International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2017; 5(6): 1663-1665

Received: 22-09-2017
Accepted: 24-10-2017

RK Bony
Dept of Seed Science and Technology ANGRAU, Rajendranagar, Hyderabad, Telangana, India

B Rajeswari
Dept of Plant Pathology, ANGRAU, Rajendranagar, Hyderabad, Telangana, India

K Jhansi
Dept of Seed Science and Technology ANGRAU, Rajendranagar, Hyderabad, India

K Keshavulu
Dept of Seed Science and Technology ANGRAU, Rajendranagar, Hyderabad, Telangana, India

Correspondence
RK Bony
Dept of Seed Science and Technology ANGRAU, Rajendranagar, Hyderabad, Telangana, India

Effect of seed coating polymer on biochemical constituent of soybean (*Glycine max*. L)

RK Bony, B Rajeswari, K Jhansi and K Keshavulu

Abstract
Soybean is an important oilseed and pulse crop which is grown throughout the India and World. One of the major problems encountered in soybean production in India is lack of availability of good quality seeds at the time of planting as many of the seed lots produced lost their viability quickly. The post maturation and storage phases of seed encompass a series of deteriorative processes that can alter seed performance potential. Seed coating especially film-coating, is one such technique which has gained commercial importance owning to its practical utility as an effective delivery system for seed protectant and fortifying chemicals. Film coating is a new concept in which the plasticizer polymer forms a flexible film that adheres and protects fungicide and insecticide. The polymer coating is simple to apply, diffuses rapidly and non- toxic to the seed during germination. An experiment was conducted to determine the protein and oil content with soybean cv. JS-335. The seeds were coated with polymer in combination with fungicide (thiram), insecticide (imidacloprid), bioagent (*Trichoderma viride*) and maintained untreated seeds (control) and were packed in cloth bag and polythene bag (700 gauge). The data were subjected to Factorial experiment laid out in Completely Randomized Design (FCRD). Seed treatments gave significant impact by improving the protein and oil content over untreated seeds. Protein and oil content were high in seeds treated with polymer + thiram + imidacloprid + *T. viride* as compared to all other seed treatments. Seeds packed in vapour proof container (polythene bag) recorded better performance in extending seed longevity and in improving the seed quality parameters of the soybean.

Keywords: Soybean, polymer, cloth bag, polythene bag, protein, oil content

Introduction

Soybean is an important oilseed and pulse crop which is grown throughout the India and World. It is playing an important role in overcoming the present shortage of edible oil and vegetable proteins in India as it contains 20% oil, 21% starch and 40% high quality protein. Soybean protein is rich in essential amino acids like lysine (5%) in which most of the cereals are deficient. It is also a good source of vitamin-B complex, thiamine and riboflavin.

Among the several factors affecting the seed storability, seed mycoflora is mainly responsible for the degradation of protein and other food reserves resulting in reduction of vigour and germination. The poor storability of soybean seeds is accounted for high oil content, physiological fragility and thin seed coat, which leads to rapid loss of viability and vigour in storage and ultimately results in poor establishment of the crop in the field and low productivity. Seed deterioration is an irreversible, inexorable and inevitable process. But the rate of seed deterioration could be slowed down either by storing the seeds under controlled conditions or by imposing seed treatment with polymer coating along with seed treatment chemicals. Seed coatings are extremely thin, which allows multiple layers on the seed with only a 1 to 10% increase in seed weight. The film coat provides a uniform, yet precise placement of chemicals at much lower rates than the traditional seed treatment systems and offers the opportunity to add many enhancement layers as needed to improve performance, flowability of the seed, essentially dust free, safe to handle and has bright color and nice appearance. Seed treatment is an efficient technology replacing wasteful foliar and soil application of chemicals. Film coating is a new concept in which the plasticizer polymer forms a flexible film that adheres and protects fungicide and insecticide. The polymer coat provides protection from the stress imposed by accelerated ageing, which includes fungal invasion. It improves plant stand and emergence of seeds, accurate application of the chemical reducing chemical wastage, helps to make room for including all required ingredients, protectants, nutrients, plant growth promoters, hydrophobic/hydrophilic substance, oxygen suppliers etc.

