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EFFECT OF POTASSIUM NITRATE ON SEED QUALITY ENHANCEMENT IN DIFFERENT AGED SEEDS OF BOTTLE GOURD

[*Lagenaria siceraria* (Molina) Standl]

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KEYWORDS

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ABSTRACT

In the present investigation, three bottle gourd varieties *i.e.*, AB-1, Pusa Santusti and Pusa Navin were subjected to seven different osmopriming chemical treatments of KNO₃ at three storage periods. The data obtained from various observations were analyzed by using Factorial Completely Randomized Design (FCRD). The better seed quality was recorded when the seeds stored for 3 months under ambient condition. Among the studied varieties Pusa Navin stored for 3 months and treated with 150 ppm KNO₃ recorded significantly highest seed germination as well as other seed quality parameters. The results depicted that the seed quality of bottle gourd was significantly influenced by varieties, storage periods and osmopriming treatments.

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1 Introduction

Bottle gourd [*Lagenaria siceraria* (Molina) Standl] is an important cucurbitaceous vegetable crop grown for its fleshy fruits in tropical and subtropical regions. It is cultivated both in *kharif* and summer season in western part of the country; whereas in tropical regions it is cultivated round the year under mild temperature conditions (Desai et al., 2016). Germination percentages of several vegetable species have been shown to increase after seed treatment with chemicals and various osmotica (Malik et al., 2001). In many seeds crops, particularly vegetables and small seeded grasses, seed priming has been successfully used to improve germination and emergence (Gharahlar et al., 2009). There are several methods of seed priming which includes hydropriming, halopriming, osmopriming and nano priming. The priming with nitrate solutions stimulates the germination which might be due to nitric oxide (NO) synthesis (Lara et al., 2014).

Storing and preserving the quality seed stock till the next season is equally important as producing quality seeds but some time seeds lose their viability during storage period condition. The seed deterioration during storage leads to various changes apart from quantities losses viz., change or shift in metabolic activity, changes in composition, decrease or change in enzymatic activities, morphological, cellular changes. Since the seeds have the capacity to absorb water the viability and vigour of the seeds are regulated by various physicochemical factors, initial seed quality, package materials etc (Arvindkumar et al., 2014).

Poor seedling emergence and lower seedling vigor cause poor establishment in crop stand. For this different seed treatment practices have been adopted for different crops. Post-harvest seed enhancement treatments improve germination and seedling vigor. Seed pre-soaking causes hydration of membrane proteins and initiation of several metabolic processes and re-drying of seeds arrest the process (Maiti et al., 2011).

In light of the above facts, the present research work was conducted in order to study the effect of potassium nitrate on different stored seeds of Bottle gourd.

2 Materials and Methods

The experiment was carried out at the Department of Seed Science and Technology, B. A. College of Agriculture, Anand Agricultural University, Anand, Gujarat, India during 2013-14 and 2014-15 with three varieties of bottle gourd i.e., AB-1(V1), Pusa Santusti (V2) and Pusa Navin (V3). The experiment was conducted for three different stored seeds viz 3, 6 and 9 months (P1, P2, and P3). The seeds were exposed to seven different duration treatments i.e. Control (T1), 100 ppm KNO₃ for 12 hrs

(T2), 100 ppm KNO₃ for 18 hrs (T3), 150 ppm KNO₃ for 12 hrs (T4), 150 ppm KNO₃ for 18 hrs (T5), 200 ppm KNO₃ for 12 hrs (T6) and 200 ppm KNO₃ for 18 hrs (T7) and kept for germination by using between the paper method as per ISTA procedure. Ten normal seedlings were randomly selected from each replication and observations were recorded for germination percentage, root length (cm), shoot length (cm), dry weight of seedling (gm) and vigor index. The data obtained from various observations were analyzed by using Factorial Completely Randomized Design (FCRD). The method used in the present study was indigenously developed by Department of Statistics, B. A. College of Agriculture, Anand Agriculture University, Anand.

