

# Influence of Seed Priming and Coating on Seed Longevity in Greengram (*Vigna mungo* L.) cv.CO 8

K MALARKODI

Agricultural Research Station, Tamil Nadu Agricultural University, Bhavanisagar, Erode Dt., Tamil Nadu, India

jujumalar2000@gmail.com

(Received: January 2020, Revised: February 2020, Accepted: March 2020)

**ABSTRACT:** The greengram cv.CO 8 seeds were imposed with various treatments viz., seed priming by adopting seed to solution ratio of 1:1 ( $T_2$ ), seed coating with TNAU seed coating polymer @  $4\text{g kg}^{-1}$  of seed ( $T_3$ ) and seed priming + seed coating ( $T_2 + T_3 = T_4$ ). The treated seeds were packed in super bag and cloth bag and stored under ambient condition along with untreated control seeds ( $T_0$ ). During storage period the seeds were evaluated for quality parameters at bimonthly interval. The result revealed that primed, coated and combined treatment (primed + coated seed) maintained more than 75% germination [above Indian Minimum Seed Certification Standards (IMSCS)] even after 20 months of storage study period compared to control both in super bag and cloth bag under ambient condition.

**Keywords:** Seed priming, Seed coating, Seed longevity, Super bag, Cloth bag

The seed is the generative dispersal unit, which enables plants to spread and survive through periods or seasons of less favourable conditions. Modern agriculture, with its bias for technology and precision, demands that each and every seed should readily germinate and produce vigorous seedlings to ensure high yield.

In the view to supply higher quality seeds to farmer's, researchers have developed new technologies called seed quality enhancement techniques like seed priming and seed coating. Seed priming is a simple and cost effective technique to improve germination behavior of seeds, promote faster and uniform germination.

Seed coating technology has developed rapidly during the past two decades and provides an economical approach to enhance seed quality, especially for larger seeded field and horticultural crops [1]. Seed coating is the practice of covering seeds with external materials to improve handling, protection and to enhance germination and plant establishment [2]. This is accomplished with the original shape of the seed being largely unaffected.

Combinational treatments have their own properties in improving the vigour status of the seed with the significant increase over the individual treatments. During the combination of treatments like priming and coating, priming improves all the physiological, anatomical and biochemical parameters of the seed [3]. Coating over the

primed seed will strengthen the seedling during its developmental stages by hastening the nutrient availability to the seeds.

It is necessary to make the availability of good quality seeds to farmers in order to improve the productivity. The ultimate aim of the seed producers should be the timely supply of quality seeds with good storage potential. In any productive seed production programme carry over of seed is highly needed to tide over adverse situations. For prolonged storage of seeds from season to season or years together seeds are to be protected from the deteriorative factors.

Keeping these in view, the present experiment was conducted in greengram cv.CO 8 to evaluate the influence of seed priming and seed coating techniques on seed longevity under ambient condition.

## MATERIALS AND METHODS

### Seed material

Genetically pure seeds of greengram cv.CO 8 produced during April 2019 at Agricultural Research Station, Tamil Nadu Agricultural University, Bhavanisagar formed the base material for the study. The seeds having initial germination of 98% with computed vigour value of 5026 were imposed with following seed quality enhancement techniques.

### Treatments

- T<sub>1</sub> - Control
- T<sub>2</sub> - Seed priming by adopting seed to solution ratio of 1:1(3 h soaking and 3 h humid invigoration) by volume by volume basis
- T<sub>3</sub> - Seed coating with TNAU seed coating polymer (4g / kg of seed)
- T<sub>4</sub> - Seed priming + Seed coating (T<sub>2</sub> +T<sub>3</sub>)

The treated seeds were dried under shade to bring the original moisture content (8.5%), packed in super bag and cloth bag and stored under ambient conditions along with control for a period of 20 months. At bimonthly intervals, the treated seeds were evaluated for the following seed quality characters.

### Moisture content (%)

Five grams of seeds in triplicate were taken separately in a pre weighed (M<sub>1</sub>) moisture estimation bottle and the sample weights along with the bottle were recorded (M<sub>2</sub>). The bottles were kept in a hot air oven maintained at 103±2°C for 17h. Then the bottles were taken out and cooled in a desiccator with CaCO<sub>3</sub> for 30 minutes. The weight of bottle along with dried seeds were recorded (M<sub>3</sub>) individually. The moisture content was calculated on wet weight basis adopting the following formula and expressed as percentage [4].

