J. of Plant Production, Mansoura Univ., Vol. 12 (12): 1335 - 1341, 2021

Journal of Plant Production

Journal homepage: www.jpp.mans.edu.eg
Available online at: www.jpp.journals.ekb.eg

Effect of Duration and Substance of Priming White Teosinte Hybrid Seed on Improves Viability, Seedling Vigor, Growth and Forage Productivity
A- Effect of Priming and Its Duration on Viability and Seedling Vigor

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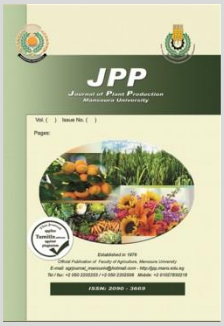

ABSTRACT

Present study was conducted at Laboratory conditions of Seed Technology Research Department at Sakha, Field Crops Research Institute, ARC, Giza during 2019 season. The purpose of the research was to study the effect of priming duration (6, 8 and 10 hours) and seed priming (hydro-priming, 50, 75 and 100 mgL^{-1} of salicylic acid, 1, 2 and 3 % of KH_2PO_4 and 1, 2 and 3 % of $ZnSO_4$) and dry seed on improving germination of seed and seedling vigor of white hybrid teosinte**.** Results indicated that six hours priming duration gave the highest germination percentage, seedling vigor, speed germination index and seedling vigor index. Seed treatment with 2 % of KH_2PO_4 was the best treatment followed by salicylic acid 100 mgL^{-1} and 3 % of $ZnSO_4$ recorded the highest seed germination%, seedling vigor, speed germination index and seedling vigor index. Hydro-priming produced the higher values of most traits such as plumule and radical length, seedling dry weight, speed germination index and the lowest in electrical conductivity. The interaction effect was significantly where six hours duration and seed priming with 2% KH_2PO_4, 3% of $ZnSO_4$ and 100 mgL^{-1} of salicylic acid were the highest germination% and seedling vigor and insignificant with hydro-priming. The lowest values of EC produced by 6 hours with 2% of KH_2PO_4 followed by 3% of $ZnSO_4$ and hydro-priming. We can conclude that hydro-priming for 6 hours before sowing of white hybrid teosinte increased germinationpercentage to reach 80% compared to dry seed, also seedling vigor characters.

Keywords: vigor, salicylic acid, KH_2PO_4, $ZnSO_4$, hybrid teosinte

INTRODUCTION

Teosinte is one of the most essential summer forge crops in Egypt. Seed germination percentage of teosinte did not reach the optimum levels this leads to decreasing plant density under field conditions. Pre-sowing techniques like seed priming are widely used to improve seed performance by improving rate and percentage uniformity of germination, reducing seed sensitivity to external factors, promoting low-activity seeds in field, slow and irregular germination, low seed viability, low yield, biotic and abiotic stresses, etc. Chatterjee *et al.* (2018) and Zulfiqar (2021).

Soaking is a pre-sowing treatment in which the seeds are partially moistened so that there is an initiation of the germination process without an observable radical emergence Aryal *et al.* (2020). Various priming method-s are available to enhance seed germination, increase germination speed, germination vigor, seedling establishment that may have a positive effect on yield Singh *et al.* (2017). Meanwhile priming of seeds of nutrient is better used and can have more resistance against pests and diseases. Also primed the seeds induce some of biochemical processes necessary to begin the process of breaking dormancy and germination, hydrolysis or metabolism inhibitors, salt and drought tolerance, water absorption and enzyme activities Kazemi-Golezani *et al.* (2010). Different types of priming include: hydro-priming, osmo-priming, halo-priming, matric-priming, thermoelectric-priming, bio-priming and seed priming with plant growth hormones Mohajeri *et al.* (2016).

