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# Effect of accelerated ageing and dry dressing with botanicals on seed quality of soybean

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## ABSTRACT

*The laboratory study on accelerated ageing of soybean seeds were evaluated for seed quality parameters. After five days of accelerated ageing soybean seeds were treated with fenugreek seed powder, ashwagandha, tea and noni leaf powder for 60 min @ 2 g kg$^{-1}$ and evaluated for seed quality parameters. After five days of ageing germination came down to 65 % with reduced seedling length (cm), dry matter of seedling (mg 10 seedlings$^{-1}$) and vigour index. Aged seeds of soybean treated with fenugreek seed powder @ 2 g kg$^{-1}$ of seeds (ball milling for 1 h with 60 min shaking) recorded higher values for physiological parameters. The per cent gain over control was 19 (seedling emergence speed), 9.7(seedling emergence %), 37.5 (root length), 29.0 (shoot length), 18.1 (dry matter of seedlings) and 38.8(vigour of the seedlings).*

***Keywords:*** Ageing, botanicals, seedling quality, soybean

Seed aeging is the main problem in storage of seeds. Changes in physiological and bio-chemical qualities are the consequence of seed deterioration. Oil seeds are delicate to the harsh environmental conditions. Oil content is present in oil seeds, that are readily oxidizes which worsen the quality of the seeds in storage (Kausar *et al.,* 2009). Various factors such as pests and disease incidence, moisture level of seed, manual and mechanical damages, relative humidity and other factors taking place during storage affects seed quality (Marshal and Levis, 2004).

Deterioration can reduce quality, viability and vigour of seeds (Siadat *et al*., 2012; Kapoor *et al*., 2010). Accelerated ageing of seed is one of the techniques to predict the storage period of seeds. Pattern of deterioration in various crops seed can be easliy studied by accelerated aeging process instead of waiting to acquire naturally aged seeds (Scialabba *et al.,* 2002).In accelerated ageing, seeds can be exposed to elevated conditions of temperature (40 - 45° C) and relative humidity (95 – 100 %) (Abdul-Baki, 1969). The process of deterioration occurred during accelerated ageing was assumed to be similar to natural ageing but with a faster rate (Al-Maskri *et al*., 2003). The aged seeds exhibit a variety of symptoms such as reduced seed quality parameters seedling emergence speed, seedling emergence (%), root and shoot length, dry matter (mg 10 seedling$^{-1}$) and vigour of the seedlings as reported by Al-Maskri *et al.* (2002) in cucumber seeds.

Soybean seed is considered to be short lived as it loses viability under fluctuating ambient temperature and relative humidity. Therefore, there is a need to improve the performance of deteriorated seeds through seed treatments. There are many methods of seed treatments but safest and feasible approach is the treatment of seeds with botanicals (fenugreek seed (*Trigonella foenum-graecum L.*), ashwagandha leaf (*Withania somnifera*), noni leaf (*Morinda citrifolia*) and tea leaf (*Camellia sinensis*). It was established that the deteriorating effect of seed ageing was mainly due to the production of free radicals (Bailly *et al.,* 2008). The deterioration effect can be minimized by use of antioxidants that can quench the free radicals and increase the storage of seeds (Maeda *et al.,* 2005; Sattler *et al.,* 2006). So the present study was formulated to standardize the effect of accelerated ageing and botanicals for improving the performance of aged seeds of soybean.

## MATERIALS AND METHODS

Seeds of soybean *cv.* CO 3 were kept in perforated butter paper and placed in accelerated ageing chamber for ten days at 40 ± 1$^{0}$C with 95 ± 2 % RH (Delouche and Baskin, 1975). The seeds were shuffled every day, sampled and allowed for moisture stabilization in a desiccator containing calcium chloride and seed quality parameters such as speed of germination, seedling emergence (%) (ISTA, 2010), root and shoot length (cm), dry matter (mg 10 seedlings$^{-1}$) and seedling vigour index (Abdul-Baki and Anderson, 1969) were measured. The non aged seeds were served as control. The fresh leaf samples of noni, tea and ashwagandha and

