Seed Research 47(1): 90-94, June, 2019

Short Communication

Genotypic Variation in Primed Seed of Muskmelon for Seed Emergence and Vigour under Sub Optimal Conditions

DIDAR SINGH AND RAJINDER SINGH*

Department of Vegetable Science
Punjab Agricultural University, Ludhiana - 141004, Punjab, India
*rajinder@pau.edu

(Received : April 2019; Revised : May 2019; Accepted : June 2019)

Muskmelon (*Cucumis melo* L.) is also called melon, casaba and cantaloupe belongs to the family Cucurbitaceae. It is grown worldwide but leading muskmelon growing countries are China, Turkey, Iran, India, Egypt, Kazakhstan, United States of America, Spain and Guatemala. India has fourth rank in area and fifth rank in production in world and Asia [1]. Under northern plains of India, it is one of the most important cashcrop among the farmers due to its short growing season. It also fits well in their cropping system. The usual sowing time of muskmelon is February-March directly in the field but to get early premium in the market, the seeds are sown in polythene bags or plug trays under protected structure in the last week of January to first week of February. However, low temperature prevailing in northern plans of India hampers the germination of the seeds. For successful seedling emergence, it requires temperature range from 25-28^{0}C. It may fail or take a long time to emerge if the soil temperature is below 20^{0}C and it altogether ceases when temperature goes below 15^{0}C. Normally, seedlings emerge 6-8 days after sowing [2]. Due to low temperature prevailing in January- February, the germination is slow and vigour also declines. As a result, patchy germination and growth gives undesirable look in the field. Therefore, in order to improve its emergence, treatment is given to seeds before seeding in the soil. Priming treatments are successfully applied either to poor germinating seed lots or to seeds sown under different stress conditions. This technique enhances germination and improves the physiological activity of seed by different priming chemicals. Priming initiates metabolic activities, such as protein, RNA and DNA synthesis, DNA replication and b-tubulin accumulation [3].

The seed priming is very effective tool to protect seed from oxidative injury given by adverse climacteric conditions like sub-optimum temperature and also improve vigor index of crop species [4]. Application of growth regulators as priming agents improve enzymes activity which leads to rapid breakdown of food reserve of seed and make it available to the embryo for good germination of seed and improve the vigour of seedling [5]. The muskmelon seed germination at low temperature condition with seed priming treatments like salicylic acid and proline [6], mannitol [7] and GA_3 [8] gives the beneficial effect in several studies. Since the choice of farmers is different for varieties and their growing season, hence genotypic response to different seed priming treatments under different environment are investigated. Therefore, present investigations were conducted to ascertain the effect of priming treatments on different genotypes of muskmelon under sub optimal temperature.

The experiment was conducted during January and February 2016 and 2017 at Vegetable Research Farm, Punjab Agricultural University, Ludhiana. The region is characterized by hot summer months to cold wave conditions in winter with occasional frost spells. The experiment was laid out as a randomized complete block design (RCBD) with a factorial arrangement and replicated three times. The treatments consisted of three genotypes (Punjab Sunehri, Hara Madhu and MH-27) and 11 priming treatments i.e. Seeds were soaked in water, 100 ppm GA_3, 100 ppm KNO_3, KH_2PO_4 10^{-1} M and 250 ppm ethrel for 12 hours and then placed in wet gunny bags for 24 and 48 hours, and hydration for 12 hours along with placing in farm yard manure (FYM) for 48 hours and a control. Following the treatment, seeds were air dried at room temperature until their original weight was restored. After drying, the seeds were taken to field immediately for sowing in polythene bags. Seeds were sown in last

week of January in each year. These polythene bags were protected from cold conditions by covering with polythene sheets during night. Observations were recorded on per cent field emergence, speed of emergence, seedling length (cm), seedling fresh weight (g), seedling dry weight (g), vigour index-I and vigour index-II.

