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Effect of types of seed coating and period of storage after coating on pigeonpea seed infection (%) and seed infestation (%)

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Abstract
The present investigation entitled studies on the effectiveness of biological seed coating on seed quality parameters of Pigeonpea (*Cajanus cajan* L.) was carried out during *Summer*, 2018, *Kharif*, 2018 and *Rabi*, 2018-19 at the Department of Seed Science and Technology, Seed Research and Technology Centre and Agriculture Research Station, Tandur, PJTSAU, Rajendranagar, Hyderabad to study the effect of types of seed coating and period of storage after seed coating on pigeonpea seed infection (%) and seed infestation (%). The seed quality parameters were studied at bimonthly intervals during storage period of six months. The results of the study thus indicated the possibility of coating seed with biological agents with effective chemical protectant and bio friendly polymer as an adjuvant showed better results without affecting the seed quality.

Keywords: Pigeonpea, biological seed coating, seed infection (%), seed infestation (%).

1. Introduction
Pigeonpea [*Cajanus cajan* L.] is an important staple food pulse crop rich in protein content of 15.5 - 28.8% which is almost three times that of cereals. It is also known as redgram, arhar and tur. Pigeonpea supplies a major share of protein requirement of vegetarian population of the country. It is particularly rich in lysine, riboflavin, thiamine, niacin and iron. Nutritionally pigeonpea contains high levels of proteins and important amino acids lysine, methionine and tryptophan. Dry pigeonpea seeds contain protein (20-22%), carbohydrate (57.3%), fat (1.5%) and ash (8.1%). Its protein has two globulins, cajanin and concajanin accounting for 58 and 8% respectively (Saxena *`et al.,* 2002) [12]. Pigeonpea being a leguminous plant is capable of fixing atmospheric nitrogen and thereby restores lot of nitrogen into the soil.
Pigeonpea is mainly cultivated and consumed in developing countries of the world. It is the second most important pulse crop of India after chickpea. In India, pigeonpea is cultivated in an area of 4.78 mha with a production of 3.59 mt and productivity of 751 kg ha^{-1} (DES, Ministry of Agriculture, 2018-19). Karnataka has contributed more than 32 percent of area and 27 percent of country's production. More than 80 percent of the production is contributed by 10 states of Maharashtra, Madhya Pradesh, Karnataka, Gujarat, Uttar Pradesh, Telangana, Jharkhand, Odisha, Andhra Pradesh and Tamil Nadu. Telangana, with 0.19 million tonnes contributes to 5.35 percent of country's production. The main constraints in obtaining potential yield of the pigeonpea are incidence of diseases, insects and other physiological stresses in the field. It is known to be affected by more than hundred pathogens, among them, pigeonpea wilt caused by *Fusarium udum* is the major disease in India. The disease may appear during early stages of plant growth (4-6 week old plant) period and essentially affects yield. This disease drastically influences the crop yield by poor field emergence, seedling establishment and plant stand in the field finally leading to the reduction in the productivity and production.
Moreover, the seed performance can be enhanced by the way of application of fungicides, insecticides and other protecting agents on to the seed surface by means of coating to protect the seed from pathogens. Even though seed treatment with biological agents is not new, the main constraint is that the seed treatment can only be done just before the sowing. Because of hectic field operations, mostly farmers are skipping this important process of seed inoculation which is leading to poor field stand in the pulses. Keeping this in view, the present investigation is planned to find out the technology output for taking up of combined inoculation of biocontrol agents and biofertilizers well in advance of taking up of sowing i.e., at the time of seed processing and packaging stage only. This may provide an assurance to the farmer sown seed with good quality and seedling protection under field conditions. In this

context, this research study is planned with the objective to study the effect of types of seed coating and period of storage after coating on seed quality and storability of pigeonpea.