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

### Seed germination (%)

Four replicates of 100 seeds each were germinated by using paper (Between paper) medium under the test conditions of 25±2°C temperature and 90±3% RH maintained in a germination room illuminated with fluorescent light. After the test period of seven days the number of normal seedlings in each replication was counted and expressed in percentage [4].

### Root length (cm)

At the time of germination count, ten normal seedlings were selected at random from each replication and used for measuring the root length of seedlings. Root length was measured from the point of attachment of seed to the tip of primary root. The mean values were calculated and expressed in centimeter.

### Shoot length (cm)

The seedlings used for measuring root length were also used for measuring shoot length. The shoot length was measured from the point of attachment of seed to tip of the leaf and the mean values were expressed in centimeter.

### Dry matter production (mg seedlings<sup>-10</sup>)

Ten normal seedlings from the germination test were selected at random, dried in shade for 24h and then, in a hot air oven maintained at 85°C for 48 h and allowed to cool in a desiccators for 30 minutes. The dried seedlings were weighed in an electronic digital balance and the mean values were expressed in mg seedlings<sup>-10</sup> [5].

### Vigour index I

Vigour index value was computed using the following formula and the mean values were expressed in whole number [6].

$$\text{Vigour index I} = \text{Germination (\%)} \times \text{Seedling length (cm)}$$

### Damaged seed (%)

The number of infested seeds with bruchid (*Callosobruchus maculatus* (F.)) damage were counted and the mean damage (identified based on the existence of exit hole) was reported as percentage adopting the following formula [7].

$$\text{Damaged seed (\%)} = \frac{\text{Number of damaged seed}}{\text{Total number of seeds taken for counting}} \times 100$$

### Seed mycoflora (%)

Four replicates of 25 seeds each were counted and placed equidistantly on a three layered moist Whatman No.1 blotter taken in sterilized petridishes and covered with lid. The petridishes were incubated at room temperature of 20 ± 2°C with alternate cycles of 12 h NUV light and 12 h of dark for seven days and examined on eighth day under stereo binocular (WILD M 45) microscope. The number of seeds infected were counted and expressed in percentage to the total seeds placed for incubation [8].

### Statistical Analysis

The data obtained from various experiments were analyzed for the 'F' test of significance [9]. Wherever necessary, the per cent values were transformed to angular (Arc-sine) values before analysis. The critical difference (CD) was calculated at 5 per cent (P = 0.05)

probability level and wherever 'F' value is non-significant it is denoted by 'NS'.

## RESULT AND DISCUSSION

One of the prime factors that determine the quality of seeds in storage is the seed moisture content which is environmentally influenced intrinsic factors for seed storage [10]. In the present study, due to seed treatment, the seed moisture content showed non-significant difference. However, the significant difference due to containers and period of storage in seed moisture content was observed (Table 1). The seeds packed in cloth bag gained 0.4 per cent moisture content as against 0.2 per cent in seeds packed in super bag over 20 months of storage under ambient condition. The imposed seed treatment did not influence the moisture content of seeds majority in either of the containers during storage and it ranged from 8.5 to 8.9 per cent in cloth bag (C<sub>1</sub>) and 8.5 to 8.7 per cent in super bag (C<sub>2</sub>). Upon storage, there was a gradual increase in moisture content in the seeds packed in cloth bag and super bag. However, the increase was more in the seeds in cloth bag compared to super bag. Cloth bag being a pervious container, moisture exchange took place frequently until it reaches the equilibrium status with environment [11]. In super bag, the increase was less [12] due to their nil exposure to variations in atmospheric moisture [13-16].

Seed vigour is the energy or stamina of the seed. The basic seed quality characters decreased with time as the

seed enters sequential deterioration with time. Seed invigoration / seed quality enhancement is activation of inbuilt process of seed vigor for better expression of plant character that leads to higher productivity. Seeds are invigorated through physical and physiological seed invigoration techniques. Physical treatments are seed coating, polymer coating and pelleting techniques, while physiological techniques are the priming techniques.

The germination potential is the basic requirement for any seeds. The viability and vigour are the two sides of seed quality and go hand in hand while judging the seed quality. In the present study, the seeds exposed to seed priming with water (seed to solution ratio of 1:1) + seed coating with TNAU seed coating polymer @ 4g kg<sup>-1</sup> of seed (T<sub>4</sub>), recorded the highest germination of 92% followed by seed coating (T<sub>3</sub>- 91%) and primed seed (T<sub>2</sub>- 90%), irrespective of containers and period of storage (Table 2).