To determine field emergence, 100 seeds per replication for each priming treatment were sown in polythene bag containing soil and farm yard manure in equal ratio. The number of seeds emerged and developed into seedlings after 24 days were counted. Speed of emergence was computed by recording daily observations on 100 seeds sown in polythene bags until the final count day (24 days). The speed of emergence was calculated as total number of seeds emerged on day basis, and the mean was calculated as suggested by Maguire [9]. For determining seedling length, 10 normal seedlings from each replication of field emergence test were taken at random, and seedlings length was measured. Seedling dry weight was taken after drying ten normal seedlings at 110ºC for 17 hr and mean dry weight was calculated. The vigour index-I and II were calculated as per the formulae suggested by Abdul Baki and Anderson [10]. Analysis of variance for the data recorded was conducted using CPCS-1 package.

The data presented in table 1 clearly indicated that among the genotypes, cultivar Hara Madhu recorded significantly better emergence than other genotypes of muskmelon. Among various priming treatments, seeds treated with KH_2PO_4 and then kept in wet gunny bags for 48 hours resulted in maximum field emergence followed by hydration + 48 h in wet gunny bags. Among the interactions, maximum emergence was reported in cultivar Hara Madhu when treated with KNO_3 + 24 h in wet gunny bags followed by hydration + 48 h in wet gunny bags. The hybrid MH-27 was less responsive to the priming treatments. The minimum emergence was observed in untreated seeds in all the cultivars. The variation in field emergence in genotypes might be due to their genetic makeup or the seed lot taken for seed experiment. The seed priming treatments improved field emergence (%) compare to non-primed seeds by enhancing the activities of enzymes like alpha amylase and maltase which increased the sugar, protein and DNA content of seed [11]. The availability of food reserve to embryo for development increased by rapid hydrolysis of starch and emergence percentage improved than untreated seeds.The results were also corroborated with Sathish [12] who reported that seed priming with 1% solution of KH_2PO_4 for 6 hours improved the field emergence (%) in maize.

Table 1. Effect of priming treatments on the field emergence (%) of different genotypes of muskmelon seeds

Genotypes / Treatments	2016				2017			
	Hara Madhu	Punjab Sunehri	MH-27	Mean	Hara Madhu	Punjab Sunehri	MH-27	Mean
Control	39.33	21.33	28.00	29.55	37.67	22.33	28.00	29.33
Hydration + 24 h in wet gunny bags	47.00	26.00	28.67	33.89	46.00	25.00	32.33	34.44
Hydration + 48 h in wet gunny bags	60.67	80.00	33.33	58.00	62.33	78.00	33.67	58.00
GA_3 + 24 h in wet gunny bags	57.33	38.00	45.00	46.78	55.67	39.00	44.00	46.22
GA_3 + 48 h in wet gunny bags	65.00	47.33	50.33	54.22	64.33	51.67	50.00	55.33
KNO_3 + 24 h in wet gunny bags	81.33	36.33	47.67	55.11	80.67	38.33	48.33	55.77
KNO_3 + 48 h in wet gunny bags	31.33	48.33	38.00	39.22	29.67	50.00	37.00	38.89
KH_2PO_4 + 24 h in wet gunny bags	51.33	29.33	34.33	38.33	52.00	32.00	33.33	39.11
KH_2PO_4 + 48 h in wet gunny bags	67.00	72.00	44.67	61.22	65.67	72.67	41.67	60.00
Ethrel + 24 h in wet gunny bags	52.67	31.33	46.67	43.56	52.67	29.67	45.33	42.55
Ethrel + 48 h in wet gunny bags	31.33	48.67	61.67	47.22	30.00	48.00	59.00	45.67
Hydration + 48 h in FYM	49.00	33.67	37.00	39.89	49.67	26.00	37.00	37.56
Mean	52.77	42.69	41.27	45.58	52.19	42.72	40.81	
CD (p=0.05) = Genotypes: 1.83, Treatments: 3.67 and Genotypes x Treatments : 6.37					CD (p=0.05) = Genotypes: 1.78, Treatments: 3.57 and Genotypes x Treatments : 6.17			

