

## Influence of Polymer Seed Coating along with Fungicide, Insecticide and Hoagland Solution in Soybean (*Glycine max* L.)

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**ABSTRACT:** Pot experiments were conducted during three consecutive years at the research farm of Indian Institute of Seed Science, Mau soybean variety JS-71-05 was taken with three replications under complete randomized design, to study the influence of seed coating with polymers @ 3ml/kg seed, along with different combinations of Blitox (@2.5g/kg seed), Hoagland solution (@5ml/kg seed) and imidachloprid (@2.5ml/kg seed). Results obtained revealed that seed coating with polymers along with combination of blitox, Hoagland solution and imidachloprid in prescribed doses significantly enhanced the seed quality parameters, growth and yield of soybean, over uncoated control as well as overseed coated with polymer alone (@3ml/kg seed). The extent of enhancements in aforesaid characters varied with different combinations and was further increased with increasing number of components in the combinations (T<sub>2</sub>-T<sub>8</sub>); the highest values were noted in T<sub>8</sub> followed by T<sub>5</sub>, T<sub>7</sub> and T<sub>6</sub>. The treatments applied did not improve the storability of seed in subsequent generation. Conclusively, polymer seed coating in combination with fungicide (Blitox@2.5g/kg seed), Hoagland solution (5ml/kg seed) and insecticide (imidachloprid @2.5ml/kg seed) may be recommended for improving the seed quality parameters, growth and yield of soybean crop especially when the crop is grown using one year old seed lot.

**Key words:** Soybean, seed coating, polymer, germination, seed quality, storability

Soybean (*Glycine max*L.) is an important protein and oilseed crop in many regions of the world, including India. It contains 20% oil and 40% protein and it is one of nature's most versatile and fascinating crop in the present farming system of Indian agriculture. Non availability of good quality seed is a constraint in the cultivation of soybean. The first and foremost requirement in the production of good crop is seeds which should be capable of exhibiting high germination with capacity to utilize the inputs like fertilizer, water etc. One of the major problems associated with the seed production of soybean in India, is the maintenance of seed viability up to the prescribed minimum germination standard (70%) from harvest till next sowing season. Soybean seed is reported to have poor viability and field emergence as compared to other *Kharif* oil seed/pulse crops due to its inherent seed structure and composition.

Maintenance of seed viability and vigour till sowing is very critical (9-10 months). In recent times various seed quality enhancement treatments are given to seeds as pre-sowing treatment. Seed coating is a technique adopted on cleaned/graded seed at any stage between post-processing and pre-sowing; wherein external material is applied to the seed without altering its shape. Polymer is a film coating chemical being applied, in recent years, over seeds, without significantly increasing its size or weight. This kind of plasticizer polymer forms a flexible film that prevents seed coat peeling, dusting off and loss of fungicide during handling and is readily soluble in water (hydrophilic), so as not to impede with normal germination [1]. The application of polymers to seed serves as an extra exterior cover in order to get the desired performance viz., quick or delayed water uptake and enhanced germination that

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would be beneficial for better emergence and establishment in the given condition [2]. Film coating provides protection from the stress imposed by accelerated ageing, including fungal and insect's invasion. It improves plant stand and emergence of seeds and this technique is recommended for high value agricultural crops [1]. The positive and significant response of polymer seed coating alone or in combination with insecticide/fungicide/bio-agents/natural fillers on germination seedling vigour, growth and yield improvement have been reported by several workers in Soybean [3, 4 and 5], Indian mustard [6], Sweet corn [7], Tomato [8] etc but the information in soybean crop in relation to influence of polymer seed coating along with insecticide, fungicide and Hoagland solution on seed quality parameters, seed storability, growth and yield is still scanty or rather is not known. Keeping these in view, the present investigation was undertaken i) to study the effect of applying fungicide, insecticide and Hoagland solution applied along with polymer seed coating on enhancement of seed quality parameters, growth and yield of soybean and ii) to study the effect of applied treatments on storability of soybean seeds for subsequent use.