3 Results and Discussion

The duration of germination process varies according to the type of seed and the local environmental conditions to which the seed is exposed (Kevin et al., 2015). The seed quality of bottle gourd was significantly influenced by variety, storage period and priming treatments. Three months of storage in ambient condition recorded highest seed quality. Significantly higher germination percentage as well as other seed quality parameters was recorded for the same storage period. It was observed that as storage period increased, there was concomitant reduction in germination percentage and other seed quality parameter. Potassium nitrate has been used extensively in the seed testing laboratories for many years. IT has been reported that seed priming with KNO₃ showed enhancement in seed germination, seedling emergence, vigor index in different vegetable crops (Nath & Dekha, 2015). The priming treatments involving different concentrations and durations with KNO₃ was found to influence the germination potential as well as other quality parameters of bottle gourd. Among the priming treatments the bottle gourd seeds primed with 150 ppm for 12 hrs recorded significantly higher germination

percentage as well as other seed quality parameters viz., root length, seedling fresh weight, seedling dry weight and vigor index I & II. Pusa Navin was recorded highest seed germination of 82.51% and this was followed by AB-1 (80.45%) and Pusa Santusti (79.11%) but these three treatments are not significantly different. The other parameters viz., root length, shoot length, seedling fresh weight, seedling dry weight, vigor index I and vigor index II also followed similar trend (Table 1). Pusa Navin stored for 3 months and primed with 150 ppm KNO₃ for 12 hrs recorded significantly higher germination percentage (99.77%). The similar treatment combination (V3×P1×T3) recorded significantly higher vigor index I (3472) and other parameters (Table 2). The result were in accordance with the work of Farooq et al., (2007) where they reported that osmopriming with KNO₃ not only improved

germination of seeds but also improved the seedling emergence rate and early seedling growth. It was reported by Abnavi & results in higher weight. Also, Tian (2009) reported an increase in the germination of red clover seeds by treating the seeds with

Table: - 1 Seed quality parameters as influenced by potassium nitrate treatments in different aged seeds of three varieties of Bottle Gourd (pooled for two years)

Treatment	Germination (%)	Root length	Shoot length	Seedling length	Seedling fresh weight	Seedling Dry weight	Vigour index I	Vigour index II
V1	80.45*	9.81*	13.76*	23.10*	9.15*	0.36*	1889.1*	30.5
V2	79.11*	9.29*	13.39*	23.18*	8.76*	0.33*	1895.3*	30.6
V3	82.51*	11.33*	14.92*	26.30*	9.62*	0.39*	2201.2*	33.8
CD _{0.05}	0.80	0.59	0.77	0.43	0.64	0.01	72.17	NS
S.Em.	0.206	0.151	0.196	0.111	0.163	0.005	18.383	0.951
P1	87.59*	12.04*	16.00*	28.05*	11.25*	0.48*	2470.2*	44.6*
P2	81.99*	10.10*	14.41*	24.52*	9.02*	0.33*	2024.3*	29.5*
P3	72.48*	8.33*	11.67*	20.01*	7.26*	0.27*	1491.2*	20.8*
CD _{0.05}	2.12	0.89	2.35	2.42	1.09	0.03	277.93	6.47
S.Em.	0.542	0.227	0.599	0.617	0.279	0.010	70.798	1.650
T1	62.98*	6.91*	11.72*	18.64*	6.87*	0.22*	1182*	14.4*
T2	90.63*	11.92*	15.26*	27.18*	10.64*	0.45*	2478.2*	43.4*
T3	94.85*	12.52*	15.88*	28.40*	11.14*	0.52*	2704*	50.6*
T4	86.11*	10.99*	14.70*	25.70*	9.89*	0.40*	2225.1*	36.6*
T5	81.67*	10.24*	14.09*	24.34*	9.30*	0.36*	1997.8*	30.8*
T6	76.74*	9.61*	13.56*	23.17*	8.61*	0.31*	1792.3*	25.3*
T7	71.85*	8.90*	12.99*	21.90*	7.78*	0.27*	1587.1*	20.3*
CD _{0.05}	0.52	0.44	0.69	0.62	0.86	0.006	45.56	1.41
S.Em.	0.170	0.143	0.224	0.203	0.282	0.002	14.785	0.460

*, P<0.05 (Significant at 5% level)

Ghobadi (2012) that the superiority in speed of germination of KNO₃ priming was related to more nitrogen and potassium accumulation in seeds. The increase in the germination may be due to the higher activity of α -amylase during osmopriming. Seed priming with KNO₃ might have resulted in enhancement of nutrient supply (K⁺ and NO₃⁻) toward the developing seedling that

0.2% KNO₃ solution soaking for 6 or 12 hour.

