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Impact of Some Seed Treatments on Teosinte Seed Quality Under Laboratory and Field Conditions

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ABSTRACT

This investigation was conducted under the laboratory conditions of Seed Technology Research Unit, Mansoura and field conditions of the Experimental Farm, Tag El Eizz Research Station Dakahlia Governorate, (ARC) during 2015 year. The objectives of the experiment were to evaluate the effect of some pre-sowing seed treatments on seed germination, seed and seedling vigor traits and field emergence of teosinte seed (*Zea Mexicana*). Seed treatments were dry heat (70°C and 80°C) for 3, 5 and 8 minutes; hot water for 5 and 10 minutes; H_2SO_4 75% for 15 and 20 minutes; cold storage (4°C) for 1, 2 and 3 months; static magnetic field 60 mT for 0, 6 and 12 hours; dry seeds and wet seeds. The main reveled that, treating teosinte seed pre-sowing by dry heat (70°C for 5 minutes or 80°C for 3 minutes) improved seed quality treats i.e. germination percentage, seed and seedling vigor traits. Expose teosinte seed to static magnetic field (60 mT for 6 hours produced the fastest mean germination time. Soaking teosinte seed in H_2SO_4 75% for 15 minutes) produced the fastest germination speed and highest field emergence%. General, we can get high germination percentage, seed and seedling vigor under laboratory and field emergence consequently high plant density under field condition by treating teosinte seed (c.v. population Damietta) with dry heat or H_2SO_4 75% for 15 minutes.

INTRODUCTION

Teosinte (*Zea mexicana*) is one of the most essential summer forge crops in Egypt. Seed germination of teosinte did not reach the optimum levels this leds to decreasing plant density under field conditions. Some studies reveled that seed of annual teosinte are dormant when harvested and require after ripening period where seed germination and hormones activity are among the major factors deciding seed quality. Methods of breaking dormancy are widely used for enhancing seed performance by improving the rate and uniformity of germination and decreasing seed sensibility to external factors, enhancing seed with low vigor and improving dormancy.

The seeds of various plants, even mature, undamaged and viable seeds, don't germinate if they aren't sowing in suitable environments. These conditions are called dormancy which is caused by both internal and external factors (Mirbadin and Shibani, 1992). Numerous different factors influence seed dormancy and germination including age of plant and length of day (Gutterman and Genotypic, 1997; Castor *et al*., 2000), temperature (Marayama *et al*., 1997) and date of harvest (Kondo, 1993; Ghosh and Bruin, 1997). Dormancy plays a major role in the ecological adaptation of plant species. It is common in plants, in which it may ensure the ability of a species to survive natural catastrophes, decrease competition between individuals of the same species, or prevent germination out of season (Finkelstein *et al*., 2008). Seed dormancy is determined by both genetics and the environment and is conferred by morphological and physiological factors including seed coats, substances contained in seed that protect and covering (flavonoids, mucilage, and lipid polyester derivatives), and plant hormones balance (abscisic acid and gibberellins) (North *et al*., 2010).

Numerous ways have been anticipated for breaking of seeds dormancy. Among these ways are chilling, storage of seeds for particular periods, seeds hydro-priming, seeds chemical and mechanical scarifications and appliance of growth hormones (Coepland, 1986; Anderson, 1996). Ungar and Khan (2001) confirmed that seeds size and color play essential roles in germination %, so that the germination % of small black seeds of *Atriplex* exhausted was 30% lower than that of big brown seeds for the same species. One - two percent of seeds germinate under laboratory conditions. Laihacer-kind and Loud (1985) indicated that soaking the seeds of this species in hot water didn't improve germination percentage of seeds. But soaking them in sulfuric acid solution (6%) for 45 minutes increased germination % of seeds by 28%.

Many investigators have indicated that magnetic field was affective on germination of seeds, growth of seedling, reproduction and growth of meristem cells and quantities of chlorophyll (Namba *et al.*, 1995; Atak *et al.*, 1997; Reina *et al.*, 2001; Amera and Hozayn, 2010a & b; Hozayn *et al.*, 2014). Magnetic field had a positive effect on photochemical activity, respiration rate and activity of enzymes (Phirke *et al.*, 1996; Martinez *et al.*, 2000; Carbonell *et al.*, 2002). Magnetic field management of seeds leads to speeding up of plants growth, biosynthesis of proteins and development of roots (Kordas, 2002). Racuciu *et al.* (2008) found that the activities of some enzymes were improved by exposure to magnetic field. Hozayn *et al.*, (2015) reported that magnetic field treatment improved all germination and seedling growth traits of onion seeds compared with control treatment.

