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VIABILITY AND EMERGENCE OF MAIZE KERNELS AS INFLUENCED BY MOISTURE AT HARVEST AND DRYING TEMPERATURE

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Abstract

Two separate experiments were conducted to determine the influence of grain moisture at harvest and drying temperature on viability and emergence of maize kernels, an experiment was carried out in the Laboratory of college of Agriculture Engineering and Department of crop, unit of Baghdad during 2016, and 2017. A CRD was used in the Lab, and RCBD with three replicates of the field expedient. Grain moisture at harvest of 20.25 %, 26-35%, 36-45%, and higher than 49%were used. These kernels were subjected to drying temperatures of 35.45, and 55C°. The results showed that grains of law moisture (20-25%) gave higher% of plumbed grains, bulk density, and lab, emergence. At the same time they had longer reside, heavier dry weight of seedling, and higher field emergence. on the opposite side, grains have at moisture over 45% gave lowest values. Meanwhile, grains drying 35C° gave better results of the studied traits, while, drying at 55C° gave the longest range. Drying grains at 45C° and below of grains with low moisture gave best results, for they had higher viability. It was concluded that have sting maize at high moisture content and drying at high temperature gives poor results of traits studied. Results indicate that maize should be harvested at moisture around 20%and drying temperature in needed should not exceed 45C°.

***Keyword* :** *Zea mays*, seed quality, temperature, seed deterioration.

Introduction

One of the important variables to have high crop productivity is to use seeds of high quality. Environmental factors have their impacts on seed quality, such as temperature and air humidity through maturation, since those factors effects system capacity constant of growing plants. Harvesting early or late has a clear relationship with suitability of seed storage (Micheal, 2003), safe grain moisture for storage differs as seed genera differ. However, in maize seed moisture of 14% is considered safe for storage (Kelly, 1988). In lay, we can grow maize in to two seasons, spring in march, and fall in July. The fall season of planting maize is more productive, but, the grain moisture at harvest is usually higher in of the spring, Sedeeq *et al*. (2015) reported a negative influence of high grain humidity on safe storage, and then their viability. When maize harvested with high moisture, they should be dried artificially, and that will cause some injury to the seed viability, bulk density, permeability, and water absorb one (Drouzas *et al*., 1999). Besides that, artificial drying could affect seed to have lees active seedlings, for destroying some enzymes, and also could cause deterioration of phenolic compounds which reflected on seed quality (Jaya *et al*., 2003). There are two methods familiar for seed drying, air drying (Jaya *et al*., 2003), and oven drying (Wang *et al*., 2010). However, many farmers used hot air front air-blowing burners to dry seeds. In soybeans (Carvajal-Millan *et al*., 2007), beans air-dried with moisture less than 40% lose viability although temperature of up to 45C° is safe for drying, but we can use higher temperature for drying of the time is short (McLean, 1989). Artificial drying in most cases affect seed viability, but mechanisms of that are clear. Poor plasma membranes of maize kernels has 9 positive relationship with seed viability as found when high temperature used in drying (Cordova-Tellez and Burris, 2002). Ali *et al*. (2005) found that field emergence was better for maize harvested one month after physiologic maturity as compared to early harvested. Wambagu *et al*. (2012) reported that seed vigor of those harvest at harvest maturity was better than those harvest at physiologic maturity. Meanwhile, Sedeeq *et al*. (2015) found that delaying maize harvest at 32%moistare to reach 26% has improved seed vigor, especially field emergence. On the other hand, Cheyed and Elsahookie (2018) found that delaying maize harvest after harvest maturity has reduced maize seed quality due to fungal attacks under limed climate. According to the foregoing results, this research was conducted to verify the influence of grain moisture percentage at harvest and temperatures of drying on seed quality of fall grown maize in the middle of Iraq.

