

Storability study in bitter gourd (*Momordica charantia* L.) cv. PUSA VISESH

■ P.R. ARVINDKUMAR, S.N. VASUDEVAN, M.G. PATIL AND M.C. RAJARAJESHWARI

SUMMARY : The field experiment was conducted during *Rabi* season of the year 2009 at College of Agriculture, Raichur, in order to find out the efficacy of NAA, triacontanol and boron on initial seed quality and storability in bitter gourd cv. Pusa Visesh. The experiment was laid out in randomized block design considering eight treatments viz., NAA (25 and 50 ppm), triacontanol (0.5 and 1.0 ppm), boron (3.0 and 4.0 ppm), water spray and absolute control. Results revealed that NAA 50 ppm recorded highest initial seed germination. Whereas, boron at 4 ppm recorded highest seedling length and seedlings dry weight. Resultant seeds stored in cloth bags under ambient storage condition and seed quality tested after every month to end of storage period (Feb 10 – January 2011). The storage study revealed that boron at 4 ppm maintained highest seed quality parameters like seed germination, seedling length and seedling dry weight at the end of twelve months storage period.

KEY WORDS : Bitter gourd, Seed quality, Cloth bag, Ambient storage condition

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Bitter gourd (*Momordica charantia* L.) is one of the most important tropical vegetable crops. It belongs to the family Cucurbitaceae and popularly known as balsom pear, karela, or bitter melon. In India, it is cultivated on an area of 26,004 hectare (ha) with a production of 1, 62,196 tonnes and the productivity level is 6.23 tonnes per ha.

The plant growth regulators (PGR's) are considered as a new generation agrochemicals after fertilizers, pesticides and herbicides. In bitter gourd, it is possible to increase the yield by increasing the fruit set by using growth regulators. Use of PGR's and micro nutrient like boron might be a useful alternative to increase crop production. GA₃ and NAA are also important growth regulators that may have ability to modify the growth, sex ratios and yield contributing characters of plant (Shantappa

et al., 2007). The micronutrient and cations are involved in enzyme systems as cofactors with the exception of Zn, Mn, Cu and B. These are capable of acting as 'electron carriers' in the enzyme systems and are responsible for the oxidative-reduction process in the plant system. In the present study efforts were made to know the effect of plant growth regulators (NAA and triacontanol) and chemical (B) on seed yield and quality of bitter gourd (*Momordica charantia* L.) cv. PUSA VISESH.

Storage and preservation of quality seed stocks till the next season is as important as producing quality seeds. Farmers and scientists opined that safe storage of seeds is advantages as it reduces the burden of seed production every year, besides timely supplying of desired genetic stocks for the use in years following periods of low production. The germination and vigour which can be expected from stored seeds is another matter of great importance. Seed is said to be in storage on plant itself right from its physiological maturity and it continues to be in storage until next sowing or further use or death. Deterioration of seed during storage is inevitable and leads to different changes at different levels viz., impairment or shift in metabolic activity, compositional changes, decline or change in enzyme activities, phenotypic, cytological changes apart from quantitative losses. Being hygroscopic in nature the viability and vigour of seeds under storage are known to be

MEMBERS OF THE RESEARCH FORUM

Author for Correspondence :

P. R. ARVINDKUMAR, Department of Seed Science and Technology, College of Agriculture, University of Agricultural Sciences, RAICHUR (KARNATAKA) INDIA

Email : arvindkrathod09@gmail.com

Coopted Authors:

S.N. VASUDEVAN, M.G. PATIL AND M. C. RAJARAJESHWARI, Department of Seed Science and Technology, College of Agriculture, University of Agricultural Sciences, RAICHUR (KARNATAKA) INDIA

regulated by variations in the physico-chemical factors, initial seed quality, storage structures, packaging materials etc. (Doijode, 1988). A knowledge of proper storage of seeds under ambient conditions at relatively low cost with minimum deterioration in quality for a period of at least one or more seasons will be of immense use to seed industry and farming community.