2. Materials

Freshly harvested seeds of Pigeonpea variety PRG - 176 were collected from Regional Agricultural Research Station, Palem, Mahabubnagar, Telangana. The seed possessed initial germination of 90% and seed moisture content of 8.1%. Biological agents like *Trichoderma viride*, *Pseudomonas fluorescens*, *Rhizobium spp* and Phosphorous Solubilizing Bacteria were obtained from Biological Control Laboratory, Department of Agriculture, ARI, Rajendranagar, Hyderabad. *Beauveria brongniartii* (Bioinsecticide) was obtained from Ecosense labs, Mumbai. Bio-friendly polymer was collected from Centor India, Bliss Paradise Hitex, Secunderabad, Telangana.

3. Methodology

For biological seed coating, biological agents like *Trichoderma viride*, *Pseudomonas fluorescens*, *Rhizobium* and Phosphorous Solubilizing Bacteria were used @ 4 g kg^{-1} seed. For each treatment, 300g pigeonpea seed was weighed separately and placed into seed coating machine. Biological coating material was prepared by weighing 4 g of adjuvant (biofriendly polymer) into a beaker and to that 2-3 ml of distilled water was added and mixed thoroughly. To this diluted adjuvant, biological agents was added and mixed thoroughly. Uniformly coated seed was removed from the coating machine and was shade dried for 2 hr. This treated seed was then made into 3 replications @ 100 g each and packed in zip lock polythene covers and kept for storage under ambient conditions.

Table 1: Details of the Treatments

Factor 1	**:**	**Seed coating treatments (Four)**			
C1	:	Thiram @ 2 g kg^{-1} + Deltamethrin @ 0.04 ml kg^{-1} + Biofriendly polymer @ 3-4 g kg^{-1}			
C2	:	*Trichoderma viride* @ 4 g kg^{-1}+ *Pseudomonas fluorescens* @ 4 g kg^{-1} + *Bacillus subtilis* @ 4 g kg^{-1} + *Rhizobium* @ 4 g kg^{-1} + Deltamethrin @ 0.04 ml kg^{-1} + Biofriendly –Polymer @ 3-4 g kg^{-1}			
C3	:	*Trichoderma viride* @ 4 g kg^{-1}+ *Pseudomonas fluorescens* @ 4 g kg^{-1} + *Bacillus subtilis* @ 4 g kg^{-1} + *Rhizobium* @ 4 g kg^{-1} + Bioinsecticide @ 4 g kg^{-1} + Biofriendly –Polymer @ 3-4 g kg^{-1}			
C4	:	Untreated control			
Factor 2	**:**	**Storage period after seed coating (Five)**			
S1	:	Four months storage			
S2	:	Three months storage			
S3	:	Two months storage			
S4	:	One month storage			
S5	:	No storage			
Number of treatments	**:**	**20**			
T1	:	C1S1	T11	:	C3S1
T2	:	C1S2	T12	:	C3S2
T3	:	C1S3	T13	:	C3S3
T4	:	C1S4	T14	:	C3S4
T5	:	C1S5	T15	:	C3S5
T6	:	C2S1	T16	:	C4S1
T7	:	C2S2	T17	:	C4S2
T8	:	C2S3	T18	:	C4S3
T9	:	C2S4	T19	:	C4S4
T10	:	C2S5	T20	:	C4S5
Number of replications	**:**	**3**			

Testing of seed quality and storability of biologically coated pigeonpea seed

Seed Infection (%)

Standard Blotter technique (ISTA, 2018) was used to estimate the seed health status of pigeonpea. Petri plates of 90 mm diameter and discs of blotter paper of the same diameter were used. Blotter discs were dipped in beaker containing sterile distilled water with the help of a forceps and placed at the bottom of each sterilized petri plate. Ten treated seeds of pigeonpea were placed in petriplate per treatment in 3 replications.

Petriplates were labelled and incubated at 25 ± 1ºC under alternating cycles of 12 hours light and 12 hours darkness for 6 days in BOD incubator. On 6th day of incubation the plates were examined under stereo binocular microscope in standard blotter method and the percentage of total number of fungal colonies of seeds were calculated.

$$\text{Percent Seed Infection} = \frac{\text{No. of seeds colonized in each plate by particular species}}{\text{Total no. of seeds in each plate}} \times 100$$

Seed Infestation (%)

This is the weight loss incurred by the different storage conditions. The average percentage of seed infestation (A %) was assessed as a function of the number of infested seed and the volume of healthy seed based on the formula below (Harris and Lindblad, 1978) [5].

$$A\ (\%) = Nd/Nu \times 100$$

Where:
Nd = No. of damaged seeds.
Nu = No. of undamaged seeds.