This investigation was conducted to determine the best methods of breaking dormancy for teosinte seed to improve performance of seed viability, seedling vigor, enzyme activity and field emergency.

MATERIALS AND METHODS

Laboratory and field were conducted at Seed Technology Research Unit, El-Mansoura, and Experimental Farm Tag El Ezz Research Station Dakahlia Governorate, Egypt, during 2015 year, to study the effect of pre-sowing seed treatments on seed germination, seed and seedling vigor, enzyme activity and field performance of teosinte seed.

Laboratory Experiment:

Teosinte seed (c.v. population Damietta) was obtained from Forage Crops Research Department,

Field Crops Research Institute, ARC. The experiment was laid out in completely randomized design with three replicate. Teosinte seed were subjected to the following treatments: -

1- Dry heat: Seed sample was heated at 70°C and 80°C with free air circulation for 3, 5 and 8 minutes before they placed under germination test.
2- Hot water: Teosinte seed were soaked in hot water 70°C for 5 and 10 minutes before sowing. After the required time seed were removed from hot water then sowing.
3- Sulfuric acid treatment: Seed sample were soaked in sulfuric acid (75%) for 15 and 20 minutes. Seed were removed before any acid penetrated the seed coats and washed thoroughly several times with water before sowing.
4- Cold storage treatment: - Teosinte seed sample was stored in refrigerator at (4°C) for 1, 2 and 3 months before sowing.
5- Magnetic treatment: - Seed sample was immersed in Sodium Hypochloride (5%) for 5 minutes to avoid fungal invasion. Seed were exposed to magnetic field through rimming it in static device with 60 mT for different times (passing, 6 and 12 hours) before sowing.
6- Dry seed.
7- Wet seed: Teosinte seed were soaked in water for 12 hours.

The following traits were recoded

Germination Percentage: 25 seeds from the etch treatment were seeded in Petri dishes containing sterilized sandy soil. The boxes were incubated at 25°C in germination chamber for 10 days. Germination percentage was estimated according to **(ISTA, 1996)**.

$$GP = \frac{\text{Total number of germinated seeds}}{\text{Total number of seeds evaluated}} \times 100$$

Speed germination index: Speed of germination index was calculated as described in the Association of Official Seed Analysts (AOSA, 1983) by following formula:

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

Energy of germination: Energy of germination was recorded on the 4th day after planting. It is the percentage of germinating seeds 4 days after planting relative to the total number of seeds tested **(Ruan *et al.*, 2002)**.

$$EG = \frac{\text{Germination percentage after 4 days}}{\text{Total number of seeds tested}} \times 100$$

Mean germination time: Mean germination time was calculated using the formula by **(Ellis and Roberts, 1981)**.

$$MGT = \frac{D \times n}{n}$$

"n" is the number of seeds, which were germinated (emerged) on day D.

"D" is the number of days counted from the beginning of emergence (test).

Means daily germination: Means daily germination is an index of daily germination rate (Scott *et al.,* 1984).

$$MDG = \frac{FGP}{D}$$

FGP is final germination percent, D is day of maximum germination (experiment period).

Coefficient of velocity of germination: Coefficient of velocity of germination is an index for germination speed **(Maguire, 1962)**.

$$CVG = \frac{G1+G2+ \ldots..+ Gn}{(1XG1)+(2XG2)+\cdots.+(nXGn)} \text{ (seed day}^{-1}\text{)}$$

G is number of germinated seeds.

Plumele length, radical length and seedling dry weight: Were taken as an average of ten normal seedlings from each replication according to **(**Kirshnasamy and Seshu, 1990) the seedlings were put into paper packet separately and placed into the preheated oven dry weight was taken after 3 days at 70°C.

Seedling Vigor Index: Was determined according to the formula given by **(Reddy and Khan, 2001**).

Seedling vigor index 1 = Germination percentage X Seedling length.

Seedling vigor index 2 = Germination percentage X Seedling dry weight.

Field emergence percentage: One hundred seeds were randomly selected from each treatment and used for field emergence studies. The seeds were hand dibbled to about four centimeters' depth with a spacing of 20 x 10 centimeters. The seed bed was provided with adequate moisture to get good germination and plant stand. Seedlings which emerged three centimeters above the soil surface on tenth day after sowing were counted and expressed as field emergence percentage.

