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Effect of NAA, triacontonol and boron on seed longivity of bitter gourd (*Momordica charantia* L.) cv. PUSA VISESH

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ABSTRACT : Present investigation was carried out to study the effect of NAA, triacontanol and boron on seed longevity of bitter gourd cv. PUSA VISESH at College of Agriculture, Raichur. Seed obtained from the vine plants imposed with treatment NAA (25 and 50 ppm), triacontanol (0.5 and 1.0 ppm), boron (3.0 and 4.0 ppm) water spray and absolute control were used for foliar application at two to four true leaf stage followed by a interval of 60, 75 and 90 days after sowing in the Seed Technology Field Block, University of Agricultural Sciences, Raichur. Results revealed that the moisture content increased gradually as storage period increased in all the treatments. Seeds were stored in cloth bags under ambient storage condition and seed quality was tested after every month upto end of storage period (February, 2010 – January, 2011). Boron at 4 ppm maintained lower moisture content of seed (7.07 %, 7.19 % and 9.16 %) after first, third and twelve months after storage, respectively. Similarly boron at 4 ppm recorded highest seed germination (88.50 %, 91.00 % and 85.50 %) and dehydrogenase activity (0.350, 0.431 and 0.359 OD values) at the end of first, third and twelve months after storage, respectively.

KEY WORDS : Bitter gourd, Boron, Dehydrogenase enzyme activity

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Bitter gourd (*Momordica charantia* L.) is one of the most important Cucurbitaceae vegetable widely cultivated in Karnataka. 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 like GA_3 and NAA have an ability to modify the plant growth, sex ratios and yield contributing characters, while micro nutrient like boron will be a useful alternative to increase crop production (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.

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 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. Considering all these, the present investigation were undertaken to study the seed longevity of different growth regulators and micronutrient sprayed bitter gourd seeds.

RESEARCH 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 × 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 × 8.0 = 86.4 m^2 and net plot size: 8.4 × 6.4 m = 76.8 m^2. 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 fruits were harvested as when they turn orange red colour and seeds were harvested manually. Seed moisture content, seed germination percentage, and dehydrogenase enzyme activity were noted at monthly intervals (February, 2010 – January, 2011) during storage period, seed stored in cloth bag under ambient condition.

Two replicates of five grams of seed material were taken for determining the moisture content using low constant method. The powdered seed material was placed in a weighed metal cup and after removing the lid, moisture cups were placed in hot air oven maintained at 103 ± 2°C for 16 ± 1 hr and the contents were allowed to dry. Then, the contents were weighed in an electronic balance along with metal cup and lid. The moisture content was worked out using the following formula and expressed as percentage (Anonymous, 1999).

$$\textbf{Moisture content (\%)} = \frac{M_2 - M_3}{M_2 - M_1} \times 100$$

where,

M_1 : Weight of the metal cup alone,

M_2 : Weight of the metal cup + sample before drying,

M_3 : Weight of the metal cup + sample after drying.

Representative 25 seeds from each treatment were taken and preconditioned by soaking in water for overnight at room temperature. Seeds were taken at random and the embryos were excised. The embryos were steeped in 0.25 per cent solution of 2, 3, 5-triphenyl tetrazolium chloride (TZ) solution and kept in dark for two hours at 40°C for staining. The stained seeds were thoroughly washed with water and then soaked in 5 ml of 2 methoxy ethanol (methyl cellosolve) and kept overnight for extracting the red colour formation. The intensity of red colour was measured using ELICO UV-VIS spectrophotometer (Model SC-159) using blue filter (470 nm) and methyl cellosolve as the blank. The OD value obtained is reported as dehydrogenase activity (Anonymous, 1999).

Statistical analysis :

The obtained data was analyzed by statistical significant at $P<0.05$ level, S.E. and C.D. at 5 per cent level by the procedure given by (Panse and Sukhatme, 1994).

RESEARCH FINDINGS AND DISCUSSION

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).

Effect of plant growth regulators and micronutrient on moisture content (%) of bitter gourd cv. PUSA VISESH :

With the advancement of storage period, moisture content of seed differed significantly due to the influence of plant growth regulators and chemical (Table 1). A linear increase in the moisture content was observed with increase in the storage period upto 12 months in all the treatments. The absolute control recorded highest moisture content (7.27 %) and significantly lowest moisture content (7.07 %) was recorded with boron at 4 ppm during the first month of storage. At the end of storage period highest moisture content (9.84 %) recorded with absolute control and lowest in boron 4 ppm (9.16 %).

Effect of plant growth regulators and micronutrient on seed germination percentage (%) of bitter gourd cv. PUSA VISESH :

In the present study the growth regulators and chemical had a significant effect on seed germination. Boron treatment 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 2). Growth regulators and nutrient sprayed treatments showed beneficial significant influence on seed quality parameters over control.

The seeds harvested from the plant received boron @ 4 ppm recorded highest (Table 2) seed germination percentage (88.50 %, 91.00 % 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 %) at the end of first, third and twelve month of storage period, respectively. Arvindkumar *et al.* (2012) 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. Similar effect of NAA on seed germination was also earlier reported by Shantappa *et al.* (2007) in bitter gourd. Effect of boron on seed germination was also earlier reported by Gedam *et al.* (1996) in bitter gourd, these differences in storability might be due to variations in their effectiveness in combating the seed borne pathogen.

