Original Research Article

Standardization of seed coating polymer in Pigeonpea (*Cajanus cajan* L.)

.

ABSTRACT

Laboratory experiment was conducted at Department of Seed Science and Technology, College of Agriculture, University of Agricultural Sciences, Raichur to standardize seed coating polymer for Pigeonpea (*Cajanus cajan* L.) seeds. The experiment consisted of six treatments of different polymer dosage. Among the treatments imposed, seed coating polymer (@ 8 ml/kg) of pigeonpea seeds recorded significantly higher germination, speed of germination, shoot length (cm), root length (cm) , seedling dry weight (mg/seedling) and seedling vigour index (SVI) as compared to control. However, seed coating polymer (@ 8 ml/kg) of seed was on par with the results obtained by seed coating polymer (@ 10 ml/kg and @ 6 ml/kg respectively) of seed. Therefore, the polymer (@ 6 ml/kg) of seed was found to be economically feasible over all the treatments.

Keywords: {Pigeonpea, Polymer dosage, Seed coating polymer, Seed Quality, Standardization}

1. INTRODUCTION

Pigeonpea is an important pulse crop in India. It is also known as Red gram, Arhar and Tur. Pigeonpea is mainly cultivated and consumed in developing countries of the world. This crop is widely grown in India. India is the largest producer and consumer of Pigeonpea in the world, accounting for about 20 percent of the total production of pulses in the country during the year 2000-2001 [1].

Pigeonpea is a protein rich staple food. It contains about 22 percent protein, which is almost three times that of cereals. It supplies a major share of protein requirement of vegetarian population of the country and is mainly consumed in the form of split pulse as Dal, which is an essential supplement of cereal based diet. The combinations of Dal-Chawal (pulse-rice) or Dal-Roti (pulse-wheat bread) are the main ingredients in the average Indian diet. The biological value improves greatly, when wheat or rice is combined with Pigeonpea because of the complementary relationship of the essential amino acids. It is particularly rich in lysine, riboflavin, thiamine, niacin and iron [1]. In addition to being an important source of human food and animal feed, Red gram also plays an important role in sustaining soil fertility by improving physical properties of soil and fixing atmospheric nitrogen. Being a drought resistant crop, it is suitable for dryland farming and predominantly used as an intercrop with other crops.

In order to increase the productivity, good quality seeds need to be made available to the farmers in time at an affordable price through different seed quality enhancement techniques *viz.,* pre-sowing hydration treatment, coating techniques and seed pelleting. Seed coating (polymerization) is a technique wherein any substance applied to the seed does not obscure or change its shape. The film is readily water soluble (hydrophilic) so as not to impede seed germination. The major benefit of seed polymerization (polymer coating) is that the seed enhancement material *viz.,* fungicide, microbiological treatment, micronutrients *etc.,* can be placed directly on to the seed preventing dusting off and loss of added chemicals during handling [2]. In this method small quantity of chemicals or micronutrients are needed as compared to soil application or foliar spray. Seed polymerization is one of the most economical approaches for improving seed performance. Film coating helps to smoothen the seed surface which improves ability of flow and helps in mechanized planting. The improvements in crop establishment, growth and yield due to coating or pelleting have been reported in several agricultural, horticultural and tree crops (Jagathambal, 1996; Punithavathi, 1997) [3-4].

With this background, an experiment was carried out in the Department of Seed Science and Technology, University of Agricultural Sciences, Raichur with the main objective of Standardization of seed coating polymer in pigeonpea (*Cajanus cajan* L.) for ascertaining seed quality parameters.

2. MATERIAL AND METHODS

The Laboratory experiment was conducted during 2014-2015 in the Department of Seed Science and Technology, College of Agriculture, University of Agricultural Sciences, Raichur for standardization of seed coating polymer of pigeonpea seeds (variety TS-3R). The polymer used in the present study was Disco Agro DC Red L-603 procured from the Incotec Pvt. Ltd. Ahmedabad, Gujarat. The experiment consisted of five different dosages of polymer (P) along with a control *viz.,* P_1: Control, P_2: polymer @ 2 ml per kg of seed, P_3: polymer @ 4 ml per kg of seed, P_4: polymer @ 6 ml per kg of seed, P_5: polymer @ 8 ml per kg of seed, P_6: polymer @ 10 ml per kg of seed. The cleaned and graded seeds were coated with polymer as per the above treatment schedule after diluting with 45 ml distilled water in a rotary seed coating machine (Figure 1).