EXPERIMENTAL METHODS

A field experiment was conducted at College of Agriculture, Raichur, Karnataka during *Rabi* 2009 with three replications in randomized block design. The healthy and bold seeds were dibbled with a spacing of 120 cm x 80 cm to a depth of 4.0 cm. After germination one seedling per hill was maintained. The gross plot size of the plot was 10.80 x 8.0 = 86.4 m² and net Plot size: 8.4 x 6.4 m = 76.8 m². The plant protection measures were adopted as and when required. Two growth regulators *viz.*, NAA (25 and 50 ppm), triacontanol (0.5 and 1.0 ppm) and boron (3.0 and 4.0 ppm) were used for foliar application at two concentrations with absolute control and water spray at two to four true leaf stage and then at 60 days after sowing (DAS), 75 DAS and 90 DAS. Precaution was taken to prevent drifting of spray solution from one treatment plot to other. In each treatment five plants were randomly selected and tagged for recording various biometric observations as detailed below. Fruits were harvested as when they turn orange red colour and seeds were harvested manually. Seed germination percentage, seedling length and seedling dry weight were recorded immediately after harvest and subsequently at monthly intervals (Feb., 10 – January, 2011). The germination test was conducted as per ISTA (International Seed Testing Association) procedure by rolled towel method. From the germination test, ten normal seedlings were selected randomly from each treatment on the day of final count. The seedling length was measured from shoot tip to root tip. Ten normal seedlings were taken in butter paper and dried in a hot-air oven maintained at 90°C for 24 hours used for measuring seedling dry weight, later seedlings were removed and allowed to cool in a desiccators for 30 minutes before weighing in an electronic balance (Agrawal, 1995).

EXPERIMENTAL FINDINGS AND ANALYSIS

The experimental findings of the present study have been presented in the following sub heads:

Effect of NAA, triacontanol and boron on initial seed quality:

In the present study the growth regulators and chemical had a significant effect on germination. Boron treatment

Table 1: Effect of plant growth regulators and chemical on seed germination (% of bitter gourd cv. PUSA VISHU during storage

Treatments	Storage period (month)												
	0	1	2	3	4	5	6	7	8	9	10	11	12
T ₁ : Absolute control	79.50 (63.09)	81.75 (64.73)	83.25 (65.85)	83.75 (66.25)	82.75 (65.53)	81.25 (64.36)	80.00 (63.45)	79.25 (62.94)	78.50 (62.42)	77.75 (61.88)	76.50 (61.04)	75.75 (60.52)	74.50 (59.69)
T ₂ : Water spray	80.25 (63.63)	82.25 (65.09)	84.50 (66.87)	85.50 (67.69)	84.75 (67.09)	83.50 (66.11)	82.25 (65.15)	81.75 (64.75)	81.00 (64.26)	79.75 (63.47)	78.25 (62.23)	77.00 (61.40)	75.75 (60.54)
T ₃ : Naphthalene acetic acid @25 ppm	82.75 (65.47)	86.25 (68.26)	88.00 (69.81)	88.75 (70.41)	88.50 (70.34)	88.00 (69.79)	87.25 (69.24)	86.75 (68.75)	86.25 (68.37)	86.00 (68.08)	85.25 (67.42)	84.50 (67.16)	83.75 (66.51)
T ₄ : Naphthalene acetic acid @ 50 ppm	83.25 (65.34)	87.75 (69.57)	89.25 (70.93)	90.25 (71.84)	90.25 (71.83)	90.25 (71.88)	89.00 (70.75)	88.50 (70.26)	88.00 (69.79)	87.25 (69.13)	87.00 (69.08)	86.25 (68.26)	85.25 (67.44)
T ₅ : Triacontanol @ 0.5 ppm	80.00 (63.46)	84.00 (66.45)	87.00 (68.90)	87.50 (69.33)	87.25 (69.10)	87.25 (69.10)	86.75 (68.79)	86.50 (68.59)	86.50 (68.55)	86.00 (68.03)	85.50 (67.69)	84.75 (67.03)	83.75 (66.24)
T ₆ : Triacontanol @ 1.0 ppm	80.75 (63.98)	85.00 (67.22)	87.25 (69.13)	88.00 (69.75)	87.75 (69.59)	87.50 (69.53)	86.75 (68.70)	86.75 (68.68)	86.50 (68.46)	86.50 (68.45)	86.00 (68.15)	85.50 (67.84)	84.50 (67.01)
T ₇ : Boron @ 3.0 ppm	82.50 (65.28)	86.75 (68.57)	87.25 (69.10)	89.25 (70.88)	89.00 (70.69)	88.75 (70.47)	88.25 (70.03)	88.00 (69.81)	87.75 (69.59)	87.25 (69.09)	86.50 (68.49)	86.00 (68.08)	85.00 (67.26)
T ₈ : Boron @4.0 ppm	83.00 (65.55)	88.50 (70.22)	90.25 (71.84)	91.00 (72.61)	90.50 (72.13)	90.25 (71.94)	89.25 (70.53)	89.00 (70.78)	88.75 (70.59)	87.50 (69.37)	87.00 (69.01)	86.50 (68.48)	85.50 (67.65)
S.E.±	0.68	0.68	0.88	0.74	1.14	0.98	1.15	1.18	1.29	1.09	1.28	1.35	1.31
C.D. at 5%	2.00	1.99	2.56	2.16	3.32	2.85	3.35	3.46	3.76	3.18	3.74	4.05	3.83