Polymer is a gel like material based substances used for coating the seed. The polymer coating improved the water conductivity, by enhancing the seed water contact area [19,20] which is important in improving the imbibition process. Polymers were useful in quick or delayed water uptake and enhanced germination which would be beneficial for better emergence and establishment in any given conditions [18].

Between the containers, the seeds packed in super bag (C<sub>2</sub>) recorded 82 per cent germination which was 3 per

**Table 1.** Effect of seed treatments, containers and storage period on moisture content (%) of green gram cv.CO 8

C/T/P	Cloth bag (C <sub>1</sub> )				Mean (C <sub>1</sub> )	Super bag (C <sub>2</sub> )				Mean (C <sub>2</sub> )	Mean (P)
	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>		T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>		
P <sub>0</sub>	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5
P <sub>2</sub>	8.6	8.6	8.6	8.6	8.6	8.5	8.5	8.5	8.5	8.5	8.6
P <sub>4</sub>	8.6	8.6	8.6	8.6	8.6	8.5	8.5	8.5	8.5	8.5	8.6
P <sub>6</sub>	8.7	8.7	8.7	8.7	8.7	8.5	8.5	8.5	8.5	8.5	8.6
P <sub>8</sub>	8.8	8.8	8.8	8.8	8.8	8.5	8.5	8.5	8.5	8.5	8.7
P <sub>10</sub>	8.8	8.8	8.8	8.8	8.8	8.6	8.6	8.6	8.6	8.6	8.7
P <sub>12</sub>	8.8	8.8	8.8	8.8	8.8	8.6	8.6	8.6	8.6	8.6	8.7
P <sub>14</sub>	8.9	8.9	8.9	8.9	8.9	8.6	8.6	8.6	8.6	8.6	8.8
P <sub>16</sub>	8.9	8.9	8.9	8.9	8.9	8.6	8.6	8.6	8.6	8.6	8.8
P <sub>18</sub>	8.9	8.9	8.9	8.9	8.9	8.7	8.7	8.7	8.7	8.7	8.8
P <sub>20</sub>	8.9	8.9	8.9	8.9	8.9	8.7	8.7	8.7	8.7	8.7	8.8
Mean (T)	8.8	8.8	8.8	8.8	8.8	8.6	8.6	8.6	8.6	8.6	
Mean	T <sub>1</sub> - 8.7		T <sub>2</sub> - 8.7		T <sub>3</sub> - 8.7	T <sub>4</sub> - 8.7					
	T	P	C	T × P	P × C	T × C	T×P×C				
SEd	0.04	0.07	0.03	0.13	0.09	0.06	0.19				
CD(P=0.05%)	NS	0.13	0.06	0.26	0.19	0.11	0.37				

