



RESEARCH PAPER

Impact of priming techniques on germination, vigour, growth and survivability of drumstick (*Moringa oleifera* L.) variety PKM-1 under open and protected condition

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Abstract : The present investigation was carried out in *Kharif* season 2017-18 at the Horticulture nursery and dry land research farm College of Agriculture, Indore (M.P.) to study the germination, physiological parameters, biotic stress susceptibility, survivability per cent, as influenced by different condition and priming. The experimental materials for the present investigation was practiced with factorial experiment in Completely Randomized Design replicated thrice with different combinations of condition and priming. Condition and priming (CxP), the treatment combination C₁P₆ (Open x Hormonal Priming Gibberellic acid @2000 ppm) maximum germination percentage, physiological parameters, survivability per cent, economics while treatment combination C₂P₁ (Protected x Unprimed) recorded with minimum results in terms of all the parameters except in incidence of pest per cent.

Key Words : Drumstick, Priming, Open, Protected condition, Germination, Vigour, Growth, Survivability

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INTRODUCTION

Drumstick (*Moringa oleifera* L.) is an important vegetable crop belonging to the family Moringaceae having chromosome no. $2n = 28$. It has tremendous economic and dietic importance. It is called “Miracle tree” because it content all kinds of nutrient and amino acids needed for human body. The high proportion of minerals and vitamins suggest its value for both human beings and animals. It can be successfully grown in open

and protected condition by direct sown or transplant method. Under both methods, slow and late emergence rate in the crop lead smaller and weak seedlings that affect the uniformity of the crop and ultimately affect the yield, quality and net return. Hence, for obtaining better seedlings along with strong establishment, priming techniques helps in reducing the time between seed sowing, seedling emergence and synchronize emergence (Parera and Cantliffe, 1994).

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MATERIAL AND METHODS

The experiment were carried out at protected nursery area, during *Kharif* season 2017-18 at Department of Horticulture, College of Agriculture, Indore (M.P.) and Research farm, Dryland Agriculture Research College of Agriculture, Indore (M.P.). The soil of the experimental field was black soil with poor drainage and low status of nitrogen, medium in phosphorus and potassium. The experimental materials for the present investigation were practiced with factorial experiment in Completely Randomized Design replicated thrice with different combinations of condition and priming. The experiment comprised of two condition *i.e.* open and protected in combination with six different priming C_1P_1 (Open x Unprimed), C_1P_2 (Open x Hydropriming), C_1P_3 (Open x Matrimpriming), C_1P_4 (Open x Osmopriming with Potassium Nitrate @3%), C_1P_5

(Open x Osmopriming with moringa leaf extract in dilution (30 times) and C_1P_6 (Open x Hormonal Priming Gibberellic acid @2000 ppm) C_2P_1 (protected x unprimed), C_2P_2 (Protected x Hydropriming), C_2P_3 (Protected x Matrimpriming), C_2P_4 (Protected x Osmopriming with Potassium Nitrate @3%), C_2P_5 (Protected x Osmopriming with moringa leaf extract in dilution (30 times) and C_2P_6 (Protected x Hormonal Priming Gibberellic acid @2000 ppm). The main purpose of study the germination percentage, physiological parameters, biotic stress susceptibility, survivability per cent, as influenced by different condition and priming.

RESULTS AND DISCUSSION

The data with respect to germination percentage summarized in Table 1. Result indicated that the treatment effect showed significant impact on this character. In

Table 1 : Impact of condition, priming and its interaction on germination per cent of drumsticks

Condition /Treatment	Open (C ₁)	Protected (C ₂)	Mean
P ₁ (Unprimed)	63.00	59.00	61.00
P ₂ (Hydropriming)	71.00	63.00	67.00
P ₃ (Matrimpriming)	65.00	60.00	62.50
P ₄ (Osmopriming with Potassium Nitrate @3%)	73.11	65.00	69.05
P ₅ [Osmopriming with moringa leaf extract in dilution (30 times)]	68.00	61.85	64.93
P ₆ (Hormonal Priming Gibberellic acid @2000 ppm)	79.00	68.00	73.50
Mean	69.85	62.81	66.33
S.E.± (C)		0.24	
C.D. (P=0.05) (C)		0.69	
S.E.± (P)		0.41	
C.D. (P=0.05) (P)		1.20	
S.E.± (C X P)		0.58	
C.D. (P=0.05) (C X P)		1.70	

Table 2 : Response of condition, priming and its interaction on stem length (cm) at 35 days after sowing

Condition /Treatment	Open (C ₁)	Protected (C ₂)	Mean
P ₁ (unprimed)	21.56	13.22	17.39
P ₂ (Hydropriming)	35.02	29.57	32.29
P ₃ (Matrimpriming)	29.57	23.09	26.33
P ₄ (Osmopriming with Potassium Nitrate @3%)	38.70	31.42	35.06
P ₅ [Osmopriming with moringa leaf extract in dilution (30 times)]	44.24	34.99	39.61
P ₆ (Hormonal Priming Gibberellic acid @2000 ppm)	46.82	37.58	42.20
Mean	35.98	28.31	32.15
S.E.± (C)		0.96	
C.D. ((P=0.05) (C)		2.79	
S.E.± (P)		1.66	
C.D. ((P=0.05) (P)		4.83	
S.E.± (C X P)		2.34	
C.D. ((P=0.05) (C X P)		NS	

