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Effect of Seed Soaking in Various Chemical Solutions on Seed Quality Parameters of Bitter Gourd (*Momordica charantia* L.) Varieties

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ABSTRACT: *Seed quality studies of bitter gourd varieties Pusa Do Mausmi and Pusa Vishesh under laboratory and field conditions using eight chemicals [KCl (1%), KNO_3 (1%), K_3PO_4 (1%), $ZnSO_4$ (1%), Borax (25ppm), GA_3 (50 ppm), IBA (75 ppm) and Canal water (Control)] and three seed soaking durations (12 h, 24h and 36 h) was carried out in two season [Summer season (March) and Rainy season (August), 2009]. Analysis of variance revealed highly significant differences among the treatment effects for different seed quality characters in both the varieties for respective seed soaking durations. In both the sets of experiment GA_3 50ppm followed by KCl (1%) and seed soaking for 12h followed by 24h gave significantly higher field emergence index and seed vigour indices then the canal water (Control) treatment in both the varieties. It was observed that soaking of seeds of bitter gourd varieties in Kcl (1%) for 12h was best treatment combination for summer season and soaking of seeds of bitter gourd varieties in GA_3 50ppm for 24h was best treatment combination for rainy season in respect of highest vigour and field emergence index. Moreover, these treatment combinations were showing significantly different observations for all above-mentioned characters.*

Keywords: *Bitter gourd, field emergence index, seed vigour index-I and II, test weight.*

INTRODUCTION

Bitter gourd (*Momordica charantia* L.), is one of the important cucurbitaceous vegetable crops. It is grown mainly in tropical and subtropical regions of the world. In India, this crop is mainly taken during spring summer and rainy seasons. Bitter gourd is a good source of vitamin A(210 IU), vitamin C(88-96 mg), potassium (152-171 mg) and magnesium (17-21 mg) per 100g of edible portion [Bose and Som, (1986)[1]]. Among various vegetables, bitter gourd is much useful due to its medicinal value. It is useful in controlling the human diabetic and blood pressure problems. Its immature fruits are always valued high in the market. In recent years, area under this vegetable crop has increased significantly. Major bitter gourd growing states in India are Maharashtra, Kerala, Karnataka, Tamil Nadu, Uttar Pradesh and Bihar.

The quality of the seed used and other cultural practices adopted for raising a crop largely determine its production level. Among various production problems the field emergence of seedlings, which is usually poor even under normal field condition, is an important issue in bitter gourd. The poor field emergence is primarily due to hard seed coat and low seed vigour in bitter gourd. Quality seed is the basic input for growing of bitter gourd because this enhances the field emergence percentage and ultimately productivity of the crop. Quality seed denotes high genetical and physical purity, high vigour, high germination percentage and uniformity in appearance. The seed vigour as a quality attribute has gained wide significance as it determines the performance potential of a seed under varying field conditions. The advantages of high quality seed are most often associated with rapid and high rate of emergence and field establishment.

However, information on seed quality attributes of bitter gourd is very scanty. Thus, there has been increased interest for enhancing seed vigour and field emergence percentage in bitter gourd in order to improve crop stand and uniformity, which

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Table 1
Effect of seed soaking chemical treatments and duration on field emergence index in bitter gourd varieties under field conditions during summer season 2009