**Table 2.** Effect of seed treatments, containers and storage period on germination (%) of green gram cv.CO 8

C/T/P	Cloth bag (C <sub>1</sub> )				Mean (C <sub>1</sub> )	Super bag (C <sub>2</sub> )				Mean (C <sub>2</sub> )	Mean (P)
	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>		T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>		
P <sub>0</sub>	98 (81.87)	98 (81.87)	99 (81.87)	99 (84.26)	99 (84.26)	98 (81.87)	98 (81.87)	99 (84.26)	99 (84.26)	99 (84.26)	99 (84.26)
P <sub>2</sub>	96 (78.47)	96 (78.47)	97 (80.03)	97 (80.03)	97 (80.03)	97 (80.03)	97 (80.03)	98 (81.87)	99 (84.26)	98 (81.87)	97 (80.95)
P <sub>4</sub>	95 (77.08)	96 (78.47)	97 (80.03)	97 (80.03)	96 (78.47)	96 (78.47)	97 (80.03)	97 (80.03)	98 (81.87)	97 (80.03)	96 (79.25)
P <sub>6</sub>	94 (75.82)	95 (77.08)	95 (77.08)	96 (78.47)	95 (77.08)	95 (77.08)	96 (78.47)	97 (80.03)	97 (80.03)	96 (78.47)	95 (77.78)
P <sub>8</sub>	90 (71.57)	94 (75.82)	92 (73.57)	94 (75.82)	93 (74.66)	92 (73.57)	95 (77.08)	93 (74.66)	94 (75.82)	94 (75.82)	93 (75.24)
P <sub>10</sub>	88 (69.73)	89 (70.63)	90 (71.57)	90 (71.57)	89 (70.63)	90 (71.57)	93 (74.66)	93 (74.66)	94 (75.82)	93 (74.66)	91 (72.65)
P <sub>12</sub>	85 (67.22)	87 (68.67)	87 (68.87)	88 (69.73)	87 (68.87)	88 (69.73)	89 (70.63)	90 (71.57)	90 (71.57)	89 (70.63)	88 (69.75)
P <sub>14</sub>	84 (66.42)	87 (68.67)	87 (68.87)	88 (69.73)	87 (68.87)	86 (68.03)	87 (68.87)	97 (80.03)	88 (69.73)	87 (68.87)	87 (68.87)
P <sub>16</sub>	82 (64.90)	84 (66.42)	85 (67.22)	86 (68.03)	84 (66.42)	85 (67.22)	85 (67.22)	85 (67.22)	88 (69.73)	86 (68.03)	85 (67.23)
P <sub>18</sub>	80 (63.44)	82 (64.90)	83 (65.65)	84 (66.42)	82 (64.90)	83 (65.65)	84 (66.42)	86 (68.03)	86 (68.03)	85 (67.22)	83.5 (66.06)
P <sub>20</sub>	76 (60.67)	78 (62.03)	80 (63.44)	80 (63.44)	79 (62.73)	80 (63.44)	81 (64.16)	83 (65.65)	84 (66.42)	82 (64.90)	80 (63.82)
Mean (T)	88 (69.73)	90 (71.57)	90 (71.57)	91 (72.54)	90 (72.44)	90 (71.57)	91 (72.54)	92 (73.57)	92 (73.57)	92 (74.07)	
Mean	T <sub>1</sub> - 89 (70.65)		T <sub>2</sub> - 91 (72.06)		T <sub>3</sub> - 91 (72.57)		T <sub>4</sub> - 92 (73.57)				
	T	P	C	T × P	P × C	T × C	T × P × C				
SEd	0.5	0.8	0.4	1.7	1.2	0.7	2.4				
CD(P=0.05%)	1.0	1.7	0.7	3.3	2.4	1.4	4.7				

(Figures in parentheses are arcsine values)

**Table 3.** Effect of seed treatments, containers and storage period on root length (cm) of green gram cv.CO 8

C/T/P	Cloth bag (C <sub>1</sub> )				Mean (C <sub>1</sub> )	Super bag (C <sub>2</sub> )				Mean (C <sub>2</sub> )	Mean (P)
	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>		T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>		
P <sub>0</sub>	21.1	21.6	23.1	24.3	22.5	21.1	21.6	23.1	24.3	22.5	22.5
P <sub>2</sub>	20.5	20.9	22.7	24.4	22.1	21.0	21.3	23.2	24.3	22.5	22.3
P <sub>4</sub>	20.3	20.3	21.7	23.0	21.3	20.4	21.0	22.7	23.5	21.9	21.6
P <sub>6</sub>	19.3	19.4	20.3	21.6	20.2	19.5	20.1	21.4	21.8	20.7	20.5
P <sub>8</sub>	18.3	18.4	19.2	19.6	18.9	19.1	19.3	20.3	20.4	19.8	19.4
P <sub>10</sub>	17.3	17.9	18.2	18.7	18.0	18.2	18.6	19.0	19.7	18.9	18.5
P <sub>12</sub>	16.2	17.0	17.3	18.0	17.1	17.1	18.0	18.2	18.5	18.0	17.6
P <sub>14</sub>	15.4	16.1	16.7	17.1	16.3	16.2	17.1	17.9	18.0	17.3	16.8
P <sub>16</sub>	14.3	15.2	16.0	16.5	15.5	15.4	16.2	16.9	17.1	16.4	16.0
P <sub>18</sub>	13.8	14.5	15.2	15.7	14.8	14.0	15.3	16.0	16.4	15.4	15.1
P <sub>20</sub>	11.9	13.0	13.7	14.0	13.2	13.1	14.3	14.8	15.2	14.4	13.8
Mean (T)	17.2	17.8	18.6	19.4	18.2	17.7	18.4	19.4	19.9	18.9	18.6
Mean	T <sub>1</sub> - 17.5		T <sub>2</sub> - 18.1		T <sub>3</sub> - 19.0		T <sub>4</sub> - 19.7				
	T	P	C	T × P	P × C	T × C	TPC				
SEd	0.09	0.14	0.06	0.28	0.20	0.12	0.40				
CD(P=0.05%)	0.17	0.28	0.12	0.56	0.39	0.24	0.79				

cent higher than seeds packed in cloth bag (79%) over 20 months of storage, irrespective of treatments. As the period of storage advanced, germination percentage got reduced significantly from 99 per cent ( $P_0$ ) to 81 per cent ( $P_{20}$ ), irrespective of treatments and containers. However, the rate of deterioration was less in seeds coated with polymer ( $T_3$  &  $T_4$ ) when compared to other treatments. The present study highlighting the beneficial effect of coating treatment ( $T_3$  &  $T_4$ ) and that of super bag in extending the shelf life of greengram seeds stored under

ambient condition [21] is due to moisture vapour proof nature of super bag. The coating process is worthy to be applied for many species of seeds with consequent improvement in the seed quality and its maintenance in storage in the present study was supported [22].