Statistical analysis

The data recorded were analyzed statistically by adopting Two Factorial Completely Randomized Design (CRD), as described by Panse and Sukhatma (1985) [9] and the standard error of difference was calculated at 5% probability level to compare the mean difference among the treatments. The data recorded as percentage were transformed to the respective Angular (arc sin) values before subjecting them to statistical analysis.

4. Results and Discussions

4.1 Effect of types of seed coating & period of storage after coating on seed infection (%) and longevity in pigeonpea

The data pertaining to the effect of types of seed coating & period of storage after coating on seed infection (%) were presented in the Table 2 and Fig 1. The mean seed infection (%) recorded from the start of treatment (0MAT) was 12.49%. Mean seed infection was observed to be increased gradually from 0MAT to 6MAT (12.49% to 31.66%, respectively) with a mean increase of 19.84%. This finding was in conformity with Mondal `*et al*. (1981) [8] and Shelar (2007) [14] who have reported in soybean that there was an increase in the microflora with the increase in the seed storage period.

At 0MAT treatment T8 (*Trichoderma viride* @ 4 g kg^{-1} seed + *Pseudomonas fluorescens* @ 4 g kg^{-1} seed + *Bacillus subtilis* @ 4 g kg^{-1} seed + *Rhizobium* @ 4 g kg^{-1} seed + Deltamethrin @ 0.04 ml kg^{-1} seed + Biofriendly polymer @ 3-4 g kg^{-1} seed) recorded significantly lowest seed infection (6.66%).This treatment T8 also recorded lowest seed infection (16.67%) even after 6 months of storage, when compared to untreated control seed T16 with (53.33%).

Among the types of seed coating, seeds treated with insecticide + fungicide + biofriendly polymer recorded lowest increase in seed infection (13.20%) over a period of six months. This is followed by the seeds treated with insecticide + bioagents + biofriendly polymer (13.33%) and bioagents + biofriendly polymer (24.66%). Highest increase in seed infection (25.33%) was recorded in the seeds of untreated control.

Periods of storage showed a significant effect on the seed infection. Among the periods of storage, six months after treatment, seeds of untreated control 4 months before recorded more seed infection (53.33%) compared to freshly coated same seed (33.33%). Similar trend was also noticed with regard to the treatment, bioagents + biofriendly polymer (43.33% and 26.67%, respectively). Whereas, period of storage showed no significant effect on seed infection with regard to seed coating with insecticide + bioagents + polymer and insecticide + fungicide + polymer.

Similar findings of the lowest seed infection with chemical protectants + biofriendly polymer were also reported in chilli with polymer dye and thiram (Manjunatha, 2008) [7], in black gram with carbendazim and thiram (Shailbala and Tripathi 2004), in cotton with polymer + fungicide + insecticide (Vijaykumar, 2005) [15] and in cotton with polymer + fungicides (carboxin + thiram) (Arantes `*et al.*, 2000) [1] and carbendazim + polymer in chilli (Geetharani and Srimathi, 2006) [4]. These findings of the lowest seed infection with biological agents are in conformity with (Ashwini and Giri 2014) who have reported that seed coating with *Trichoderma viride* and *Bacillus subtilis* recorded the lowest seed infection in green gram and black gram.

4.2 Effect of types of seed coating & period of storage after coating on seed infestation (%) and longevity in pigeonpea

The data pertaining to the effect of type of seed coating & period of storage after coating on insect damage (%) were presented in the Table 3 and Fig 2. The mean seed damage (%) recorded from the start of treatment (0MAT) was 0.37%. Mean seed damage was observed to be increased gradually from 0MAT to 6MAT (0.37% to 1.01%, respectively) with a mean increase of 0.64%. This finding was in conformity with Raghavendra and Loganathan (2017) [10] who have reported in pigeonpea that there was an increase in the insect infestation with the increase in the seed storage period.