Germination is the first stage of plant growth and is one of the most important stages in the life cycle of plants. It is considered as one of the determinants of yield, but it poses a challenge to facilitate good germination in soils of poor fertility. Soaking the seed is an acceptable method to improve germination of seed%. Improvement in soaking is affected by some factors such as: plant types, vigor, type and concentration of priming media, priming duration, temperature Hussein (2016).

According to the results of some research, seed of corn soaking by H_2O for 18 hours had an appropriate performance and could increase the germination of seed, yield and its components to an acceptable level. Therefore, hydro-priming is a simple method, low cost and environmentally friendly method to improve yield in maize seed Sallam and Ibrahim (2015) revealed that teosinte seed priming with 0.6 g L^{1} SA produced the highest seed germination, speed of germination, plumule length and radical length. Soleimanzadeh (2013). The effects Osmo-priming of alfalfa are accelerated seeds improved seed vigor, increased speed of germination and germination of seed % and seedling emergence thereby increased 1000-seed weight, yield and its components Mouradi *et al.* (2016). Aneela *et al.* (2017) found that seed soaking using plant growth regulators such as SA and GA can significantly enhance the performance of wheat grain in terms of

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DOI: 10.21608/jpp.2022.115596.1083

morphological parameters and yield characteristics under drought stress and normal conditions. Narayanan *et al.* (2019) revealed that, the maize seeds primed with KH_2PO_4 1% was recorded the higher seed germination%, longer radical length, longer plumule length and higher dry matter.

Wondimu *et al*. (2018) reported that the highest of germination of seed, speed of germination, seedling length, seedling dry weight, seedling vigor index in response to seed sorghum priming for 10 hours by using $ZnSO_4$ and water over the control treatment. Damalas *et al*. (2019) report hydro-priming as a simple and inexpensive method for seed priming. The highest germination of seed%, speed of germination, seedling vigor index, radical and plumule length, seedling fresh weight and seedling dry weight on maize seed were recorded when treated seeds by (2% KH_2PO_4 and 0.5 $ZnSO_4$) compared with control Hussein (2016).

The white hybrid teosinte is characterized by its low germination percentage, although it's branching is abundant. So, the aim of the present study was to improve seed germination percentage and seedling characters in laboratory, establishment field emergence and seedling emergence of white hybrid teosinte under Sakha area by using seed priming.

MATERIALS AND METHODS

Laboratory experiment was carried out at Seed Technology Department at Sakha, Field Crops Research Institute, ARC, Giza, Egypt during 2019 season to evaluate the effect of different seed priming duration and substance with different concentration on inducing seed germination behavior and seedling vigor of white hybrid teosinte [Sakha (T.) line x maize Single cross (S-C)10]. The experiment was conducted in a factorial completely randomized design with four replicates. The temperature and relative humidity during the experimentation period were 20-25ºC and 60-85%, respectively. White hybrid teosinte seeds were fully immersed in priming media for 6, 8, and 10 hours and was priming using hydro-priming, hormonal-priming (solution of salicylic acid with 50, 75, 100 mgL^{-1}) and osmo-priming (solutions of KH_2PO_4 with 1, 2 and 3 % and $ZnSO_4$ with 1, 2 and 3 %) and dry seed was used as control. Seeds were superficially sterilized with 2% sodium hypochlorite solution for 5 minutes then rinsed with sterilized water. Then the sterilized seeds were priming with different solutions and un-priming seed (control) according to each treatment. The following standard priming treatments were air dried at room temperature and placed in Petri dish. For each replicate, 25 seeds were transferred to Petri dish on Whatman filter paper with 10 cm diameter which was previously moistened with 8 ml distilled water.

Data were collected for seed germination percentage, plumule length (cm), radical length (cm), seedling fresh weight (g), seedling dry weight (g), speed germination index, mean daily germination, seedling vigor index and electrical conductivity.