Figures in the parenthesis indicate angular transformed values 0- Initial seed quality

Table 2 : Effect of plant growth regulators and chemical on seedling length (cm) of bitter gourd cv. PUSA Visish during storage

Treatments	Storage period (month)												
	0	1	2	3	4	5	6	7	8	9	10	11	12
T ₁ : Absolute control	16.79	17.40	17.69	18.07	18.04	17.87	17.71	17.56	17.49	17.44	17.10	16.55	16.23
T ₂ : Water spray	17.79	18.26	18.38	18.85	18.82	18.63	18.53	18.43	18.33	18.21	17.92	17.18	16.94
T ₃ : Naphthalene acetic acid @25 ppm	19.93	19.97	20.32	20.91	20.88	20.79	20.69	20.63	20.62	20.58	20.59	20.42	20.19
T ₄ : Naphthalene acetic acid @ 50 ppm	21.11	21.15	21.77	22.58	22.55	22.43	22.32	22.11	22.02	22.00	21.81	21.60	21.31
T ₅ : Triacntanol @ 0.5 ppm	19.55	19.55	19.93	20.76	20.73	20.63	20.55	20.46	20.40	20.21	20.11	19.91	19.76
T ₆ : Triacntanol @ 1.0 ppm	19.80	19.70	20.12	21.04	20.99	20.83	20.73	20.67	20.65	20.57	20.47	20.18	20.07
T ₇ : Boron @ 3.0 ppm	19.67	19.94	20.49	21.12	21.09	20.96	20.94	20.84	20.81	20.68	20.51	20.36	20.30
T ₈ : Boron @4.0 ppm	21.16	21.27	21.64	22.49	22.47	22.41	22.33	22.28	22.09	22.03	21.94	21.72	21.60
S.E.±	0.38	0.33	0.35	0.31	0.38	0.35	0.32	0.39	0.42	0.40	0.34	0.36	0.36
C.D. at 5%	1.12	0.96	1.02	0.92	1.10	1.03	0.92	1.14	1.22	1.16	0.98	1.06	1.05
0- Initial seed quality													

Table 3 : Effect of plant growth regulators and chemical on seedling dry weight (mg) of bitter gourd cv. PUSA VISESH during storage

Treatments	Storage period (month)												
	0	1	2	3	4	5	6	7	8	9	10	11	12
T ₁ : Absolute control	109.00	108.50	108.70	108.77	108.75	108.74	108.74	108.71	108.69	108.68	108.66	108.64	108.63
T ₂ : Water spray	112.25	112.35	112.37	112.44	112.45	112.43	112.42	112.42	112.41	112.39	112.38	112.38	112.35
T ₃ : Naphthalene acetic acid @25 ppm	123.78	123.53	123.98	125.40	125.40	125.38	125.31	125.24	125.12	125.08	125.02	124.92	124.88
T ₄ : Naphthalene acetic acid @ 50 ppm	127.65	124.40	124.94	125.40	125.40	125.40	125.40	125.39	125.39	125.38	125.38	125.38	125.37
T ₅ : Triacntanol @ 0.5 ppm	118.95	118.70	119.15	119.24	119.24	119.24	119.24	119.23	119.23	119.23	119.23	119.23	119.23
T ₆ : Triacntanol @ 1.0 ppm	119.75	119.70	120.18	120.18	120.18	120.18	120.18	120.17	120.17	120.15	120.15	120.13	120.12
T ₇ : Boron @ 3.0 ppm	124.98	124.73	125.18	125.21	125.21	125.20	125.18	125.18	125.17	125.16	125.16	125.16	125.15
T ₈ : Boron @4.0 ppm	129.51	129.26	129.74	130.26	130.26	130.26	130.26	130.25	130.25	130.25	130.24	130.24	130.23
S.E.±	1.19	0.61	0.62	0.60	0.60	0.62	0.62	0.61	0.61	0.61	0.61	0.60	0.60
C.D. at 5%	3.46	1.78	1.81	1.75	1.75	1.80	1.80	1.77	1.77	1.75	1.77	1.76	1.76
0- Initial seed quality													