Extraction of plant enzymes: One gram of plants was ground in a mortar with 10 ml of 0.1M phosphate buffer solution (pH 7.0) and filtered through many layer of clothes. The homogenate was centrifuged at 3000 rpm for 15 minutes. The supernatant was used to determine the peroxidase and catalase activities (Goldschmidt *et al.*, 1968).

1- Assay of peroxidase activity: Peroxidase activity was determined using 0.1ml of 0.2M pyrogalol solution added to a cuvette containing 1ml of 0.01M buffer solution, 0.5ml hydrogen peroxide solution, 0.1 ml enzyme extract and 1.4 ml distilled water to make the final volume 3 ml. Peroxidase activity was expressed as the increase in absorbance at 400 nm after 30 sec. (Abeles *et al.*, 1971) using spectrophotometer (Shimadzu UV-2401 PC UV-VIS Spectrophotometer (Shimadu Co. Kyoto, Japan).

2. Assay of catalase activity: Catalase activity was measured by the spectrophotometer method given by Chen, *et al.* (2000).

The cuvette containing 0.5 ml phosphate buffer (pH 7.0), 0.3 ml of 0.5% hydrogen peroxidase and 0.4 ml enzyme extract. Distilled water was added to make up the final volume 3 ml. Data was expressed as change in absorption at 240 nm using spectrophotometer

Statistical analysis: All data were subjected to statistical analysis using "MSTAT-C" computer software package (Nissen *et al.*, 1985) as published by Gomez and Gomez (1984). Duncan's New Multiple Range Test at 5% level of probability was used to compare means which were indicated by alphabets on data sets (Waller and Duncan, 1969).

RESULTS

General results showed that treatments enhanced seed viability, seedling vigor, enzyme activity and field emergence comparing with untreated seeds.

Data presented in Table 1 (ANOVA) showed that significant effect on all characters occurred by exposing teosinte seeds for seed treatments.

Table 1. **Analysis of variance for the effect of seed treatments on the studied traits.**

S.O.V. / Characters	Degree of freedom			Treatment mean square
	Treatment	Error	Total	
Germination percentage (%)	17	34	53	537.569**
Speed germination index (SGI)	17	34	53	16.53**
Germination Energy	17	34	53	14343.17**
Mean Germination Time (MGT)	17	34	53	0.145 **
Mean daily Germination (MDG)	17	34	53	35.86**
Coefficient velocity germination (CVG)	17	34	53	0.000 **
Shoot seedling length (cm)	17	34	53	11.99**
Radical seedling length (cm)	17	34	53	7.46**
Seedling dry weight (g)	17	34	53	0.008**
Seedling vigor index (SVI1)	17	34	53	646054.29**
Seedling vigor index (SVI2)	17	34	53	91.13**
Field emergence	17	34	53	332.51**
Peroxidase activities	17	34	53	5459.77**
Catalase activities	17	34	53	2043.74**

***, ** Significant difference at P<0.05 and 0.01.**

Presented data in Table 2, showed that significant effects on all the studied characters occurred by the teosinte seed treatments compared to control. Regarding germination percentage, speed germination index, energy of germination and mean germination time, the highest values achieved by expose teosinte seeds to dry heat (80°C) for 3 minutes where germination % increased from 55 and 50% for control to 98.3% followed by 95% for soaked seed in H_2SO_4 (75%) for 15 minutes then (90.0%) for subjected seed in static magnetic field for 12 hours, cold storage for 3 months and germination of energy increased from 275 and 250 for dry and wet seed to 512.5. Speed of germination index increased from 5.2 and 4.9 in control to 12.5 when teosinte seed soaked in H_2SO_4 (75%) for 15 minutes. Mean germination time decreased from 2.2 and 2.1 days in control to 1.5 days when seed exposed to static magnetic field (60 mT) for 6 hours.

Table 2. Averages of germination percentage, speed of germination index, energy of germination and mean germination time of teosinte seeds as affected by seed treatments.