In light of the present investigation it can be concluded that pre treating bottle gourd seeds with 150 ppm KNO₃ for 12 hrs can be beneficial for seed quality enhancement at different storage intervals and slowdown the seed quality deterioration process.

Table 2 Seed quality parameters as influenced by different treatments in three varieties of Bottle Gourd (pooled for two years)

Treatment	Germination (%)	Root length	Shoot length	Seedling length	Seedling fresh weight	Seedling Dry weight	Vigour index I	Vigour index II
V1×P1×T1	71.3*	8.*	14.3*	22.6*	8.3*	0.377*	1584*	22*
V1×P1×T2	96.4*	13.7*	16.7*	29.6*	12.2*	0.587*	2861*	57*
V1×P1×T3	99.1*	13.9*	17.2*	31*	13.1*	0.671*	3075*	66*
V1×P1×T4	92.4*	12.4*	16.4*	28.6*	11.3*	0.547*	2643*	50*
V1×P1×T5	88.6*	11.4*	15.7*	27.1*	10.6*	0.502*	2412*	44*
V1×P1×T6	84.4*	10.5*	15.5*	26.3*	10*	0.457*	2217*	36*
V1×P1×T7	80.1*	9.7*	14.9*	24.8*	9.5*	0.422*	1967*	29*
V1×P2×T1	64.6*	6.6*	11.8*	18.6*	6.5*	0.157*	1136*	9*
V1×P2×T2	91.3*	10.9*	15.1*	25.2*	10.7*	0.424*	2260*	39*
V1×P2×T3	95.8*	11.4*	15.8*	26.6*	11.3*	0.508*	2529*	48*
V1×P2×T4	87.5*	10.5*	14.5*	24.4*	10.2*	0.360*	2067*	31*
V1×P2×T5	83.1*	10.1*	14.2*	23.5*	9.6*	0.304*	1886*	25*
V1×P2×T6	78.6*	9.6*	13.8*	22.8*	9*	0.253*	1739*	20*
V1×P2×T7	72.8*	8.9*	13.4*	21.7*	8*	0.203*	1523*	15*
V1×P3×T1	52.6*	4.6*	8.6*	12.5*	3.8*	0.107*	652*	5*
V1×P3×T2	82.2*	9.9*	12.7*	21.8*	8.7*	0.383*	1810*	31*
V1×P3×T3	88*	10.4*	14*	23.7*	9.1*	0.438*	2107*	38*
V1×P3×T4	78.5*	9.1*	11.9*	20.1*	8.1*	0.312*	1576*	24*
V1×P3×T5	73.1*	8.5*	11.4*	19*	7.6*	0.273*	1394*	18*
V1×P3×T6	66.8*	7.9*	10.7*	17.9*	6.7*	0.222*	1219*	14*
V1×P3×T7	61.4*	7.1*	9.7*	16.3*	6.6*	0.180*	1006*	10*
V2×P1×T1	71.4*	8.3*	13.8*	21.9*	9.7*	0.318*	1539*	27*
V2×P1×T2	95.8*	13*	16.8*	30.7*	12.1*	0.548*	2975*	57*
V2×P1×T3	98.3*	13.9*	17.2*	31.3*	12.1*	0.628*	3068*	65*
V2×P1×T4	91.7*	12.2*	16*	28.6*	11.1*	0.506*	2616*	51*
V2×P1×T5	88.8*	11.5*	15.4*	27.1*	10.5*	0.467*	2368*	45*
V2×P1×T6	84.4*	10.6*	14.7*	25.1*	10.2*	0.421*	2092*	40*
V2×P1×T7	80.1*	10*	14.3*	24.2*	9*	0.361*	1918*	34*
V2×P2×T1	59.6*	6.6*	11.6*	18.1*	7.3*	0.151*	1107*	9*
V2×P2×T2	89.7*	10.5*	15.2*	26.5*	10.2*	0.408*	2421*	40*

