Available online at www.elixirpublishers.com (Elixir International Journal)

Agriculture

Elixir Agriculture 96 (2016) 41528-41529

ISSN: 2229-712X

Evaluation of Tolerance of CP73-21 sugarcane callus to salinity

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ARTICLE INFO

Article history:
Received: 5 June 2016;
Received in revised form:
4 July 2016;
Accepted: 9 July 2016;

Keywords
Callus,
Salinity,
Sugarcane.

ABSTRACT

In order to evaluate induction of tolerance to salt stress CP73-21 sugarcane commercial cultivar in tissue culture conditions an experiment was conducted in 2014-2015 year, in tissue culture laboratory of Islamic Azad University of Ahvaz. 6 treatments for callus induction (2,4-D at levels: 1, 1.5, 2, 2.5, 3 and 3.5 mg/l) were investigated in a randomized complete block design with four replications. The highest callus value (67.5%) was obtained from treated with 3 mg/l. The effect of different levels of salinity 0, 33, 66, 99 and 132 mM were investigated to tolerance of callus in completely randomized design. After 8 weeks, the callus value reduction by 33, 66, 99 and 132 treatments in compare to control were obtained 31, 33, 22 and 26%, respectively.

Introduction

Excess amount of salt in the soil adversely affects plant growth and development. Nearly 20% of the world's cultivated area and nearly half of the world's irrigated lands are affected by salinity (Zhu et al., 1998). Plants are classified as glycophytes or halophytes according to their capacity to grow on high salt medium. Most plants are glycophytes and cannot tolerate salt-stress. High salt concentrations decrease the osmotic potential of soil solution creating a water stress in plants. Secondly, they cause severe ion toxicity, since Na+ is not readily sequestered into vacuoles as in halophytes. Finally, the interactions of salts with mineral nutrition may result in nutrient imbalances and deficiencies. The consequence of all these can ultimately lead to plant death as a result of growth arrest and molecular damage (McCue and Hanson, 1992). Sugarcane (*Saccharum officinarum* L.) is an important agro-industrial sugar crop, contributing about 70% of the world sugar production. Globally, it occupies about 20 Mha of land, a little about 2% of total cropped area, producing 1350 million MT of cane (FAO, 2004). Sugarcane is cultivated as a commercial crop in nearly 60 countries spread over the world. However, being a typical glycophyte, it exhibits stunted growth or no growth under salinity, with its yield falling to 50% or even more of its true potential (Subbarao and Shaw, 1985). Besides this, salinity in root zone of sugarcane decreases sucrose yield through its effect on both biomass and juice quality (Lingle and Wiegand, 1996).

At this study we evaluated tolerance of CP73-21 sugarcane commercial variety to salt stress in tissue culture using a variety of soma clonal.

Material and methods

Experiment was conducted in 2014-2015 year, in tissue culture laboratory of Islamic Azad University of Ahvaz. At first step, 6 treatments callus were investigated that included: 2, 4-D at 1, 1.5, 2, 2.5, 3 and 3.5 mg/l). After transferring the samples to the laboratory, samples were washed washing with running water for an hour. After washing, the samples were transferred under the hood, under the hood; the samples were disinfected with 70% ethanol and 20% sodium hypochlorite for 120 seconds. Callusing treatments included 1, 1.5, 2, 2.5 and 3 mg/l 2-4-D in a randomized complete block design with four replications. Sodium chloride was used for to determine the salinity tolerance of viable callus. For this purpose, 5 treatments were prepared 0, 33, 66, 99 and 132 mM. Analysis of variance and Duncan mean comparison were performed by using SAS statistical software, also, Probit analysis was carried out by using the software Minitab version 16 and graphs were drawn by using Excel software.

Result and discussion

Callus induction

Based on the results of analysis of variance, it was founded that callus induction treatments had significant effects on explants at 1%. 2-4-D Treatments led to a callus from explants and the highest callus (67.5 percent) was obtained by 3 mg/l treatment and it was best treatments for induction of callus. 2, 2.5, 3 and 3.5 mg/l treatments had an increasing of 6, 17, 27 and 15 fold in compare to 1 mg/l treatment.

Tolerance of callus to salinity

According to ANOVA, it was determined that treatments had significant effect on tolerance of callus to salinity, so, callus value decreased by increasing of salinity stress and this reduction was obtained 31, 33, 22 and 26% by application of 33, 66, 99 and 132 mM treatments, respectively. During the 8-week study of the percentage of callus showed that the average yield decreased with time. This reduction was observed in all treatments including the control and stress.

The success of in vitro culture depends mainly on the growth conditions of the source material (Caswell et al., 2000, Delporte et al., 2001) , medium composition and culture conditions(Saharan et al., 2004) and on the genotypes of donor plants. Among those factors, the genotype appears to be important factor influencing the efficiency of in vitro culture. Totally, 6 treatments were investigated for callus induction (2,4-D at levels: 1, 1.5, 2, 2.5, 3 and 3.5 mg/l). The highest callus value (67.5%) was obtained from treated with 3 mg/l. The effect of different levels of salinity 0, 33, 66, 99 and 132 mM were investigated to tolerance of callus in completely randomized design. After 8 weeks, the callus value reduction by 33, 66, 99 and 132 treatments in compare to control were obtained 31, 33, 22 and 26%, respectively.

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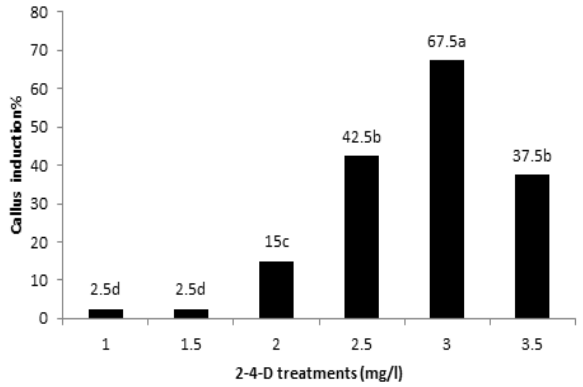

Figure 1. effects of treatments on Callus induction.

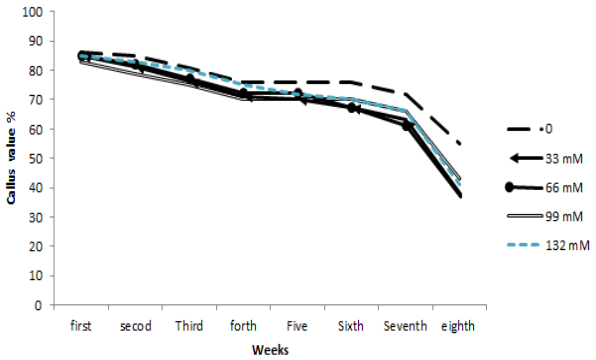

Figure 2. Trend of callus volume changes in 8 weeks.

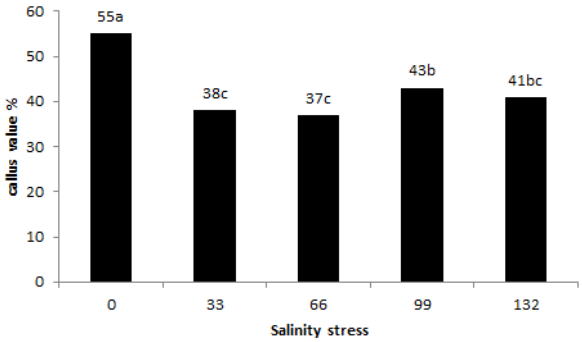

Figure 3. effect of salinity stress on callus value.

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