The speed of emergence was significantly better in cultivar Hara Madhu followed by Punjab Sunehri and least in MH-27 (Table 2). The priming treatments improved the speed of emergence as against untreated seeds. Seeds treated with KH_2PO_4+ 48 h in wet gunny bags resulted in maximum speed of emergence followed by hydration + 48 h in wet gunny bags and GA_3 + 48 h in wet gunny bags. Untreated seeds registered minimum speed of emergence. The interaction effects revealed increased speed of emergence of Punjab Sunehri variety when treated with KH_2PO_4+ 48 h in wet gunny bags. The hybrid MH-27 without treatment recorded the minimum speed of emergence in both the years. The increased speed of emergence in cultivars might be due to their difference in genetic architect and seed lot. The increased speed of emergence due to priming treatments might be due to early initiation of germination activities in seed over the control. As a result there might be increase in de novo synthesis of alpha amylase content [13] and early synthesis of protein and DNA content [14]. The rate of radical protrusion increased many folds with seed priming treatment due to increase in metabolic activities compared to non primed seed [15].

The vigour index I and II were significantly better in cultivar Hara Madhu (Table 3 and 4). Priming treatments improved seed vigour considerably than control and maximum vigour was noticed when seeds were treated with KH_2PO_4+ 48 h in wet gunny bags followed by hydration + 48 h in wet gunny bags in both the years and these were significantly better than other treatments. The interaction effects revealed maximum seedling vigour in cultivar Punjab Sunehri and Hara Madhu when treated with KH_2PO_4+ 48 h in wet gunny bags followed by treating with GA_3 + 48 h in wet gunny bags. The increased vigour indices were directly related with increase in seedling length and dry weight of the seedlings. As the priming treatment initiated metabolic changes early than the control resulting in increased seedling vigour. Similar results were reported in bitter gourd [16], muskmelon [17] and cucumber [18].

The study clearly revealed that seed emergence, speed of emergence and vigour were greatly enhanced under sub optimal conditions when treated with KH_2PO_4+ 48 h in wet gunny bags.

Table 2. Effect of priming treatments on the speed of emergence of different genotypes of muskmelon seeds

Genotypes / Treatments	2016				2017			
	Hara Madhu	Punjab Sunehri	MH-27	Mean	Hara Madhu	Punjab Sunehri	MH-27	Mean
Control	2.10	1.12	1.65	1.62	2.11	1.14	1.62	1.63
Hydration + 24 h in wet gunny bags	2.78	1.61	1.56	1.98	2.79	1.40	1.69	1.96
Hydration + 48 h in wet gunny bags	4.93	6.27	2.28	4.50	4.92	6.91	2.53	4.78
GA_3 + 24 h in wet gunny bags	4.35	2.44	2.43	3.07	4.35	2.27	2.69	3.11
GA_3 + 48 h in wet gunny bags	5.60	3.92	3.82	4.45	5.42	3.76	3.52	4.23
KNO_3 + 24 h in wet gunny bags	5.63	2.47	2.60	3.57	5.84	2.44	2.96	3.75
KNO_3 + 48 h in wet gunny bags	1.76	3.92	2.48	2.72	1.65	4.12	2.34	2.70
KH_2PO_4 + 24 h in wet gunny bags	2.83	2.24	1.92	2.33	2.98	2.23	2.03	2.41
KH_2PO_4 + 48 h in wet gunny bags	5.08	6.58	3.02	4.89	4.97	6.57	2.96	4.83
Ethrel + 24 h in wet gunny bags	3.32	1.65	2.53	2.50	3.35	1.58	2.59	2.50
Ethrel + 48 h in wet gunny bags	1.80	3.74	4.61	3.38	1.73	3.66	4.33	3.24
Hydration + 48 h in FYM	3.14	1.52	2.00	2.22	3.32	1.54	2.28	2.38
Mean	3.61	3.12	2.58		3.62	3.13	2.63	
CD (p=0.05) = Genotypes: 0.11, Treatments: 0.22 and Genotypes x Treatments : 0.39					CD (p=0.05) = Genotypes: 0.11, Treatments: 0.22 and Genotypes x Treatments : 0.38			