## MATERIALS AND METHODS

Pot experiments were conducted for three consecutive years at the research farm of Directorate of Seed Research, Mau. In this region, the soil is alkaline in nature having pH range of 8.5 to 10.0 and is low lying/regularly submerged in rainy season. Hence, field experiment is not practically possible. Soybean variety JS-71-05 was used, with three replications under complete randomized design. One year old seeds of variety JS-71-05 were obtained from IISR, Indore and after cleaning; the seeds were surface sterilized with 0.2 %  $\text{HgCl}_2$  for five minutes. After sterilization, seeds were coated as per the treatment combinations given below, keeping one set as control, using SATEC model seed coating machine.

T<sub>0</sub> (Control)

T<sub>1</sub> (Polykote@ 3ml/kg seed)

T<sub>2</sub> (Polykote@ 3ml/kg seed + Blitox@2.5g/kg seed)

T<sub>3</sub> (Polykote@ 3ml/kg seed +imidacloprid @2.5ml/kg seed)

T<sub>4</sub> (Polykote@ 3ml/kg seed +Hoagland solution @5ml/kg seed)

T<sub>5</sub> (Polykote@ 3ml/kg seed +Blitox@2.5g/kg seed +imidacloprid seed)

T<sub>6</sub> (Polykote@ 3ml/kg seed +Blitox@2.5g/kg seed + Hoagland solution @5ml/kg seed)

T<sub>7</sub> (Polykote@ 3ml/kg seed +imidacloprid @2.5ml/kg seed + Hoagland solution @5ml/kg seed)

T<sub>8</sub> (Polykote@ 3ml/kg seed+Blitox@2.5g/kg seed + Hoagland solution @5ml/kg seed+imidacloprid @2.5ml/kg seed)

Coated seeds were shade dried and used for germination test as per the ISTA procedure, under lab condition and the percentage was recorded on the basis of final count [9]. The same sets of treatments were sown in cemented pots@five seeds/pot, filled with 15 kg well pulverized moist soil and added with recommended dose of NPK. After sowing, the germination count was started just after one day and counted up to 14<sup>th</sup> day and the emergence was recorded by counting total number of seeds germinated and survived up to 14<sup>th</sup> day in each treatment [10]. Other seed quality parameters viz: seedling length, seedling dry weight and vigour (I & II) were also recorded according to method suggested by [11]. Leaf area after 60 days of sowing was measured using leaf area meter (LICOR-USA). At harvest, number of pods/plant, test weight and grain yield were recorded. Storability of seeds harvested was evaluated through germination test at bimonthly interval (0, 2, 4 and 6). The experimental data recorded during three years were pooled and statistically analyzed following the method of [12].

## RESULTS AND DISCUSSION

The germination and field emergence of soybean JS-71-05 were significantly enhanced when the seeds were coated with polykote @ 3ml/kg seed in combination with either blitox @ 2.5g/kg or imidacloprid @ 2.5 ml/kg or Hoagland solution @ 5ml/kg, over uncoated control and seeds coated with polykote @ 3.0 ml/kg alone (Table 1).

Among the individual treatments applied alone with polykote (T<sub>2</sub>, T<sub>3</sub> and T<sub>4</sub>), imidacloprid showed the maximum germination and field emergence. The germination percent further enhanced significantly when seeds were coated with polykote in combination with more than one component as in case of T<sub>5</sub>, T<sub>6</sub>, T<sub>7</sub> and T<sub>8</sub> and maximum germination (97%) was recorded when the seeds were coated with combination of Polykote @ 3ml/kg seed+Blitox@2.5g/kg seed + Hoagland solution @5ml/kg seed+ imidacloprid @2.5ml/kg seed (T<sub>8</sub>). Seed quality parameters like seedling length and seedling dry weight were significantly enhanced

by seed coating with polykote along with blitox @ 2.5 g/kg seed/Hoagland solution @ 5ml/kg/ imidacloprid @ 2.5 ml/kg separately and in combination. The response of treatments were further increased and found significantly higher in T<sub>8</sub> followed by T<sub>7</sub>, T<sub>5</sub> and T<sub>6</sub> for both the parameters. Vigour index I is the multiple of germination and seedling length whereas vigour index II is the multiple of germination and seedling dry weight. Hence, due to enhancement in these parameters, the vigor indices showed improvement, as depicted in Table 1. Enhancement in seed quality parameters through seed coating with

