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RESEARCH PAPER

Influence of de-oiled tree borne oil cakes on germination pattern of pongamia and rosewood

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Abstract: The present study was focused on the utilization of de-oiled Tree Borne Oil (TBO) seed cakes, a major by-product in the bio diesel production process, as organic manure. The experiment was conducted to study the germination pattern of pongamia (*Pongamia pinnata*) and rosewood (*Dalbergia latifolia*) as influenced by the leachates of neem (*Azadirachta indica*) and pongamia seed cake in different concentration. The highest germination percentage (76.67 % and 98.67 %), germination rate (2.24 and 9.50), peak value (2.63 and 10.97), mean daily germination (2.19 and 2.82), germination value (5.77 and 30.92), seedling length (36.25 and 16.41), seedling vigour index (2779.14 and 1619.48) and survival percentage (100 % and 93.12 %) were observed in T_6 (50 g of neem seed cake leachate) for pongamia and rosewood.

Key words: Germination, Pongamia, Rosewood, Seed cake

Introduction

The large-scale bio-energy crop plantations for producing bio-fuels following promotional activities of the governments and increased awareness among the public are expected to result in the production of large quantities of by-products such as oil cakes (after oil expulsion from seeds). The resulting oil cakes can be recycled as valuable major and micro-nutrients sources. The utility of neem oil seed cake as a fertilizer as well as a pesticide on economically important crop species is well established. However, the studies on the nutritional value of pongamia, and neem seed cakes on the productivity of annual crop plants and their impact on soil nutrient status are limited (Ramesh *et al.*, 2009). These oil cakes are rich in proteins, vitamins, antioxidants, minerals and fibers (Rafi *et al.,* 2016). Hence, it enhances the organic carbon as well as nutrient in soil (Kannan *et al*., 2016). Keeping these points in view the present experiment was planned to study the influence of leachates of neem and pongamia seed cake on the germination and germination attributes in pongamia and rosewood seeds.

Multiple uses of forestry have been emerged as a long awaited answer to the developing world's ever increasing demand for timber, fuel and fodder. Most tree species can be propagated through seeds; however, seedlings require sufficient root growth and nutrient availability to attain proper size at the time of planting. *Dalbergia latifolia Roxb*. belongs to the family leguminosae, is one of the most priced timbers of the world and is ranked among the finest woods for furniture, cabinet work, decorative objects, musical instruments, religious artifacts, etc. Under natural condition rosewood can be reproduced through seeds, root sucker and coppices, although reproduction through seeds is the cheapest easiest method, but the germination and seedling growth is found to be slow. Coupled with the slow growing nature in seedlings poses a serious problem in nursery. *etc* (Kumar *et al.*, 2014). Pongamia (*Pongamia pinnata* (L.) Pierre) belongs to the family leguminosae. It is a medium sized glabrous tree. Historically, this plant has been used in India and neighboring regions as a source of traditional medicines, animal fodder, green manure, timber and fuel. The seeds contain about 30-45 per cent oil and acts as a source of biodiesel and it is renewable, safe and non-pollutant (Bobade and Khyade, 2012).

Keeping these points in view the present experiments were planned to study the influence of leachates of neem and pongamia seed cake on the germination of pongamia and rosewood seeds.

Material and methods

The present study was planned during 2015-16 in the polyhouse of Department of Silviculture and Agroforestry, College of Forestry, Sirsi of Uttar Kannada district. This study was conducted to know the effect of extracts of leachates from neem and pongamia seed cake on germination of rosewood and pongamia seeds with the following treatments

T_1 : 50 g of pongamia seed cake leachate.
T_2 : 100 g of pongamia seed cake leachate.
T_3 : 150 g of pongamia seed cake leachate.
T_4 : 200 g of pongamia seed cake leachate.
T_5 : 250 g of pongamia seed cake leachate.
T_6 : 50 g of neem seed cake leachate.
T_7 : 100 g of neem seed cake leachate.
T_8 : 150 g of neem seed cake leachate.
T_9 : 200 g of neem seed cake leachate.
T_{10} : 250g of neem seed cake leachate.
T_{11} : Control

The uniform sized seeds were selected for germination trial. One hundred and fifty seeds of pongamia and rosewood were

used for each treatment and one hundred seedlings per replication were recorded in observation. For this study seed cake of neem and pongamia of different proportion (as mentioned in T_1 to T_{10}) was soaked in one litre of water for 24 hours so as to get seed cake leachate. This leachate was applied in the month of August to the trays of uniform size, having equal quantity of sand media. Then, the seeds were sown in trays having sand media treated with seed cake leachetes. After care operations *viz.*, watering is done as and when required so as to keep the proper moisture content in sand media, and weeding were done regularly during experimental period. Number of seeds germinated in each day was counted; emergence of plumule was taken as the criteria of germination. The germination was recorded up to 35 days from the day of seed sowing. Germination attributes are computed using formula given by Czabator (1962) for Germination value, Heydecker (1969) for germination rate, Seedling vigour index was calculated by adopting the method suggested by Abdul Baki and Anderson (1973) and expressed as number. General formulas were used to calculate germination percentage, peak value, mean daily germination, seedling length at the end of 35 days, and survival percentage. The collected data from the experiment was analyzed statistically by using MSTAT-C programme on PC by adopting Completely Randomized Design (CRD).

Results and discussion

In this experiment, influence of leachates of *Pongamia pinnata* (pongamia) and *Azadirachta indica* (neem) seed cake on the germination of seeds of pongamia and rosewood was studied.

