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EFFECT OF PLANT GROWTH REGULATORS AND MICRONUTRIENT ON SEED LONGEVITY OF BITTER GOURD (*MOMORDICA CHARANTIA*) CV. PUSA VISESH

P. R. Arvindkumar*, S. N. Vasudevan and G. Umesh

Department of Seed Science and Technology, College of Agriculture, U.A.S., Raichur – 584 102 (Karnataka), India

Abstract

Present investigation was carried out to study the effect of plant growth regulators and micronutrient on seed longevity of bitter gourd Cv. Pusa Visesh at College of Agriculture, Raichur (Karnataka), India. Seed obtained after the crop imposed with treatment *viz.,* 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 in the Seed Technology field block. Results revealed that the moisture content increases gradually as storage period increased in all the treatments. Seeds stored in cloth bags under ambient storage condition and seed quality tested after every month end of storage period (February 10 – 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. Whereas seed quality *viz.,* seed germination (88.50%, 91.00% and 85.50%) and electrical conductivity (0.318, 0.273 and 0.410 dSm^{-1}) at the end of first, third and twelve months after storage, respectively.

Key words : Bitter gourd, plant growth regulators, micronutrient, electrical conductivity.

Introduction

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.

****Author for correspondence :*** E-mail: arvindkrathod09@gmail.com

Materials and 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 m^2 and net plot size: 8.4 x 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, seedling vigour index I (SVI I) and seedling vigour index II (SVI II) at monthly intervals (Feb 10–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^{0}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 (ISTA, 1999).

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

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.

Five grams of seeds in four replicates were soaked with acetone for half a minute and thoroughly washed in distilled water for five times. Then the seeds were soaked in 25 ml distilled water and kept in an incubator maintained at 25 ± 1^{0}C for 24 hours. The seed leachate was collected and volume was made up to 25 ml by adding distilled water. The electrical conductivity of the seed leachate was measured in the digital conductivity bridge (ELICO) with a cell constant of 1.0 and the mean value expressed in decisimons per meter (dSm^{-1}).

Results 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 up to 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 are on 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 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% respectively) at the end of first, third and twelve month of storage period, respectively. 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

Table 1: Effect of plant growth regulators and micronutrient 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 **(15.65)**	7.28 **(15.65)**	7.29 **(15.65)**	7.30 **(15.68)**	7.32 **(15.67)**	7.55 **(15.95)**	7.68 **(16.09)**	7.86 **(16.28)**	8.00 **(16.64)**	8.90 **(17.35)**	8.95 **(17.40)**	9.84 **(18.28)**
T_2 : Water spray	7.18 **(15.54)**	7.28 **(15.65)**	7.30 **(15.68)**	7.43 **(15.81)**	7.45 **(15.84)**	7.50 **(15.88)**	7.64 **(15.91)**	7.82 **(15.94)**	8.15 **(16.59)**	8.71 **(17.17)**	8.78 **(17.23)**	9.53 **(17.98)**
T_3 : Naphthalene acetic acid @25 ppm	7.24 **(15.60)**	7.30 **(15.67)**	7.30 **(15.67)**	7.32 **(15.69)**	7.34 **(15.72)**	7.45 **(15.77)**	7.67 **(15.80)**	7.89 **(15.85)**	8.18 **(16.58)**	8.54 **(16.98)**	8.60 **(17.05)**	9.31 **(17.77)**
T_4 : Naphthalene acetic acid @ 50 ppm	7.15 **(15.51)**	7.17 **(15.53)**	7.25 **(15.62)**	7.26 **(15.63)**	7.28 **(15.65)**	7.30 **(15.67)**	7.33 **(15.70)**	7.38 **(15.76)**	7.80 **(16.22)**	8.25 **(16.69)**	8.41 **(16.86)**	9.21 **(17.67)**
T_5 : Triacontanol @ 0.5 ppm	7.23 **(15.60)**	7.25 **(15.62)**	7.29 **(15.68)**	7.38 **(15.76)**	7.40 **(15.78)**	7.43 **(15.82)**	7.52 **(16.00)**	7.60 **(15.68)**	7.95 **(16.60)**	8.69 **(17.14)**	8.69 **(17.14)**	9.45 **(17.90)**
T_6 : Triacontanol @ 1.0 ppm	7.08 **(15.43)**	7.12 **(15.47)**	7.17 **(15.52)**	7.24 **(15.61)**	7.25 **(15.62)**	7.36 **(15.73)**	7.43 **(15.81)**	7.45 **(15.84)**	7.73 **(16.03)**	8.37 **(16.92)**	8.78 **(17.23)**	9.46 **(17.91)**
T_7 : Boron @ 3.0 ppm	7.20 **(15.57)**	7.32 **(15.69)**	7.33 **(15.71)**	7.38 **(15.76)**	7.40 **(15.79)**	7.54 **(15.94)**	7.64 **(16.05)**	7.78 **(16.20)**	8.22 **(16.62)**	8.79 **(17.24)**	8.90 **(17.35)**	9.42 **(17.87)**
T_8 : Boron @4.0 ppm	7.07 **(15.42)**	7.11 **(15.47)**	7.19 **(15.56)**	7.30 **(15.67)**	7.30 **(15.68)**	7.44 **(15.83)**	7.58 **(15.98)**	7.88 **(16.30)**	7.90 **(16.32)**	8.49 **(16.94)**	8.53 **(16.98)**	9.16 **(17.62)**
S. Em±	**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 at 5%	**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 significanceTreatments.