The low seed germination percentage recorded after one month of storage latter on increased because seeds might be possess 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 upto third month after storage. From fourth month onwards there was a slightly decrease in seed germination and seed quality parameters indicating the

Table 1 : Effect of NAA, triacontanol and boron on moisture content (%) of bitter gourd cv. PUSA VISESH

Treatments	Storage period (month)											
	1	2	3	4	5	6	7	8	9	10	11	12
T_1 : Absolute control	7.27	7.28	7.29	7.30	7.32	7.55	7.68	7.86	8.00	8.90	8.95	9.84
	(15.65)	(15.65)	(15.65)	(15.68)	(15.67)	(15.95)	(16.09)	(16.28)	(16.64)	(17.35)	(17.40)	(18.28)
T_2 : Water spray	7.18	7.28	7.30	7.43	7.45	7.50	7.64	7.82	8.15	8.71	8.78	9.53
	(15.54)	(15.65)	(15.68)	(15.81)	(15.84)	(15.88)	(15.91)	(15.94)	(16.59)	(17.17)	(17.23)	(17.98)
T_3 : Naphthalene acetic	7.24	7.30	7.30	7.32	7.34	7.45	7.67	7.89	8.18	8.54	8.60	9.31
acid @25 ppm	(15.60)	(15.67)	(15.67)	(15.69)	(15.72)	(15.77)	(15.80)	(15.85)	(16.58)	(16.98)	(17.05)	(17.77)
T_4 : Naphthalene acetic	7.15	7.17	7.25	7.26	7.28	7.30	7.33	7.38	7.80	8.25	8.41	9.21
acid @ 50 ppm	(15.51)	(15.53)	(15.62)	(15.63)	(15.65)	(15.67)	(15.70)	(15.76)	(16.22)	(16.69)	(16.86)	(17.67)
T_5 : Triacontanol @	7.23	7.25	7.29	7.38	7.40	7.43	7.52	7.60	7.95	8.69	8.69	9.45
0.5 ppm	(15.60)	(15.62)	(15.68)	(15.76)	(15.78)	(15.82)	(16.00)	(15.68)	(16.60)	(17.14)	(17.14)	(17.90)
T_6 : Triacontanol @	7.08	7.12	7.17	7.24	7.25	7.36	7.43	7.45	7.73	8.37	8.78	9.46
1.0 ppm	(15.43)	(15.47)	(15.52)	(15.61)	(15.62)	(15.73)	(15.81)	(15.84)	(16.03)	(16.92)	(17.23)	(17.91)
T_7 : Boron @ 3.0 ppm	7.20	7.32	7.33	7.38	7.40	7.54	7.64	7.78	8.22	8.79	8.90	9.42
	(15.57)	(15.69)	(15.71)	(15.76)	(15.79)	(15.94)	(16.05)	(16.20)	(16.62)	(17.24)	(17.35)	(17.87)
T_8 : Boron @4.0 ppm	7.07	7.11	7.19	7.30	7.30	7.44	7.58	7.88	7.90	8.49	8.53	9.16
	(15.42)	(15.47)	(15.56)	(15.67)	(15.68)	(15.83)	(15.98)	(16.30)	(16.32)	(16.94)	(16.98)	(17.62)
S.E. ±	0.09	0.10	0.10	0.10	0.10	0.10	0.08	0.11	0.14	0.15	0.19	0.11
C.D. (P=0.05)	NS	NS	NS	NS	NS	0.28	0.22	0.31	0.39	0.43	0.56	0.32

Figures in the parenthesis indicate angular transformed value; NS=Non-significant on-set of deterioration which might be due to the combined effects of high temperature, low oxygen, and high CO_2 partial pressures (Edelstein *et al.*, 1995) in melon. This phenomenon is due to slow rate of deterioration process in boron treatment seeds might be due to primary cell wall structure, membrane functional integrity and activity of IAA oxidase (Chauhan *et al.*, 1984 and Nalawade *et al.*, 2011).

Effect of plant growth regulators and micronutrient on dehydrogenase enzyme activity (OD values) of bitter gourd cv. PUSA VISESH :

The highest dehydrogenase activity (0.350, 0.431 and 0.359) was recorded with boron 4 ppm (Table 3), with NAA 50 ppm (0.330, 0.400 and 0.348) treatment, which were at par with each other. The lowest dehydrogenase activity (0.272, 0.311 and 0.264) was

Table 2 : Effect of NAA, triacontanol and boron on seed germination (%) of bitter gourd cv. PUSA VISESH