At 0MAT treatment T10 (*Trichoderma viride* @ 4 g kg^{-1} seed + *Pseudomonas fluorescens* @ 4 g kg^{-1} seed + *Bacillus subtilis* @ 4 g kg^{-1} seed + *Rhizobium* @ 4g kg^{-1} seed + Deltamethrin @ 0.04 ml kg^{-1} seed + Biofriendly polymer @ 3-4 g kg^{-1} seed) recorded significantly lowest insect infestation (0.15%). And this same treatment T10 was also recorded lowest insect infestation (0.45%) even after 6 months of storage, when compared to untreated control seed T19 with (3.18%).

Among the types of seed coating, seeds treated with insecticide + bioagents + biofriendly polymer recorded lowest increase in insect infestation (0.39%) over a period of six months. This is followed by the seeds treated with bioagents + biofriendly polymer (0.48%) and insecticide + fungicide + biofriendly polymer (0.49%). Highest increase in insect damage (1.18%) was recorded in the seeds of untreated control.

Similar findings of the lowest insect infestation with chemical protectants were reported in pigeonpea with deltamethrin and spinosad (Rathod `*et al.*, 2018) [11], in cotton with polymer + thiram + imidacloprid (Vijaykumar, 2005) [15].

Table 2: Effect of types of seed coating and period of storage after coating on Seed infection (%) & longevity of pigeonpea seed

Treatment details	Period of storage (Months)	Treatment	0MAT	2MAT	4MAT	6MAT	Increase (6-0)	Avg
Insecticide + Fungicide + Polymer	4	T1	13.33 (21.41)	16.67 (24.09)	20.00 (26.56)	23.33 (28.88)	10.00	13.20
	3	T2	13.33 (21.41)	13.33 (21.41)	23.33 (28.88)	26.67 (31.09)	12.67	
	2	T3	6.66 (14.75)	6.66 (14.75)	13.33 (21.41)	23.33 (28.78)	16.67	
	1	T4	6.66 (14.96)	10.00 (18.43)	23.33 (28.88)	23.33 (28.88)	16.67	
	0	T5	10.00 (18.43)	10.00 (18.43)	13.33 (21.41)	20.00 (26.56)	10.00	
Insecticide + Bioagents + Polymer	4	T6	10.00 (18.43)	6.66 (14.96)	10.00 (18.43)	26.67 (31.09)	16.67	13.33
	3	T7	13.33 (21.41)	20.00 (26.56)	26.67 (31.09)	23.33 (28.88)	10.00	
	2	T8	6.66 (14.96)	6.66 (14.96)	10.00 (18.43)	16.67 (24.09)	10.01	
	1	T9	6.66 (14.96)	10.00 (18.43)	20.00 (26.56)	23.33 (28.88)	16.67	
	0	T10	6.66 (14.96)	10.00 (18.43)	13.33 (21.41)	20.00 (26.56)	13.34	
Bioagents + Polymer	4	T11	20.00 (26.56)	36.67 (37.26)	40.00 (39.23)	43.33 (41.16)	23.33	24.66
	3	T12	23.33 (28.88)	20.00 (26.56)	33.33 (35.26)	46.67(43.09)	23.34	
	2	T13	13.33 (21.41)	16.67 (24.09)	23.33 (28.88)	43.33 (41.16)	30.00	
	1	T14	13.33 (21.41)	13.33 (21.41)	33.33 (35.26)	43.33 (41.16)	30.00	
	0	T15	10.00 (18.43)	10.00 (18.43)	21.22 (27.37)	26.67 (31.09)	16.67	
Untreated control	4	T16	13.33 (21.41)	16.67 (24.09)	30.00 (33.21)	53.33 (46.90)	40.00	25.33
	3	T17	13.33 (21.41)	16.67 (24.09)	20.00 (26.56)	40.00 (39.23)	26.67	
	2	T18	16.66 (24.09)	23.33 (28.88)	30.00 (33.21)	30.00 (33.21)	13.34	
	1	T19	16.66 (24.09)	20.00 (26.56)	30.00 (33.21)	46.67 (43.09)	30.01	
	0	T20	16.66 (24.09)	23.33 (28.88)	30.00 (33.21)	33.33 (35.26)	16.67	