Materials and Methods

Seeds of maize *Zea miaz* L. cv. Buhooth 106 were grown in July 2016 on farm of Field Crop Sic, Collage of Agriculture Engineering/Unite. of Baghdad. At time of early maturity, grain moisture was tested by Feuchtemesser–HE 50, ears were harvested at moistures 20-25%, 26-35%, 36-45%, and over 45%. Ears were oven dried at 35, 45, and 55ºC. Moistures were tested daily until reached 14%. After shelling, shrunken grain %were determined by deriding shrunken grains by total grains. Grain bulk density was estimated by weighing grains of one liter in a graduated cylinder .All samples were weighed by an accurate scale (Elsahookie, 2007), in the next year (2017), germination % was examined by taking 200 kernels of each experimental unit, and grown by rolled towels and kept in incubator for 10 days (ISTA, 2013). The experiment was assigned to CRD of three replicates. Ten seedling were taken to measure radicle and coleoptile lengths by a ruler (AOSA, 1988). The radicles and coleoptiles were kept in paper bags and left in over at 80ºC for 24h (Hampton and Tekrony, 1995). In the same year (2017), in the spring, auditable area of land was taken on the farm to test field emergence of all samples harvested at different moistures and dried under different oven temperatures. After pouching and disking, the land divided in to twelve plots of 1.0 × 1.5. A fifty kernels was planted on rows, 3cm deep, covered and watered .All plots were covered by fishing nets to avoid bird attacks. An RCBD of three replicates was used for the factorial experiment. After 12 day, emergence percentages were calculated for each experimental unit. Data of all results of the two experiments were tabulated and subjected to statistical analyzing according to design used. Means were compared by as reported by Elsahookie and Wuhaib (1990).

Results and Discussion

Days to reach standard moisture

Days reach standard moisture (14%) were the longer in samples harvest at grain moisture more than 45% (Table 1). At the same time samples harvest at lowest moisture (20-25%) elapsed the least days. According, increasing drying temperature decrease days required to reach standard moisture .50, harvesting at lower grain moisture and drying at higher temperature will, result in less time grains need to reach stand and moisture. this result has been confirmed by results of Kelly (1988).

Table 1 : Effect of moisture at harvest and drying temperature on days to reach standard moisture and Shrunken of maize kernels

Harvest at grain moisture (%)	Days to reach standard moisture				Shrunken kernels (%)			
	drying temperature			Average	drying temperature			Average
	35 C°	45 C°	55 C°		35 C°	45 C°	55 C°	
25-20	2.25	1.50	1.13	1.63	2.15	2.64	3.14	2.64
35-26	3.25	2.75	1.50	2.50	2.67	3.30	3.50	3.16
45-36	4.25	3.75	2.50	3.50	11.22	12.62	15.29	13.04
More than 45	4.00	4.25	2.75	3.66	14.90	15.10	17.80	15.93
CD (p=0.05)	N.S			0.33	0.21			**0.12**
Average	3.44	3.06	1.97		7.74	8.42	1.97	
CD (p=0.05)	0.10				0.28			

Shrunken kernels

The percentage of shrunken kernels in maize samples under study are shown in Table 1. Increased grain moisture at harvest coincided with high temperature of drying gave higher percent of shrinkage. The interaction of gain moisture to drying temper was significant, and that was due to magnitude of response but not direction. One of the prime importance result here is that the means of shrunken kernels among drying temperature were much close to each other, while the means of grain moistures at harvest show very wide significant differs in multi- folds. These differences obtained among values of grain moisture are attributed to the differences in degree of kernel maturation. Increased grain moisture kernels at harvest will precipitate less starch in the endosperm, and vice versa with low grain moisture.

Bulk density

Grain moisture at harvest and drying temperatures affected bulk density of maize grains obtained (Table 2). Harvesting, at high grain moisture reduced grain bulk density. Grain bulk density was decreased gradually with increased drying temperature. Meanwhile, the interaction between grain moisture and drying temperature was significant. This significant interaction was due to change of values in magnitude and direction of response. This statement can be noticed with values of grain moisture at harvest of 36-45%and above 45%, they were going down as drying temperature increased.

Table 2 : Effect of moisture at harvest and drying temperature on Bulk density and Standard Lab. Germination

Harvest at grain moisture (%)	Bulk density (gm/1000cm^3)				Standard Lab. Germination (%)			
	drying temperature			Average	drying temperature			Average
	35 C°	45 C°	55 C°		35 C°	45 C°	55 C°	
25-20	735.4	723.4	722.0	726.8	93.83	89.38	70.41	84.54
35-26	727.4	725.4	726.6	726.4	91.71	88.55	67.70	82.65
45-36	724.0	706.6	692.6	727.8	91.20	73.30	52.92	72.47
more than 45	690.6	681.4	676.6	682.8	66.54	52.58	36.51	51.88
CD (p=0.05)	10.2			5.8	4.33			2.50
Average	719.4	709.2	704.4		85.82	75.95	56.89	
CD (p=0.05)	5.0				2.17			

Standard lab. Germination

Drying temperate grain moisture and interaction were significant in this trait as shown in Table 2. All values of germination percent were going down as drying temperature increased and same response is going so with increased grain moisture at harvest. The significant interaction was due to magnitude of response in regardless of direction. less grain maturation could be related to less mRNA and less proteins and /or enzymes of germination were reduced (Elsahookie, 2007). This explanation is with agreement with that of Owolade *et al.* (2005) when they found that harvesting maize at grain moisture between 49.50%which gave higher germination. Again, low germination of high moisture grain could be related to damage of plasma membranes of seeds when highly heated (Cordova-Tellez and Burris, 2002).

