

Effect of Seed Colouring on Seed Quality and Bruchid Damage in Soybean

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ABSTRACT Seed coloured with botanical dyes, namely flower extract of *Hibiscus rosasinensis*, root extract of beet root and rhizome extract of turmeric, synthetic chemical dyes and polykotes at 100 ml/kg, 1% and 3 g/kg of seed, respectively were evaluated for seed quality and bruchid (*Callosobruchus chinensis*) damage in soybean seeds. The study indicated that coloured seeds showed differences in seed quality and insect damage. Seeds coated with *H. rosasinensis* and polykote colours showed higher per cent germination, root and shoot length and seedling vigour index compared to control. Synthetic chemical dye and red polykote protected the seeds from bruchid up to one month storage.

Keywords: Seed colouring, seed quality, bruchid damage

Seed enhancement implies an improvement in seed quality attributes by any post harvest treatment resulting in improved germinability, better field emergence and longer storability than the corresponding untreated seed [1]. Several seed coating treatments including seed colouring as post harvest treatment have been applied to improve seed quality/vigour and storability [2]. Seed colouring was unrealistic and uneconomical a decade ago. But now it has provoked the interest among many seed traders and seed companies to enhance their companies image and trademark. Developed countries are practicing this since a decade as it has other advantages in improving the appearance of seeds, marketability, consumer preference, combating storage pests and diseases, enabling to identify carry over seeds and to prevent adulteration. Ryker [3] reported non-deleterious effects of colouring with dyes on seeds. Some dyes were harmful and some were non-harmful to seeds but seeds coloured with dyes registered less fungal and insect activity [4]. Ramya [5] found the beneficial effect of seed colouring by using botanicals on tomato seeds. However, only few reports are available on the effect of colouring on seed quality and bruchid damage in soybean. The present study was, therefore, conducted to know the effect of seed colouring on seed quality and insect damage in soybean cv. CO 1.

MATERIALS AND METHODS

The experiment was conducted at the Department of Seed Science and Technology, Tamil Nadu Agricultural University, Coimbatore during 2003-04. One month old pure seeds of soybean cv. CO 1 collected from the Pulses Breeding Station of the University were imposed colouring treatments with botanicals viz., root extract of *Beta vulgaris* and rhizome powder of *Curcuma longa* @ 100 ml/kg of seed and flower extract of *Hibiscus rosasinensis* @ 50 ml/kg of seed; synthetic chemical dyes viz., yellow, black and congo red at 1 per cent and polykotes of yellow, black and red colour @ 3 g (dissolved in 5 ml of water) per kg of seed. In case of botanical dyes, the extraction methods involved grinding of roots without addition of water for beet root and maceration of fresh petals from fully opened red coloured flowers with addition of water at 5 ml/20 flowers for *Hibiscus*. For turmeric, the dried rhizomes were powdered sieved through muslin cloth and mixed with water at 1:1 ratio on weight basis. The initial seed moisture content of seeds was 9 per cent. Seed was coated with respective doses of the colouring agents and shade dried. Four replications of each treatment were maintained including control. Treated as well as control seeds were used for quality studies such as germination, root and shoot length of seedlings, speed of germination, seedling vigour index and field emergence.