Germination test:

- **Germination percentage:** It was expressed by the laying 25 seeds on filter papers in four replicates using Petri dishes and was calculated by counting normal seedling 10 days after sowing according to ISTA. (1999) the percentage of germination was calculated using the following formula:

$$\textbf{Germination \%} = \frac{Number\ of\ normal\ seedlings}{Total\ number of seed\ tested} \times \mathbf{100}$$

- **Speed germination index (SGI)**: Calculated as described in the AOSA. (1983) with the following formula:

$$\textbf{SGI} = \frac{No.of\ germinated\ seed}{Days\ of\ first\ count} + \cdots + \cdots + \cdots + \frac{No.of\ germinated\ seed}{Days\ of\ final\ count}$$

- **Means daily germination**: Means daily germination is an indicator of the daily germination rate Scott *et al*. (1984).

$$\textbf{MDG} = \frac{\textbf{GP}}{\textbf{D}}$$

Where GP is the final percentage of germination, D is day of maximum germination (experiment period).

Electrical Conductivity Test:

Three replicates of fifty weighted seeds from each treatment were incubated for 24 hours in a 250 ml of distilled water and held at 25°C. After that period, the conductivity of the leachate was measured immediately with a CMD 830 WPA conductance meter and is expressed as µS.cm^{-1}.g^{-1} ISTA. (1999).

Seedling growth and vigor test:

At the 10th day after seed placement, 10 normal seedlings were taken from each Petri dish at randomly to measure the characteristics of seedling:

- **Plumule and radical length**: Ten normal seedlings were measured 10 days after planting recording with a meter scale.
- **Seedling fresh weight**: Ten normal seedlings were weighted fresh after 10 days after planting.
- **Seedling dry weight**: Ten normal seedlings were dried in oven at 70ºC for 48 hour then dry weight of seedlings was recorded using electric balance which was determined according to the procedures reported in the seed vigor testing handbook AOSA. (1986).
- **Seedling vigor index**: It was calculated according to on the following equation of Abdul-Baki and Anderson (1973).

Seedling vigor index = Germination (%) × seedling length (cm).

All obtained character data were subjected to statistical analysis according to the analysis of variance technique (ANOVA) of factorial completely randomized design. For comparison between means, LSD at 0.05% of probability level was used. All data were described by Gomez and Gomez (1984). All statistical analyses were performed using analyses of variance technique with the computer software package "MSTAT-C" (1990).

RESULTS AND DISCUSSION

The seed germination%, plumule length, radical length, seedling fresh and dry weight in white hybrid teosinte was significantly differed due to treatments (Table 1).

The highest seed germination % (75.00 %), plumule length (24.98 cm), radical length (16.80 cm), seedling fresh weight (4.21 g) and seedling dry weight (0.435 g) were attained for 6 hour priming duration compared to control and another seed duration. And these results are in agreement with Singh *et al*. (2014), Mohajeri *et al*. (2016) and Narayanan *et al*. (2019) who found that soaking seed for 6 hours can improve seed germination percentage, longer radical length, longer plumule length and higher dry matter production and seedling vigor index and superior to un-soaked treatment in corn and cowpea.

Seed priming with 2% of KH_2PO_4 and 3% of $ZnSO_4$ increased significantly seed germination percentage (77.00 and 75.00 %) compared to the control (dry seed) (50.00 %). Plumule length (26.20, 25.75 and 25.00 cm) was increased significantly by using 100 mgL^{-1} of salicylic acid, 2 of KH_2PO_4 and hydro-priming, respectively. While, seedling fresh weight were increased significantly by using 75 and 100 mgL^{-1} of salicylic acid , 1,2 and 3 of KH_2PO_4, 1% $ZnSO_4$ and hydro-priming. In addition, the maximum seedling dry weight was gained in seedling under the priming by all priming except 3% of $ZnSO_4$ compared to the control.