Seed soaking chemical treatments	*12h seed soaking*			*24h seed soaking*			*36h seed soaking*			*Mean*		*Grand mean*
	*PDM**	*PV**	*Mean*	*PDM**	*PV**	*Mean*	*PDM**	*PV**	*Mean*	*PDM*	*PV*	
T_1 KCl 1%	6.76	9.53	8.15	6.64	8.81	7.73	4.29	6.97	5.63	5.90	8.44	7.17
T_2 KNO_3 1%	6.67	6.35	6.51	6.38	6.66	6.52	4.62	7.21	5.92	5.89	6.74	6.32
T_3 K_3PO_4 1%	6.28	7.05	6.67	6.31	4.94	5.63	5.26	8.91	7.09	5.95	6.97	6.46
T_4 $ZnSO_4$ 1%	6.25	7.61	6.93	5.40	5.18	5.29	5.80	5.75	5.78	5.82	6.18	6.00
T_5 Borex 25 ppm	7.72	7.86	7.79	7.11	4.53	5.82	5.29	5.16	5.23	6.71	5.85	6.28
T_6 GA_3 50 ppm	7.49	7.22	7.36	7.61	7.69	7.65	5.59	7.09	6.34	6.90	7.30	7.10
T_7 IBA 75 ppm	6.07	5.95	6.01	6.63	6.45	6.54	4.37	6.52	5.45	5.69	6.31	6.00
T_8 Canal water	6.27	6.36	6.32	6.81	6.18	6.50	5.87	7.50	6.69	6.31	6.68	6.50
Mean	6.69	7.24	6.97	6.61	6.31	6.46	5.14	6.89	6.02	6.15	6.81	6.48
LSD (P = 0.05)	12h seed soaking			24h seed soaking			36h seed soaking					
Varities	0.04			0.07			0.03					
Treatments	0.09			0.13			0.05					
Var. × Treatments	0.13			0.19			0.08					

*PV = Pusa Vishesh, PDM = Pusa Do Mausmi; NS = Non significant

ultimately results in the improved marketable fruit yield per unit area. The result reports of studies carried out on seed quality of bitter gourd and other cucurbits have been either confusing and/or inconclusive in nature. Except a few, none has been practiced as effective recommendation in this regard. In view of the seed germination and quality problem faced by the vegetable growers in bitter gourd crop that affects its field stand, and to bring out any justified recommendation for enhancing the field emergence index and seed quality, the present investigation on seed quality studies in bitter gourd was carried out during March and August, 2009.

MATERIAL AND METHODS

The field experiment was conducted at Vegetable Research Farm and the Laboratory experiment in Department of Seed Science and Technology, CCS HAU, Hisar during summer and rainy seasons. Treatment wise 100 seeds of uniform weight and size of varieties-Pusa Do Mausmi and Pusa Vishesh for field study and 50 seeds each for laboratory experiment were soaked for 12, 24 and 36 hours in the solutions of seven chemicals of respective concentrations prepared just prior to soaking of seeds. While, canal water was eighth solution used as a control treatment for seed soaking for each of the three durations. Field used for the study of seed germination was uniform in fertility level having sandy loam soil texture. A pre-sowing irrigation was given to ensure adequate soil moisture forgermination. The well-pulverized and leveled field was divided into three smaller equal sized blocks constituting each replication with net plot area of 5 × 2 m accommodating 16 rows representing eight single row treatments of each of the two varieties being tested for three seed soaking periods within each replication block repeated thrice.

Treatment wise soaked seed samples were sown on each plot in rows spaced 10 cm apart at 5 cm spacing uniformly in five-meter long single rows and arranged in randomized block design. Percent field emergence was calculated as per Maquire (1962) [2]. On the other hand, similar experiment was also conducted in laboratory in both the seasons (March and August, 2009). Here, treatment-wise all the samples of soaked fifty seeds were sown between towel paper method arranged in a completely randomized design with three replications and incubated in seed germination chamber at 25°C. The seed germination was recorded on 14th day after sowing during both the sowing seasons. Data on estimates of the seed vigour and field emergence indices were analyzed following designs of experiments as per Panse and Sukhatme (1967)[3].

Field emergence index or germination index was calculated as described by Maquire (1962)[2].

$$FEI = \frac{\text{Number of normal seedling}}{\text{Days to first count}} ... + ... + ... + \frac{\text{Number of normal seedling}}{\text{Days to final count}}$$

Table 2
Effect of seed soaking chemical treatments and duration on field emergence index in bitter gourd varieties under field conditions during rainy season 2009