Treatments	Characters	Germination percentage (%)	Speed germination index	Energy of germination (%)	Mean germination time (day)
Dry heat 70°C	3 min	75.0 cde	7.5 efgh	375.0 cdef	2.0 abcd
	5 min	83.3 abcd	8.1 defg	416.7 bcde	2.1 a
	8 min	85.0 abcd	8.2 cdefg	425.0 abcd	2.1 a
Dry heat 80°C	3 min	98.3 a	9.8 bcde	512.5 a	2.2 a
	5 min	85.0 abcd	8.2 cdefg	425.0 abcd	2.1 a
	8 min	62.7 efg	5.9 gh	312.5 fgh	2.2 a
Hot water (70°C)	5 min	65.0 efg	6.4 fgh	325.0 efgh	2.0 abc
	10 min	70.0 def	6.8 fgh	350.0 defg	2.1 ab
Sulfuric acid (75%)	15 min	95.0 ab	12.5 a	475.0 ab	1.8 de
	20 min	75.0 cde	10.3 abcd	375.0 cdef	1.6 ef
Cold storage	1 month	65.0 efg	7.3 efgh	325.0 efgh	2.0 abcd
	2 months	75.0 cde	10.7 abcd	375.0 cdef	1.6 ef
	3 months	90.0 abc	12 ab	450.0 abc	1.9 cd
Magnetic field (60 mT)	Passing	77.7 bcde	8.8 cdef	387.5 bcdef	1.9 bcd
	6 hours	75.0 cde	11.8 ab	375.0 cdef	1.5 f
	12 hours	90.0 abc	10.8 abc	450.0 abc	1.8 de
Dry seed (control 1)		55.0 fg	5.2 h	275.0 gh	2.2 a
Wet seed (control 2)		50.0 g	4.9 h	250.0 h	2.1 abc
F test		**	**	**	**

Values within the same column followed by the same letters are not significantly different using Duncan's multiple range test at the level of 5% probability.

Presented data in Table 3, showed significant effect on mean daily germination, coefficient velocity of germination and seedling vigor traits i.e. (plumule and radical length and seedling dry weigh) occurred by

exposing teosinte seeds for the different seed treatments compared to control. Mean daily germination increased from 13.8 and 12.5 for control treatments to 25.6 for dry heat treatment 80 ^{0}C for 3 minutes. Coefficient velocity of germination increased from 0.257 and 0.249 for dry and wet seed, respectively to 0.263 when teosinte seed soaked in hot water (70°C) for 10 minutes. Data in Tables 3 and 4, showed that significant increase in seedling traits (plumule and radical length, seedling dry weight, seedling vigor index 1 and seedling vigor index 2, the highest values achieved by exposing seed to dry heat (70°C) for 8 minutes, (80°C) for 3 minutes and (80°C) for 5 minutes, but the highest plumule length recorded when teosinte seed stored in cold condition for 2 months.

Table 3. Averages of means dally germination, coefficient velocity of germination and seedling vigor (plumule length and radical length and seedling dry weigh) of teosinte seeds as affected by seed treatments.

Treatments		Characters	Means daily germination	Coefficient velocity of germination	Plumule length (cm)	Radical length (cm)	Seedling dry weight (g)
Dry heat	70°C	3 min	18.8 cdef	0.250 abcde	17.5 bcd	12.6 b	0.29 abc
		5 min	20.8 bcde	0.253 abcd	18.0 bc	11.5 bcdef	0.30 ab
		8 min	21.3 abcd	0.254 abc	17.1 bcd	15.4 a	0.21 de
	80°C	3 min	25.6 a	0.258 ab	17.3 bcd	12.1 bcd	0.29 abc
		5 min	21.3 abcd	0.261 a	18.8 ab	12.2 bc	0.36 a
		8 min	15.6 fgi	0.255 abc	17.2 bcd	10.4 cdefghi	0.25 bcde
Hot water (70°C)		5 min	16.3 efgi	0.249 abcdef	15.4 cde	9.7 fghi	0.29 abcd
		10 min	17.5 defg	0.263 a	15.6 cde	11.3 bcdefg	0.29 abc
Sulfuric acid (75%)		15 min	23.8 ab	0.234 fghi	13.8 e	9.9 efghi	0.18 e
		20 min	18.8 cdef	0.229 ghi	14.7 de	11.0 bcdefgh	0.21 cde
Cold storage		1month	16.3 efgi	0.235 efghi	19.2 ab	8.7 i	0.18 e
		2 months	18.8 cdef	0.225 hi	21.1 a	9.3 hi	0.18 e
		3 months	22.5 abc	0.243 bcdefg	19.9 ab	9.5 ghi	0.19 e
Magnetic field (60mT)		Passing	19.4 bcdef	0.242 cdefg	15.8 cde	12.4 b	0.21 de
		6 hours	18.8 cdef	0.222 i	15.9 cde	10.2 defghi	0.21 cde
		12 hours	22.5 abc	0.238 defgh	14.7 de	11.8 bcde	0.21 e
Dry seed (control 1)			13.8 gi	0.257 abc	15.5 cde	11.8 bcde	0.24 bcde
Wet seed (control 2)			12.5 i	0.249 abcdef	15.1 de	10.7 bcdefgh	0.22 bcde
F test			**	**	**	**	**

Values within the same column followed by the same letters are not significantly different using Duncan's multiple range test at the level of 5% probability.