Mean	12.49 (20.37)	15.33 (22.54)	23.22 (28.42)	31.66 (33.95)	19.84
S.D	0.600	0.937	1.077	1.420	
C.V %	5.165	4.210	3.518	3.993	

Table 3: Effect of types of seed coating and period of storage after coating on Seed infestation (%) & longevity of pigeonpea seed

Treatment details	Period of storage (Months)	Treatment	0MAT	2MAT	4MAT	6MAT	Increase (6-0)	Avg
Insecticide + Fungicide + Polymer	4	T1	0.50 (4.18)	0.30 (4.05)	0.45 (4.05)	0.55 (4.36)	0.05	0.49
	3	T2	0.15 (4.05)	0.30 (4.05)	0.45 (4.05)	1.21 (6.32)	1.06	
	2	T3	0.30 (4.05)	0.15 (4.05)	0.45 (4.05)	0.45 (4.05)	0.15	
	1	T4	0.15 (4.05)	0.30 (4.05)	0.90 (5.47)	1.21 (6.32)	1.06	
	0	T5	0.30 (4.05)	0.50 (4.19)	0.50 (4.19)	0.45 (4.05)	0.15	
Insecticide + Bioagents + Polymer	4	T6	0.15 (4.05)	0.15 (4.05)	0.45 (4.05)	0.75 (4.99)	0.60	0.39
	3	T7	0.30 (4.05)	0.45 (4.05)	0.90 (5.47)	0.75 (4.99)	0.45	
	2	T8	0.15 (4.05)	0.30 (4.05)	0.45 (4.05)	0.75 (4.99)	0.60	
	1	T9	0.45 (4.05)	0.15 (4.05)	0.45 (4.05)	0.45 (4.05)	0.00	
	0	T10	0.15 (4.05)	0.30 (4.05)	0.30 (4.05)	0.45 (4.05)	0.30	
Bioagents + Polymer	4	T11	0.45 (4.05)	0.75 (4.99)	0.90 (5.47)	1.21 (6.32)	0.76	0.48
	3	T12	0.15 (4.05)	0.30 (4.05)	0.45 (4.05)	1.21 (6.32)	1.06	
	2	T13	0.45 (4.05)	0.60 (4.46)	0.30 (4.05)	0.45 (4.05)	0.00	
	1	T14	0.15 (4.05)	0.15 (4.05)	0.45 (4.05)	0.45 (4.05)	0.30	
	0	T15	0.45 (4.05)	0.30 (4.05)	0.60 (4.46)	0.75 (4.99)	0.30	
Untreated control	4	T16	0.15 (4.05)	0.30 (4.05)	1.21 (6.32)	1.36 (6.70)	1.21	1.18
	3	T17	0.90 (5.47)	1.36 (6.70)	1.66 (7.41)	1.51 (7.07)	0.61	
	2	T18	0.30 (4.05)	0.30 (4.05)	0.75 (4.99)	1.66 (7.41)	1.36	
	1	T19	1.36 (6.70)	2.57 (9.23)	2.72 (9.50)	3.18 (10.27)	1.82	
	0	T20	0.45 (4.05)	0.45 (4.05)	0.75 (4.99)	1.36 (6.70)	0.91	
Mean			0.37 (4.26)	0.50 (4.52)	0.75 (4.94)	1.01 (5.60)	0.64	
S.D			0.038	0.071	0.072	0.083		
C.V %			5.050	3.907	2.583	3.865		

