compared to the blank without hydrogels.

The evolution of plants is influenced by both the swelling behavior of the hydrogels and the nature of the polymer included.

It was noted, however, that throughout the study period the plants of the TerraCottem hydrogel group were best developed, then those on the Zeba SP hydrogel lot and ultimately the hydrogel-free consignment, which did not allow the development of spectacular plants, even if the conditions were the same. This behavior is due to the fact that TerraCottem includes more nutrients and a higher water retention capacity of about 15% compared to Zeba SP.

The moment of vegetation start for Artemisia absinthium L. varies around 3.04.2016 on the witness lot, on 1.04.2016 on the lot with Zeba P and around 24.03.2016 for the plot withTerraCottem.

For Artemisia lanceaVaniotis around 7.04.2016 on the witness lot, on 2.04.2016 on the lot with Zeba P and around 26.03.2016 for the lot with TerraCottem. For Artemisia lavandulaefolia DC the moment of vegetation poniation is around 15.04.2016 on the witness lot, on 10.04.2016 on the lot with Zeba P and around 28.03.2016 for the lot with TerraCottem. The results are summarized in (Table 1).

Table 1.

Evolution of the start of vegetation and flowering for the 3 species of Artemisia

Speciesname	**Date of vegetation start**			**Date of flowering start**		
	Control lot	**Lot with Zeba SP**	**Lot withTerra Cottem**	**Control lot**	**Lot with Zeba SP**	**Lot withTerra Cottem**
Artemisiaabsinthium L.	3.04.2016	1.04.2016	24.03.2016	8.08.2016	5.08.2016	1.08.2016
*Artemisialancea*Vaniot	7.04.2016	2.04.2016	26.03.2016	12.08.2016	9.08.2016	2.08.2016
Artemisialavandulaefolia DC.	15.04.2016	10.04.2016	28.03.2016	21.08.2016	16.08.2016	7.08.2016

The earliest species is Artemisia absinthium L., which blossoms around 8.08.2016 on the control lot, on 5.08.2016 on the lot with Zeba P and around 1.08.2016 for the TerraCottemlot.

The next species, as the moment of blooming, is represented by Artemisia lanceaVaniotaround 12.08.2016 on the witness lot, on August 9.08.2016 on the lot with Zeba P and around 2.08.2016 for the TerraCottemlot.

The species Artemisialavandulaefolia DC, which blossoms around 21.08.2016 on the control lot, on 16.08.2016 on the lot with ZebaP and around 7.08.2016 for the lot with Teracottem.

In (Figure3) thedevelopment of thespecies *ArtemisiaabsinthiumL.* is presented in the year of study 2016.

It isnotedthatthe maximum heightisreached on 10.08.2016 , a maximum of of 181.6 cm in thepresence of TerraCottem, 159.3 cm the one treated with Zeba P and 151.7 cm on the control lot.

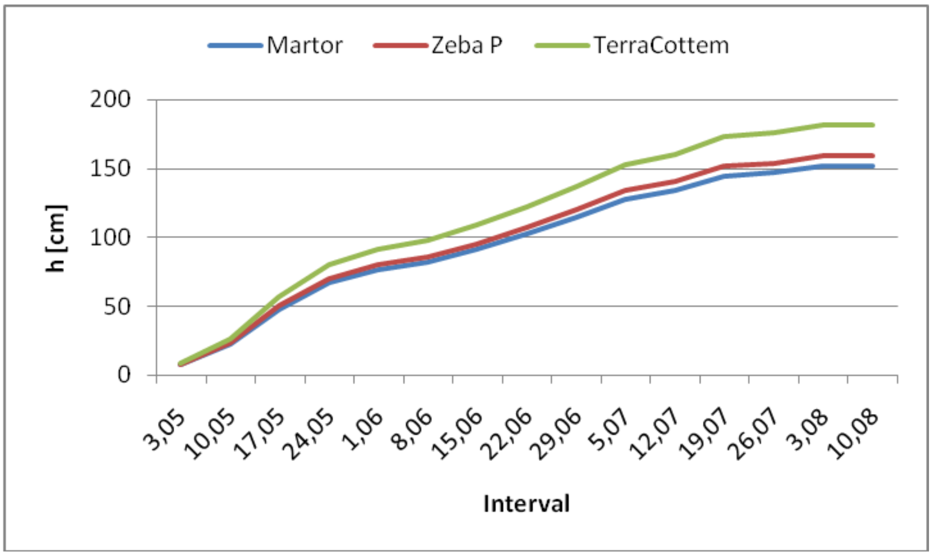

Figure.3. The development of thespeciesArtemisiaabsinthiumL.intheyear of study 2016