Table 3. Effect of priming treatments on the vigour index I of different genotypes of muskmelon seeds

Genotypes / Treatments	2016				2017			
	Hara Madhu	Punjab Sunehri	MH-27	Mean	Hara Madhu	Punjab Sunehri	MH-27	Mean
Control	150.44	144.44	119.33	138.07	155.68	150.37	123.59	143.21
Hydration + 24 h in wet gunny bags	403.06	90.89	199.56	231.17	383.76	86.92	220.79	230.49
Hydration + 48 h in wet gunny bags	659.65	1039.33	236.55	645.18	675.45	985.95	243.19	634.87
GA_3 + 24 h in wet gunny bags	619.17	266.94	281.83	389.31	588.40	282.13	270.22	380.25
GA_3 + 48 h in wet gunny bags	738.83	345.00	340.67	474.83	720.26	374.88	332.04	475.73
KNO_3 + 24 h in wet gunny bags	632.78	258.94	246.39	379.37	627.20	269.87	257.07	384.72
KNO_3 + 48 h in wet gunny bags	242.44	408.33	275.67	308.85	231.88	443.58	264.44	313.30
KH_2PO_4 + 24 h in wet gunny bags	212.44	184.06	209.33	201.94	232.83	196.69	205.43	211.65
KH_2PO_4 + 48 h in wet gunny bags	880.99	788.39	321.68	663.68	862.98	796.79	300.75	653.51
Ethrel + 24 h in wet gunny bags	477.33	145.50	238.33	287.05	467.87	145.59	240.57	284.68
Ethrel + 48 h in wet gunny bags	214.22	329.67	527.17	357.02	202.17	319.15	536.98	352.77
Hydration + 48 h in FYM	402.22	220.61	277.17	300.00	401.79	168.59	277.45	282.61
Mean	469.47	351.84	272.81		462.52	351.71	272.71	
CD (p=0.05) = Genotypes: 22.01, CD (0.05) Treatments: 44.01 and Genotypes x Treatments :76.23					CD (p=0.05) = Genotypes: 15.95, Treatments: 31.91 and Genotypes x Treatments :55.26			

Table 4. Effect of priming treatments on the vigour index II of different genotypes of muskmelon seeds

Genotypes / Treatments	2016				2017			
	Hara Madhu	Punjab Sunehri	MH-27	Mean	Hara Madhu	Punjab Sunehri	MH-27	Mean
Control	1.70	0.64	1.53	1.29	1.56	0.60	1.48	1.22
Hydration + 24 h in wet gunny bags	4.52	1.36	2.26	2.71	4.38	1.19	2.57	2.71
Hydration + 48 h in wet gunny bags	9.62	11.75	3.22	8.20	10.03	11.48	3.22	8.23
GA_3 + 24 h in wet gunny bags	8.82	1.80	2.76	4.46	8.42	1.70	2.64	4.25
GA_3 + 48 h in wet gunny bags	11.69	2.84	3.93	6.15	11.22	2.97	3.86	6.13
KNO_3 + 24 h in wet gunny bags	10.04	2.30	2.49	4.94	9.66	2.47	2.44	4.86
KNO_3 + 48 h in wet gunny bags	2.00	3.90	3.59	3.16	1.84	3.99	3.50	3.11
KH_2PO_4 + 24 h in wet gunny bags	3.10	1.59	1.78	2.16	2.94	1.59	1.69	2.07
KH_2PO_4 + 48 h in wet gunny bags	12.02	12.09	4.58	9.56	11.59	12.32	4.32	9.41
Ethrel + 24 h in wet gunny bags	5.83	1.10	2.43	3.12	5.78	0.88	2.08	2.91
Ethrel + 48 h in wet gunny bags	1.70	3.55	10.03	5.09	1.52	3.45	9.72	4.90
Hydration + 48 h in FYM	5.30	1.65	3.37	3.44	5.32	1.16	3.31	3.26
Mean	6.36	3.71	3.50		6.21	3.65	3.40	
CD (p=0.05) = Genotypes: 0.20, Treatments: 0.40 and Genotypes x Treatments : 0.71					CD (p=0.05) = Genotypes: 0.17, Treatments: 0.35 and Genotypes x Treatments : 0.60			