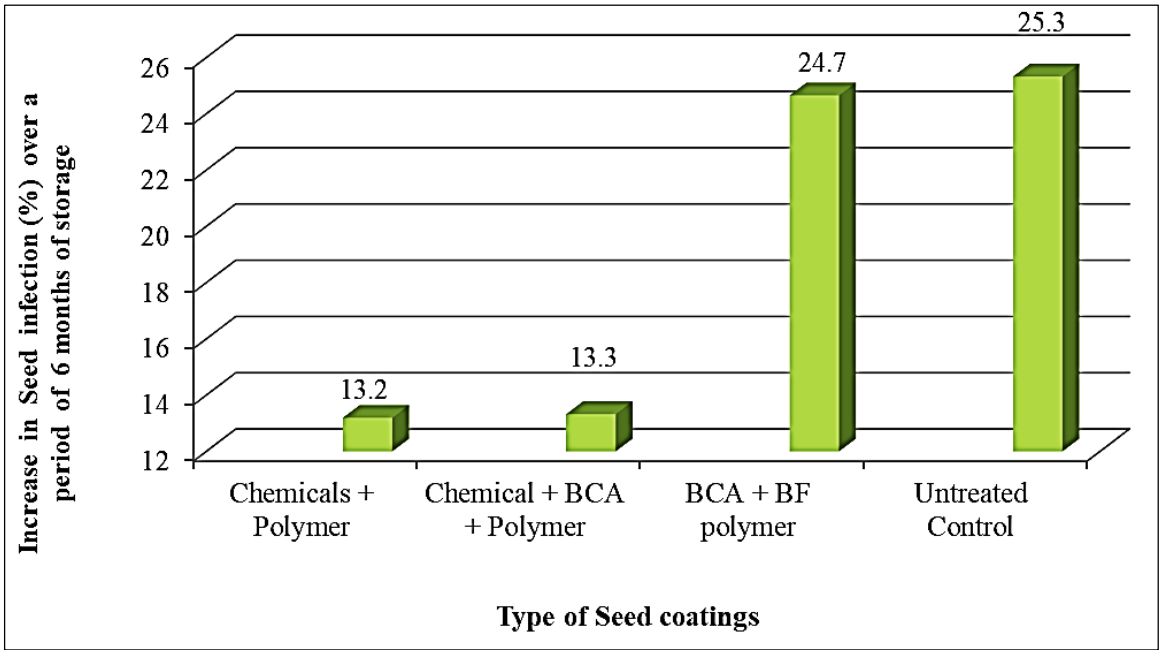

Fig 1: Effect of seed coating materials on seed infection and longevity in pigeonpea

