



Effect of botanicals and insecticides seed treatment and containers on seed longevity of black gram under natural ageing conditions

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Abstract : Good storage is the basic requirement in seed production programme as maintenance of high seed viability and vigour from harvest to planting is of utmost importance in a seed production programme. Therefore, inexpensive, simple and practicable technology to prolong the shelf life of seeds under ambient condition is immensely needed. Hence, an experiment was carried out to study the effect of seed treatment with neem oil, nimbecidin, emamectin benzoate 5 SG, deltamethrin 2.8 EC, novuluron EC on black gram seed quality under ambient conditions. The seeds without any seed treatment were included as control. The treated and untreated seeds were stored in cloth bag and polylined cloth bag. The results revealed that, botanicals and emamectin benzoate seed treatments were significantly superior in controlling the storage insect and maintaining higher seed quality up to 10 months of storage when compared to control. Among the chemicals, the emamectin benzoate 5 SG @ 40 mg kg⁻¹ of seed found better by recording significantly higher germination percentage (80.28), vigour index I (2124) and dry weight of seedlings (43.14 mg) and lower electrical conductivity (0.939 dSm⁻¹) and seed damage (0.00 %) compared to control (78.78%, 2012, 38.90 mg, 0.942 dSm⁻¹, respectively) at the end of 10th month of storage. The emamectin benzoate 5 SG and nimbecidintreated seeds stored in polylined cloth bags were considered as effective seed storage management approach in blackgram.

Keywords: Blackgram, Botanical products, Emamectin benzoate, Insecticides

INTRODUCTION

Blackgram (*Vignamungo* (L.) Hepper), occupies a unique place among pulses for its use as seed and vegetable and it is grown both as pure and mixed crop. It is native to India, belong to the family Leguminaceae. It also supplements the income of many small scale farmers and contributes to the maintenance of soil fertility by fixing nitrogen in the soil. Black gram is rich protein food, contains about 26 % protein, 1.2% fat and 56.6% carbohydrates on dry weight basis and it is rich source of calcium and iron.

The quality of seeds in storage is influenced by several factors like variety of seed, initial seed quality, storage condition, moisture content, insect pest, bacteria and fungi. The poor storage of black gram seeds is problem because of *Callasobruchus chenensis* (L.) and *C. maculatus* (F.) belonging to the family of *Bruchidae*, which causes qualitative and quantitative losses. Therefore, maintenance of seed viability and vigour during storage is a matter of prime concern. The seed potentiation is mainly achieved by treating the seeds with various chemicals and botanicals can reduce the infestation and maintain the quality of the seed in term of viability and vigour for longer period in storage (Duruigbo, 2010; Basavegowda and Arunkumar, 2013; Maintenance

of seed quality during storage period is important not only for successful crop production but also for maintaining the quality and integrity of the seed that are inconstant threat of genetic erosion (Barua *et al.*, 2009). To maintain the quality of seeds during storage the standardization of suitable seed treatments and packaging material is most important because seed treatment is the basic measure to assure adequately healthy crops at emergence and during further growth of plants (Wani *et al.*, 2014). Therefore, the purpose of this study was to determine the influence of botanicals, insecticides seed treatment and containers on seed longevity of black gram under natural ageing conditions.

MATERIALS AND METHODS

The experiment was carried under ambient conditions (20.3 ± 2.3°C temperature and 50.5 ± 6.3% relative humidity) at Department of Seed Science and Technology, University of Agricultural Sciences, Bengaluru during 2012-13. The experiment was laid out in completely randomized block design in 2 by 6 factorial with three replications. The black gram seeds (variety LBG 625 Rashmi) were put in two different packaging material (cloth bag and polylined cloth bag) in combination with different seed treatments like botanicals (neem oil @ 5ml kg⁻¹, Nimbecidin 10,000 ppm i. e., @ 5 ml kg⁻¹

and NovuluronEC 0.05 ml kg⁻¹) and insecticides (Emamectin benzoate 5 SG @ 40 mg kg⁻¹ seeds, Deltamethrin 2.8 EC @ 0.04 ml kg⁻¹) along with no treatment (control).

Data was collected on seed samples drawn from each treatment on the following parameters for bi monthly intervals upto ten months: seed moisture content (%), seed germination (%), mean seedling length (cm), seedling vigour index-I, seed damage (%), electrical conductivity (dSm⁻¹), total dehydrogenase activity and field emergence (%). The germination test was conducted as per International Seed Testing Association (ISTA, 2007), the seedling vigour index- II was calculated by multiplying germination (%) with mean seedling length (cm) as suggested by Abdul-Baki and Anderson (1972). Seed damage in each treatment were determined by dividing the number of seeds from 100 randomly selected seeds with holes/ perforations by beetles by the total randomly collected seeds and expressed as a percentage. The seeds from each treatment were soaked in 25 ml of distilled water for 24 h at 25±10°C. The steeped water from soaked seeds was collected and the electrical conductivity (EC) of seed leachate was measured in digital conductivity meter (Model: Systronic conductivity meter 306) and was expressed as dSm⁻¹. The total dehydrogenase activity was determined by method described by Perl *et al.* (1978) with slight modifications.

