IJTA © Serials Publications

National Academy of Agricultural Science (NAAS) Rating : 3.03

Effect of Priming to Enhance the Germination and Seedling Vigour in Maize Hybrid DHM-117

Sudha Rani M., Rajasri M. and *Rao PS

ABSTRACT: *A laboratory investigation was carried out with maize hybrid DHM-117 to study the effect of priming on seed quality parameters at Seed Research and Technology Centre, Rajendra Nagar, Hyderabad during 2011-12. The maize hybrid seed material was primed with water (Hydropriming) and halopriming with potassium salts (2% KCl, 2.5% KNO_3 and 2% KH_2 PO_4) for 10 hours at 25^0C and shade dried to attain the original moisture content. The un primed seed lot was used as control. Data were recorded on various seed quality parameters viz.,speed of germination, germination per cent, root length, root volume, shoot length, dry matter production, seedling vigour index and total chlorophyll content on the day of final count. The results indicated that maize seed primed with 2.5 % KNO_3 found to be significantly superior for germination (98%), root length (23.1), shoot length (17.2) dry matter production (25.66 mg/10 seedlings), seedling vigour index (2515) and total chlorophyll content (1.53 mg/g) as against the un primed seed lot which was very slow to emerge (38.17) and recorded low germination per cent (86) and lesser vigour index of 1737.*

Keywords: *Maize, Hydropriming, Halopriming, Germination*

INTRODUCTION

Maize is the important cereal crop next to rice and wheat in the world. Maize is cultivated over an area of 159M ha with a production of about 817 MT and the productivity of 5 T / ha in 2009 (en.wikipedia.org/ wiki. maize). In India, maize area has slowly expanded over the past few years from 6.6M ha to 8.6 M ha (2002-2011). During the same period the productivity also increased from 1.6 to 2.6 t/ha. The utilization pattern of maize in India is1 % in brewing, starch 11 %, food 24%, cattle feed 11%, seed 1 % and poultry feed 52%. In India, by 2020 AD, the requirement of maize in various sections will be around 100 MT, of which the poultry sector demand will be 31 MT. Maize is the promising option for diversifying agriculture due to its resilience to changing climate (Sai Kumar, 2012). Timely availability of quality seed is foremost requisite for successful seed production and sustainable agriculture. Higher production and productivity of crop is possible only through use of good quality seed and proper management practices. Good quality seeds imply vigour, uniformity and structural soundness besides its genetic and physical purity. To improve the seed quality, seed enhancement techniques have been developed by the researchers. The objective of this technique is to optimize the application of seed treatment by improving the technical quality of seeds. Of late, seed priming, an effective seed invigoration method, has become a common practice to increase the rate of emergence and uniformity in crop establishment in most of the vegetable, flower crops in advanced countries.

Seed priming is a controlled hydration process that involves exposing the seeds to low water potentials that restrict the germination, but permits pre emergence physiological and biochemical changes to occur (Bradford, 1986: Khan, 1992). Upon rehydration, primed seeds may exhibit faster rate of germination, more uniform emergence and greater tolerance to environmental stresses and reduced dormancy in many species (Khan, 1992). Priming, a technology that enhance early emergence and stand establishment would enable the crop to capture more soil moisture, nutrients and solar radiation and thus, increase the dry matter production (Ahmed and Shad, 2010). Further, several investigations confirmed that seed priming has many benefits including early and

* Seed Research & Technology Centre, ANGRAU, Hyderabad 530 030 (A. P.) India, *E-mail: sampalrao@gmail.com*

rapid emergence, stand establishment, higher nutrient use efficiency, deeper roots, increase in root growth, uniformity in emergence, germination in wider range of temperature, better competition with weeds etc. Hence, the current study was undertaken to study the effect of halo and osmo-priming on seedling germination, field emergence, speed of germination and growth parameters as well in comparison to the un primed seed lots in maize.

MATERIAL AND METHODS

The study was carried out at Seed Research and Technology Centre, Rajendranagar during 2011-12. Freshly harvested maize hybrid DHM 117seed was obtained from Maize Research Centre, Rajendranagar, Hyderabad and cleaned and graded. The seeds were soaked in different chemicals in 1:1:1 ratio of seed, sand and water for 10 hours at 25^0C and subsequently shade dried to bring back its original moisture content of 11%.The priming treatments includes

T1:Untreated control	T4: Seed primed with 2.0% KCl
T2: Seed primed with water	T5: Seed primed with 2.0% KH_2 PO
T3:Seed primed with 2.5% KNO_3	

The primed seed lots were evaluated under laboratory conditions along with unprimed seed lot by adopting completely randomized block design with 4 replications. The seed samples drawn from the above treatments were evaluated for various seed quality parameters *viz.*, speed of germination (Maguire, 1962), germination per cent (ISTA, 2008), root and shoot length, dry matter production (Abdul Baki and Anderson, 1973), root volume and total chlorophyll content (Yoshida *et al.*, 1971) and the data were analyzed and tested for significance according to Panse and Sukhatme (1985). Percentage values were transformed into arcsine values prior to analysis.