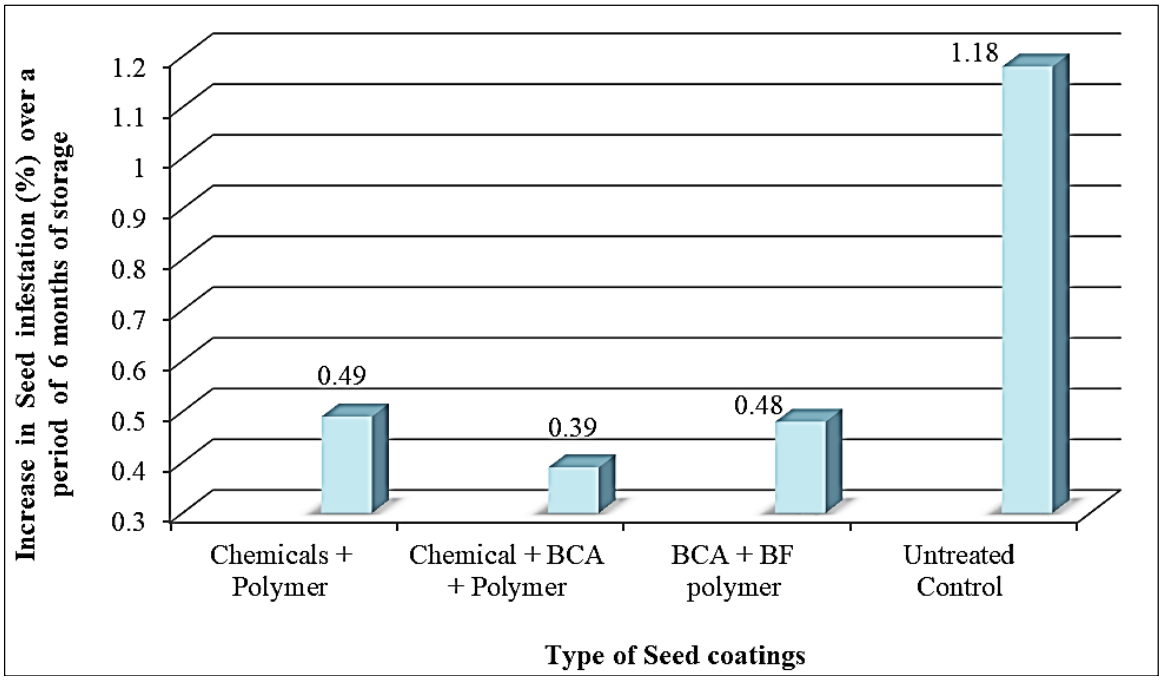

Fig 2: Effect of seed coating materials on seed infestation and longevity in pigeonpea

5. Conclusion

Some seed quality parameters of pigeonpea were gradually increased with the increase in the storage period from one month after treatment to the 6 months after treatment with a mean increase of 19.84% in seed infection and 0.64% in seed infestation, over a period of 6 months of storage. Among the types of seed coating, seeds treated with insecticide + fungicide + bio friendly polymer recorded lowest increase in seed infection (13.20%) over a period of six months. Among the types of seed coating, seeds treated with insecticide + bioagents + bio friendly polymer recorded lowest increase in insect infestation (0.39%) over a period of six months.

6. References

1. Arantes HAG, Cicero SM, Novembre AD. Encapsulation effects on cotton seed health and germination. Scientia Agricola. 2000; 57:81-88.
2. Ashwini C, Giri GK. Control of seed borne fungi in green gram and black gram through bioagents. International Journal of Applied Biology and Pharmaceutical Technology. 2014; 5(3):21-23.
3. Directorate of Economics and Statistics (DES), Ministry of Agriculture & Farmer's Welfare, Govt. of India, 2019.
4. Geetharani, Ponnuswamy AS, Srimathi P. Influence of polymer coating on nursery management in chillies. Seed Research. 2006; 34:212-214.
5. Harris KL, Lindblad CJ. Post-harvest grain loss assessment methods. A manual of methods for evaluation of post-harvest losses. American Association of Cereal Chemists. St. Paul, Minnesota, 1978, 193.
6. International Seed Testing Association (ISTA), 2018.
7. Manjunatha SN, Ravi Hunje, Vyakaranahal BS, Kalappanavar IK. Effect of seed coating with polymer, fungicide and containers on seed quality of chilli during storage. Karnataka Journal of Agricultural Sciences. 2008; 21:270-273.
8. Mondal GC, Nandi D, Nandi B. Studies on deterioration of some oil seeds in storage: variation in seed moisture, infection and germinability. Mycoflora. 1981; 73(1):157-166.
9. Panse VG, Sukhatme PV. Statistical methods for agricultural workers. 2nd edn. pp/381, ICAR, New Delhi, 1985.
10. Raghavendra D, Loganathan M. Effect of pulse beetle (*Callosobruchus maculates* L.) Infestation on quality of pigeonpea seed. International Journal of Pure and Applied Bioscience. 2017; 5(6):976-980.
11. Rathod PK, Kolhe GK, Chopade BJ, Borkar PA, Murumkar RP, Bhalkare SK, Mate VN. Effect of newer insecticide molecules on seed viability. International Journal of Current Microbiology and Applied Sciences. 2018; 6:2561-2566.
12. Saxena KB, Kumar RV, Rao PV. Pigeonpea nutrition and its improvement in quality crops. Journal of crop production. 2002; 5:227-260.
13. Shailbala, Tripathi HS. Seed treatment with fungicides and biocontrol agents on pathogens in urdbean seeds. Indian Journal of Mycology and Plant Pathology. 2004; 34(3):851-852.
14. Shelar VR. Strategies to improve the seed quality and storability of soybean in India. Agricultural Review. 2007; 28(3):188-196.
15. Vijaykumar Kunkur. Effect of seed coating polymer, fungicide and insecticide on storability and field performance in cotton. *M.Sc. Thesis*. University of Agricultural Sciences, Dharwad, 2005.