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fenugreek seeds were collected from the Department of Medicinal Plants, Tamil Nadu Agriculture University, Coimbatore. The ground samples were ball milled for 1 h and 2 h using ball mill machine so as to get ball milled botanical powder samples. Soybean seeds were treated with ball milled seed powders of fenugreek, ashwagandha leaf powder, tea leaf powder and noni leaf powder, it was ball milled for 1 h and dry dressed @ 2 g $kg^{-1}$ by shaking the seeds for 60 min. The experiment was carried out with four replications in adopting factorial completely randomized block design. The data obtained were analysed by the 'F' test of significance following the methods described by Rangaswamy (2002). The per cent values were transformed to arc-sine values and used for analysis. The critical differences (CD) were calculated at 5 % probability level. The data were tested for statistical significance by three ways ANOVA. If the F test is non-significant, it was indicated by the letters NS.

## RESULTS AND DISCUSSION

The initial seedling emergence was 78 % which started declining with the advancement of days of accelerated ageing recording 39 % at the end of ageing process. The speed of germination declined from 10.91 to 7.31, root length from 13.3 cm to 5.6 cm, shoot length from 25.2 cm to 13.1 cm, dry matter production declined from 3.0 to 0.6 and vigour index of 3003 to 730. Considering the certification standards, five days accelerated ageing was considered as optimum for experimental purpose when the germination decreased to 65 % (Table 1). In the present study, soybean seeds subjected to accelerated ageing for ten days showed decreased germination per cent and vigour. The same results were reported by Mythili (2012) in onion and Magdy *et al.* (2010) in watermelon. The decline in germination in accelerated aged seeds may be due to reduction of food reserves (Kovalenko *et al.,* 1977), denature the proteins and enzymes, ultra structural changes (Roberts, 1973) in seeds and loss of membrane integrity (Kooshi, 1978). Five days accelerated ageing of soybean seeds brought down germination to 65% which is below the Indian minimum seed certification standards for soybean seeds.

Among the treatments, speed of germination (11.81), germination (72 %), root length (13.6 cm), shoot length (22.7 cm), dry matter (1.712 g 10 $seedlings^{-1}$) and vigour index of seedlings (2614) was maximum in fenugreek seed powder treated seeds compared to control (9.52, 65, 8.5, 16.1, 1.401 and 1599, respectively) (Table 2 and Fig. 1). Soybean seeds accelerate aged for five days and dry dressed with fenugreek seed powder recorded 11 per cent higher germination followed by ashwagandha leaf powder, which was 8 per cent higher than control. Botanical treated seeds increase the conversion of compound reserve material to mobile compounds and altering their physiological and biochemical nature so that the seeds can utilize the resources quickly for their emergence (Manimekalai, 2006). Plant products contain various antioxidants which are needed to quench free radical attack during seed ageing. The antioxidants which is present in the botanicals may enhance the performance of the seed quality during the aeging process. The increase in germination with botanical treatments is similar in clusterbean (Renugadevi *et al*., 2008), Bengal gram (Layek *et al*., 2006), rice (Vijayan, 2005), muskmelon (Roopa, 2006) and tomato (Alex Albert, 2004)