While, the increase in radical length due to priming treatments were hydro-priming, 75 and 100 mgL^{-1} of salicylic acid and 2% of KH_2PO_4 (18.12, 17.87, 18.28, 17.32 cm), respectively. The toxic effect of potassium salt on the seeds may be the reason behind the fact that KH_2PO_4 had high seed germination and seedling characters by 2%, and when its concentration increased to 3%, the percentage of germination and seedling characters decreased Yari *et al*. (2011). Wondimu *et al*. (2018) showed that the highest seed germination%, seedling dry weight seedling length, seedling vigor index were recorded when seed soaking in $ZnSO_4$ and hydro-primin over the unprimed sorghum seeds. Jeammuangpuk *et al*. (2020) found that seed soaking for in 50 mgL^{-1} of SA before germinating encouraged seed germination when compared to un-soaked seeds. Harris *et al*. (2000) showed that soaking seed in water on the farm significantly improved establishment and viability of chickpea and maize, caused in faster growth, early flowering and maturation and higher yields.

This simple method, low-cost, low-risk intervention also had positive effects on the broader agricultural system, economically and cost-effective livelihoods and the technology have proven very popular with farmers. The role of salicylic acid in germination of seed, enzymatic activity, plant growth and yield has been described by salicylic acid mediated in photosynthesis transpiration, stomata regulation, nutrient uptake and transport and led to increasing seed germination under low temperature condition and improved tolerance to faster cooling Sedghi *et al*. (2010).

Table 1. Seed germination%, plumule and radical length, seedling fresh and seedling dry weight of seed white hybrid teosinte as affected by duration and substance of priming.

Treatments	Germination %	Plumule length (cm)	Radical length (cm)	Seedling fresh weight (g)	Seedling dry weight (g)
			Priming duration (hour)		
Control (dry seed)	50.00	15.13	6.22	1.71	0.295
6 hours	75.00	24.98	16.80	4.21	0.435
8 hours	60.00	22.32	14.97	3.51	0.404
10 hours	44.00	21.97	13.17	3.44	0.370
F-test	**	*	**	*	**
LSD0.05	3.94	1.46	0.971	0.350	0.034
			Substance of priming		
Control (dry seed)	50.00	15.13	6.22	1.71	0.295
Hydro-priming	56.00	25.00	18.12	3.90	0.432
SA (50mgL^{-1})	51.00	23.89	14.70	3.61	0.395
SA (75mgL^{-1})	61.00	24.48	17.87	4.10	0.408
SA (100mgL^{-1})	62.00	26.20	18.28	4.29	0.449
KH_2PO_4 (1%)	56.00	24.06	14.78	4.14	0.416
KH_2PO_4 (2%)	77.00	25.75	17.32	4.44	0.417
KH_2PO_4 (3%)	58.00	24.87	15.75	4.34	0.422
$ZnSO_4$ (1%)	56.00	23.60	15.34	4.01	0.436
$ZnSO_4$ (2%)	63.00	22.33	14.30	3.26	0.395
$ZnSO_4$ (3%)	75.00	18.67	12.12	3.10	0.364
F-test	**	**	**	**	**
LSD0.05	7.54	2.80	1.86	0.671	.067

***, ** and NS indicated P<0.05%, P<0.01% and not significant, respectively**

The highest speed germination index (15.11), mean daily germination (8.97) and seedling vigor index (2461.89) were attained for 6 h priming duration compared to control Table (2). While, the highest viability recorded by the lowest electrical conductivity for 6 hours priming duration (17.71$\mu S.cm^{-1}.g^{-1}$) and compared to control was the highest value (36.40 $\mu S.cm^{-1}.g^{-1}$). Narayanan *et al*. (2019) showed that, the seeds soaked for 6 h was recorded the higher speed germination index and seedling vigor index.

Seed priming with 100mgL^{-1} of salicylic acid treatment increased significantly speed germination index (15.59). Seed priming with 2% of KH_2Po_4 and 3% of $ZnSO_4$ increased significantly mean daily germination (9.16 and 9.52) compared to the control (un-priming) (5.63). While, seed priming treatment using 2% of KH_2PO_4 recorded the maximum seedling vigor index (2672.47) as compared to control (seeds unprimed) which gave (844.87).