The observations on the vigour parameters viz., root length (Table 3), shoot length (Table 4), dry matter production (Table 5) and vigour index (Table 6) were in line with germination percentage exerting direct relation

**Table 4.** Effect of seed treatments, containers and storage period on shoot length (cm) of green gram cv.CO 8

C/T/P	Cloth bag (C <sub>1</sub> )				Mean (C <sub>1</sub> )	Super bag (C <sub>2</sub> )				Mean (C <sub>2</sub> )	Mean (P)
	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>		T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>		
P <sub>0</sub>	31.3	32.5	32.8	32.5	32.3	31.3	32.5	32.8	32.5	32.3	32.3
P <sub>2</sub>	30.9	31.3	31.6	31.8	31.4	30.7	31.7	32.5	31.9	31.7	31.6
P <sub>4</sub>	30.5	31.0	31.3	31.1	31.0	30.6	31.2	32.3	32.6	31.7	31.4
P <sub>6</sub>	29.2	29.4	30.0	31.2	30.0	29.6	30.1	30.9	31.4	30.5	30.3
P <sub>8</sub>	28.1	28.5	29.4	30.3	29.1	28.5	29.1	30.0	30.7	29.6	29.4
P <sub>10</sub>	27.2	27.3	28.5	29.2	28.1	27.8	28.4	29.1	29.8	28.8	28.5
P <sub>12</sub>	26.5	26.9	27.0	28.1	27.1	27.0	27.6	28.7	29.0	28.1	27.6
P <sub>14</sub>	25.0	25.4	26.2	27.0	25.9	26.1	26.8	28.0	28.8	27.4	26.7
P <sub>16</sub>	24.3	24.7	25.1	26.2	25.1	25.0	25.6	27.9	28.0	26.6	25.9
P <sub>18</sub>	22.9	23.0	24.9	25.0	24.0	23.8	24.4	26.8	27.9	25.7	24.9
P <sub>20</sub>	21.0	22.1	23.4	23.9	22.6	22.0	23.6	25.7	26.3	24.4	23.5
Mean (T)	27.0	27.5	28.2	28.8	22.6	27.5	28.3	29.5	29.9	28.8	
Mean	T <sub>1</sub> - 27.3		T <sub>2</sub> - 27.9		T <sub>3</sub> - 28.9	T <sub>4</sub> - 29.4					
SEd	T	P	C	T x P	P x C	T x C	TPC				
CD(P=0.05%)	0.12	0.20	0.09	0.41	0.29	0.17	0.58				
	0.24	0.40	0.17	0.80	0.57	0.35	1.14				

**Table 5.** Effect of seed treatments, containers and storage period on dry matter production (mg per 10 seedlings) of green gram cv.CO 8

C/T/P	Cloth bag (C <sub>1</sub> )				Mean (C <sub>1</sub> )	Super bag (C <sub>2</sub> )				Mean (C <sub>2</sub> )	Mean (P)
	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>		T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>		
P <sub>0</sub>	47	47	47	48	47	47	47	47	48	47	47.0
P <sub>2</sub>	45	45	45	45	45	46	46	46	47	46	45.5
P <sub>4</sub>	46	44	46	46	46	48	46	45	47	47	46.5
P <sub>6</sub>	44	45	45	46	45	45	46	46	48	46	45.5
P <sub>8</sub>	42	42	43	44	43	43	44	44	46	44	43.5
P <sub>10</sub>	39	40	41	41	40	40	42	43	44	42	41.0
P <sub>12</sub>	37	39	40	40	39	38	40	41	42	40	39.5
P <sub>14</sub>	37	38	40	40	39	37	39	41	41	40	39.5
P <sub>16</sub>	36	38	39	39	38	37	39	40	41	39	38.5
P <sub>18</sub>	34	36	37	37	36	35	37	38	40	38	37.0
P <sub>20</sub>	33	35	36	36	35	34	36	37	37	36	35.5
Mean (T)	40	41	42	42	41.2	41	42	43	44	42.3	
Mean	T <sub>1</sub> - 40.5		T <sub>2</sub> - 41.5		T <sub>3</sub> - 42.5	T <sub>4</sub> - 43.0					
SEd	T	P	C	T x P	P x C	T x C	TPC				
CD(P=0.05%)	0.2	0.3	0.1	0.6	0.5	0.3	0.9				
	0.4	0.6	0.3	1.3	0.9	0.5	1.8				

