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Full Length Research Paper

INFLUENCE OF SEED PRIMING ON DROUGHT INDICES OF MAIZE

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Abstract

Objective of this investigation is to study the influence of seed priming treatments on drought indices in maize (*Zea mays* L.). The experiment was carried out during kharif 2016 -17 at research farm JNKVV, Jabalpur (MP) which was laid out in a randomized block design replicated thrice. The treatments comprised of nine seed priming treatments in maize cv, African tall viz., water, $ZnSO_4$ @ 0.5%, KNO_3 @ 0.5% & amp; KH_2PO_4 @ 0.5% for 6 and 12 hrs and control which were assessed for drought indices. The seed priming treatments showed variable response for most of the traits. Water primed for 12 hrs indicated the highest values for drought indices. Water primed for 12 hours had highest desiccation tolerance (619.93) and leaf water potential (-4.83). KNO_3 primed for 12 hours (11.69) possessed higher water use efficiency which suggested that this treatment may be induced in the maize genotypes which are cultivated in drought sensitive areas. KH_2PO_4 primed for 12 hours (81.39) was associated with the highest relative water content followed by water primed for 6 and 12 hours and had lowest (18.61) water saturation deficit. This is a desirable character which a treatment should possess for drought affected areas.

Keywords: maize, water use efficiency, desiccation tolerance, water saturation deficit, seed priming

Introduction

Maize (*Zea mays* L.) is one of the most important cereal crops in the world and is third important position in India after rice and wheat with enormous role in food and nutritional security. Maize is having special significance because in addition to staple food for human being and quality feed for animal. It serves as a basic raw material as an ingredient to thousands of industrial products that include starch, oil, protein, alcoholic beverages, food sweetners, pharmaceutical, cosmetic, film, textile, gum, package and paper industries etc.Seed priming, a pre-sowing partial hydration of seeds, is often used to improve crop performance (Ashraf and Foolad, 2005) [2]. Seed priming resulted in earlier emergence of seedlings by 1-3 days and significantly increased plant stand and initial growth vigour (Singh *et al*., 2015) [5]. Increase in LAI stay-green and maintain photosynthesis of green leaves during R_1 stage (Tollenaar *et al*., 2004) [6]. Though a few physiological investigations have been carried out to evaluate the performance of maize under various seed priming methods, detailed investigations are needed to identify phenophases, morphophysical and biophysical traits influencing productivity along with the constraints of productivity under drought conditions.

Material and methods

The present investigation was carried out during the Kharif 2016. The experiment was carried out at Research Farm, AICRP on FORAGE CROPS, Department of Agronomy, JNKVV, Jabalpur (M.P.). The experiment conducted in randomized block design with three replications having 9 treatments. The observations were recorded on five randomly selected plants from each plot and from each replication for the desired characters.

Results and discussions

The results revealed (table 1, fig. 1) that KNO_3 primed for 12 hours (11.69) possessed higher water use efficiency which suggested that this treatment may be induced in the maize genotypes which are cultivated in drought sensitive areas. KH_2PO_4 primed for 12 hours (7.93) indicated the lowest water use efficiency indicating its unsuitability for drought prone areas. Seed priming with nutrient solutions improved the germination and increased the seed nutrient content, stimulated growth, nutrient uptake and water use efficiency of seedling (Ajouri *et al*. 2004) [1]. Water primed for 12 hours (619.93) recorded highest desiccation tolerance and $ZnSO_4$ for 12 hours (529.87) registered lowest value. Priming for prolong period will allow excess of water that may exceeds the quantity required for the initiation of lag phase of germination and radicle protrusion will occur due to which seed lose its desiccation tolerance thereby results in loss of seed viability (Dekkers *et al*., 2015) [3]. Water primed for 12 hours (-4.83) showed highest leaf water potential and water primed for 6 hours (-6.34) had the lowest value. Analysis of variance indicated that irrigation treatments and hydro-priming durations significantly influenced leaf water content (LWC), leaf temperature (LT) and chlorophyll content index (CCI) (Ghassemi *et al*., 2016). $ZnSO_4$ primed for 6 hours (679.33) possessed the maximum membrane thermostability as indicated by the lowest electrical conductivity of the water in which the treated leaf tissues of treatments were immersed. On the other hand KH_2PO_4 primed for 6 hours (560.93) was associated with lowest value. KH_2PO_4 primed for 12 hours (81.39) was associated with the highest relative water content followed by water primed for 6 and 12 hours and had lowest (18.61) water saturation deficit. This is a desirable character which a treatment should possess for drought affected areas. The drought primed plants tolerate subsequent water stress by improvement in RWC (Wang *et al.*, 2014). KH_2PO_4 primed for 6 hours (0.635) possessed superiority over rest of the treatments for this trait. This treatment is suitable for drought affected areas as it holds much water which cope up stress due to deeper root penetration. Water primed for 6 hours (0.238) showed lower root shoot ratio.