Radicle and coleoptile lengths

Drying temperature and grain moisture at harvest, both reduced raddle length of seedling, while the interaction was significant (Table 3).Mean value of radicle length decreased from 17.4 cm to 9.32 cm as drying temperature increased from 35-55ºC, while with increased grain moisture from 20-25% to over 45%decreased radicle length from 17.15 and to 12.44 cm. The same trend was with the coleoptile length (same Table 3). Coleoptile length was decreased as drying temperature and grain moisture increased. However, there interaction was significant due to difference in magnitude of response and not the direction. This reduction in radicle and coleoptile lengths could be traced back to les carbohydrate accumulation and proteins related to growth motor (Elsahookie, 2007).

Table 3 : Effect of moisture at harvest and drying temperature on Radicle and coleoptile lengths.

Harvest at grain moisture (%)	Radicle lengths (cm)				Coleoptile lengths (cm)			
	drying temperature			Average	drying temperature ºC			Average
	35 Cº	45 Cº	55 Cº		35 Cº	45 Cº	55 Cº	
25-20	17.31	17.37	16.78	17.15	15.47	14.05	13.77	14.43
35-26	18.15	16.64	15.88	16.89	15.17	14.27	12.50	13.98
45-36	17.77	14.90	14.39	15.69	13.80	13.00	9.50	12.10
more than 45	16.37	11.63	9.32	12.44	12.87	10.63	7.73	10.41
CD (p=0.05)	N.S			0.87	0.99			0.57
Average	17.40	15.13	14.09		14.33	12.99	10.87	
CD (p=0.05)	0.75				0.50			

Seedling dry weight and field emergence:

Grain moisture at harvest, drying temperature and their interactions had significant effects on seedling dry weights (Table4). Lowest grain moisture (20-25%) gave heavier seedling dry weight (483mg), while higher grain moisture gave lower seedling dry weight(288mg). At the same time, increasing drying temperature decreased seedling dry weight. Drying at 35Cº gave 322mg while drying at 55ºCgave only 239 mg per seedling. The significant interaction was due to both magnitude and direction of response, especially with grain moisture 36-45% under 35 and 45ºC drying temperatures. This difference is still of unknown reason. Field emergence shown in Table 4 shows that increased harvest grain moisture and drying temperature decreased percentage rat field emergence. The best value of this trait was obtained by first and second grain moisture percentages. This implies that grain had bother physiologic maturity at these two levels of grain moisture. Meanwhile, when grains were not fully matured, high drying temperatures will clarify now much carbohydrates have been accumulated in the grain, So, field emergence decreased linearly with higher drying temperatures. The significant interaction was due to both magnitude and direction of response, especially with values of the two high grain moisture. This result is with agreement with that obtained by Ali *et al*. (2005). Wambangu *et al*. (2012) found that seed and seedling vigor will be higher when harvested at low grain thirstier, on the same stream, Sedeeq *et al*. (2015) reported that maize ears harvested ay low moisture (26%) gave higher values of field emergence as compared with those harvested with higher grain moisture (30-32%). It was clear from data in Table 4 that raising drying temperature gave lower field emergence and vice versa with values obtained by drying at low temperature (35%).

Table 4 : Effect of moisture at harvest and drying temperature on Seedling dry weight and field emergence.

Harvest at grain moisture (%)	Seedling dry weight (mg)				Field emergence (%)			
	drying temperature			Average	drying temperature			Average
	35 Cº	45 Cº	55 Cº		35 Cº	45 Cº	55 Cº	
25-20	483	460	415	453	91.50	87.13	62.36	80.33
35-26	486	403	318	402	91.32	85.86	52.94	76.71
45-36	388	416	267	357	86.85	65.02	44.16	65.34
more than 45	322	302	239	288	80.75	38.38	32.40	50.51
CD (p=0.05)	51			26	4.64			2.63
Average	420	495	310		87.60	69.10	47.97	
CD (p=0.05)	25				2.32			

This could be attributed to damaged proteins and /or hormones related germination and emergence. This finding could also be explained by the result obtained by Dos Santos *et al*. (2019) that temperature of soil higher than 35ºC will negatively affect activity of seedling germination, and emergence. Result obtained indicate that high grain moisture at harvest will negatively affect seed viability and field emergence. When grains of moderate moisture (20-35%), they will tolerate drying temperature of 35-45ºC, but when grains are of higher moisture content (over 35%), they should be dried at lower temperature (35-36ºC), and will take longer time.

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