with storage period. The seeds exposed to seed priming with water (seed to solution ratio of 1:1) + seed coating with TNAU seed coating polymer (4g kg<sup>-1</sup> of seed) (T<sub>4</sub>), recorded the highest root length (18.2, 18.9 cm), shoot length (22.6, 28.8 cm), dry matter production (41.2, 42.3 mg per 10 seedlings) and vigour index (4160, 4357) in both the cloth bag and super bag containers respectively, irrespective of the storage period and was followed by seed coating (T<sub>3</sub>) and primed seed (T<sub>2</sub>) highlighting the superiority of preservation of seed quality characters by primed + polymer coated seed packed in super bag than in cloth bag. This might be due to the property of hydrophilic colloids which accelerated the water uptake from soil resulting in good emergence under normal conditions in the field [23]. The higher germination and seedling vigour of coated seeds was due to the increase in the rate of imbibition, where the fine particle in the coating acts as a moisture attracting material and improved the germination. The lower values for the vigour parameters of the untreated seeds might be due to the increased moisture content and increased rate of deteriorative process occurring with ageing in storage.

Deterioration of seedling vigour in stored seeds was associated with weakening of cell membrane [24], depletion of stored food reserves [25] that declined the synthetic activity of the embryo. The higher vigour characters maintained by polycoated seed could be due to the reduced seed deterioration rate [26] and the

minimized fungicidal activity [11] promoted by the characteristic feature of polymer. Maintenance of seed quality in storage due to seed treatment with polymer, separately or in combination with priming of the present study was also addressed [27] and was also confirmed in maize [28], bean [29] and canola [30]. Thus the study highlighted that better performance of seed coated with the polymers also said to have some growth regulatory substances that are invigoration in function.

Seed health is felt as the wealth of the seed and the seed health is viewed through insect and pathogen infection that can alter the physical, physiological and biochemical deterioration rate of the seed. Storage fungi have been reported to invade and destroy seeds if the seeds are not protected and storage environment is favourable to them, which may leads to loss of viability, development of discolouration of seeds. In the present study, seed infection with pathogen, advances with seed storage period in untreated seeds packed in cloth bag [31, 32] but it was nil in treated seeds and seeds packed in super bags (Table 7).

However within the storage period of 20 months the insect infestation was nil which might be due to absence of primary infestation from field and protection of seeds from secondary infestation. The bruchids lay eggs in the field before the harvest of pod [33] and these would be multiplied in the seed during storage and resulted with the manifestation of infestation as damaged seed [7].

**Table 6.** Effect of seed treatments, containers and storage period on vigour index of green gram cv.CO 8

C/T/P	Cloth bag (C <sub>1</sub> )				Mean (C <sub>1</sub> )	Super bag (C <sub>2</sub> )				Mean (C <sub>2</sub> )	Mean (P)
	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>		T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>		
P <sub>0</sub>	5026	5412	5586	5674	5425	5026	5412	5586	5674	5425	5425
P <sub>2</sub>	4937	5033	5220	5401	5148	4959	5091	5346	5394	5198	5173
P <sub>4</sub>	4835	4886	5086	5194	5000	4952	4996	5301	5389	5160	5080
P <sub>6</sub>	4493	4569	4684	4840	4647	4640	4710	4794	4874	4755	4701
P <sub>8</sub>	4176	4409	4471	4691	4437	4379	4598	4678	4803	4615	4526
P <sub>10</sub>	3916	4023	4203	4311	4113	4140	4371	4473	4653	4409	4261
P <sub>12</sub>	3630	3819	3854	4057	3840	3881	4058	4221	4275	4109	3975
P <sub>14</sub>	3394	3611	3732	3881	3655	3638	3819	3993	4118	3892	3774
P <sub>16</sub>	3165	3352	3494	3672	3421	3434	3553	3808	3969	3691	3556
P <sub>18</sub>	2936	3075	3328	3419	3190	3137	3335	3681	3810	3491	3341
P <sub>20</sub>	2576	2816	3048	3112	2888	2808	3070	3362	3486	3182	3035
Mean (T)	3917	4091	4246	4387	4160	4090	4274	4477	4586	4357	
Mean	T <sub>1</sub> - 4004		T <sub>2</sub> - 4183		T <sub>3</sub> -4362		T <sub>4</sub> - 4487				
	T	P	C	T × P	P × C	T × C	TPC				
SEd	19.4	32.2	13.7	64.3	45.5	27.4	90.9				
CD(P=0.05%)	38.3	63.5	27.1	126.9	89.8	54.1	179.5				