**Table 1: Impact of different durations of accelerated ageing on physiological parameters of soybean seeds**

| Ageing Days | Germination (%) | Speed of germination | Root length (cm) | Shoot length (cm) | Dry matter production (g 10 $seedlings^{-1}$) | Vigour index |
|---|---|---|---|---|---|---|
| 1 | 78 (62.0) | 10.91 | 13.3 | 25.2 | 3.0 | 3003 |
| 2 | 77 (61.3) | 10.80 | 11.7 | 22.4 | 2.6 | 2626 |
| 3 | 74 (59.3) | 10.64 | 10.2 | 21.4 | 2.3 | 2338 |
| 4 | 71(57.4) | 10.31 | 9.7 | 18.3 | 2.0 | 1988 |
| 5 | 65 (53.7) | 9.82 | 9.1 | 17.9 | 1.7 | 1755 |
| 6 | 61 (51.4) | 9.84 | 8.6 | 16.2 | 1.5 | 1513 |
| 7 | 57 (49.0) | 8.81 | 8.2 | 15.7 | 1.2 | 1363 |
| 8 | 52 (46.1) | 8.64 | 7.4 | 15.0 | 0.9 | 1165 |
| 9 | 43 (40.9) | 7.46 | 6.9 | 14.7 | 0.7 | 929 |
| 10 | 39 (38.6) | 7.31 | 5.6 | 13.1 | 0.6 | 730 |
| **Mean** | **62 (52.0)** | **9.43** | **9.1** | **18** | **1.7** | **1740** |
| **SEm (±)** | **0.874** | **0.034** | **0.062** | **0.074** | **0.064** | **40.030** |
| **CD (P=0.05)** | **1.784** | **0.069** | **0.127** | **0.151** | **0.131** | **81.753** |

(Figures in parentheses indicate arcsine values)

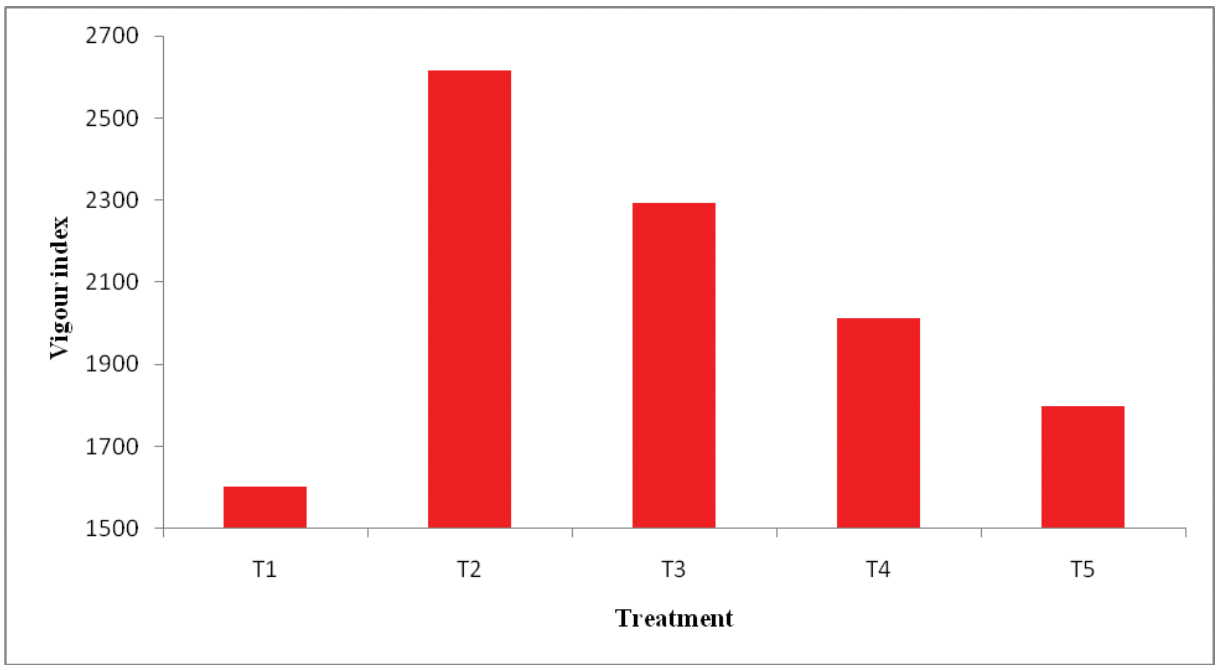


**Fig. 1: Vigour Index of artificially aged soybean seeds after treatments with botanicals**
*Note:$T_1$ - Control, $T_2$ - Fenugreek seed, $T_3$ - Ashwagandha leaf, $T_4$ - Tea leaf, $T_5$ - Noni leaf*