NS= Non-significant

priming, the treatment P₆ (Hormonal Priming Gibberellic acid @2000 ppm) exhibited maximum germination percentage (73.50%). However, the minimum germination percentage (61%) was noted in treatment P₁ (unprimed). Among different condition of sowing of drumstick, maximum germination was observed under open (69.85%) as compared to protected (62.81%). Among the priming and condition interaction, the maximum germination percentage (79%) was observed in P₆C₁ (Open x Hormonal Priming Gibberellic acid @2000 ppm). While, minimum germination percentage was observed in C₂P₁ (Protected x Unprimed) (59%) followed by C₂P₃ (Protected x Matripriming) (63%). The open condition with hormonal priming with Gibberellic

acid favours the early emergence and higher germination percentage. Gibberellic acid penetrated the seed coat activating hydrolytic enzymes that break down stored food resources into metabolically useful chemical allowing the cell of the embryo to divide and grow. It also causing rapid germination of seeds. Similar result was confirmed with the findings of Eghobor *et al.* (2016).

Looking at the Table 2 that the interaction effect of stem length was found non-significant. The data depicted magnitudinally at the same interval showed maximum stem diameter in treatment combination C₁P₆ (Open condition + Hormonal Priming Gibberellic acid @2000 ppm) (46.82cm). Although, minimum was recorded in treatment combination C₂P₁ (Protected condition +

Table 3 : Response of condition, priming and its interaction on root length (cm) at 35 days after sowing

Condition /Treatment	Open (C ₁)	Protected (C ₂)	Mean
P ₁ (unprimed)	2.37	2.08	2.23
P ₂ (Hydropriming)	3.46	3.25	3.36
P ₃ (Matripriming)	2.79	2.48	2.64
P ₄ (Osmopriming with Potassium Nitrate @3%)	3.71	3.37	3.54
P ₅ [Osmopriming with moringa leaf extract in dilution (30 times)]	3.12	2.91	3.01
P ₆ (Hormonal Priming Gibberellic acid @2000 ppm)	4.17	3.94	4.05
Mean	3.27	3.00	3.14
S.E.± (C)		0.03	
C.D. (P=0.05) (C)		0.09	
S.E.± (P)		0.05	
C.D. (P=0.05) (P)		0.15	
S.E.± (C X P)		0.07	
C.D. (P=0.05) (C X P)		NS	

NS= Non-significant

Table 4 : Response of condition, priming and its interaction on leaf area (cm²) of drumstick variety pkm-1

Condition /Treatment	Open (C ₁)	Protected (C ₂)	Mean
P ₁ (Unprimed)	1.96	1.48	1.72
P ₂ (Hydropriming)	3.30	2.52	2.91
P ₃ (Matripriming)	2.97	2.28	2.63
P ₄ (Osmopriming with Potassium Nitrate @3%)	4.13	2.66	3.40
P ₅ [Osmopriming with moringa leaf extract in dilution (30 times)]	3.83	2.53	3.18
P ₆ (Hormonal Priming Gibberellic acid @2000 ppm)	4.60	2.96	3.78
Mean	3.46	2.41	2.94
S.E.± (C)		0.05	
C.D. (P=0.05) (C)		0.14	
S.E.± (P)		0.09	
C.D. (P=0.05) (P)		0.25	
S.E.± (C X P)		0.12	
C.D. (P=0.05) (C X P)		0.35	

Table 5 : Response of condition, priming and its interaction on leaf area index of drumstick variety pkm-1

Condition /Treatment	Open (C ₁)	Protected (C ₂)	Mean
P ₁ (Unprimed)	4.37	4.18	4.28
P ₂ (Hydropriming)	5.61	4.99	5.30
P ₃ (Matrimpriming)	5.32	4.86	5.09
P ₄ (Osmopriming with Potasium Nitrate @3%)	7.06	5.13	6.09
P ₅ [Osmopriming with moringa leaf extract in dilution (30 times)]	6.67	4.93	5.80
P ₆ (Hormonal Priming Gibberellic acid @2000 ppm)	7.12	5.34	6.23
Mean	6.02	4.91	5.46
S.E.± (C)		0.05	
C.D. (P=0.05) (C)		0.14	
S.E.± (P)		0.08	
C.D. (P=0.05) (P)		0.24	
S.E.± (C X P)		0.12	
C.D. (P=0.05) (C X P)		0.34	

Table 6 : Response of condition, priming and its interaction on incidence of pest (%) of drumstick