**Table 7.** Effect of seed treatments, containers and storage period on damaged seed (%) of green gram cv.CO 8

C/T/P	Cloth bag (C <sub>1</sub> )				Mean (C <sub>1</sub> )	Super bag (C <sub>2</sub> )				Mean (C <sub>2</sub> )	Mean (P)
	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>		T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>		
P <sub>0</sub>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
P <sub>2</sub>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
P <sub>4</sub>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
P <sub>6</sub>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
P <sub>8</sub>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
P <sub>10</sub>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
P <sub>12</sub>	0.2	0.0	0.0	0.0	0.05	0.0	0.0	0.0	0.0	0.0	0.03
P <sub>14</sub>	0.5	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.05
P <sub>16</sub>	1.2	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.15
P <sub>18</sub>	2.3	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.30
P <sub>20</sub>	3.5	0.0	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.45
Mean (T)	0.48	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.10
Mean	T <sub>1</sub> - 0.24		T <sub>2</sub> - 0.0		T <sub>3</sub> - 0.0	T <sub>4</sub> - 0.0					
	T	P	C	T × P	P × C	T × C	T × P × C				
SEd	0.004	0.007	0.003	0.013	0.009	0.006	0.019				
CD(P=0.05%)	NS	NS	NS	NS	NS	NS	NS				

## CONCLUSION

The green gram seeds exposed to seed priming (seed to solution ratio of 1:1) + seed coating with TNAU seed coating Polymer (@ 4g kg<sup>-1</sup> of seed) registered significantly higher seed quality characters, followed by seed coating (T<sub>3</sub>) and seed priming (T<sub>2</sub>) treatment even after 20 months of storage period, irrespective of the storage containers without any insect infestation and pathogen infection.

## REFERENCES

- HALMER P (1987). Technical and commercial aspects of seed pelleting and film coating. *British Protection Council, Thornton Health*, p.191-204.
- SCOTT JM (1989). Seed Coatings and treatments and their effects on plant establishment. *Advances in Agronomy*, **42**: 43-83.
- CHANDAN MN, K MALARKODI AND R UMARANI (2019). Evaluation of Anatomical, Molecular and physiological potential of primed and nonprimed seeds of solanaceous vegetables. *International Journal of Current Microbiology and Applied Sciences*, **Special Issue-9**: 58-70.
- ISTA(1999). International rules for seed testing. *Seed Science and Technology*, **27**: Supplement rules.
- GUPTA PC (1993). Seed vigour testing. Hand book of seed testing. *Quality Control and Research Development*, New Delhi. P. 243
- ABDUL-BAKI AA AND JD ANDERSON (1973). Vigour deterioration of soybean seeds by multiple criteria. *Crop Science*, **13**: 630-633.
- MOHAN S (1993). A new device to trap pulse beetle. *TNAU News letter*, **23(2)**: 1.
- NEERGAARD P (1977). Seed Pathology. Vol. I. The Macmillan Press Ltd., pp.739.
- PANSE VG AND PV SUKHATME (1985). Statistical methods for agricultural workers. ICAR publication, New Delhi. P. 359.
- Copeland LO (1988). Principles of Seed Science and Technology, Subject publishers, New Delhi, pp. 107-115.
- MALARKODI K AND C DHARMALINGAM (1999). Effect of halogenation treatment on viability maintenance and crop productivity in bajra CO7. *Madras Agricultural Journal*, **86 (1-3)**: 14-17.
- BANDOPADHYOY PK AND SS MAHAPATRA (1990). Storage and treatment of mesta seeds (*H. sabdariffa* and *H. cannabinus*) for the maintenance of vigour and viability under ambient storage conditions. *Journal of National Botanical Society*, **44 (1-2)**: 77-87.
- HARRINGTON JF (1972). Seed storage and longevity. In: Seed Biology. (Ed: T.T. Kozlowski) Academic Press. New York & London, pp. 145-245.
- ROBERTS EH (1986). Quantifying seed deterioration. In: Physiology of seed deterioration (Eds. M.B. McDonals Jr. and C.J. Nelson). Crop Science Society America Special Publication Number 11, CSSA, Madison, WI, pp. 101-123.
- SUMATHI S (2010). Studies on seed production, post harvest handling and seed testing in *Psoralea corylifolia*. Ph.D. (Ag.) Thesis, Tamil Nadu Agricultural University, Coimbatore-3.
- CHAUHAN RS AND M NAUTIYAL (2007). Seed germination and seed storage behaviour of *Nardostachys jatamansi* DC. An endangered medicinal herb of high-altitude Himalaya. *Current Science*, **92(11)**: 1620-1624.
- FAROOQ M, SM BASRA AND H REHMAN (2006). Seed priming enhances emergence, yield and quality of direct-seeded rice. *Crop Management and Physiology*, **6**: 42-44.
- TAYLOR AG, PS ALLEN, MA BENNETT, KJ BRADFORD, JS BURRIS AND MK MISRA (1998). Seed enhancements. *Seed Science Research*, **8**: 245-256.