**Table 2: Physiological parameters in artificially aged soybean seeds, after dry dressing with botanicals**

| Treatment | Germination (%) | Speed of germination | Root length (cm) | Shoot length (cm) | Dry matter production (g 10 seedlings$^{-1}$) | Seedling emergence on 8$^{th}$ day after sowing (%) | Field emergence at 14$^{th}$ day after sowing (%) |
|---|---|---|---|---|---|---|---|
| $T_1$ | 65 (53.7) | 9.52 | 8.5 | 16.1 | 1.401 | 25 (29.8) | 63 (52.2) |
| $T_2$ | 72 (58.1) | 11.81 | 13.6 | 22.7 | 1.712 | 38 (37.7) | 91 (72.8) |
| $T_3$ | 70 (56.8) | 11.42 | 12.4 | 20.3 | 1.601 | 37 (37.4) | 83 (65.8) |
| $T_4$ | 69 (56.2) | 9.88 | 10.9 | 18.2 | 1.711 | 33 (35.3) | 75 (60.0) |
| $T_5$ | 67 (54.9) | 9.69 | 9.6 | 17.2 | 1.402 | 31 (33.8) | 71 (57.4) |
| **Mean** | **69 (55.9)** | **10.45** | **11** | **18.9** | **1.57** | **33 (35.3)** | **77 (61.3)** |
| **SEm (±)** | 0.811 | 0.006 | 0.085 | 0.086 | 0.078 | 1.586 | 1.029 |
| **CD (P=0.05)** | 1.729 | 0.013 | 0.180 | 0.184 | 0.166 | 3.380 | 2.192 |

*(Figures in parentheses indicate arcsine values)*
*Note:$T_1$ - Control, $T_2$ - Fenugreek seed, $T_3$ - Ashwagandha leaf, $T_4$ - Tea leaf, $T_5$ - Noni leaf*

Fenugreek seed powder contains antioxidant such as poly phenolics, flavonoids, namely tricin, vitexin, quercetin and naringenin. This quenchs the free radiclas as well as act as $H^+$ donor and the $OH^-$ scavenger and reduces the aeging effect in seeds (Kaviarasan *et al.,* 2007). Titanium, molybdenum, iron and other trace elements were also present in fenugreek seed powder (Sathish and Bhaskaran, 2013). Antioxidants are the substances when present in low concentration, effectively protects the cell membrane against the oxidative damage induced by oxidants. The physiologically active substance which is present in the botanical might have activated the embryo by synthesis of alpha amylase and other ezymes which are needed for the seed germination and also alter thr physiological and biochemical structures wich resulted in enhanced water absorbtion due to elasticity of cell wall. Sathish and Bhaskaran (2013) found that blackgram seeds treated with fenugreek seed powder @ 3 g kg$^{-1}$ seeds with 1 hr shaking boost up physiological performance of seedling. Fenugreek seeds contain both antioxidant and high nutrient content (Toppo *et al.,* 2009).

Ashwagandha, tea and noni leaf powder also contains antioxidants and nutrients.Therefore the botanicals may be utilized as dry seed treatment to enhance the seedling quality. Titanium, molybdenum and iron were present in botanicals. Titanium mainly involves in the biomass production of plant and also involves in cell metabolism as redox catalyst (Tlustos *et al.,* 2005). Kaiser *et al.* (2005) disclosed that molybdenum element is utilized by selected enzymes to do the redox reactions thereby upgrade the seedling vigour. Iron (Fe) participates in the energy-yielding electron transfer reactions of respiration during germination (Guerinot and Yi, 1994). The noticeable out-turn of Fenugreek seed powder could be attributed to magnificient proton radical scavenging activity and suceeding alleviation of deteriorative effect (Chandrashekar and Kulkarani, 2011). The aged soybean seeds treated with ball milled fenugreek seed powder at the quanity of 2g $kg^{-1}$ with 1 hr shaking recorded enhanced seedling physiological quality.

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