Seed soaking chemical treatments	*12h seed soaking*			*24h seed soaking*			*36h seed soaking*			*Mean*		*Grand mean*
	*PDM**	*PV**	*Mean*	*PDM**	*PV**	*Mean*	*PDM**	*PV**	*Mean*	*PDM*	*PV*	
T_1 KCl 1%	3.29	2.88	3.09	3.41	3.18	3.30	3.28	2.75	3.02	3.33	2.94	3.14
T_2 KNO_3 1%	3.26	2.65	2.96	3.11	3.21	3.16	2.78	3.18	2.98	3.05	3.01	3.03
T_3 K_3PO_4 1%	3.38	3.23	3.31	3.62	3.16	3.39	2.23	3.00	2.62	3.08	3.13	3.11
T_4 $ZnSO_4$ 1%	4.07	2.93	3.50	3.33	4.47	3.90	2.73	3.00	2.87	3.38	3.47	3.43
T_5 Borex 25 ppm	3.27	3.41	3.34	2.45	3.64	3.05	3.31	2.92	3.12	3.01	3.32	3.17
T_6 GA_3 50 ppm	4.72	3.95	4.34	4.30	4.50	4.40	3.81	3.38	3.60	4.28	3.94	4.11
T_7 IBA 75 ppm	3.19	3.19	3.19	2.76	3.76	3.26	2.85	2.51	2.68	2.93	3.15	3.04
T_8 Canal water	3.19	2.85	3.02	2.55	2.90	2.73	3.74	2.96	3.35	3.16	2.90	3.03
Mean	3.55	3.14	3.35	3.19	3.60	3.40	3.09	2.96	3.03	3.28	3.23	3.26

LSD (P = 0.05)	12h seed soaking	24h seed soaking	36h seed soaking
Varities	0.085	0.038	0.121
Treatments	0.171	0.075	0.242
Var. × Treatments	0.242	0.106	0.343

The vigour indices were calculated according to the following formulae [Abdul Baki and Anderson, (1973)[4]].

Vigour Index-I: Standard germination (%) × Seedling length (cm)

Vigour Index-II: Standard germination (%) × Seedling dry weight (mg)

RESULTS AND DISCUSSION

Field Emergence Index

The data on field emergence index in respect of two bitter gourd varieties are presented in Table 1 and 2 for the two sets of experiments. The field emergence index values were high in magnitude in 1st set then the 2nd set of experiment. The variances due to varietal and treatment differences along with their interaction effects were significant in both sets of experiment for all the three seed soaking durations. Comparatively the field emergence index was higher in magnitude for variety Pusa Vishesh than Pusa Do Mausmi in 1st set of experiment while it was slightly lower for some chemical treatments in Pusa Vishesh than the Pusa Do Mausmi, which indicated the prevalence of the interaction of varieties × treatments especially in 2nd set of experiment.

The field emergence index was maximum with GA_3 50ppm followed by KCl (1%) both with 12 and 24h seed soaking durations and GA_3 50ppm followed by K_3PO_4 (1%) with 36h seed soaking duration. And overall mean suggested that GA_3 50ppm followed by KCl (1%) recorded highest field emergence index while, it was minimum with IBA 75ppm for 12h seed soaking, $ZnSO_4$ (1%) for 24h, and boron 25ppm for 36h seed soaking duration. However, it was observed minimum with IBA 75 ppm and $ZnSO_4$ (1%) in experiment set-I. The varietal differences showed higher values for Pusa Vishesh in both the experiments, though it was recorded lower than Pusa Do Mausmi in 24h seed soaking in experiment set-I and with 36h seed soaking duration in experiment set-II.

The interaction values also indicated a pattern similar to mean values of treatments over the varieties but with selective changes in the performance values of treatment effects for individual varieties and seed soaking duration in set-I of experiment. Response similar to set-I, as noticed for both the varieties and respective seed soaking durations, was also observed in 2nd set of experiment. In this set the treatment GA_3 50ppm recorded highest field emergence index followed by $ZnSO_4$ (1%) while, minimum values were observed for KNO_3 (1%), IBA 75ppm and canal water treatments.

