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RESEARCH ARTICLE

EFFECT OF THE USE OF POTASSIUM POLYACRYLATE CLAY SOILS FOR OPTIMIZATION OF IRRIGATION WATER IN THE VALLEY OF MEXICALI, BAJA CALIFORNIA, MEXICO

***Isabel Escobosa Garía, [2]Khaled M. Bali, [1]Adolfo Pérez Márquez and [1]Jesús Román Calleros**

[1,*]Instituto de Ciencias Agríolas de la Universidad Autónoma de Baja California, Mexicali, Baja California México
[2] University of California Coorporative Extension, Holtville CA, USA

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ABSTRACT

Synthetic polymers are admixtures with high water retention capacity addition to improving the efficiency in the use of water. The three main groups of polymers, co-polymers of starch, polyvinyl alcohols and polyacrylamides. The principal goal of this study was to evaluate the use of potassium polyacrylate on water retention capacity and efficiency in the use of water in clay soils. Data comes from the experimental field of the Institute of Agricultural Sciences of the Autonomous University of Baja California. To evaluate the polymers were selected two specific points, soil samples were taken (0-30 and 30-60 cm) deep, were tested in laboratory (n = 144) determinations: Percent saturation (% Sat), electrical conductivity (EC), the potential of hydrogen (pH) and total dissolved solids (TSS). Data were analyzed from the structure of a completely randomized design in 4 x 3 factorial arrangement; 4 treatments 0, 5, 10 and 15 parts per million (ppm) and potassium polyacrylate; To save water treatment 10 and 15 ppm potassium polyacrylate recommended. It is important to mention that's a start working in the Valley of Mexicali applied to prevent erosion of potassium polyacrylate and packet loss foods as well as water-saving irrigation; suggestion for producers is to work with universities to find solutions to the problems that exist as we know it, optimization of irrigation water and soil loss.

INTRODUCTION

The rapid population growth (7.1, 8.5 and 9.6) billion people in the world to 2013.2015 and 2050, respectively; implies an increasing demand for farmland and irrigation water to meet the demand of the population for agricultural products. The rapid population growth implies an increasing demand for farmland; and irrigation water to meet the demand of the population for agricultural products is a big need in the agricultural production in northwest Mexico, including the states of Baja California and Sonora; maintain appropriate levels of soil moisture, and is consistently one of the most limiting factors to provide a uniform and adequate plant growth, and high production yields and higher quality crops produced under conditions of Baja California. In order to optimize the use of irrigation water applications potassium polyacrylate clay soil were performed. The use of superabsorbent polymers (hydrogels) such as potassium polyacrylate, can be a viable alternative in the reduction and water use in agriculture; These polymers have the ability to absorb large quantities of water and release it in a controlled and gradual, to mix the hydrogel with the ground is achieved better use rainwater or irrigation to miss fewer vital liquid by filtration in addition it reduces the evaporation of the same, biological activity and the production of soil (Rojas *et al.,* 2006) is improved.

Corresponding author: Isabel Escobosa Garía
Instituto de Ciencias Agríolas de la Universidad Autónoma de Baja California, Mexicali, Baja California México.

MATERIALS AND METHODS

To fulfill the objectives, the work was done in the experimental field of the Institute of Agricultural Sciences of the Autonomous University of Baja California located in North Latitude: 32 º 24.289 'west longitude and 115 ° 11.813' in the Ejido Nuevo León, Mexicali, Baja California, México; according to American soil classification study the place belongs to the series: Row Phase Heavy; Aquic Haplotorrert, fine, smectitic, hyperthermic, Haplic Vertisol (Calcaric, Endogleyic), Fig. 1.

Soil sampling: Soil samples were taken at two depths (0-30 and 30-60 cm); conducting laboratory tests consisted of applying 4 treatments: 0, 5, 10 and 15 parts per million (ppm) of potassium polyacrylate with three replicates to determine: Percentage of saturation (% Sat), electrical conductivity (EC), potential hydrogen (pH) and total dissolved solids (TSS), with a total of 144 determinations. Synthetic polymers, commonly called superabsorbent by high water retention capacity, are additives that are designed to enhance the establishment and

plant growth in soils of arid environments (El Sayed *et al.,* 1991; Johnson and Piper, 1997).

Fig. 1. Soil sampling site

Analysis methodology

Electrical conductivity

To determine the electrical conductivity of a conductivity meter YSI Brand M-33 (Table 1);The equipment was calibrated before taking readings according to an established procedure, using standard solutions was used. The data were expressed in dS.m-1 and multiplied by 640 to convert them into Total Dissolved Solids (TDS) in mg / L, (NOM, 2003).

Table 1. Analytical Instruments

parameter	method	unit	detection limit	sensitivity	Accuracy	exact
Salinity	CE (Tanji, 1990)	$dS.m^{-1}$	0 - 3.0	0.05	±2%	±5%

Statistical analysis

Data were analyzed from the structure of a completely randomized design in 4 x 3 factorial arrangement; 4 treatments 0, 5, 10 and 15 parts per million (ppm) potassium polyacrylate with three replications.

RESULTS AND DISCUSSION

Percent saturation, profile 1

Table 2. Results of mean comparisons profile 1 for percentage saturation of soil samples (0-30 cm) deep, and the application of 4 treatments (0, 5, 10 and 15 ppm) polyacrylate potassium

Depth		Treatment			
cm			Parts per	million (ppm)	
		0	5	10	15
	average	74.17	72.50	66.87	67.70
0-30	74.17	------	P>.05	P<.05	P<.05
0-30	72.50		------	p<.05	P<.05
0-30	66.87			------	P>.05
0-30	67.70				

To values (P> 0.05) are not statistically different averages specified comparisons between two means.
b values (P <.05) are statistically different for a specific comparison between two means.

Profile 2

Percent saturation, profile 2

Table 3. Results of comparisons of average profile 2 for percentage saturation of soil samples (0 to 30 cm) deep, and the application of 4 treatments (0, 5, 10 and 15 ppm) polyacrylate potassium

Depth		Treatments			
cm			Parts per	million (ppm)	
		0	5	10	15
	average	73.25	73.67	67.02	67.63
0-30	73.25	------	P>.05	P<.05	P<.05
0-30	73.67		------	P<.05	P>.05
0-30	67.02			------	P>.05
0-30	67.63				------

To values (P> 0.05) are not statistically different averages specified comparisons between two means.
b values (P <.05) are statistically different for a specific comparison between two means.

Conclusion

As may be seen that the addition of 10 and 15 ppm potassium polyacrylate significantly (P <0.05) the percentage of saturation at a depth of 0-30 in the profile 1 and profile 2 (Table 2 y 3), without affecting the pH and electrical conductivity in any of the treatments applied. There is limited information on the effect of gelatinized nutrient solution and mix with the substrate to produce ornamental plants in container, so it is important to do research about it and thereby generate an alternative for the efficient use of water and nutrients in production and simultaneously impacting on a significant reduction in the emission of fertilizer to the environment (Rojas *et al.,* 2006), the Water and soil Academic ICA, consider it very important to continue research in the application of Potassium Polyacrylate Mexicali Valley soils as an alternative for the optimization of irrigation water and fertilizer losses avoided into groundwater.

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