Table 1: Effect of seed priming treatments on drought indices in maize

T No.	Seed priming treatments	Water Use Efficiency (µmol mmol^{-1})	Desiccation tolerance	Leaf water potential (MPa)	Membrane thermostability (µmhoscm^{-2})	Root Shoot ratio (g)	Relative water content (%)	Water Saturation Deficit (%)
T1	H2 O for 6 hours	9.31	584.07	- 6.34	600.43	0.238	80.03	19.97
T2	H2 O for 12 hours	11.19	619.93	- 4.83	598.27	0.267	80.54	19.46
T3	ZnSO4 @ 0.5 % for 6 hours	10.41	561.13	- 5.13	679.33	0.325	71.80	28.20
T4	ZnSO4 @ 0.5 % for 12 hours	10.75	529.87	- 4.98	632.00	0.306	76.03	23.97
T5	KNO3 @ 0.5 % for 6 hours	10.09	585.70	- 5.13	590.23	0.296	71.60	28.40
T6	KNO3 @ 0.5 % for 12 hours	11.69	548.30	- 5.13	624.83	0.324	73.97	26.03
T7	KH2PO4 @ 0.5 % for 6 hours	7.95	550.00	- 5.13	560.93	0.635	73.77	26.23

T8	KH2PO4 @ 0.5 % for 12 hours	7.93	588.63	- 4.83	631.17	0.398	81.39	18.61
T9	CONTROL	8.97	599.93	- 5.13	567.03	0.485	66.90	33.10
SEm ±		1.23	42.68	0.26	38.10	0.09	1.48	1.52
CD 5%		3.70	127.96	0.78	114.23	0.28	4.45	4.55

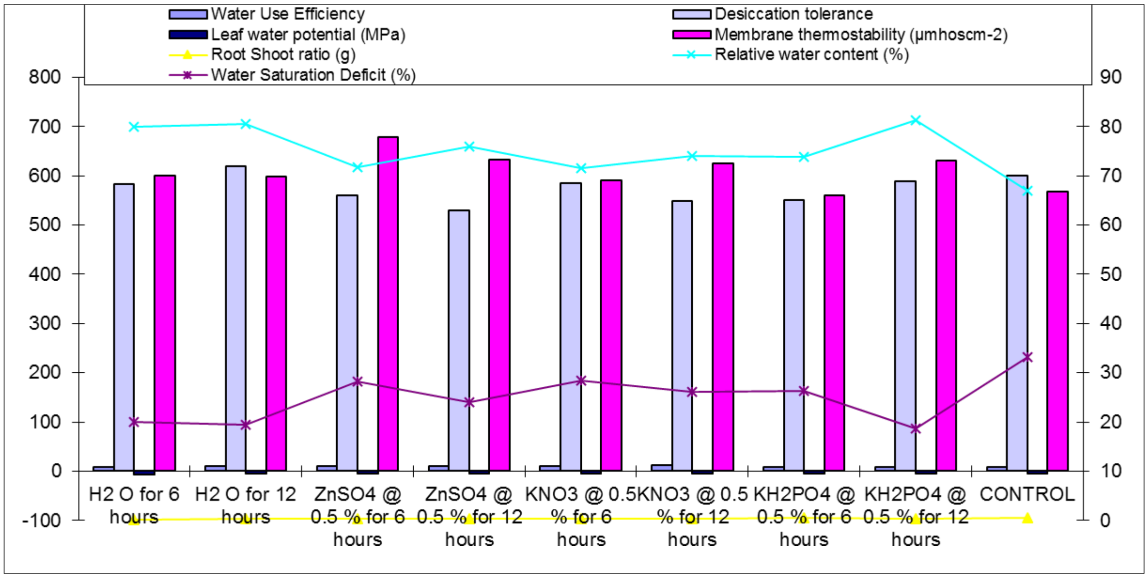

Fig 1: Various drought traits in seed priming treatments in maize

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