Evaluation of the effect of potassium polyacrylate in two varieties and four hybrids of maize (Zea mays L.), as a potential practice for adaptation to drought in La Máquina(Centro Uno),Suchitepéquez. (Phase I)

Under the project: Maize and bean resilience in the face of climate change

Carlos Humberto Rodríguez Hernández (E.P.S.A.T 2,013) USAC - CUNSUROC.

USAID DEL PUEBLO DE LOS ESTADOS UNIDOS DE AMÉRICA

ICC Instituto Privado de Investigación sobre Cambio Climático

Climate scenarios for Guatemala and Central America

The Central American agriculture (especially in Guatemala) is very sensitive to changes in temperature and precipitation associated with climate change, and farmers are already suffering the impacts. The projected climate scenarios for Central America estimate changes in temperature and precipitation, using climate models recommended by the IPCC (Intergovernmental Panel on Climate Change). These scenarios (A1, A2, B1, and B2) are based on originating sources (demographics, economics and technology), presence or absence of climate policies, and temperature and precipitation data recorded from 1950 to 2006. According to CEPAL (2011), the Central American region can expect a 28% reduction in rainfall and an increase in temperature up to 3.6 ° C by 2100. Given these projections and their expected outcome in Central America, it is necessary to find alternatives to reduce or minimize these impacts, and thus increase the resilience of societies and ecosystems to potential changes in climate.

Corn and beans are the most important food crops for the Guatemalan population; any negative effect will impact food security for thousands of families who subsist from these crops. Small corn producers face continuous challenges, and with climate change new ones will arise. In order to overcome this situation, it is necessary to promote and support adaptation practices.

This study evaluated potassium polyacrylate as a potential adaptation tool to drought. This product (Aqua Warehouse, 2009) is a granular, biodegradable, non-toxic powder, able to absorb up to 200 times its weight in water, and used in other countries to address water scarcity. The component acts as a water reservoir that allows that 65%- 70% of the stored water is taken by the root system of the plants, according to their water needs. We are presenting the methodology and results of the research conducted in Centro Uno, La Máquina, Suchitepéquez in the months of May to August 2,013.

Research objectives :

1) To evaluate performance kg/ha of two varieties and four hybrids of *Z. mays* under the effect of potassium polyacrylate .

2) To determine whether there is an interaction between the use of potassium polyacrylate and the two varieties and four hybrids of *Z. mays* evaluated .

Experimental design: For statistical analysis we used a two way factorial experiment following a completely randomized design.

Treatments:

Factor A: Application of potassium polyacrylate (with and without potassium polyacrylate)

Factor B: Genetic material of Z. mays (six genetic materials)

Methodology:

Site preparation (including ridges): Land preparation consisted of plowing and raking; the distance used between ridges was 0.75 m and 0.50 m between plants, according to the recommendations made by CIMMYT (1985) for *Z. Mays* trials, with a population density of 26,667 plants / ha.

Potassium polyacrylate hydration and application: Potassium polyacrylate is an absorbent polymer, which must be hydrated with water. For Z. mays crops, it must be hydrated at a ratio of 10 grams of product per liter of water (according to the manufacturer; Aqua warehouse 2009). After we hydrated it, we waited between 15 to 20 minutes for water to be absorbed (Aqua warehouse, 2009), then proceeded to the application on the field, at a ratio of a liter of solution per meter, as shown in Figure 1.

Figure 1: Potassium polyacrylate hydration and application
Source: Author, 2013.

Agronomic crop management: The agronomic crop management was conventional, with weed control, disease and pest control, and fertilization as recommended by ICTA (2002): 100 kg N/ha, 40 kg of P2O5/ha and 0 kg of K2O/ha. Among the genetic materials used, we have: DK-390 ©, PIONNER © 4082W, HR-245 ©, ICTA-B7 ®, RHQ-596 ©, and ICTA-LM7422 ®.

Response variables: The vegetative variables considered to assess the effect produced by potassium polyacrylate in the different Z. Mays genetic materials were: plant height, ear height, stalk lodging, root lodging, and days to flowering. The performance variable was measured in kg/ha in each of the materials tested.

Figure 2: Stages of phenological growing in Z. mays.
Source: Author(2013)

Results:

1. Precipitation records: From the precipitation records (May-August 2013), we generated a water balance taking into account weather variables, such as maximum and minimum temperatures, relative humidity, wind speed and light hours. We also obtained daily evapotranspiration (ET), and monitored available soil moisture.

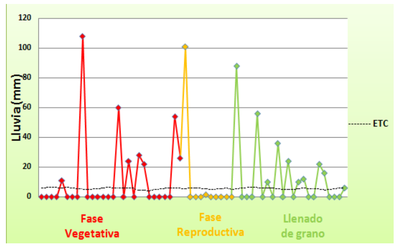

Figure 3: Precipitation behavior in the different phenological stages of Z. mays crop.
Source: Author, (,013)

During the growing season, we registered a cumulative precipitation of 772.8 mm. The *Z. mays* crop has a water requirement of 700 mm. This shows that soil moisture was above the optimal values of irrigation.

2. Statistical analysis

We determined that there was no significant difference between applying potassium polyacrylate or not applying it, since it didn't show any effect on plant height, ear height, stalk lodging, root lodging , days to flowering and yield. Therefore we infer that there was no interaction between potassium polyacrylate and Z. mays genetic material. Water availability for the maize plants was constant during this research, for which the potential effects that potassium polyacrylate has under drought conditions did not show.

However, when we analyzed the performance variable, each material showed significant differences between them. This is due to the different genotypes, which influences the yields.

The yields obtained were as followed:DK-390 ©(6976.76 kg/ha), PIONNER© 4082W (6523.1 kg/ha), HR-245© (5676.05 kg/ha), ICTA-B7® (5410.37 kg/ha), RHQ-596© (5405.53 kg/ha), ICTA- LM7422® (4679.85 kg/ha).

3. Conclusions:

With a significance level of 5% and with no drought conditions for 2013 in the town of La Máquina, the applied treatments (with and without potassium polyacrylate) gave the same results in kg/ha performance.

We dismissed the possibility of polyacrylate causing any negative effects (damage) in the roots and in the physiological maize plant during the rainy season.

The highly significant difference in yield in kg/ha among the material tested is mainly due to the different genotypes which influence performance factors such as: the size of the cob, number of harvested pods, number of rows, grain weight, among others.

Bibliography:

Aqua warehouse. 2009. Características principales del poliacrilato de potasio (en línea). Consultado 28 Febr. 2013. Disponible en: www.Aqua warehouse.com.

CEPAL, (Comisión Económica para América Latina y del Caribe) 2,011, la Economía del Cambio Climático en Centro América, Reporte técnico . México. D.F. 419 p.

CIMMYT, (Centro Internacional de Mejoramiento de Maíz y Trigo). 1,985. Manejo de ensayos e informe de datos de ensayos internacionales del CIMMYT. México. D.F. 23p.

ICTA (Instituto de Ciencia y Tecnología Agrícola). 2,002. El cultivo del maíz en Guatemala: Una guía para su manejo agronómico. Subprograma de maíz. Guatemala, Gt. 45p.