showed significantly higher germination throughout the storage period followed by NAA and triacontanol which were at par with each other. After the harvest of the crop, the resultant seeds were analyzed for various seed quality parameters (Table 1.). Growth regulators and nutrient sprayed treatments showed beneficial significant influence on seed quality parameters over control.

The seeds harvested from the plant received NAA 50 ppm showed higher germination (83.25 %) which was on par with boron 4 ppm (83.00 %). While, control recorded lowest (79.50 %). This increase in seed quality due to spray of growth regulators might be due to adequate supply of food reserves to resume embryo growth and synthesis of hydrolytic enzymes which are secreted and act on starchy endosperm in turn affecting physiology of seed germination and establishment of seedling as reported by Shantappa *et al.* (2007) in bitter gourd. The low seed germination percentage recorded in freshly harvested seeds might be due to the primary dormancy associated with embryo of fresh seeds. Later on as storage proceeds there was gradual increase in seed germination in all the treatments up to third month after storage. From fourth month onwards there was a slightly decrease in seed germination and seed quality parameters indicating the on-set of deterioration which might be due to the combined effects of high temperature, low oxygen, and high CO₂ partial pressures (Edelstein *et al.*, 1995) in melon.

Boron 4 ppm treatment (Table 2 and 3), revealed highest seedling length and seedling dry weight (21.16 cm and 129.51 mg value, respectively) which were at par with NAA at 50 ppm (21.21 cm and 127.65 mg, respectively) whereas, (16.79 cm, and 109.00 mg respectively) recorded in control (Table 3 and 4.). This might be due to adequate supply of food reserves to resume embryo growth and in addition to release enzymes responsible for degradation of macromolecules into micromolecules to be utilized in growth promoting processes (Gedam *et al.*, 1996) in bitter gourd.

Effect of NAA, triacontanol and boron on seed quality during storage :

Seed is the nucleus of life and is subjected to continuous ageing once it has reached physiological maturity. This phenomenon results in an irreversible change in seed quality ultimately affecting viability. The quantitative deterioration during storage is mainly attributed to period of storage (Delouche and Baskin, 1973).

The storage study revealed that the germination percentage (Table 1.) was significantly highest in boron @ 4 ppm (88.50 %, 91.00 per cent and 85.50 %) followed by NAA @ 50 ppm (87.75 %, 89.25 % and 85.25 %), boron @ 3 ppm (86.75 %, 89.25 % and 85.00 %) and water spray (82.25 %, 85.50 % and 75.75 %) whereas, lowest germination percentage was observed in absolute control (81.75 %, 82.75 % and 74.50 %, respectively) at the end of first, third and twelve month of storage period, respectively. Similarly seedling length (21.27 cm, 22.49 cm and 21.60 cm) and seedling dry weight (129.26 mg, 130.26 mg and 130.23 mg) highest in boron at 4.0 ppm (Table 2 and 3). Highest seed quality at the end of third month of storage period might be due to the natural breakdown of seed dormancy due to external environmental factors. It might be due to adequate supply of food reserves to resume embryo growth and synthesis of hydrolytic enzymes which are secreted and act on starchy endosperm in turn affecting physiology of seed germination and establishment of seedling. Effect of boron on seed germination was also earlier reported by (Gedam *et al.*, 1996 and Hilli *et al.*, 2010) in bitter gourd and ridge gourd, respectively. These differences in storability might be due to variations in their effectiveness in combating the seed borne pathogen.

Conclusion :

All the treatments maintained above the Minimum Seed Certification Standards of 60 per cent of seed germination up to twelve months of storage.

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