The polymer coating is simple to apply, diffuses rapidly and non- toxic to the seed during germination. By encasing the seed with thin film of biodegradable polymer, the adherence of seed treatment to the seed is improves, ensures dust free handling, making treated seed both useful and environment friendly.

Materials and method

The seeds were treated with polymer @2 ml kg^{-1} seed, thiram @ 3 g kg^{-1} seed, imidacloprid @ 2.5 ml kg^{-1} and *Trichoderma viride* @ 10 g kg^{-1} seed. After imposition of seed treatments, the treated seed along with untreated seeds (control) were packed in cloth bag and polythene bag (700 gauge) and stored under ambient conditions of Department of Seed science and Technology, College of Agriculture, ANGRAU, Rajendranagar, Hyderabad for six months period at two months interval. The laboratory experiment was conducted in four replications adopting Factorial experiment laid out in CRD for laboratory studies, as described below.

Factor 1 : seed treatments	**Factor 2 : containers**
T_1 : Polymer coat alone	C_1 : Cloth bag
T_2 : Polymer + thiram	C_2 : Polythene bag
T_3 : Polymer + imidacloprid	
T_4 : Polymer + thiram + imidacloprid	
T_5 : Polymer + thiram + imidacloprid + *T. viride*	
T_6 : Untreated (control)	

Protein content was determined by the Kjeldahl method of AOAC (1995). 0.2 g flour sample was digested with 10 g of digestion mixture (potassium sulphate and copper sulphate in the ratio 100:20), and 25 ml of concentrated sulphuric acid. The contents were then digested for 90 minutes till a carbon free liquid was obtained and clean light green colour was obtained. The volume of the digested material was made up to 100 ml with distilled water. A 20 ml aliquot of digested sample was distilled with 40 per cent sodium hydroxide solution for 15-20 minutes. The ammonia liberated was collected in a conical flask containing 25 ml of 4 per cent boric acid added with few drops of mixed indicator (bromocresol green and methyl red in the ratio 2:1), and the distillate was then titrated against 0.1N H_2SO_4 until the end point (light pink colour) was reached. Blank determination was done without any sample.
Nitrogen content in the sample was calculated using the following formula:
Per cent nitrogen =

$$\frac{(\text{Sample titre volume} - \text{blank titre volume}) \times 0.0014}{\text{Weight of the sample}} \times \frac{\text{total volume of sample}}{\text{Aliquot distilled}} \times 100$$

Protein% = Nitrogen % x Conversion factor (6.25)

Oil content: The analysis of oil content in soybean cv.-JS335 was done by NMR method. The seed moisture was lowered to 4 per cent without damage to living seed by drying the samples for 5 days at 52 - 55 ºC in forced draft oven or it can be obtained in 1-3 hr in a forced draft oven at 130 ºC. Sample of 25 g were scanned by NMR and then gravimetrically analysed for oil content (Yaklich and Vinyard, 2004).

Result and discussion

Protein content: Irrespective of the seed treatments and containers, the protein content gradually decreased with increase in period of seed storage (Table 1 and Fig. 1). Seeds stored in polythene bag (700 gauge) recorded higher protein content than cloth bag. The decline in seed protein content over initial seed storage period was high in cloth bag (4.57 %) as compared to polythene bag (3.21 %) storage. Seed treatments gave significant impact by improving the protein content over untreated control. At the end of six months period of seed storage, the seed treatments, T_5 (polymer + thiram + imidacloprid + *T.viride*) (37.95%) recorded higher protein content and it was on par with T_4 (polymer + thiram + imidacloprid) (37.27%) followed by T_2 (polymer + thiram) (36.85 %) and T_3 (polymer + imidacloprid) (36.54 %) over T_6 (untreated seeds) (34.77 %). Irrespective of the seed treatments, seeds stored in polythene bag had higher protein content than the cloth bag storage. At the end of six months of storage period, treated seed stored in polythene bag (37.05 %) was effective for increasing the protein content over untreated seed stored in cloth bag (35.69 %). Seed treatments especially polymer + thiram + imidacloprid + *T.viride* (T_5) were found effective for improving the protein content over untreated control which recorded the maximum protein content during all the periods of seed storage.
The pattern of reduction in the protein content may be related to oxidation of the amino acids, due to increase in the respiratory activity and advance in the deterioration process of the stored seeds. The decline in protein content over the storage period may be attributed to ageing effect and because of fungal invasion, insect attack, fluctuating temperature, relative humidity, increase in moisture content, and storage containers. Similar results were observed by Braccini *et al.* (2000) [2], Sharma *et al.* (2013) [5].