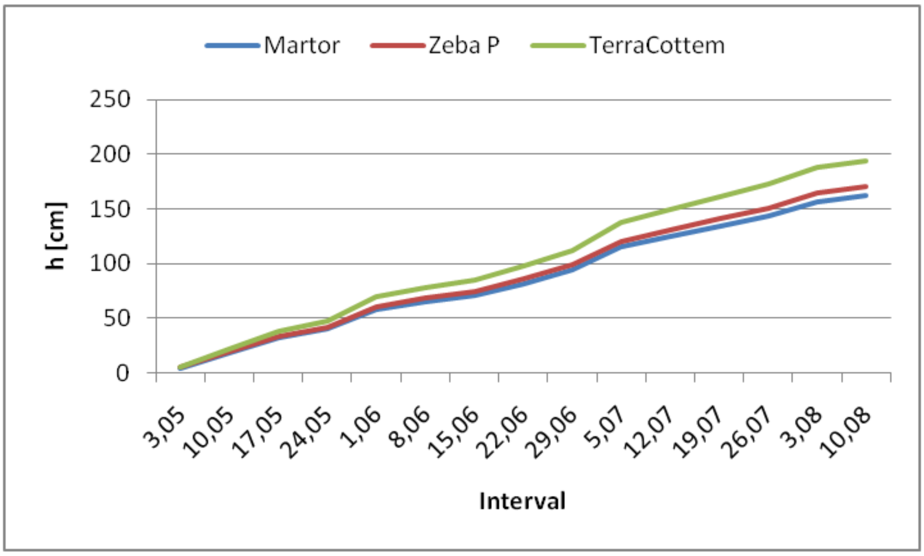

Figure4. The development of thespeciesArtemisia lancea VaniotLintheyear of study 2016

In (Figure 5)thedevelopment of thespeciesArtemisialavandulifolia DC ispresented in theyear of study 2016.

Thisspeciesreached maximum height on 10.08.2016 as followed : 233.2 cm in thepresencepresence of TerraCottem, 204.5 cm the one treated with Zeba P and 194.8 cm on the control lot.

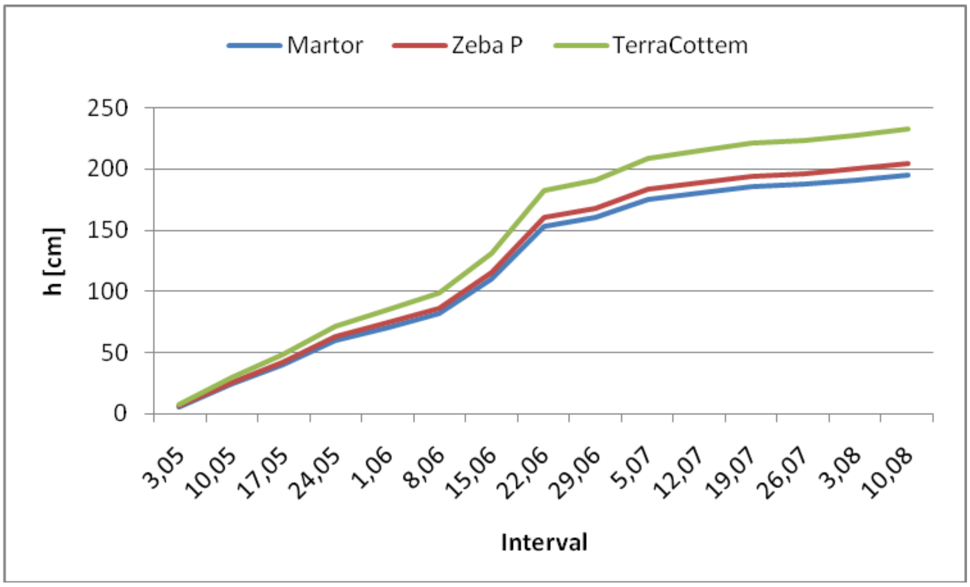

Figure5. The development of thespeciesArtemisialavandulifolia DC Lin theyear of study 2016

CONCLUSIONS

Germination and plant growth is influenced by the hydrogel characteristics introduced into the soil.

Hydrogels with high initial swelling rates determine the high water retention capacity and hence stimulate germination and plant growth.

The degree of inflation is the main factor of influence on plant vegetation as long as the hydrogel is not biodegraded to a significant extent.

It is found that in the presence of TerraCottem the plants germinate and grow faster compared to the Zeba P hydrogel and the control group without hydrogels.

The production of plants on the experimental lot with Teracottem is about 14% higher compared to the one on the Zeba P hydrogel lot and about 18-20% higher than on the control lot.

The rate of biodegradation of absorbent systems and the nature of biodegradation products differentiate plant growth.

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