Table 1. Effect of seed colouring on seed quality and bruchid damage in soybean

Treatment	Germination (%)	Root length (cm)	Shoot length (cm)	Speed of germination	Vigour index I	Vigour Index II	Field emergence (%)	Germination after accelerated ageing (%)	Bruchid damage (%)
T ₁ Root extract of <i>Beta vulgaris</i> @ 100 ml/kg of seed	83 (65.65)	9.44	26.49	14.09	44.25	2982	59 (50.32)	33 (34.90)	17.25 (24.53)
T ₂ Rhizome extract of <i>Curcuma longa</i> @ 100 ml/kg	82 (64.90)	7.55	25.95	14.60	42.66	2743	61 (51.49)	33 (34.90)	63.00 (52.53)
T ₃ Flower extract of <i>Hibiscus rosasinensis</i> @ 100 ml/kg	84 (66.42)	10.56	27.63	16.23	51.20	3206	66 (54.28)	33 (34.90)	17.75 (24.88)
T ₄ Chemical dye yellow @ 1%	82 (64.90)	10.62	27.48	14.10	46.51	3124	64 (53.36)	32 (34.60)	1.25 (6.33)
T ₅ Chemical dye black @ 1%	81 (64.16)	10.49	27.52	14.76	47.96	3078	65 (53.58)	33 (34.90)	1.50 (6.93)
T ₆ Chemical dye congo red @ 1%	82 (64.90)	10.70	27.51	14.94	46.56	3215	69 (55.68)	33 (34.90)	0.50 (3.09)
T ₇ Yellow polykote @ 3 ml/kg	84 (66.42)	10.65	26.55	14.65	47.26	3124	65 (53.44)	32 (34.60)	15.25 (24.90)
T ₈ Black polykote @ 3 ml/kg	84 (66.42)	10.55	26.44	13.51	46.51	3095	64 (53.40)	33 (34.90)	18.25 (25.28)
T ₉ Red polykote @ 3 ml/kg	84 (66.42)	11.27	26.33	13.49	48.97	3107	64 (53.42)	33 (34.90)	1.25 (6.25)
T ₁₀ Control	83 (65.65)	9.52	28.55	14.09	46.53	3120	65 (53.58)	33 (34.90)	14.25 (22.16)
SED	0.32	0.13	0.16	0.47	0.44	21.95	0.64	NS	0.89
CD (0.05)	0.66	0.26	0.33	0.96	0.87	44.82	1.30	-	1.81

* Figures in parentheses indicate arcsine values

Seed germination test was carried out as per ISTA [6] in sand medium and final count was taken after 10 days. After counting the normal seedlings, root and shoot length and dry weight of 10 randomly selected normal seedlings were recorded. Seedling vigour index I and II were derived by multiplying germination per cent with dry matter production and seedling length respectively as suggested by Abdul-Baki and Anderson [7]. Daily germination counts were taken to calculate speed of germination as described by Maguire [8]. Accelerated ageing of seeds was conducted at 40 °C and 100 per cent relative humidity for seven days. Five pairs of 24-48 hours old bruchid were released in plastic boxes containing 100 g of seeds from each replication and small holes were made on the plastic boxes. The percentage of seed damage by bruchid was recorded after one month. The data were statistically analysed for completely randomised block design with four replications.

RESULTS AND DISCUSSION

The seed colouring treatment showed differential response in germination percentage in soybean cv. CO 1 (Table 1). The seeds treated with polykotes namely yellow, black, red and flower extract of *H. rosasinensis* recorded significant increase in germination per cent (84%) over control. The promotory effect of these treatments might be due to the probable stimulatory effect of enzymes like α -amylase and dehydrogenase activity and their efficient release during seed germination [4]. However, the seed germination declined with the chemical dyes irrespective of colours compared to control. This reduction in germination might be due to decreased mobilization of reserve substances by the chemical dye [9]. The speed of germination did not show significant difference over control among the treatments except, *H. rosasinensis* dye. Seeds coloured with flower extract of *H. rosasinensis*

recorded maximum speed of germination (16.23). The superiority in speed of germination might be due to improvement in the seed imbibition as a result of which seedlings emerged more rapidly [10]. Similarly, root and shoot length and seedling vigour index also enhanced significantly with *H. rosasinensis* and chemical dye congo red colouring over control. The beneficial effect of seed colouring is known to occur due to induced reduction of lipid peroxidation and quantitative changes in biochemical activities including greater amylase activity and increased free sugars during germination [11]. Seeds coloured with chemical dye of congo red significantly increased the field emergence (69%), followed by flower extraction of *H. rosasinensis* (66%). However, the other dyes did not influence field emergence. Vishwa Prasad and Kurdikeri [12] reported improvement in field performance with natural crude plant material and non-toxic chemical dyes without any harmful effects. However, seed colouring treatment had no significant effect on germination after six days of accelerated ageing. Thus, the coloured seeds could maintain germination without harmful effects of dyes and could be treated with dyes safely before storage [13].

Observations on the per cent damage of soybean seed by bruchids indicated that synthetic chemical dyes and polykote reduced the damage appreciably. The reduction in bruchid damage could probably be due to repellent action of dyes and red polykote [13].

However, the maximum seed damage was found with turmeric rhizome coloured seeds (63%). This might be due to the attraction of bruchids with curcumin the major active ingredient in turmeric [14]. Close perusal of data on insect damage revealed that there is an interesting colouring effect on insect damage. Within the groups of botanical, chemical dyes and polykotes red colour had shown lesser insect damage as compared to other colours.

Thus the botanical dyes such as *H. rosasinensis* and congo red and red polykote can be used for colouring soybean seeds to improve appearance and seed quality in soybean.

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