Oil content: The results showed significant differences with respect to oil content due to containers, seed treatments and their interaction effect during seed storage period are presented in Table 2 and Fig.2. Irrespective of the seed treatments, the oil content gradually decreased with the increase in period of storage. Significant differences in oil content were observed in seed treatments and storage containers. However, the interaction between seed treatments and containers was found non-significant at two and four months of seed storage. Seed treatment T_5 (poymer + thiram + imidacloprid + *T.viride*) recorded the highest oil content (18.80 %) at the end of seed storage period as compared to all other seed treatments. The lowest was recorded with T_6 (untreated control) (17.52 %). At the end of six months of seed storage period, polythene bag maintained the higher oil content (18.49 %) as compared to cloth bag (17.99 %).
The interaction effect due to containers and seed treatments showed significant differences with respect to oil content only after the six months of storage period. At the end of the six month of storage period, treatment with polymer + thiram + imidacloprid + *T.viride* (T_5) recorded significantly higher oil content (18.90 %) followed by polymer + thiram + imidacloprid (T_4) (18.72 %), polymer + thiram (T_2) (18.57 %) which was on par with polymer + imidacloprid (T_3) (18.47) where the seeds were stored in polythene bag. The lowest oil content (17.12 %) was observed in untreated seeds stored in cloth bag at the end of storage period. The decline in oil content might be due to fungal invasion, insect attack, fluctuating temperature, relative humidity, increase in moisture content and reduction in iodine value of the stored seeds. The results were in accordance with Rubbi and Sarwar (1980) [4], Kakde and Chavan (2011) [3] and Sharma *et al.* (2013) [5].

Table 1: Effect of seed treatments and containers on protein content (%) at different periods of seed storage in soybean cv. JS-335

Period of storage										
Treatment	**Initial**	**2 months**		**Mean**	**4 months**		**Mean**	**6 months**		**Mean**
		C1	**C2**		**C1**	**C2**		**C1**	**C2**	
T_1	40.12	38.37	39.17	38.77	36.37	37.87	37.12	33.57	36.12	34.85
T_2	40.20	39.25	39.45	39.35	38.05	38.65	38.35	36.35	37.35	36.85
T_3	40.20	39.20	39.27	39.24	37.80	38.27	38.03	36.10	36.97	36.54
T_4	40.17	39.35	39.90	39.62	38.35	38.70	38.52	36.85	37.70	37.27
T_5	40.40	39.80	40.00	39.90	38.80	39.30	39.05	37.60	38.30	37.95
T_6	40.17	38.17	39.17	38.67	36.175	37.67	36.92	33.67	35.87	34.77
Mean	40.26	39.02	39.49		37.592	38.41		35.69	37.05	
		2 months			**4 months**			**6 months**		
		T	**C**	**T x C**	**T**	**C**	**T x C**	**T**	**C**	**T x C**
SEm±		0.07	0.04	0.10	0.07	0.04	0.10	0.08	0.05	0.12
CD at 5%		0.21	0.12	0.30	0.21	0.12	0.30	0.24	0.14	0.35

C1- Cloth Bag T_1- Polymer coat alone T_5- Polymer + thiram + imidacloprid + *Trichoderma viride*
C2- Polythene Bag T_2- Polymer + thiram T_6- Untreated control
T_3- Polymer + imidacloprid T_4- Polymer + thiram + imidacloprid

Table 2: Effect of seed treatments and containers on oil content (%) at different periods of seed storage in soybean cv. JS-335