Meanwhile, the lowest electrical conductivity (6.17 $\mu S.cm^{-1}.g^{-1}$) was recorded at 2% of KH_2PO_4 followed by 3% of $ZnSO_4$ (6.17 and 7.26 $\mu S.cm^{-1}.g^{-1}$) compared to unprimed seeds which gave (36.400 $\mu S.cm^{-1}.g^{-1}$). The enhancing effect of salicylic acid can be attributed to the effects of the bio-regulator on the physiological and biochemical processes in plants such as an increase in level of cell differentiation, cell division and cell elongation within the apical meristem of seedling radical.

Enhancement in germination%, germination speed index and seedling vigor index might be due to that soaking of seed induces germination by repair of proteins damage, RNA and DNA.

Hussein (2016) showed that maximum speed of germination and seedling vigor index were recorded when the seed of maize treated with (2% KH_2PO_4) for 6 hours.

Narayanan *et al*. (2019) revealed that, the maize seeds primed with 2% of KH_2PO_4 were recorded higher speed germination index and higher seedling vigor index compared to unprimed seeds.

Table 2. Speed germination index, mean daily germination, seedling vigor index and electrical conductivity of seed white hybrid teosinte as affected by duration and substance of priming.

Treatments	Speed germination index	Mean daily germination	Seedling vigor index	Electrical conductivity ($\mu S.cm^{-1}.g^{-1}$)
		Priming duration (hour)		
Control (dry seed)	14.16	5.15	844.87	36.40
6 hours	15.11	8.97	2461.89	17.71
8 hours	15.05	7.83	1890.91	18.21
10 hours	14.98	6.51	1147.27	26.47
F-test	**	**	**	**
LSD0.05	0.198	1.04	188.10	0.496
		Substance of priming		
Control (dry seed)	14.16	5.63	844.87	36.40
Hydro-priming	15.11	7.52	1957.20	11.28
SA (50mgL^{-1})	14.99	6.44	1587.93	58.72
SA (75mgL^{-1})	15.17	7.87	1884.86	11.03
SA (100mgL^{-1})	15.59	7.62	2225.95	9.21
KH_2PO_4 (1%)	15.08	7.05	1722.11	32.84
KH_2PO_4 (2%)	15.13	9.16	2672.47	6.17
KH_2PO_4 (3%)	15.00	6.93	1828.69	16.48
$ZnSO_4$ (1%)	15.06	6.69	1573.58	23.00
$ZnSO_4$ (2%)	15.08	8.12	1610.22	10.44
$ZnSO_4$ (3%)	15.12	9.52	2259.03	7.26
F-test	**	*	**	**
LSD0.05	0.380	0.677	360.30	0.947

***, ** and NS indicated P<0.05%, P<0.01% and not significant, respectively**

Data in (Table 3) observed that the effect of interaction between seed priming duration and substance of priming had a highly significant effect on all characters.

Maximum seed germination% (93.00 and 90.00 %) produced from 6 hours priming duration and seed primed with 2% of KH_2PO_4 and 3% of $ZnSO_4$.

Maximum plumule length (31.05 and 30.77 cm) were from 100 mgL^{-1} of salicylic acid and 1% of KH_2PO_4 and radical length (22.09 and 23.76 cm) were obtained from 6 hours priming duration and 75 and 100 mgL^{-1} salicylic acid and hydro-priming with 8 hours (24.32 cm) compared with control.

Maximum seedling fresh weight (5.79, 5.52, 5.06 and 5.61 g) was obtained from 6 hours priming duration and hydro-priming, 100 mgL^{-1} of salicylic acid and 1 and 2% of KH_2PO_4.

While, the highest seedling dry weight (0.552, 0.544, 0.534 and 0.512 g) were obtained from 6 hours priming duration and hydro-priming, 1% of $ZnSO_4$, 100 mgL^{-1} of salicylic acid and 3% of KH_2PO_4.