RESULTS AND DISCUSSION

The moisture content (%) of the seeds increased from fresh seeds to 10th month of storage in cloth bag (8.00 to 9.93) compared to polylined cloth bag (8.00 to 8.38) irrespective of the chemicals used (Table 1). Cloth bag being a pervious container, moisture exchange took place frequently until it reaches the equilibrium status with environment where as polylined cloth bag is impervious nature and caused less fluctuation in seed moisture content and it eliminates dampness, deterioration, and micro-organisms and enhance the seed longevity. These results are also incongruence with Jaya *et al.* (2014), who revealed that cloth bags recorded maximum moisture content at the end of 6-month storage period. Emamectinbenzoate treated seed maintained the highest germination percentage (80.28%), mean seedling length (26.73 cm) and seedling vigour index I (2243) during storage period and seeds stored in 400 guagepolylined cloth bag recorded significantly highest germination per cent (80.00 %) (Table 1) mean seedling length (27.26cm) and seedling vigour index I (2152) (Table 2). It is due to emamectinbenzoate found effective in protecting black gram seeds from insect damage without any adverse effect on seed physical characters. The results are in agreement with Ghelani *et al.* (2009) in pearl millet where emamectin benzoate and deltamethrin also provided better over botanicals.

The electrical conductivity (0.939dSm⁻¹) was lowest in Emamectin benzoate treated seeds and was low (0.939 dSm⁻¹)

in 400 guagepolylined cloth bag container at the end of 10 months of storage (Table 3). The total dehydrogenase activity was highest in emamectin benzoate (0.730).The seeds stored in 400 guagepolylined cloth bag recorded significantly highest dehydrogenase activity (0.731) (Table.3).The marked decrease in the seed quality parameters under advancing storage period may be attributed to seed coat characters (Deloucheet *al.*, 1973), age induced physicochemical seed deterioration, lipid peroxidation leading to production of toxic metabolites that act upon cell and cell organelles denaturation of proteins and enzymes (Roberts, 1972). Similar decline in seed quality parameters with advancing storage period was also reported by Pramila (2003) in black gram.

Seed damagewas nil in all the seed treatments and 400 guagepolylined cloth bag container at the end of 10 months of storage compared to control (Table.4) The treatment with insecticides significantly reduced the larval and adult population of bruchid beetles due to their ovicidal and inhibitory repellent properties. The similar results were reported by Ghelani *et al.* (2009) in pearl millet. The field emergence percentage was highest in emamectin benzoate (73.67 %) and seeds stored in 400 guagepolylined cloth bag (73.11 %) (Table.4) may be attributed to the impervious nature to moisture vapours and thus it has caused less fluctuation in seed moisture content and seed infestation and thus indicating polylined cloth bag as a better storage container.

Conclusion

It is evident from present study that the seed stored in cloth bag showed poor quality parameter *i.e.* decreased germination, vigour and higher EC value due to increase seed quantitative losses and it might be ascribed to the increased activities of pulse bruchids due to greater fluctuations in moisture content in view permeable nature of cloth bag to moisture vapours. Hence these results indicated cloth bag as a poor container for storage of black gram seeds under ambient conditions, while the emamectin benzoate 5 SG and nimbidin treated seeds stored in polylined cloth bag were considered as effective seed storage management approach in blackgram.

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Table 1. Influence of seed treatment chemicals (T) and containers (C) on seed moisture and germination during seed storage of black gram.