RESULTS AND DISCUSSION

Pre sowing hardening or priming is the kingpin to increase the productivity by overcoming the moisture stress and nutrient deficiency for sustained production. Many researchers standardized the formulations of bio fertilizers, halogen salts and compared the performance for productivity with untreated conditions (Gomathy*et al.*, 2007 and 2009, Martin and Maria, 2009).

In the present study, among the treatments, seed lot primed with 2% KH_2 PO_4 registered significantly superior speed of germination (45.36) followed by seed lot primed with 2.5% KNO_3 (44.87) as against the unprimed control seed lot which recorded a low speed of germination of 38.17 (Table 1). The high speed of germination in seed lot primed with 2% KH_2 PO_4might be due to advancement in the physiology of germination during soaking (Punithavathi, 1997). These initial changes culminate in enlargement of the latent embryo. As the primed seeds were dried back to its original moisture content, the triggered germination events were halted. When the seeds were sown, germination event begins from the point where it was stopped previously. As a result early emergence and seedling establishment was realized in the primed seed lots.

Unlike the speed of germination, the seed lot primed with 2.5% KNO_3 recorded significantly superior germination (98%), which accounted for 13.9 per cent higher than untreated control. The probable reason for higher germination might be due to higher viscosity and elasticity of protoplasm, increase in bound water content, lower water deficit (May *et al.*, 1962) and increased metabolic activity (Joseph and Nair, 1989). Similar improvement in germination by 1% KH_2PO_4 in wheat was reported by Vanangamudi and Kulandaivelu, 1989; Paul and Choudhury (1993). The K element being more permeable through seed coat might have promoted the germination (Kohli *et al.*, 1992). These findings are in line with the current study where the effect of KNO_3 is much evident in the growth of seedling (Table 1). The performance of seedlings primed with $KNO_3$and KH2PO_4 for root length was on par with each other and was significantly superior to unprimed seed lot. Among the treatments KNO_3 recorded the highest root length (23.1), shoot length (17.2) and root volume (2.4cm^3), which accounted for 24.2 and 26.1 and 25 per cent increase over control. The improvement may be ascribed to activation of cells which result in enhancement of mitochondrial activity leading to the formation of more energy compounds and vital biomolecules which were made available during early phase of seed germination (Dharmalingam *et al.*, 1988).

The seedling vigour index based on dry weight was significantly superior in the seed lot primed with KNO_3 (2515) followed by seed lot treated with KH_2PO_4 (2372) and seed lot hardened with KCl (2262). However, the control seed lot recorded lesser vigour index of 1737. Further, an improvement of 13.5 per cent in dry matter production was recorded over control by KNO_3. These results are in conformity with

Table 1
Effect of priming on seed quality parameters in maize hybrid DHM-117

Priming Treatments	*Speed of Germination*	*Germination (%)*	*Root length (cm)*	*Root volume (cm³)*	*Shoot length (cm)*	*Dry Matter Production (mg/ 10 seedlings)*	*Seedling vigour index (Based on dry weight)*	*Total chlorophyll content (mg/g)*
Untreated Control	38.17	86(68.06)	17.5	1.2	12.7	22.20	1737	1.26
Seed lot primed with water	41.22	93(76.45)	19.7	1.9	13.1	23.21	2159	1.39
Seed lot primed with 2.5% KNO_3	44.36	98(82.66)	23.1	2.4	17.2	25.66	2515	1.53
Seed lot primed with 2% KCl	40.15	93(76.45)	22.1	2.2	15.2	24.32	2262	1.41
Seed lot primed with 2% KH_2PO_4	45.87	95(75.61)	20.5	2.1	17.2	24.97	2372	1.49
Mean	42.0	93.0	20.6	2.0	15.08	24.07	2209	1.42
S.Em±	0.05	1.41	0.21	0.01	0.19	0.06	35.22	0.07
CD at 5%	1.12	2.93	1.56	0.02	1.41	1.27	75.01	0.17

earlier reports indicating the beneficial effect of priming on root dry weight of maize and sorghum (Aher, 2003 and Gupta *et al.*, 2006). The increased dry matter production might be due to the effect of priming which enhanced the root and shoot ratio and nutrient uptake (Rangasamy *et al.*, 1993). The increased dry weight might also due to enhanced lipid utilization through glyoxalate cycle, a primitive metabolic path way, there by facilitating the conversion of acetate into nucleic acid as quoted by Vanni and Vivenzinni (1972). The maize seed lots primed with 2.5 per cent KNO_3 for 10 hours at 25 ^{0}C was found to be the best treatment for improving the seed quality parameters like speed of germination per cent, speed of germination, root and shoot growth and uniform crop establishment and seedling vigour.