The field emergence index referred to as the speed of germination in the field, where there is interplay of seed germination process with the physical properties of the soil and the environment. The higher value for any treatment in the present study is the indicative of early germination of the seed on account of the effect of that particular treatment, while the lower values referred delayed and lesser count of seedling emerged. Similar to the results of field emergence, the results in case of field emergence index were identical where the GA_3

Table 3
Effect of seed soaking chemical treatments and duration on Seed Vigour Index-I in bitter gourd varieties under laboratory conditions during summer season 2009

Seed soaking chemical treatments	*12h seed soaking*			*24h seed soaking*			*36h seed soaking*			*Mean*		*Grand mean*
	*PDM**	*PV**	*Mean*	*PDM**	*PV**	*Mean*	*PDM**	*PV**	*Mean*	*PDM*	*PV*	
T_1 KCl 1%	3.07	3.19	3.13	2.74	3.02	2.88	2.49	2.47	2.48	2.77	2.89	2.83
T_2 KNO_3 1%	2.81	2.77	2.79	2.63	2.85	2.74	2.57	2.57	2.57	2.67	2.73	2.69
T_3 K_3PO_4 1%	2.80	3.15	2.98	2.56	2.96	2.76	2.46	2.51	2.48	2.61	2.87	2.74
T_4 $ZnSO_4$ 1%	3.00	3.14	3.07	2.70	2.71	2.71	2.18	2.49	2.34	2.63	2.78	2.70
T_5 Borex 25 ppm	2.43	2.50	2.48	2.11	2.75	2.43	2.32	2.16	2.24	2.28	2.49	2.39
T_6 GA_3 50 ppm	2.67	2.42	2.54	2.45	2.34	2.39	2.09	2.51	2.30	2.40	2.42	2.41
T_7 IBA 75 ppm	1.46	1.27	1.36	0.58	0.59	0.59	1.07	1.01	1.04	1.04	9.56	0.99
T_8 Canal water	2.53	2.96	2.74	2.44	2.55	2.50	2.21	3.07	2.64	2.39	2.86	2.63
Mean	2.60	2.68	2.64	2.28	2.47	2.37	2.17	2.35	2.26	2.35	2.50	2.42
LSD (P = 0.05)	12h seed soaking			24h seed soaking			36h seed soaking					
Varities	N.S			0.15			0.13					
Treatments	0.32			0.30			0.27					
Var. × Treatments	N.S			N.S			0.38					

50ppm, KCl (1%) and K_3PO_4 (1%). IBA 75ppm and $ZnSO_4$ (1%) reduced the field emergence index.

Moreover, the variety Pusa Vishesh recorded higher field emergence index while, KNO_3 (1%) had the lower values. Thus, the effect of $ZnSO_4$ (1%) and KCl (1%) was not in consistency during both the experiments. Such a response might be due to the ageing effect of the seeds. Devi and Selvaraj (1994)[5] also repeated inverse speed of germination with seed soaking in different solutions as compared to untreated dry seeds sown for the investigation. Thirusenduraselvi and Jerlin (2009)[6] also indicated that wet seeds excelled in all quality parameters in comparison to sowing of the dry seeds. Johnsons and Loyd (1978)[7] reported positive relation between seed vigour and field emergence. Metthews (1981)[8] also reported vigour test as indicative of field emergence in traditional field crops. The germination test results were also found correlated with field emergence under favorable conditions (ISTA 1985)[9].

Seed Vigour Index-I

The varieties showed differences in seed vigour index-I for 24 and 36 h seed soaking durations in experiment set-I (Table 3) while, varieties differed in seed vigour index-I for 24 h seed soaking duration and set-2 of experiment (Table 4). The treatment differences in both sets of experiments for all the three seed soaking durations were significant. The varieties × treatments interaction was noted significant for 36 h seed soaking duration in experiment set-1 while, interaction was present for 12 and 24 h seed soaking durations in set-II experiment. In first set of experiment the seed vigour index-I was higher of variety Pusa Vishesh and in set-II experiment the reverse was true where Pusa Do Mausmi had higher seed vigour index-1 than Pusa Vishesh. Among the treatments IBA 75ppm recorded lowest seed vigour index-I, and it was maximum in GA_3 50ppm followed by KCl (1%), $ZnSO_4$ (1%), K_3PO_4 (1%) and KNO_3 (1%) for the 12 and 24h seed soaking durations in set-1 of experiment.While the maximum value of seed vigour index-I observed for GA_3 50ppm was closely followed by the canal water and KNO_3 (1%) solutions in 36h seed soaking duration. Varieties × treatments interaction was noted for 36h seed soaking duration.