Narayanan *et al*. (2019) revealed that, the maize seeds primed with 2% of KH_2PO_4 for 6 hours produced higher germination%, longer radical and plumule length and higher seedling dry matter compared to dry seeds (control) gave the lowest seed germination%, radical length, plumule length and lower seedling dry matter. Hussein (2016) showed that maximum seed germination%, radical length, plumule length and seedling fresh and dry weight was found when the seeds soaked in (2% KH_2PO_4) for 6 hours.

Data in (Table 4) indicated that the effect of interaction between seed priming duration and substance of priming had a highly significant effect on mean daily germination, seedling vigor index and electrical conductivity.

Maximum mean daily germination (10.89, 10.54, 10.76 and 9.89) produced from 6 hours priming duration and seed primed with hydro-priming, 2% of KH_2PO_4, 3% of $ZnSO_4$ and 100 mgL^{-1} salicylic acid.

While, maximum seedling vigor index (3735.93, 3450.67 and 3843.60) produced by hydro-priming, 100 mgL^{-1} salicylic acid and 2% of KH_2PO_4.While, the minimum of electrical conductivity (4.90 and 5.65 $\mu S.cm^{-1}.g^{-1}$) was obtained from 6 hours priming duration and 2% of KH_2PO_4 and 3% of $ZnSO_4$ and (5.66, 4.78 and 4.91 $\mu S.cm^{-1}.g^{-1}$) for 8 hours priming duration and 100 mgL^{-1} of salicylic acid, 2% KH_2PO_4 and 3% of $ZnSO_4$.

Narayanan *et al*. (2019) showed that, the seeds primed with 2% of KH_2PO_4 for 6 hours gave the higher vigor index compared to the dry seed (control).

Table 3. Interaction effect of duration and substance of priming on seed germination%, plumule and radical length, seedling fresh and dry weight of seed white teosinte hybrid.

Duration hours	Priming	Germination%	Plumule length (cm)	Radical length (cm)	Seedling fresh weight (g)	Seedling dry weight (g)
Control (dry seed)		50.00	15.13	6.22	1.71	0.295
6 hours	Hydro-priming	80.00	28.93	12.50	5.79	0.552
	SA (50mgL^{-1})	50.00	22.73	18.99	3.24	0.326
	SA (75mgL^{-1})	68.00	24.83	22.09	3.36	0.407
	SA (100mgL^{-1})	81.00	31.05	23.76	5.52	0.534
	KH_2PO_4 (1%)	73.00	30.77	17.01	5.06	0.460
	KH_2PO_4 (2%)	93.00	28.72	18.78	5.61	0.463
	KH_2PO_4 (3%)	68.00	28.00	11.80	4.98	0.512
	$ZnSO_4$ (1%)	45.00	26.02	18.55	4.33	0.478
	$ZnSO_4$ (2%)	65.00	22.03	17.60	3.49	0.383
	$ZnSO_4$ (3%)	90.00	16.55	17.53	3.17	0.376
8 hours	Hydro-priming	43.00	23.28	24.32	1.98	0.481
	SA (50mgL^{-1})	60.00	27.99	13.71	3.89	0.415
	SA (75mgL^{-1})	63.00	28.73	15.57	4.22	0.418
	SA (100mgL^{-1})	63.00	21.88	20.01	4.48	0.429
	KH_2PO_4 (1%)	45.00	17.74	16.38	4.03	0.322
	KH_2PO_4 (2%)	73.00	29.38	17.67	3.52	0.467
	KH_2PO_4 (3%)	40.00	27.28	17.29	3.04	0.500
	$ZnSO_4$ (1%)	55.00	22.66	13.70	4.20	0.544
	$ZnSO_4$ (2%)	67.00	17.60	11.51	3.96	0.292
	$ZnSO_4$ (3%)	78.00	13.80	8.33	3.57	0.279
10 hours	Hydro-priming	35.00	17.35	17.55	3.94	0.262
	SA (50mgL^{-1})	30.00	22.73	11.06	3.13	0.398
	SA (75mgL^{-1})	32.00	23.57	11.41	3.68	0.403
	SA (100mgL^{-1})	45.00	25.67	15.97	4.47	0.430
	KH_2PO_4 (1%)	38.00	21.26	9.18	2.77	0.306
	KH_2PO_4 (2%)	50.00	23.67	18.16	5.01	0.323
	KH_2PO_4 (3%)	53.00	17.22	17.28	4.75	0.419
	$ZnSO_4$ (1%)	35.00	26.09	15.95	4.65	0.429
	$ZnSO_4$ (2%)	50.00	25.67	11.61	1.87	0.418
	$ZnSO_4$ (3%)	53.00	23.36	10.49	1.82	0.389
F-test		**	**	**	**	**
LSD.0.05		13.06	4.843	3.222	1.162	0.115