REFERENCES

Abdul-Baki AA and Anderson J D. (1973), Vigour determination in soybean by multiple criteria. *Crop Science*. 13: 630-633.

Aher R K. (2003), Mass multination of *Glomus fasciculatum* using different hosts. Mycorriza News. 15 (3): 12-14.

Ahmed K and Shad K K. (2010), Effect of leaf area on dry matter production in aerated mungbean seed. International Journal of Physiology and Biochemistry 2 (4): 52-61.

Bradford KJ. (1986), Manipulation of seed water relations via osmotic priming to improve the germination under stress conditions. *Horticultural Sciences*. 21: 1105-1112.

Dharmalingam C, Paramasivam K, and Sivasubramanian V. (1988), Seed hardening to overcome adversity. *The Hindu*, No. 16 (Wed.).

Gomathy M, Thangaraju Mand Sarathambal C. (2009), Optimization of liquid *Phosphobacteria*required for maize seeds. *Asian Journal of Biological Sciences*. 4 (1): 53-55.

Gomathy M, Thangaraju M, Gunasekaran S, Gopal N O and Sarathambal C. (2007), Comparative performance of liquid formulation of *Phosphobacteria* with carrier based inoculants on the growth and yield of maize (Co-1). *Journal of Soil Biology*. 27 (1&2): 7-12.

Gupta N, Rautaray S and Bassak U-C. (2006), The growth and development of arbuscularmycorrhizal fungi and its effect on the growth of maize.Mycorriza News 18 (3): 15-23.

International Seed Testing Association. (2008), International rules for seed testing. Seed Science and Technology. 13: 356-513.

Joseph, K and Nair NR. (1989), Effect of seed hardening on germination and seedling vigour in paddy.*Seed Research*. 17 (2): 188-190.

Khan A A. (1992), Pre plant physiological seed conditioning. *Horticulture Review*. 13: 131-181.

Kohli VK, Thakur IK and Shukla Y R. (1992), Studies on improving field emergence in the autumn crop of garden pea (*Pisumsativum* L.) Ann. Agric. Res. 14 (4) 394-395.

Maguire JD. (1962), Speed of germination- aid in selection and evaluation of seedling emergence and vigour. *Crop Science*. 161 (1) 79-83.

Martin D, Maria V F (2009), Field performance of liquid formulation *Azosporillumbrasilense*. *Arid Soil Research and Rehabilitation*. 1: 115-157.

May LH, Milthorpe EJ and Milthorpe F L. (1962), Pre sowing hardening of plants to drought. An Appraisal of the contributions by P.A. Genkel. *Field Crop Abstracts*. 15: 93-98.

Panse V G and P V Sukhatme. (1985), Statistical methods for Agricultural workers, ICAR, New Delhi, pp. 327-340.

Paul SR and Choudhury AK. (1993), Effect of seed hardening with potassium salts of different concentrations and soaking durations on germination and seedling vigour of wheat.*Annals of Agricultural Research*. 14 (3): 357-359.

Punithavathi N. (1997), Seed hardening and pelleting studies in ragi cv. CO13 (Master of Science dissertation, Tamilnadu Agricultural University, Coimbatore).

Rangasamy A, Purushothaman S and Devasenapathy P. (1993), Seed hardening in relation to seedling quality characters of crops. *Madras Agricultural Journal*. 80 (9): 535-537.

Sai Kumar R. (2012), Improving maize productivity in India: Progress. Proc. of 11th Asian Maize Conference, Beijing, China, Nov 7-11, 2011.

Vanangamudi K and Kulandaivelu R. (1989), Pre sowing treatment for dry land farming. Seeds Farms. 15 (9-10): 33-34.

Vanni P and Vivenzinni M. (1972), The presence of isicitratelyase and malate synthase activity in germinating gingobilbo seeds. *Expermentia.* 28: 405-406. In: Bradnock (ed.) Adv. Res. Technology seeds. Part 1. Centre for Agricultural Publishing and Documentation, wageningen.

Yoshida S, Forno A A and Cock J H. (1971), Laboratory manual for physiological studies of rice. International Rice Research Institute, Philippines, 36-37.