	Seed moisture (%)										Germination (%)									
	Storage period (months)										Storage period (months)									
	Initial	2	4	6	8	10	Initial	2	4	6	8	10								
T ₁ : Neem oil @ 5ml kg ⁻¹ seeds	8.00	8.65	8.95	9.20	9.25	9.28	93.94	90.20	86.16	80.16	80.10	79.12								
T ₂ : Nimbicidin 10,000 ppm i. e., @ 5 ml kg ⁻¹	8.00	8.50	8.75	9.05	9.06	9.09	93.94	90.75	86.71	80.68	80.08	79.06								
T ₃ : Emamectin benzoate 5 SG @ 40 mg kg ⁻¹ seeds	8.00	8.40	8.70	8.95	8.98	8.98	93.94	91.50	87.46	81.43	81.23	80.28								
T ₄ : Deltamethrin 2.8 EC @ 0.04 ml kg ⁻¹	8.00	8.55	8.87	9.15	9.25	9.18	93.94	91.10	87.06	81.03	81.02	80.08								
T ₅ : Novuluron EC 0.05 ml kg ⁻¹ seeds	8.00	8.60	8.95	9.20	9.20	9.20	93.94	90.40	86.36	80.33	80.21	79.22								
T ₆ : Control	8.00	8.75	9.10	9.37	9.39	9.37	93.94	89.95	85.91	79.88	79.76	78.78								
F test	NS	*	*	*	*	*	NS	*	*	*	*	*								
S.Em ±	-	0.06	0.04	0.04	0.05	0.04	-	0.3584	0.3536	0.3459	0.3457	0.3357								
CD at 5%	-	0.19	0.11	0.11	0.12	0.11	-	1.0462	1.0319	1.0095	1.0094	1.0084								
Containers (C)																				
C ₁ : Cloth bag	8.00	9.02	9.52	9.92	9.94	9.93	93.94	90.33	86.23	80.14	80.04	79.03								
C ₂ : Polylined cloth bag (400 guage)	8.00	8.13	8.26	8.39	8.39	8.38	93.94	90.97	86.99	81.02	81.00	80.00								
F test	NS	*	*	*	*	*	NS	*	*	*	*	*								
S.Em ±	-	0.04	0.02	0.02	0.02	0.02	-	0.21	0.20	0.20	0.21	0.23								
CD at 5%	-	0.11	0.07	0.06	0.06	0.06	-	0.60	0.60	0.58	0.59	0.56								

Table 2. Influence of seed treatment chemicals and containers (C) on mean seedling length (cm) and seedling vigour index-I during seed storage of black gram.

Seed Treatment chemicals	Mean seedling length (cm)										Seedling vigour index-I									
	Storage period (months)										Storage period (months)									
	Initial	2	4	6	8	10	Initial	2	4	6	8	10								
T ₁ : Neem oil @ 5ml kg ⁻¹ seeds	33.68	31.01	29.8	28.15	25.94	24.53	3164	2796	2568	2257	2246	2124								
T ₂ : Nimbicidin 10,000 ppm i. e., @ 5 ml kg ⁻¹	33.68	32.15	30.78	29.3	27.28	26.21	3164	2918	2684	2364	2253	2132								
T ₃ : Emamectin benzoate 5 SG @ 40 mg kg ⁻¹ seeds	33.68	33.25	32.04	30.39	28.09	26.73	3164	3041	2802	2475	2364	2243								
T ₄ : Deltamethrin 2.8 EC @ 0.04 ml kg ⁻¹	33.68	32.5	31.29	29.64	27.56	26.25	3164	2960	2724	2402	2301	2201								
T ₅ : Novuluron EC 0.05 ml kg ⁻¹ seeds	33.68	31.85	30.16	28.51	26.41	25.17	3164	2835	2605	2290	2180	2070								
T ₆ : Control	33.68	30.56	29.35	27.71	25.7	24.56	3164	2748	2521	2213	2112	2012								
F test	NS	*	*	*	*	*	NS	*	*	*	*	*								
S.Em ±	-	0.24	0.33	0.49	0.48	0.32	-	25.95	17.68	17.32	18.32	18.30								
CD at 5%	-	0.70	0.97	1.42	1.40	1.96	-	75.74	51.59	50.56	50.58	50.50								
Containers (C)																				
C ₁ : Cloth bag	33.68	31.37	30.12	28.48	26.37	26.37	3164	2835	2602	2282	2171	2060								
C ₂ : Polylined cloth bag (400 gauge)	33.68	32.38	31.02	29.42	27.3	27.26	3164	2931	2698	2384	2263	2152								
F test	NS	*	*	*	*	*	NS	*	*	*	*	*								
S.Em ±	-	0.10	0.08	0.01	0.01	0.10	-	14.98	10.21	10.00	10.00	10.00								
CD at 5%	-	0.30	0.23	0.04	0.04	0.30	-	43.73	29.79	29.19	29.20	30.20								

Table 3. Influence of seed treatment chemicals and containers (C) on mean seedling dry weight (mg) and seedling vigour index-I during seed storage of black gram.