Table 4. Averages of seedling vigor index 1, seedling vigor index 2, field emergence percentage, Peroxidase and Catalase activities of teosinte seeds as affected by seed treatments.

Treatments		Characters	Seedling vigor index 1	Seedling vigor index 2	Field emergence percentage	Peroxidase (units mg^{-1} protein)	Catalase (units mg^{-1} protein)
Dry heat	70°C	3 min	2257.5 bcde	21.83 bcd	66.0 ef	1.05 i	1.03 h
		5 min	2459.5 abc	24.55 abc	68.0 ef	2.54 ab	2.19 a
		8 min	2762.8 ab	17.86 cdef	74.0 cd	1.28 j	1.25 g
	80°C	3 min	3010.5 a	30.03 ab	57.0 hi	2.50 d	0.55 i
		5 min	2635.0 ab	30.46 a	67.5 ef	2.51 d	1.57 d
		8 min	1720.0 efgh	15.94 def	56.0 hi	2.54 abc	0.30 m
Hot water 70°C		5 min	1631.5 fgh	18.85 cdef	53.0 i	2.55 a	0.87 j
		10 min	1892.0 cdefg	20.78 cde	58.0 h	1.04 i	0.61 k
Sulfuric acid (75%)		15 min	2254.5 bcde	17.03 cdef	84.5 a	2.23 e	1.05 h
		20 min	1927.5 cdefg	16.01 cdef	70.0 de	2.49 d	1.33 f
Cold storage		1month	1813.5 defgh	11.70 f	60.0 gh	1.45 h	1.62 c
		2 months	2275.0 bcde	13.57 def	64.0 fg	1.33 i	1.45 e
		3 months	2641.5 ab	16.83 cdef	78.0 bc	1.27 j	1.36 f
Magnetic field (60mT)		Passing	2177.7 bcdef	16.27 cdef	56.5 hi	1.69 f	2.02 b
		6 hours	1962.8 cdefg	16.14 cdef	64.5 fg	2.51 bcd	2.05 b
		12 hours	2380.5 bcd	18.63 cdef	79.0 b	2.51 cd	0.92 i
Dry seed (control 1)			1495.8 gh	13.09 ef	44.0 j	1.18 k	1.03 h
Wet seed (control 2)			1292.7 h	10.79 f	52.5 i	1.55 g	1.27 g
F test			**	**	**	**	**

Values within the same column followed by the same letters are not significantly different using Duncan's multiple range test at the level of 5% probability.

Data illustrated in Table 4, indicated that significant effect on field emergency percentage, peroxidase and catalase activity occurred by the different seed treatments compared to control. Field emergency percentage increased from 44% and 52.5% for dry and wet seed to 84.5% for soaked seed in 75%

H_2 SO_4 for 15 minutes followed by exposed seed to static magnetic field 60 mT for 12 hours and stored seed in cold condition for 3 months. Data presented in the same Table showed that seed treatments induced significantly Peroxidase activity. Maximum activity (2.55 units mg^{-1} protein) were observed when teosinte seed soaked in hot water (70°C) for 5 minutes, followed by 2.54 units mg^{-1} protein for dry heat treatment (70°C and 80°C for 5 minutes), respectively compared with dry and wet seed. Data presented of Catalase activity in teosinte shoots shown in Table (4). Maximum CAT activity (2.19 units mg^{-1} protein) were observed when teosinte seed exposed for dry heat at 70°C for 5 minutes, followed by exposed seed to static magnetic field 60 mT for 6 hours compared to control (1.03 and 1.27 units mg^{-1} protein).