In set-II of experiment similarly, GA_3 50ppm recorded the high seed vigour index-I for all the three seed soaking durations. In 12h seed soaking duration the high value of seed vigour index-I observed for GA_3 50ppm was followed by K_3PO_4 (1%) and $ZnSO_4$ (1%) whereas, for 24 and 36h seed soaking durations the GA_3 50ppm was followed by boron 25ppm and K_3PO_4 (1%) as shown in Table. As such this trend was observed on overall mean basis also. The presence of interaction variances for 12 and 24h seed soaking durations was on account of variation in the response toward chemicals by the two verities investigated and also on such shift in response.

The seed vigour index, which is a result product of the standard germination and the seedling length or seedling dry weight, is a measure of the quality

Table 4
Effect of seed soaking chemical treatments and duration on Seed Vigour Index-I in bitter gourd varieties under laboratory conditions during rainy season 2009

Seed soaking chemical treatments	*12h seed soaking*			*24h seed soaking*			*36h seed soaking*			*Mean*		*Grand mean*
	*PDM**	*PV**	*Mean*	*PDM**	*PV**	*Mean*	*PDM**	*PV**	*Mean*	*PDM*	*PV*	
T_1 KCl 1%	2.31	2.11	2.21	2.50	2.16	2.33	2.06	2.03	2.05	2.29	2.10	2.20
T_2 KNO_3 1%	2.31	1.91	2.11	2.54	2.00	2.27	1.78	1.86	1.82	2.21	1.93	2.07
T_3 K_3PO_4 1%	2.85	2.26	2.56	2.13	2.45	2.29	2.16	2.15	2.16	2.38	2.29	2.34
T_4 $ZnSO_4$ 1%	2.31	2.30	2.31	2.39	2.15	2.27	2.16	2.03	2.10	2.29	2.16	2.23
T_5 Borex 25 ppm	2.08	2.32	2.20	2.63	2.51	2.57	2.53	2.28	2.41	2.41	2.37	2.39
T_6 GA_3 50 ppm	2.65	2.34	2.50	3.04	2.61	2.83	2.40	2.14	2.27	2.70	2.36	2.53
T_7 IBA 75 ppm	1.30	1.06	1.18	1.35	1.64	1.50	1.20	1.28	1.24	1.28	1.33	1.31
T_8 Canal water	1.97	2.71	2.34	2.49	2.07	2.28	1.99	1.62	1.81	2.15	2.13	2.14
Mean	2.22	2.13	2.18	2.38	2.20	2.29	2.04	1.93	1.99	2.21	2.08	2.15
LSD (P = 0.05)	12h seed soaking			24h seed soaking			36h seed soaking					
Varities	N.S			0.126			N.S					
Treatments	0.282			0.252			0.309					
Var. × Treatments	0.399			0.357			N.S					

potential of the seeds. The seed vigour index was reported correlated with the seedling emergence rate (Verma *et al.*, 1999)[10]. The data of seed vigour index given in Tables revealed that variety Pusa Do Mausmi had higher seed vigour index-I in set-I while Pusa Vishesh had higher seed vigour index in set-II experiment. Among treatments, IBA 75ppm had lowest seed vigour index-I and GA_3 50ppm followed by KCl (1%), $ZnSO_4$ (1%), K_3PO_4 (1%) and KNO_3 (1%) had maximum seed vigour index. In experiment set-II GA_3 50ppm recorded maximum seed vigour index-I.

Seed Vigour Index-II

The varieties differed significantly with respect to seed vigour index-II in 24h seed soaking duration in first set of experiment (Table 5) while, they differed for this character in 2nd set of experiment for 24 and 36h seed soaking durations (Table 6). In general, Pusa Vishesh, which recorded high vigour index-I, now had lower seed vigour index-II and vice-versa was true for variety Pusa Do Mausmi where, it had higher seed vigour index-II than Pusa Vishesh. A similar pattern was observed for seed vigour index-II regarding varietal differences in 2nd set of experiment. Significant treatment differences were present among treatments for all the three seed soaking durations except 36h seed soaking duration in first set of experiment. The varieties x treatments interaction were absent for all the three seed soaking durations except 12h seed soaking duration in second set of experiment.