**Table 1.** Effect of polymer coating along with fungicide, insecticide and Hoagland solution on seed quality parameters in soybean

Treatments	Germination %	Field emergence %	Seedling length (cm)	Seedling dry weight (mg)	Vigour index I	Vigour index II
T <sub>0</sub> (Control)	72.67	65.60	28.80	219	2092.89	15914.73
T <sub>1</sub> Polykote @ 3ml/kg seed	74.13	69.80	29.60	223	2194.24	16530.99
T <sub>2</sub> (Polykote@ 3ml/kg seed +Blitox @2.5g/kg seed)	87.33	82.40	32.80	237	2864.42	20697.21
T <sub>3</sub> (Polykote@ 3ml/kg seed + imidacloprid @2.5ml/kg seed)	88.67	84.00	33.00	239	2926.11	21192.13
T <sub>4</sub> (Polykote@ 3ml/kg seed + Hoagland solution @5ml/kg seed)	84.67	80.20	33.40	235	2827.97	19897.45
T <sub>5</sub> (Polykote@ 3ml/kg seed + Blitox@ 2.5g/kg seed +imidacloprid @2.5ml/kg seed)	94.67	90.80	35.20	249	3332.38	23572.83
T <sub>6</sub> (Polykote@ 3ml/kg seed + Blitox@ 2.5g/kg seed + Hoagland solution @5ml/kg seed)	90.67	86.40	34.80	247	3155.31	22395.49
T <sub>7</sub> (Polykote@ 3ml/kg seed+imidacloprid @2.5ml/kg seed + Hoagland solution @5ml/kg seed)	92.00	87.50	35.50	250	3266.00	23000.00
T <sub>8</sub> (Polykote@ 3ml/kg seed+Blitox @2.5g/kg seed + Hoagland solution @5ml/kg seed+imidacloprid @2.5ml/kg seed)	96.67	91.20	36.20	253	3499.45	24457.51
SE±	1.5784	1.736	0.854	3.91	-	-
CD at 5%	3.3462	3.680	1.81	8.29	-	-

Table 2. Effect of polymer coating along with fungicide, insecticide and Hoagland solution on growth and yield of soybean

Treatments	Leaf area (cm <sup>2</sup> )	No. of pods/plants	Test weight (g)	Grain yield/plant (g)
T <sub>0</sub> (Control)	22.57	30.91	73.33	6.22
T <sub>1</sub> Polykote @ 3ml/kg seed	22.63	35.67	72.77	6.10
T <sub>2</sub> (Polykote@ 3ml/kg seed +Blitox@2.5g/kg seed)	23.41	39.20	77.07	7.47
T <sub>3</sub> (Polykote@ 3ml/kg seed +imidacloprid @2.5ml/kg seed)	23.77	39.88	76.43	7.60
T <sub>4</sub> (Polykote@ 3ml/kg seed +Hoagland solution @5ml/kg seed)	23.72	38.44	77.93	7.52
T <sub>5</sub> (Polykote@ 3ml/kg seed +Blitox@2.5g/kg seed +imidacloprid @2.5ml/kg seed)	27.65	46.67	78.00	8.17
T <sub>6</sub> (Polykote@ 3ml/kg seed +Blitox@2.5g/kg seed + Hoagland solution @5ml/kg seed)	26.85	44.67	78.13	8.11
T <sub>7</sub> (Polykote@ 3ml/kg seed +imidacloprid @2.5ml/kg seed + Hoagland solution @5ml/kg seed)	27.43	46.67	78.23	8.10
T <sub>8</sub> (Polykote@ 3ml/kg seed+Blitox@2.5g/kg seed + Hoagland solution @5ml/kg seed+imidacloprid @2.5ml/kg seed)	29.16	46.70	78.30	8.20
SE±	0.396	0.9373	0.4137	0.0952
CD at 5%	0.840	1.987	0.877	0.202