19. HADAS A AND D RUSSO (1974). Water uptake by seeds as affected by water stress, capillary conductivity and seed-soil water contact. 1. Experimental Study. *Agronomy Journal*, **66**: 643-647.
20. COLLIES GN AND JB HECTOR (1996). Germination of seeds as influenced by matric potential and by the area of contact between seed and soil water. *Australian Journal of Soil Research*, **4**: 145-164.
21. GOMATHI G (2011). Designing, comprehensive seed and crop management techniques for enhancing seed quality, productivity and storability of black gram cv. ADT 3. M.Sc. (Ag.) Thesis, Tamil Nadu Agricultural University, Coimbatore
22. TAYLOR AG AND GE HARMAN (1990). Concepts and technologies of selected seed treatments. *Annals of Review and Phytopathology*, **28**: 321-339.
23. DEXTER ST AND M TAKAO (1960). Acceleration of water uptake and germination of sugar beet seed balls by surface coating of hydrophilic colloids. *Agronomy Journal*, **51**: 388-389.
24. HEYDECKER W (1972). Vigour In: "Viability of Seeds", (Ed. E.H. Roberts). Chapman Hall. London. pp. 209-252.
25. KOOSTRA PJ AND JF HARRINGTON (1969). Biochemical effects of age on membranal lipids of *Cucumis sativus* L. seed. *Proceedings of International Seed Testing Association*, **34**: 329-340.
26. SELVAKUMARI A (2010). Standardization of seed fortification and development of a comprehensive seed treatment for enhancing seed quality, productivity and storability of pioneer maize hybrid 31y45. Ph.D. Thesis, Tamil Nadu Agric. Univ., Coimbatore, India.
27. JOHN S, A BHARATHI, P NATESAN K AND RAJA (2005). Effect of polymer coating on germination and seedling vigour in maize cv. CO 1. *Karnataka Journal of Agricultural Science*, **18**: 343-348.
28. NI BRANDAL BIDDLE (2001). Alleviation of seed imbibitional chilling injury using polymer coating. Seed treatment challenges and opportunities. *Proceedings of International Symposium Wishaw*, New, arwickshire, UK, 26-27 February, 13: 73-80.
29. LARISSA LP, B CLADIO AND LSC JEFFERSON (2004). Storage of dry bean seeds coated with polymer and treated with fungicides. *Pesqagropee Brass*, **39 (7)**: 2-10.
30. JOHNSON EN, PR MILLER, RE BLACKSHAW, Y GAN, KN HARKER, GE CLAYTON, KD KEPHART, D WICHMAN, K TOPINKA AND KJ KIRKLAND (2004). Seeding date and polymer seed coating effects on plant establishment and yield of fall-seeded canola in the Northern Great Plains. *Canadian Journal of Plant Science*, **84 (4)**: 955-963.
31. JAGADISH GV, KPR PRASANNA AND KG RANGANATHAIAH (1994). Influence of storage conditions and containers on seed storability in onion (*Allium cepa* L.). *Seed Technology News letter*, **24**: 15.
32. SRIMATHI P, G SASTHRI AND K MALARKODI (2001). Influence of fungicides and insecticides on storability of pearl millet seeds. *Madras Agricultural Journal*, **88(1-3)**: 16-21.
33. HOWLADER AJ AND ASMA MATIN (1988). Observations on the pre-harvest infestation of paddy by stored grain pests in Bangladesh. *Journal of Stored Products Research*, **24 (4)**: 229-231.