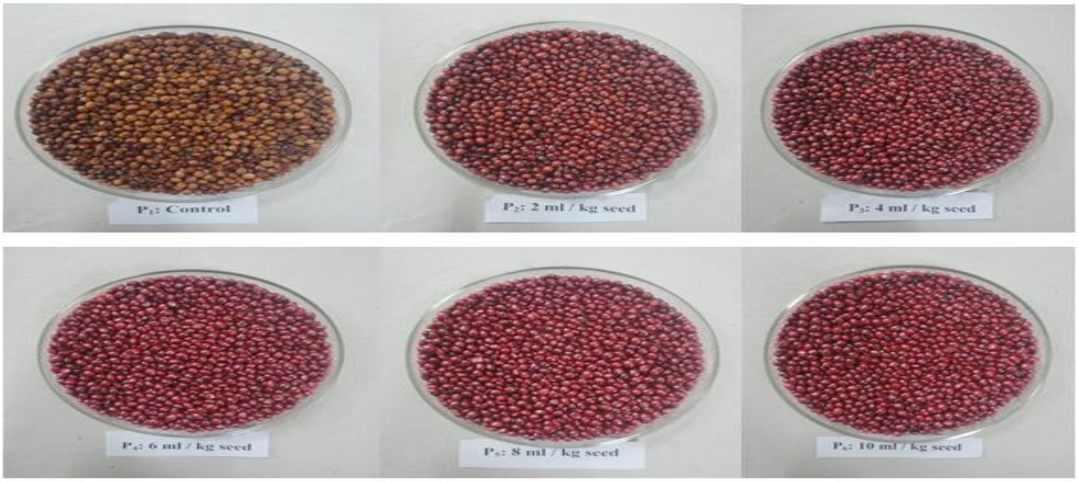

Figure 1. Pigeonpea seeds coated with different dosage of polymer

Care was taken during coating to ensure that the seeds were uniformly coated and air dried under shade for 24 hours to bring back to original moisture content. The experiment was laid out in the Completely Randomized Block Design (CRD) with four replications. The observations on germination percentage (ISTA, 1999) [5], speed of germination (Maguire, 1962), shoot length, root length, seedling dry weight and vigour index (Abdul-Baki and Anderson, 1973) [6] were recorded. The statistical analysis of the data was done as per the procedure described by Sundararaj *et al.* (1972) [7].

3. RESULTS AND DISCUSSION

The data on seed quality parameters *viz.,* germination (%), speed of germination, seedling dry weight (mg), shoot length (cm), root length (cm) and seedling vigour index are presented in Table 1 and Table 2.

From the laboratory experiment, it was ascertained that germination percentage (94.60 %) was significantly higher in the seeds coated with 8 ml polymer per kg seed (P_5) as compared to all other treatments and control (P_1 - 91 %). However, 8 ml polymer per kg seed (P_5) was on par with 10 ml polymer per kg seed (P_6 - 94.38 %) and 6 ml polymer per kg seed (P_4 - 94.10 %). Similar beneficial effects of germination due to polymer coating were reported by Min (1988) in Lucerne [8], Chachalis and Smith (2001) [9] in soybean and Sherin Susan *et al.* (2005) in maize [10]. The increase in germination might be attributed to the increase in the rate of moisture imbibition where the fine particles in the coating act as a 'wick' or moisture attracting material or perhaps to improve seed soil contact. Coating with hydrophilic polymer regulates the rate of water uptake, reduce imbibition damage and improve the emergence (Vanangamudi *et al.,* 2003) [11], similar findings were also reported by Geetharani *et al.* (2006) in chilli [12].

Significantly higher speed of germination (30.55) was recorded in P_5 (8 ml per kg of seed) as compared to control i.e. P_1 (27.00). The treatment P_5 (8 ml per kg of seed) was on par with P_6 at the rate of 10 ml per kg of seed and P_4 at the rate of 6 ml per kg of seed which recorded 29.74 and 29.50 speed of germination, respectively. The increase in speed of germination of polymer coated seeds is attributed to its hydrophilic nature, leading to higher water uptake, which resulted in quicker radicle emergence (Baxter and Waters, 1986) [13]. Similar findings were reported by Sherin Susan *et al.* (2005) in maize [10].

Seeds coated with polymer at the rate of 8 ml per kg of seed (P_5) recorded significantly higher seedling dry weight (84.62 mg) as compared to control (79.83 mg) and all other treatments. Whereas, P_5 (8 ml per kg of seed) was on par with 10 ml per kg seed (P_6 - 84.36 mg) and 6 ml per kg seed (P_4 - 84.20 mg). The increase in seedling dry weight might be due to the greater vigour reflected in early stage and higher percentage of germination of seeds that had reached autotrophic stage well in advance than others. Increase in dry weight might further be enhanced due to enhanced lipid utilisation through glyoxalate cycle, a primitive metabolic pathway thereby, facilitating the conversion of acetate into nucleic acid (Sherin Susan *et al.,* 2005) [10]. Similar findings were reported by Geetarani *et al.* (2006) in chilli [12], Verma and Verma (2014) in soybean [13], Suma and Srimathi (2014) in sesame [14].