Condition /Treatment	Open (C ₁)	Protected (C ₂)	Mean
P ₁ (Unprimed)	40.00 (39.20)	36.67 (37.30)	38.33 (38.30)
P ₂ (Hydropriming)	13.33 (21.40)	10.33 (18.80)	11.83 (20.10)
P ₃ (Matrimpriming)	23.33 (28.90)	6.67 (15.00)	15.00 (22.80)
P ₄ (Osmopriming with Potasium Nitrate @3%)	20.00 (26.60)	13.67 (21.70)	16.83 (24.20)
P ₅ [Osmopriming with moringa leaf extract in dilution (30 times)]	6.67 (15.00)	3.33 (10.50)	5.00 (12.90)
P ₆ (Hormonal Priming Gibberellic acid @2000 ppm)	10.33 (18.80)	6.67 (15.00)	8.50 (17.00)
Mean	18.94 (25.80)	12.89 (21.00)	15.92 (23.50)
S.E.± (C)		2.85	
C.D. (P=0.05) (C)		NS	
S.E.± (P)		4.93	
C.D. (P=0.05) (P)		14.37	
S.E.± (C X P)		6.97	
C.D. (P=0.05) (C X P)		NS	

NS= Non-significant

Table 7 : Response of condition, priming and its interaction on survivability per cent of drumstick

Condition /Treatment	Open (C ₁)	Protected (C ₂)	Mean
P ₁ (Unprimed)	35.00	30.00	32.50
P ₂ (Hydropriming)	71.67	46.67	59.17
P ₃ (Matrimpriming)	64.00	56.67	60.33
P ₄ (Osmopriming with Potasium Nitrate @3%)	85.00	78.33	81.67
P ₅ [Osmopriming with moringa leaf extract in dilution (30 times)]	90.00	66.67	78.33
P ₆ (Hormonal Priming Gibberellic acid @2000 ppm)	91.33	71.67	81.50
Mean	72.83	58.33	65.58
S.E.± (C)		1.68	
C.D. (P=0.05) (C)		4.90	
S.E.± (P)		2.91	
C.D. (P=0.05) (P)		8.48	
S.E.± (C X P)		4.12	
C.D. (P=0.05) (C X P)		NS	

NS= Non-significant

Unprimed) (13.22cm).

The maximum root length of plant was recorded in open condition C_1 (Open condition), P_6 (Hormonal Priming Gibberellic acid @2000 ppm) and its interaction C_1P_6 (Open x Hormonal Priming Gibberellic acid @2000 ppm) while the minimum was observed in C_2 (Protected), P_1 (Unprimed) and its interaction C_2P_1 (Protected x Unprimed) shown in Table 3.

It is cleared from Table 4 and 5 that the maximum leaf area and leaf area index were recorded in the open condition C_1, P_6 (Hormonal Priming Gibberellic acid @2000 ppm) and its interaction C_1P_6 (Open x Hormonal Priming Gibberellic acid @2000 ppm) while the minimum value for the same character was observed in protected condition C_2 (Protected), P_1 (Unprimed) and its interaction C_2P_1 (Protected x Unprimed). Similar finding was confirmed by the findings of Chen and Park (1973). Increased leaf area by Gibberellic acid might be due to the modification in cell division not cell elongation. Leaf area and leaf area index resulted principally from the effect of Gibberellic acid @2000 ppm on cell division.

Incidence of pest per cent on different condition, priming and its composition has given in the Table 6. The maximum pest incidence (40%) was observed in the treatment combination C_1P_1 (Open x Unprimed) followed by C_2P_1 (Protected x Unprimed) (36.67%). While, minimum was observed in the treatment combination C_2P_5 (Protected x Osmopriming with moringa leaf extract in dilution (30 times) (3.33%). This might be due to the positive impact of MLE on creating such environment for minimum infestation.

The survivability per cent was significantly influenced by the priming that the Priming P_1 (Unprimed) showed minimum survivability per cent. While the maximum survivability per cent was observed in P_4 (Osmopriming with Potassium Nitrate @3%) shown in Table 7. In the data of treatment combination, maximum survivability per cent was observed in treatment combination C_1P_6 (Open x Hormonal Priming Gibberellic

acid @2000 ppm) and minimum was recorded C_2P_1 (Protected x Unprimed). Higher survivability percentage was recorded in open condition with hormonal priming with Gibberellic acid. Protected seedlings are weaker and more susceptible to pest and adverse weather condition while, open condition with Gibberellic acid seedlings, survive well due to the tolerance capacity to harsh environment, better seedling growth and more root formation at the rhizosphere area root, cell elongation and more nutrient uptake from the large area provide more survivability chances. Similar findings were confirmed with the findings of Shanmugavelu (1970).

Conclusion:

From the forgoing investigation, we can be concluded that the interaction effect is concerned between condition and priming (CxP), the treatment combination C_1P_6 (Open x Hormonal Priming Gibberellic acid @2000 ppm) produce maximum germination percentage, physiological parameters, survivability per cent, while treatment combination C_2P_1 (Protected x Unprimed) recorded with minimum results in terms of all the parameters except in incidence of pest per cent.

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