	Mean seedling length (cm)										Seedling vigour index-I									
	Storage period (months)										Storage period (months)									
	Initial	2	4	6	8	10	Initial	2	4	6	8	10								
T ₁ : Neem oil @ 5ml kg ⁻¹ seeds	33.68	31.01	29.8	28.15	25.94	24.53	3164	2796	2568	2257	2246	2124								
T ₂ : Nimbecidin 10,000 ppm i. e., @ 5 ml kg ⁻¹	33.68	32.15	30.78	29.3	27.28	26.21	3164	2918	2684	2364	2253	2132								
T ₃ : Emamectin benzoate 5 SG @ 40 mg kg ⁻¹ seeds	33.68	33.25	32.04	30.39	28.09	26.73	3164	3041	2802	2475	2364	2243								
T ₄ : Deltamethrin 2.8 EC @ 0.04 ml kg ⁻¹	33.68	32.5	31.29	29.64	27.56	26.25	3164	2960	2724	2402	2301	2201								
T ₅ : Novuluron EC 0.05 ml kg ⁻¹ seeds	33.68	31.85	30.16	28.51	26.41	25.17	3164	2835	2605	2290	2180	2070								
T ₆ : Control	33.68	30.56	29.35	27.71	25.7	24.56	3164	2748	2521	2213	2112	2012								
F test	NS	*	*	*	*	*	NS	*	*	*	*	*								
S.Em ±	-	0.24	0.33	0.49	0.48	0.32	-	25.95	17.68	17.32	18.32	18.30								
CD at 5%	-	0.70	0.97	1.42	1.40	1.96	-	75.74	51.59	50.56	50.58	50.50								
Containers (C)																				
C ₁ : Cloth bag	33.68	31.37	30.12	28.48	26.37	26.37	3164	2835	2602	2282	2171	2060								
C ₂ : Polylined cloth bag (400 gauge)	33.68	32.38	31.02	29.42	27.3	27.26	3164	2931	2698	2384	2263	2152								
F test	NS	*	*	*	*	*	NS	*	*	*	*	*								
S.Em ±	-	0.10	0.08	0.01	0.01	0.10	-	14.98	10.21	10.00	10.00	10.00								
CD at 5%	-	0.30	0.23	0.04	0.04	0.30	-	43.73	29.79	29.19	29.20	30.20								

Table 4. Influence of seed treatment chemicals and containers (C) on electrical conductivity (dSm⁻¹) and total dehydrogenase activity during seed storage of black gram.

Seed treatment chemicals	Electrical conductivity (dSm ⁻¹)					Total dehydrogenase activity						
	Initial	2	4	6	8	10	Initial	2	4	6	8	10
T ₁ : Neem oil @ 5ml kg ⁻¹ seeds	0.771	0.913	0.924	0.932	0.943	0.943	1.007	0.866	0.855	0.847	0.836	0.725
T ₂ : Nimbiocidin 10,000 ppm i. e., @ 5 ml kg ⁻¹	0.771	0.911	0.922	0.929	0.939	0.939	1.007	0.868	0.857	0.849	0.838	0.727
T ₃ : Emamectin benzoate 5 SG @ 40 mg kg ⁻¹ seeds	0.771	0.908	0.918	0.927	0.939	0.939	1.007	0.870	0.860	0.851	0.840	0.730
T ₄ : Deltamethrin 2.8 EC @ 0.04 ml kg ⁻¹	0.771	0.909	0.920	0.928	0.938	0.938	1.007	0.869	0.858	0.850	0.841	0.730
T ₅ : Novuluron EC 0.05 ml kg ⁻¹ seeds	0.771	0.912	0.923	0.931	0.941	0.941	1.007	0.867	0.857	0.848	0.837	0.726
T ₆ : Control	0.771	0.914	0.926	0.933	0.942	0.942	1.007	0.865	0.854	0.845	0.834	0.723
F test	NS	*	*	*	*	*	NS	*	*	*	*	*
S.Em ±	-	0.0007	0.0008	0.0007	0.0007	0.0007	-	0.0012	0.0012	0.0012	0.0012	0.0012
CD at 5%	-	0.0019	0.0023	0.0021	0.0022	0.0022	-	0.0034	0.0034	0.0034	0.0036	0.0036
Containers (C)												
C ₁ : Cloth bag	0.771	0.912	0.924	0.932	0.941	0.941	1.007	0.866	0.855	0.846	0.836	0.725
C ₂ : Polylined cloth bag (400 gauge)	0.771	0.910	0.920	0.928	0.939	0.939	1.007	0.869	0.859	0.850	0.841	0.731
F test	NS	*	*	*	*	*	NS	*	*	*	*	*
S.Em ±	-	0.0004	0.0005	0.0004	0.0005	0.0005	-	0.0007	0.0007	0.0007	0.0007	0.0007
CD at 5%	-	0.0011	0.0013	0.0012	0.0015	0.0015	-	0.0020	0.0020	0.0020	0.0021	0.0021

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