REFERENCES

1. ANONYMOUS (2016). Retrieved from http:www.indiastat.com
2. REYES MEC, BH GILDMECHER AND GJ JENSEN (1994). *Momordica charantia* L. In: Siemonsma J S and Piluek K (Ed) Plant Resources of South East Asia: Vegetables. pp. 206-10. The Netherlands Pudoc Scientific Publishers, Wageningen.
3. MCDONALD MB (2000). Seed priming. In: Black M and Bewley J D (Ed) Seed Technology and Its Biological Basis. Sheffield Academic Press, Sheffield, pp: 287-325.
4. CHEN CC AND JM SUNG (2001). Priming bitter gourd seeds with selenium solution enhances germinability and antioxidative responses under sub-optimal temperature. *Physiologiae Plantarum*, **111:** 9-16.
5. BEWLEY JD AND M BLACK (1986). Seeds Physiology of development and germination. Plenum Press, 233 Spring street, New York, pp: 305.
6. KAUR S AND N GUPTA (2017). Response of muskmelon seeds to salicylic acid and proline at different temperatures. *International Journal of Life Sciences*, **6:** 126-130.
7. PASSAM HC AND D KAKOURIOTIS (1994). The effects of osmoconditioning on the germination, emergence and early plant growth of cucumber under saline conditions. *Scientia Horticulturae*, **57:** 233-240.
8. EDELSTEIN M, YB TAL, M WODNER AND J KIGEL (1995). Role of endogenous gibberellins in germination of melon (*Cucumis melo*) seeds. *Physiologiae Plantarum*, **95:** 113-119.
9. ABDUL BAKI AA AND JD ANDERSON (1973).Vigour determination in soybean seeds by multiple criteria. *Crop Science*, **13**: 630-633.
10. MAGUIRE JD (1962). Speed of germination - aid in selection and evaluation for seedling emergence and vigor. *Crop Science*, **2**: 176-177.
11. AJOURI A, A HABEN AND M BECKER (2004). Seed priming enhances germination and seedling growth of barley under the conditions of P and Zn deficiency. *Journal of Plant Nutrition and Soil Sciences*, **167:** 630-636.
12. SATHISH S, S SUNDARESWARAN AND N GANESAN (2011). Influence of seed priming on physiological performance of fresh and aged seeds of maize hybrid [COH(M) 5] and its parental lines. *Research Journal of Agricultural Biological Sciences*, **6:** 12-17.
13. FAROOQ M, SMA BASRA, H REHMAN, N AHMAD AND BA SALEEM (2007).Osmopriming improves the germination and early seedling growth of melons (*Cucumis melo* L.). *Pakistan Journal of Agricultural Science*, **44:** 529-537.
14. BRAY CM, PA DAVISON, M ASHRAF AND RM TAYLOR (1989). Biochemical changes during osmopriming of leek seeds. *Annals of Botany*, **63:** 185-193.
15. ARIF M (2005). Seed priming improves emergence, yield and storability of soybean. PhD thesis, NWFPAgriculture University Peshawar, Pakistan.
16. KUMAR R AND R SINGH (2013). Effect of seed priming on emergence and vigour of bitter gourd (Momordica charantia L.). *Journal of Research Punjab Agricultural University*, **50:** 114-118
17. SINGH G, SS GILL AND KK SANDHU (1999). Improved performance of muskmelon (*Cucumis melo* L.) seed by osmo-conditioning. *Acta Agrobotanica*, **52:** 121-126.
18. PEYVAST GH, OLFATI JA, M PIRI AND MB MAHDIEH (2010). Priming effect ofcucumber germination at low temperature. Proc 4th International Symposium on Cucurbits, Changsha, Hunan, China, pp: 615-16.