In the present investigation, the results of shoot and root length differed significantly due to seed polymer coating. Significantly maximum shoot and root length (11.50 cm and 15.63 cm respectively) were recorded in the seeds treated with polymer at the rate of 8 ml per kg of seed (P_5). However, P_5 (8 ml per kg of seed) was on par with 10 ml polymer per kg seed (P_6 - 11.28 cm, 14.83 cm) and 6 ml per kg of seed (P_4 - 11.10 cm and 14.78 cm) (Figure 2) respectively. The minimum shoot and root length were recorded in the untreated seeds (P_1-9.15 cm, 12.10 cm) respectively. The improvement in shoot and root length might be due to enhanced metabolic activity resulted in early germination as reported by Sherin Susan *et al.* (2005) in maize [10]. Similar findings were also reported by Dadlani *et al.* (1992) in rice [15], Suma and Srimathi (2014) in sesame [14] and Geetharani (2006) in chilli [12].

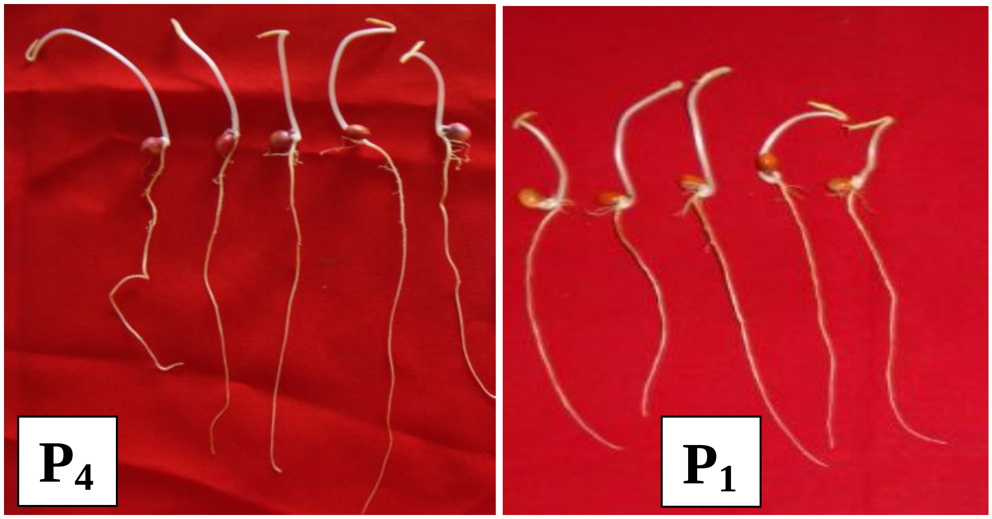

Figure 2. Influence of seed coating polymer on seedling growth of pigeonpea

Among the different dosage of polymer, the seedling vigour index was significantly higher in 8 ml per kg seed (P_5 - 2567) as compared to control (P_1 - 1934) and all other treatment. The reason for improvement in vigour might be due to the enhanced metabolic activity resulted in early germination as reported by Sherin Susan *et al.* (2005) in maize [10] and might also be due to the increased dry matter accumulation in seedling and increase in seedling dry weight as reported by Verma and Verma (2014) [13] in soybean. Similar findings were noticed by Suma and Srimathi (2014) in sesame [14] and Vinodkumar *et. al* (2013) in pigeonpea [16].

Table 1. Influence of seed coating polymer on germination percentage, speed of germination and seedling dry weight of pigeonpea

Treatment	Germination (%)	Speed of germination	Seedling dry weight (mg)
P_1: control	91.00 (72.55)	27.00	79.83
P_2: 2 ml per kg of seed	92.08 (73.68)	27.45	80.40
P_3: 4 ml per kg of seed	92.25 (73.85)	28.10	81.37
P_4: 6 ml per kg of seed	94.10 (75.98)	29.50	84.20
P_5: 8 ml per kg of seed	94.60 (76.63)	30.55	84.62
P_6: 10 ml per kg of seed	94.38 (76.31)	29.74	84.36
Mean	**93.07**	**28.72**	**82.46**
S.Em.±	0.50	0.51	0.31
CD (P = 0.01)	1.48	1.53	0.92

*Figures in the parenthesis indicate arcsine transformed values

Table 2. Influence of seed coating polymer on shoot length (cm), root length (cm) and seedling vigour index

Treatment	Shoot length (cm)	Root length (cm)	Seedling vigour index
P_1: control	9.15	12.10	1934
P_2: 2 ml per kg of seed	9.25	12.62	2013
P_3: 4 ml per kg of seed	9.35	13.20	2080
P_4: 6 ml per kg of seed	11.10	14.78	2435
P_5: 8 ml per kg of seed	11.50	15.63	2567
P_6: 10 ml per kg of seed	11.28	14.83	2464
Mean	**10.27**	**13.86**	**2249**
S.Em.±	0.21	0.33	43
CD (P = 0.01)	0.64	0.99	128

4. CONCLUSION

From the above results of the present investigation as there was no significant differences for all the seed quality parameters studied between 6 to 10 ml polymer per kg seed it can be concluded that for bulk treatment of pigeonpea seeds, polymer coating with 6 ml per kg of seed found more effective and economical as it recorded increased germination and seedling vigour.

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