DISCUSSION

The increase in germination percentage when expose seed to high temperatures before planting may be attributable to the high moisture content in seed, then leads to stop the metabolic processes, seed metabolic activities generally increased with temperature and moisture content simultaneously and a high moisture content reduced seed germination (Owolade, *et al.* 2005). Roberts (1988) decided that temperature affects the rate of dormancy loss in dry seeds and the pattern of dormancy change in moist seeds and in non-dormant seeds temperature determines the rate of germination. Dormancy in teosinte may be due to the hardness of external coat consequently the working temperature of the breakdown of hard dormancy controlled by the physical characteristics hard, water-impermeable seed-coat occurs in numerous species but is most common in members of the *Gramineae* (Bewley and Black, 1982). Mahmudzadeh *et al.* (2003) found that treatment sulfuric acid (70%) was very effective in seed dormancy breaking. Nosrati *et al.* (2008) found that treatment of the seeds of *Atriplex Canescens* with H_2SO_4 for 30 minutes was the most effectual method for breaking their dormancy, so that it gave about the highest percentage of germination, rate of germination and weight of seedling. Perhaps treating the seeds of goosefoot with H_2SO_4 (75%) for a shorter time (even some seconds) in order to break their dormancy could have led to better results for quickly and timely fighting with their germination and establishment in fields and declining their damages to the crops. Hozayn *et al.* (2015) reported that magnetic field exposure improved all germination traits. Exposed carry over and fresh onion seeds to 0.06 T with 30 mints recorded the maximum values of germination %, rate of germination, energy of germination, germination speed index and seedling vigor. Whereas, mean germination time was decreased. Using 0.03T with 60 mints recorded highest values in carry over seeds and with 60 mints in new seeds.

From this study we can treat teosinte seed pre-sowing by dry heat (70 – 80°C) for 3-5 minutes or soaking in sulfuric acid solution 75% for 15 minutes to get high germination percentage, seed and seedling vigor traits under laboratory conditions and field emergence consequently seedling establishment and plant density under field conditions.

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تأثير بعض معاملات البذور على جودة تقاوى الذرة الريانة تحت ظروف المعمل والحقل.

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قسم بحوث تكنولوجيا البذور – معهد بحوث المحاصيل الحقلية – مركز البحوث الزراعية.

تعتبر الذرة الريانة أحد أهم محاصيل العلف الصيفية في مصر إلا أن انخفاض نسبة الإنبات ربما يرجع لصلابة قصرتها. وقد استخدمت العديد من الطرق لتعزيز أداء البذور وانتظام انباتها ولتحقيق ذلك أجريت تجربتين (معملية وحقلية) بوحدة بحوث تكنولوجيا البذور بالمنصورة والمزرعة البحثية بمحطة بحوث تاج العز مركز البحوث الزراعية - محافظة الدقهلية – مصر خلال عام ٢٠١٥م لدراسة تأثير بعض معاملات التقاوى على انبات وقوة البذور والبادرات والتكشف الحقلى لتقاوى الذرة الريانة صنف (عشيرة دمياط). وقد تم معاملة البذور كما يلى: - تعريض التقاوى لدرجة حرارة جافة ٧٠ و٨٠°م لمدة ٣، ٥ و٨ دقائق، النقع في الماء الساخن ٧٠°م لمدة ٥ و١٠ دقائق والنقع فى حمض الكبريتيك تركيز ٧٥% لمدة ١٥ و٢٠ دقيقة والتخزين البارد (٤°م) لمدة ١، ٢ و٣ شهور والتعرض لمجال مغناطيسى ثابت ٦٠ ميلى تسلا لمدة صفر، ٦ و١٢ ساعة والبذور الجافة بدون معاملة والبذور الرطبة. أوضحت النتائج أن أعلى نسبة إنبات وقوة بذور وبادرات كانت عند تعريض البذور لدرجة حرارة مرتفعة ٧٠°م مع زيادة مدة التعرض إلى ١٠ دقائق أو ٨٠°م مع تقليل مدة التعرض إلى ٥ دقائق وللحصول على أسرع زمن للإنبات كان بتعريض التقاوى لحقل مغناطيسى ثابت لمدة ٦ ساعات بينما كان أعلى متوسط سرعة انبات وأكبر نسبة بزوغ حقلى عند نقع التقاوى في محلول حمض الكبريتيك تركيز ٧٥% لمدة خمس عشرة دقيقة. توصى هذه الدراسة بتعريض تقاوى الذرة الريانة (عشيرة دمياط) قبل الزراعة لدرجة حرارة جافة (٧٠ – ٨٠ °م) لمدة ٣ – ٥ دقائق أو النقع في محلول حمض الكبريتيك تركيز ٧٥% لمدة ١٥ دقيقة للحصول على أعلى نسبة انبات وقوة بادرات فى المعمل وللحصول على أعلى نسبة تكشف حقلى وكثافة نباتية تحت ظروف الحقل بتعريض التقاوى لمدة ٦ ساعات لحقل مغناطيسى ثابت.