Treatments	Storage period (month)											
	1	2	3	4	5	6	7	8	9	10	11	12
T_1 : Absolute control	81.75	83.25	83.75	82.75	81.25	80.00	79.25	78.50	77.75	76.50	75.75	74.50
	(64.73)	(65.85)	(66.25)	(65.53)	(64.36)	(63.45)	(62.94)	(62.42)	(61.88)	(61.04)	(60.52)	(59.69)
T_2 : Water spray	82.25	84.50	85.50	84.75	83.50	82.25	81.75	81.00	79.75	78.25	77.00	75.75
	(65.09)	(66.87)	(67.69)	(67.09)	(66.11)	(65.15)	(64.75)	(64.26)	(63.47)	(62.23)	(61.40)	(60.54)
T_3 : Naphthalene acetic	86.25	88.00	88.75	88.50	88.00	87.25	86.75	86.25	86.00	85.25	84.50	83.75
acid @25 ppm	(68.26)	(69.81)	(70.41)	(70.34)	(69.79)	(69.24)	(68.75)	(68.37)	(68.08)	(67.42)	(67.16)	(66.51)
T_4 : Naphthalene acetic	87.75	89.25	90.25	90.25	90.25	89.00	88.50	88.00	87.25	87.00	86.25	85.25
acid @ 50 ppm	(69.57)	(70.93)	(71.84)	(71.83)	(71.88)	(70.75)	(70.26)	(69.79)	(69.13)	(69.08)	(68.26)	(67.44)
T_5 : Triacontanol @	84.00	87.00	87.50	87.25	87.25	86.75	86.50	86.50	86.00	85.50	84.75	83.75
0.5 ppm	(66.45)	(68.90)	(69.33)	(69.10)	(69.10)	(68.79)	(68.59)	(68.55)	(68.03)	(67.69)	(67.03)	(66.24)
T_6 : Triacontanol @	85.00	87.25	88.00	87.75	87.50	86.75	86.75	86.50	86.50	86.00	85.50	84.50
1.0 ppm	(67.22)	(69.13)	(69.75)	(69.59)	(69.33)	(68.70)	(68.68)	(68.46)	(68.45)	(68.15)	(67.84)	(67.01)
T_7 : Boron @ 3.0 ppm	86.75	87.25	89.25	89.00	88.75	88.25	88.00	87.75	87.25	86.50	86.00	85.00
	(68.67)	(69.10)	(70.88)	(70.69)	(70.47)	(70.03)	(69.81)	(69.59)	(69.09)	(68.49)	(68.08)	(67.26)
T_8 : Boron @4.0 ppm	88.50	90.25	91.00	90.50	90.25	89.25	89.00	88.75	87.50	87.00	86.50	85.50
	(70.22)	(71.84)	(72.61)	(72.18)	(71.94)	(70.93)	(70.78)	(70.59)	(69.37)	(69.01)	(68.48)	(67.65)
S.E. ±	0.68	0.88	0.74	1.14	0.98	1.15	1.18	1.29	1.09	1.28	1.39	1.31
C.D. (P=0.05)	1.99	2.56	2.16	3.32	2.86	3.35	3.46	3.76	3.18	3.74	4.05	3.83

Figures in the parenthesis indicate angular transformed values

Table 3 : Effect of NAA, triacontanol and boron on dehydrogenase enzyme activity (OD values) of bitter gourd cv. PUSA VISESH during storage

Treatments	Storage period (month)											
	1	2	3	4	5	6	7	8	9	10	11	12
T_1 : Absolute control	0.272	0.280	0.311	0.303	0.294	0.295	0.289	0.287	0.282	0.279	0.275	0.264
T_2 : Water spray	0.291	0.298	0.330	0.319	0.313	0.320	0.318	0.311	0.305	0.292	0.288	0.284
T_3 : Naphthalene acetic acid @25 ppm	0.324	0.339	0.393	0.385	0.370	0.365	0.357	0.353	0.350	0.348	0.344	0.341
T_4 : Naphthalene acetic acid @ 50 ppm	0.330	0.340	0.400	0.397	0.390	0.385	0.379	0.361	0.358	0.354	0.351	0.348
T_5 : Triacontanol @ 0.5 ppm	0.282	0.300	0.350	0.338	0.330	0.330	0.324	0.320	0.316	0.309	0.305	0.300
T_6 : Triacontanol @ 1.0 ppm	0.333	0.348	0.390	0.375	0.374	0.371	0.369	0.366	0.361	0.354	0.351	0.333
T_7 : Boron @ 3.0 ppm	0.326	0.345	0.409	0.399	0.396	0.382	0.378	0.373	0.369	0.365	0.360	0.353
T_8 : Boron @4.0 ppm	0.350	0.355	0.431	0.424	0.414	0.409	0.404	0.390	0.386	0.372	0.368	0.359
S.E. ±	0.023	0.023	0.026	0.025	0.023	0.021	0.020	0.0212	0.023	0.021	0.023	0.024
C.D. (P=0.05)	0.066	0.068	0.076	0.073	0.067	0.062	0.060	0.062	0.067	0.061	0.067	0.070

recorded in absolute control at first, third and at the end of 12 months of storage period, respectively. Similar work related to the present investigation was also done by Vala and Savaliya (2014) and Arvindkumar *et al.* (2012 and 2014) and the results are significant to the present investigation.

Conclusion :

All the treatments maintained above the minimum seed certification standards of 60 per cent of seed germination upto twelve months of storage.

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