***, ** and NS indicated P<0.05%, P<0.01% and not significant, respectively.**

Table 4. Interaction effect of duration and substance of priming on mean daily germination, seedling vigor index and electrical conductivity of seed white teosinte hybrid.

Duration hours	Priming	Mean daily germination (per day)	Seedling vigor index	Electrical conductivity (µS.cm^{-1}.g^{-1})
Control (dry seed)		5.98	844.87	31.62
6 hours	Hydro-priming	10.54	3735.93	17.79
	SA (50mgL^{-1})	6.93	1535.83	44.82
	SA (75mgL^{-1})	9.15	2227.90	10.55
	SA (100mgL^{-1})	9.89	3450.67	8.83
	KH_2PO_4 (1%)	9.72	2943.78	24.79
	KH_2PO_4 (2%)	10.89	3843.60	4.90
	KH_2PO_4 (3%)	9.15	2609.98	16.12
	$ZnSO_4$ (1%)	4.36	865.53	19.33
	$ZnSO_4$ (2%)	6.90	1845.07	10.46
	$ZnSO_4$ (3%)	10.76	3177.60	5.65
8 hours	Hydro-priming	4.75	968.28	11.21
	SA (50mgL^{-1})	6.26	2212.70	65.33
	SA (75mgL^{-1})	6.84	2348.77	7.52
	SA (100mgL^{-1})	7.67	2511.33	5.66
	KH_2PO_4 (1%)	5.51	1461.25	33.20
	KH_2PO_4 (2%)	7.21	2390.07	4.78
	KH_2PO_4 (3%)	4.98	873.80	8.83
	$ZnSO_4$ (1%)	5.79	2020.33	19.42
	$ZnSO_4$ (2%)	6.89	2269.27	6.04
	$ZnSO_4$ (3%)	9.79	2899.30	4.91
10 hours	Hydro-priming	3.68	1167.40	22.85
	SA (50mgL^{-1})	2.48	715.85	66.01
	SA (75mgL^{-1})	2.55	879.20	15.02
	SA (100mgL^{-1})	5.16	1213.98	13.14
	KH_2PO_4 (1%)	3.89	761.30	40.52
	KH_2PO_4 (2%)	7.31	2002.28	8.83
	KH_2PO_4 (3%)	6.79	1783.73	24.49
	$ZnSO_4$ (1%)	3.89	955.90	30.24
	$ZnSO_4$ (2%)	5.13	965.25	14.82
	$ZnSO_4$ (3%)	7.11	1330.21	11.22
F-test		**	**	**
LSD.0.05		1.001	624.0	1.640

***, ** and NS indicated P<0.05%, P<0.01% and not significant, respectively.**

CONCOLUTION

The effect obtained from the priming depends on the method used and the time of treatment. Hydro-priming is a simple method and low cost of soaking treatment. It does not require any special technical equipment and due to the use of distilled water as priming medium. It is probably the cheapest priming method. Soaking seeds before sowing in water (hydro-priming) gives the germinating seeds a head start and speed up seed establishment with a corresponding increase in survival and yields rates.