polymers alone or in combination with insecticide/fungicide/bio-agents/natural fillers have been reported in soybean [3, 4 and 5], onion [13] Indian mustard [6], sweet corn [7], tomato [8], cotton [14] and chilli [15]. Our findings are similar to the above findings except that in present experiment seed coating with polykote alone had no significant effect on seed quality parameters. We have also used complete nutrient formulation in the form of Hoagland solution which has positive and significant response in improving the performance of parameters such as leaf area and yield components including pod number, test weight and grain yield. These traits showed positive and significant increase over uncoated control in response to treatments with polykote along with blitox @ 2.5 g/kg seed/Hoagland solution @ 5ml/kg/imidacloprid @ 2.5 ml/kg, separately and in combination. The effect was significantly higher in T<sub>8</sub> followed by other combinations. Seed coating with only polykote @ 3ml/kg seed had no

significant effect on these parameters. Improvement in growth and yield components can be attributed to enhanced seed quality parameters as well as protection/nutrition rendered to the crop by the treatments.

Storability of soybean seeds harvested in the experiment was evaluated through germination count at bi-monthly intervals up to six months of storage period, as presented in Table 3. The result revealed that there was no significant effect of treatments on maintenance of seed viability and thereby the germination gradually decreased with increasing storage period.

The above results indicate that seed coating with polymers in combination with fungicide, insecticide and complete nutrient solution, alone or in combination, has no significant effect on storability of soybean seeds. Conclusively, seed coating with polymer, along with combination of

Table 3. Effect of polymer coating along with fungicide, insecticide and Hoagland solution on storability in soybean

Treatments	Storage months			
	Germination % in stored seed			
	Initial	2	4	6
T <sub>0</sub> (Control)	88.10	85.00	80.20	71.00
T <sub>1</sub> Polykote @ 3ml/kg seed	88.00	85.10	80.35	71.20
T <sub>2</sub> (Polykote@ 3ml/kg seed + Blitox@2.5g/kg seed)	88.40	85.60	81.90	71.40
T <sub>3</sub> (Polykote@ 3ml/kg seed + imidacloprid @2.5ml/kg seed)	90.20	87.48	82.88	71.43
T <sub>4</sub> (Polykote@ 3ml/kg seed + Hoagland solution @5ml/kg seed)	90.40	87.70	81.10	71.60
T <sub>5</sub> (Polykote@ 3ml/kg seed + Blitox@2.5g/kg seed +imidacloprid @2.5ml/kg seed)	91.60	88.00	82.50	72.50
T <sub>6</sub> (Polykote@ 3ml/kg seed + Blitox@2.5g/kg seed + Hoagland solution @5ml/kg seed)	90.80	87.10	81.55	71.35
T <sub>7</sub> (Polykote@ 3ml/kg seed +imidacloprid @2.5ml/kg seed + Hoagland solution @5ml/kg seed)	91.40	87.80	82.30	71.25
T <sub>8</sub> (Polykote@ 3ml/kg seed+Blitox@2.5g/kg seed + Hoagland solution @5ml/kg seed+imidacloprid @2.5ml/kg seed)	91.60	88.05	82.60	72.50
SE±	1.848	1.543	1.293	0.887
CD at 5%	NS	NS	NS	NS

blitox, Hoagland solution and imidacloprid in prescribed doses significantly enhanced the seed quality parameters, growth and yield of soybean over uncoated control or overseed coated with polymer alone (@ 3ml/kg seed). The degrees of enhancement in aforesaid characters varied with different combinations and were further increased with increasing number of components in the combination (T<sub>2</sub>-T<sub>8</sub>); the highest values in almost all the characters under study were noted in T<sub>8</sub> followed by T<sub>5</sub>, T<sub>7</sub> and T<sub>6</sub>. The treatments applied either individually or in combination did not improve the storability of seed.

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