Treatment	Germination (%)	Root length	Shoot length	Seedling length	Seedling fresh weight	Seedling Dry weight	Vigour index I	Vigour index II
V2×P2×T3	95.5*	11.2*	15.9*	27.8*	10.6*	0.462*	2675*	46*
V2×P2×T4	84.8*	10*	14.8*	25.4*	9.4*	0.350*	2202*	32*
V2×P2×T5	79.8*	9.3*	14*	24.1*	8.6*	0.300*	1935*	27*
V2×P2×T6	75*	8.6*	13.3*	22.5*	7.9*	0.244*	1727*	21*
V2×P2×T7	70.3*	8.1*	12.8*	21.5*	6.1*	0.201*	1546*	16*
V2×P3×T1	51*	4.1*	8.5*	13.3*	5.3*	0.128*	672*	5*
V2×P3×T2	82.7*	8.8*	11.9*	21.6*	8.6*	0.343*	1785*	27*
V2×P3×T3	88.3*	9.5*	12.2*	22.6*	8.5*	0.379*	1998*	32*
V2×P3×T4	76.2*	7.9*	11.1*	20*	7.2*	0.292*	1554*	22*
V2×P3×T5	70.8*	7.1*	10.7*	18.8*	6.9*	0.238*	1356*	17*
V2×P3×T6	65.8*	6.8*	10.3*	17.9*	6.1*	0.189*	1199*	12*
V2×P3×T7	60.2*	6.2*	9.7*	16.6*	5.7*	0.151*	1009*	9*
V3×P1×T1	74.1*	8.9*	14.2*	23.1*	10.2*	0.352*	1685*	26*
V3×P1×T2	96.5*	15.8*	17.6*	33.5*	13.4*	0.568*	3238*	57*
V3×P1×T3	99.7*	16.7*	18.1*	34.9*	14.1*	0.620*	3472*	64*
V3×P1×T4	92.6*	14.2*	17.3*	31.6*	13*	0.528*	2926*	50*
V3×P1×T5	88.6*	13.1*	16.7*	29.8*	12.2*	0.457*	2641*	42*
V3×P1×T6	83.8*	12.6*	16.4*	29.1*	11.7*	0.431*	2413*	36*
V3×P1×T7	80.4*	11.5*	15.7*	27.3*	11*	0.380*	2155*	31*
V3×P2×T1	67.6*	7.9*	12.1*	20*	6*	0.252*	1331*	15*
V3×P2×T2	93.8*	13.3*	16.3*	29.7*	10.2*	0.469*	2772*	45*
V3×P2×T3	96.8*	13.8*	16.8*	30.7*	11.3*	0.537*	2966*	52*
V3×P2×T4	90.2*	12.3*	16.2*	28.5*	9.7*	0.426*	2537*	38*
V3×P2×T5	86.1*	11.2*	15.2*	26.5*	9.6*	0.378*	2242*	32*
V3×P2×T6	81.2*	10.5*	14.7*	25.2*	8.6*	0.343*	2023*	27*
V3×P2×T7	76.6*	9.9*	14.3*	24.3*	7.7*	0.308*	1849*	22*
V3×P3×T1	54.3*	6.8*	10.3*	17.2*	4.2*	0.159*	929*	8*
V3×P3×T2	86.7*	10.9*	14.5*	25.5*	9.3*	0.401*	2177*	33*
V3×P3×T3	91.7*	11.4*	15.2*	26.7*	9.8*	0.436*	2443*	39*
V3×P3×T4	80.6*	10.1*	13.6*	23.7*	8.6*	0.363*	1901*	28*

Treatment	Germination (%)	Root length	Shoot length	Seedling length	Seedling fresh weight	Seedling Dry weight	Vigour index I	Vigour index II
V3×P3×T5	75.7*	9.6*	13.1*	22.8*	7.6*	0.340*	1711*	24*
V3×P3×T6	70.2*	8.9*	12.3*	21.3*	6.9*	0.297*	1499*	18*
V3×P3×T7	64.4*	8.3*	11.8*	20.1*	6.1*	0.233*	1306*	13*
CD _{0.05}	0.887	0.256	0.157	0.760	0.138	0.010	34.553	0.950
S.Em.	0.580	0.218	0.057	0.267	0.050	0.004	12.466	0.343

*, P<0.05 (Significant at 5% level)

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