Period of storage										
Treatment	**Initial**	**2 months**		**Mean**	**4 months**		**Mean**	**6 months**		**Mean**
		C1	**C2**		**C1**	**C2**		**C1**	**C2**	
T_1	20.12	19.5	19.75	19.65	18.65	19.15	18.90	17.65	18.35	18.00
T_2	20.10	19.67	19.80	19.74	18.87	19.27	19.07	18.07	18.57	18.32
T_3	20.02	19.47	19.70	19.59	18.77	19.12	18.95	17.97	18.47	18.22
T_4	20.07	19.72	19.850	19.79	19.02	19.35	19.19	18.42	18.72	18.57
T_5	20.10	19.80	19.97	19.89	19.20	19.60	19.40	18.70	18.90	18.80
T_6	19.97	19.17	19.47	19.32	18.17	18.67	18.42	17.12	17.925	17.52
Mean	20.07	19.57	19.76		18.78	19.19		17.99	18.49	
		2 months			**4 months**			**6 months**		
		T	**C**	**T x C**	**T**	**C**	**T x C**	**T**	**C**	**T x C**
SEm±		0.05	0.03	0.07	0.05	0.03	0.08	0.06	0.03	0.08
CD at 5%		0.16	0.09	NS	0.16	0.09	NS	0.18	0.10	0.25

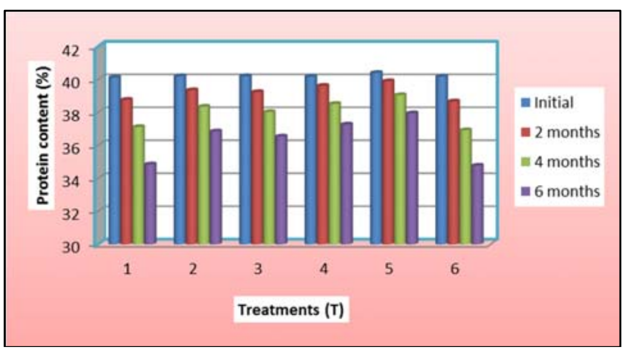

Fig 1: Effect of seed treatment on protein content (%) at different periods of storage in soybean cv. JS-335

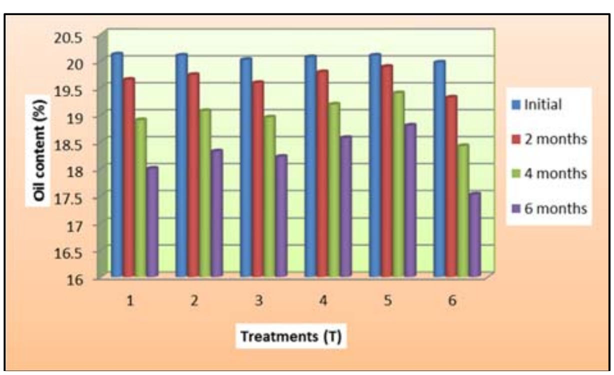

Fig 2: Effect of seed treatment on oil content (%) at different periods of storage in soybean cv. JS-335

T_1: polymer coat alone T_4: polymer + thiram + imidacloprid
T_2: polymer + thiram T_5: polymer + thiram + imidacloprid + *T. viride*
T_3: polymer + imidacloprid T_6: untreated control

Reference

1. AOAC. Official methods of analysis. 16th ed. Association of Official Analytical Chemists. Arligton, Virginia, 1995.
2. Braccini AL, Silvaries M, Moreira MA, Sediyama CS, Seapim. Biochemical changes associated to soybean seeds osmoconditioning during storage. Pesquisa Agropecuaria Brasileira. 2000; 35(2):433-447.
3. Kakde RB, Chavan AM. Deteriorative changes in oilseeds due to storage fungi and efficacy of botanicals. Current Botany. 2011; 2(1):17-22.
4. Rubbi SF, Sarwar H. Biochemical changes of soybean seed during storage. Bangladesh Agricultural Research Council, 1980.
5. Sharma S, Kaur A, Bansal A, Gill BS. Positional effects on soybean seed composition during storage. Journal of Food Science and Technology. 2013; 50(2):353-359.