In first set of experiment the seed vigour index-II was highest with IBA 75ppm in all the three seed soaking durations as compared to seed soaking in canal water. With 12h seed soaking duration IBA 75ppm was at par and closely followed by GA_3 50ppm, $ZnSO_4$ (1%) and KCl (1%). With 24h seed soaking duration with IBA 75ppm was at par and closely followed by KCl (1%), canal water and $ZnSO_4$(1%), on the other hand with 36h seed soaking duration the IBA 75ppm response was closely followed by KCl (1%), $ZnSO_4$(1%), boron 25ppm and GA 50ppm.

In 2nd set of experiment (Table 6) the seed vigour index-II was recorded highest for IBA 75ppm, GA_3 50ppm and boron 25ppm for 12, 24 and 36h seed soaking durations, respectively. These treatments were closely followed by canal water, GA_3 50ppm, KCl (1%) and $ZnSO_4$ (1%) for 12h seed soaking duration, respectively. The interaction of varieties × treatments for 12h seed soaking duration was due to high seed vigour index-II recorded by variety Pusa Vishesh with KCl (1%) and $ZnSO_4$ (1%) while, maximum seed vigour index-II recorded with IBA 75ppm followed by canal water in variety Pusa Do Mausmi however, lower seed vigour index-II with 12h seed soaking duration was noted from KNO_3 (1%) treatment in both the varieties.

In both the sets of experiment the seed vigour index-II was higher in IBA 75ppm, which was closely followed by GA_3 50ppm, $ZnSO_4$ (1%) and KCl (1%) in 1st set of experiment; while, it was followed by GA_3 50ppm and boron 25ppm in 2nd set of experiment.The variety × treatment interaction

Table 5
Effect of seed soaking chemical treatments and duration on Seed Vigour Index-II in bitter gourd varieties under laboratory conditions during summer season 2009

Seed soaking chemical treatments	*12h seed soaking*			*24h seed soaking*			*36h seed soaking*			*Mean*		*Grand mean*
	*PDM**	*PV**	*Mean*	*PDM**	*PV**	*Mean*	*PDM**	*PV**	*Mean*	*PDM*	*PV*	
T_1 KCl 1%	9.44	8.26	8.85	8.62	8.67	8.65	8.09	9.20	8.65	8.72	8.71	8.72
T_2 KNO_3 1%	7.23	7.69	7.46	8.46	7.39	7.93	7.38	7.74	7.56	7.69	7.61	7.65
T_3 K_3PO_4 1%	7.93	8.90	8.42	8.22	7.83	8.03	7.98	7.42	7.70	8.04	8.05	8.05
T_4 $ZnSO_4$ 1%	8.97	8.73	8.85	8.57	8.20	8.39	8.09	8.54	8.32	8.55	8.49	8.52
T_5 Borex 25 ppm	8.10	7.51	7.81	7.69	8.36	8.03	7.52	8.38	7.95	7.77	8.08	7.93
T_6 GA_3 50 ppm	9.33	8.39	8.86	8.29	7.41	7.85	7.84	7.83	7.84	8.49	7.88	8.19
T_7 IBA 75 ppm	9.06	9.14	9.10	10.04	8.65	9.35	8.16	9.05	8.61	9.09	8.95	9.02
T_8 Canal water	7.49	7.93	7.71	8.86	8.20	8.53	8.05	5.91	6.98	8.13	7.34	7.74
Mean	8.44	8.32	8.38	8.59	8.09	8.34	7.89	8.00	7.95	8.31	8.14	8.22
LSD (P = 0.05)	12h seed soaking			24h seed soaking			36h seed soaking					
Varities	N.S			0.41			N.S					
Treatments	0.82			0.83			N.S					
Var. × Treatments	N.S			N.S			N.S					

revealed high seed vigour index-II in variety Pusa Vishesh with KCl (1%), $ZnSO_4$ (1%) and IBA 75ppm, followed by Pusa Do Mausmi with canal water. The lowest seed vigour index-II was noted with KNO_3 (1%) in both the varieties. Yadav and Dhankar (2001)[11] observed seed vigour index-I and II significantly associated with the germination and seedling parameters as measured in the present sets of experiment. Devi and Selvaraj (1994)[5] observed high seed vigour index in seed soaked for 12h in various solutions as compared to dry seeds.