Table 2 : Effect of plant growth regulators and micronutrient 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 **(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	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	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	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	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	85.00 **(67.22)**	87.25 **(69.13)**	88.00 **(69.75)**	87.75 **(69.59)**	87.50 **(69.33)**	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	86.75 **(68.67)**	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	88.50 **(70.22)**	90.25 **(71.84)**	91.00 **(72.61)**	90.50 **(72.18)**	90.25 **(71.94)**	89.25 **(70.93)**	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. Em±	**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 at 5%	**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 plant growth regulators and micronutrient on electrical conductivity (dSm^{-1}) 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	0.339	0.338	0.335	0.336	0.337	0.346	0.349	0.353	0.413	0.429	0.449	0.527
T_2 : Water spray	0.339	0.332	0.320	0.327	0.325	0.340	0.347	0.359	0.383	0.421	0.439	0.481
T_3 : Naphthalene acetic acid @25 ppm	0.332	0.319	0.290	0.307	0.309	0.318	0.339	0.349	0.380	0.403	0.423	0.437
T_4 : Naphthalene acetic acid @ 50 ppm	0.324	0.315	0.286	0.303	0.305	0.314	0.332	0.342	0.371	0.392	0.404	0.420
T_5 : Triacontanol @ 0.5 ppm	0.337	0.324	0.295	0.312	0.314	0.323	0.344	0.354	0.385	0.408	0.428	0.442
T_6 : Triacontanol @ 1.0 ppm	0.332	0.322	0.293	0.310	0.312	0.321	0.342	0.351	0.382	0.405	0.425	0.439
T_7 : Boron @ 3.0 ppm	0.335	0.316	0.287	0.304	0.306	0.315	0.336	0.346	0.377	0.400	0.413	0.434
T_8 : Boron @4.0 ppm	0.318	0.314	0.273	0.295	0.300	0.304	0.329	0.335	0.373	0.390	0.403	0.410
S. Em±	**0.001**	**0.003**	**0.001**	**0.005**	**0.007**	**0.001**	**0.001**	**0.001**	**0.001**	**0.001**	**0.002**	**0.001**
C.D at 5%	**0.002**	**0.010**	**0.002**	**0.016**	**0.020**	**0.001**	**0.001**	**0.001**	**0.001**	**0.001**	**0.007**	**0.001**

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 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 CO_2 partial pressures (Edelstein *et al*., 1995) in melon.

Effect of plant growth regulators and micronutrient on seed electrical conductivity (dSm^{-1}) of bitter gourd Cv. Pusa Visesh

Electrical conductivity differed significantly due to different plant growth regulators and chemical (table 3). The lowest electrical conductivity (0.318, 0.273 and 0.410 dSm^{-1}) was recorded in boron 4 ppm at first, third and at the end of 12 months of storage period. The highest electrical conductivity (0.339, 0.335 and 0.527dSm^{-1}) was recorded with absolute control followed by water spray (0.339, 320 and 0.481 dSm^{-1}) treatment at first, third and at the end of 12 months of storage period, respectively.

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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