The optimal time for hydro-priming and other priming of the white hybrid teosinte seeds in this experiment was 6 h in distilled water and a solution of 100 mgL^{-1} salicylic acid, 2% KH_2PO_4 and 3% $ZnSO_4$.

In the end distilled water followed by 100 mgL^{-1} of salicylic acid, 2% of KH_2PO_4 and 3% of $ZnSO_4$ may be effective for enhanced germination and seeds viability for white hybrid teosinte.

The rational is that sowing soaked seeds reduces the time required for germination and may allow the seedlings to escape the physical conditions of the degraded soil.

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تأثير مدة و مادة نقع بذور هجين الآذرة الريانة الأبيض لتحسين حيوية و قوة البادرات و نمو وإنتاجية العلف.

أـ تأثير النقع ومدتة على حيوية و قوة البادرات

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أجريت هذه الدراسة بمعمل قسم بحوث تكنولوجيا البذور بسخا ، معهد بحوث المحاصيل الحقلية ، مركز البحوث الزراعية، مصر خلال موسم ٢٠١٩. وكان الغرض من البحث دراسة تأثيرمدة نقع البذور وهي (٦ و ٨ و ١٠ ساعات) ونقع البذور(النقع في ماء مقطر و حمض السالسيليك بتركيز ٥٠ و٧٥ و ١٠٠ مجم/لتر و فوسفات البوتاسيوم بتركيز ١ و٢ و ٣% وكبريتات الزنك بتركيز١ و ٢ و ٣%) و البذرة جافة (كنترول) علي تحسين حيوية و نسبة الإنبات وكذلك قوة البادرات في هجين الآذرة الريانة الأبيض. أوضحت النتائج أن النقع لمدة ٦ ساعات أعطت أعلي نسبة إنبات و طول الريشة و طول الجذير و أعلي وزن رطب ووزن جاف للبادرات و دليل سرعة الإنبات ومتوسط الأنبات اليومي و دليل قوة البادرات، متبوع بمدة النقع ٨ و ١٠ ساعات علي الترتيب. معامله البذرة بـ ٢% من فوسفات البوتاسيوم أعطي أفضل النتائج يليه ١٠٠ مجم/لتر من حمض السالسيليك ثم يليه ٣% كبريتات الزنك أعطوا أعلي نسبة إنبات و أطول ريشة و جذير و أثقل وزن رطب ووزن جاف للبادرات و دليل سرعة الإنبات ومعدل الإنبات ودليل قوة البادرات. و أعطي النقع في الماء أعلي القيم لمعظم الصفات مثل طول الريشة و طول الجذير و الوزن الجاف للبادرة و دليل سرعة الإنبات و كان أقل في قيمه التوصيل الكهربي. كان التفاعل بين مدة النقع و ماده النقع كان معنوي حيث أعطت مدة النقع لمدة ٦ ساعات مع ٢% فوسفات البوتاسيوم و ٣% من كبريتات الزنك أعلي نسبه إنبات و بدون فرق معنوي مع النقع في الماء. و أعطت مدة النقع ٦ ساعات مع ١٠٠ مجم/لتر من حمض السالسيليك يليه ١% من فوسفات البوتاسيوم و النقع في الماء أطول ريشة و أطول جذير وأعلي وزن رطب ووزن جاف للبادرة ومتوسط الإنبات اليومي و قوة البادرات. و كانت أقل قيمه للتوصيل الكهربي مع النقع لمدة ٦ ساعات مع ٢% من فوسفات البوتاسيوم يليه ٣% من كبريتات الزنك. و يمكن التوصية بأن نقع هجين الآذرة الريانة الأبيض في الماء لمدة ٦ ساعات قبل الزراعة يزيد من نسبة الإنبات لتصل إلي٨٠% و كذلك زيادة صفات الحيوية مقارنه بالبذور الجافة.