Krishnasamy (1992)[12] observed best seedling vigour in seeds sown in vertical down micropyle position. Similarly, Shantappa *et al.* (2007)[13] observed high seed vigour index with NAA 50ppm or 100ppm sprayed on seedlings at both early and flowering. Thirusenduraselvi and Jerlin, (2009)[6] observed high seed vigour index in osmo-primed seeds with PEG. They suggested that wet seeds excelled in all seed quality parameters. Basu *et al.* (2004)[14] observed decreased seed vigour index-I and II with storage duration. The change in the magnitude and the pattern and seed vigour index-I and II vice the varieties and the treatments and their interactions was on account of the seedling length but lower dry matter, and lower length and the high

Table 6
Effect of seed soaking chemical treatments and duration on Seed Vigour Index-II in bitter gourd varieties under laboratory conditions during rainy season 2009

Seed soaking chemical treatments	*12h seed soaking*			*24h seed soaking*			*36h seed soaking*			*Mean*		*Grand mean*
	*PDM**	*PV**	*Mean*	*PDM**	*PV**	*Mean*	*PDM**	*PV**	*Mean*	*PDM*	*PV*	
T_1 KCl 1%	6.51	8.12	7.32	7.51	8.05	7.78	7.39	7.18	7.29	7.14	7.78	6.60
T_2 KNO_3 1%	6.09	6.65	6.37	7.36	6.06	6.71	6.62	6.78	6.70	6.69	6.50	6.90
T_3 K_3PO_4 1%	6.14	6.72	6.43	7.60	7.31	7.46	6.74	6.87	6.86	6.83	6.97	7.50
T_4 $ZnSO_4$ 1%	6.61	8.02	7.32	7.45	7.33	7.39	7.22	8.37	7.80	7.09	7.91	7.57
T_5 Borex 25 ppm	6.25	6.90	6.58	7.70	7.59	7.65	7.59	9.40	8.50	7.18	7.96	8.08
T_6 GA_3 50 ppm	7.52	7.70	7.61	9.60	7.65	8.63	6.99	8.99	7.99	8.04	8.11	7.72
T_7 IBA 75 ppm	8.92	7.12	8.02	7.48	6.88	7.18	7.80	8.08	7.94	8.07	7.36	7.04
T_8 Canal water	8.16	7.57	7.87	7.14	6.37	6.76	6.40	6.60	6.51	7.23	6.85	7.36
Mean	7.03	7.35	7.19	7.73	7.16	7.45	7.09	7.78	7.44	7.28	7.43	
LSD (P = 0.05)	12h seed soaking			24h seed soaking			36h seed soaking					
Varities	N.S			0.412			0.533					
Treatments	0.944			0.823			1.067					
Var. × Treatments	1.335			N.S			N.S					

dry matter content *i.e.* shift in the dry weight of the seedlings. In the present study, such variation as has occurred is in agreement with these views and facts.

SUMMARY AND CONCLUSION

Soaking of seeds of bitter gourd varieties in Kcl (1%) for 12h was best treatment combination for summer season and soaking of seeds of bitter gourd varieties in GA_3 50ppm for 24h was best treatment combination for rainy season in respect of highest vigour and field emergence index.

- Test weight of sampled seeds was 17.99g (Pusa Do Mausmi) and 16.96g (Pusa Vishesh).
- In both sets of experiments varieties differed for all the characters in respective seed soaking durations under laboratory and field conditions where some interactions were also significant.
- Field emergence index was recorded maximum with GA_3 50ppm/boron 25ppm and or GA_3 50ppm/KCl (1%) and KNO_3 (1%) and $ZnSO_4$ (1%). It was lowest with canal water and IBA 75ppm.
- The other associated parameters of seed quality *i.e.* seedling length (root/shoot), seedling fresh/dry weight, seed vigour index-I and II were also influenced by the chemical treatments and followed almost the same pattern as of seedling field emergence Index.
- Seed soaking duration of 12h was better than 24 and 36 h seed soaking.
- The field emergence index, seedling size and seed vigour index were reduced with aging of the seeds.

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