In pongamia highest germination at the end of the 35 days was recorded by treating with the leachate of 50 g neem seed cake in one liter of water (T_6), with maximum germination percentage of 76.67 %, Highest germination rate of 2.24, maximum peak value of germination recorded was 2.63, Maximum mean daily germination with value of 2.19, Highest germination value of 5.77, highest seedling length with the value of 36.25cm. The maximum seedling vigour index recorded was 2779.17, and recorded 100 % survival at the end of experimental period. This is presented in Table 1. In case of rosewood, maximum germination percentage of 98.67 %, highest germination rate of 9.50, the highest peak of 10.97, mean daily germination 2.82, highest germination value of 30.92, the highest seedling length with the value of 16.41cm, maximum seedling vigour index recorded was 1619.48. And recorded the maximum survival percentage with the value of 93.12 % for the treatment T_6 (50 g neem seed cake in one liter of water); this is presented in Table 2.

Highest germination percentage at the end of the 35 days was recorded by treating with the leachate of 50 g neem seed cake in one liter of water. Maximum seed germination of 76.67 % and 98.67 % was recorded in *Pongamia pinnata* and *Dalbergia latifolia* respectively. The results are in conformity with the findings of Kumar *et al.* (2014) who observed that the highest germination, seedling height, collar diameter, root length,

Table 1. Influence of leachate of de-oiled Tree Borne Oil seed cakes on germination parameters of *Pongamia pinnata*

Treatments	Germination percentage	Germination rate	Peak value	Mean daily germination	Germination value	Seedling length (cm)	Seedling vigour index	Survival percentage
T_1	68.00 (55.55)	1.75	2.06	1.94	4.00	32.59	2216.18	100.00 (90.00)
T_2	54.67 (47.68)	1.30	1.68	1.56	2.61	21.45	1172.39	98.71 (83.48)
T_3	18.67 (25.60)	0.52	0.60	0.53	0.32	15.75	294.04	94.44 (76.36)
T_4	12.00 (20.27)	0.43	0.53	0.34	0.18	7.60	91.12	53.57 (47.05)
T_5	8.67 (17.12)	0.40	0.53	0.25	0.13	4.53	39.42	47.22 (43.41)
T_6	76.67 (61.12)	2.24	2.63	2.19	5.77	36.25	2779.17	100.00 (90.00)
T_7	68.67 (55.96)	1.81	2.12	1.96	4.17	34.75	2386.34	100.00 (90.00)
T_8	59.33 (50.38)	1.51	1.80	1.69	2.91	28.72	1627.49	100.00 (90.00)
T_9	56.67 (48.83)	1.51	1.69	1.62	2.88	26.59	1577.65	100.00 (90.00)
T_{10}	42.67 (40.79)	0.86	1.22	1.22	1.49	23.27	993.16	100.00 (90.00)
T_{11}	65.33 (53.93)	1.59	2.03	1.87	3.78	30.50	1992.36	100.00 (90.00)
Mean	48.30 (43.38)	1.27	1.54	1.38	2.57	23.82	1379.03	90.35 (80.03)
S.Em.±	0.46	0.06	0.05	0.01	0.12	0.15	15.06	0.05
C.D. at 5 %	1.36	0.18	0.16	0.04	0.36	0.43	44.47	0.16

Figures in parentheses are arcsin-transformed values

Table 2. Influence of leachate of de-oiled tree borne oil seed cakes on germination parameters of *Dalbergia latifolia*

Treatments	Germination percentage	Germination rate	Peak value	Mean daily germination	Germination value	Seedling length (cm)	Seedling vigour index	Survival percentage
T_1	96.00 (78.46)	9.08	9.33	2.74	25.59	15.28	1467.20	69.70 (56.60)
T_2	92.67 (74.40)	7.62	8.75	2.65	22.22	12.69	1175.80	41.21 (39.94)
T_3	70.00 (56.79)	6.27	8.40	2.00	17.50	10.63	744.10	35.89 (36.80)
T_4	55.33 (48.06)	5.12	6.04	1.58	9.54	6.39	353.74	10.18 (18.61)
T_5	44.67 (41.93)	4.51	5.82	1.28	7.42	5.98	267.11	0.00 (0.00)
T_6	98.67 (83.38)	9.50	10.97	2.82	30.92	16.41	1619.48	93.12 (74.79)
T_7	96.00 (78.46)	8.80	9.27	2.74	25.43	13.98	1342.40	88.44 (70.12)
T_8	94.67 (76.70)	8.75	8.89	2.71	23.03	13.39	1214.44	83.42 (65.97)
T_9	90.67 (72.21)	7.99	8.21	2.59	19.09	12.70	1033.26	83.31 (65.89)
T_{10}	81.33 (64.40)	7.39	6.46	2.32	17.47	10.37	981.52	82.24 (65.05)
T_{11}	96.00 (78.46)	9.16	10.67	2.74	29.26	15.44	1482.56	64.24 (53.27)
Mean	83.27 (68.46)	7.65	8.44	2.38	20.68	12.12	1061.96	59.25 (49.73)
S.Em.±	0.56	0.20	0.18	0.02	0.45	0.09	12.40	0.02
C.D. at 5 %	1.65	0.60	0.54	0.05	1.31	0.26	36.61	0.07

Figures in parentheses are arcsin-transformed values

number of root nodules, leaflets per seedling, root-shoot ratio, fresh weight and dry biomass noticed with the application of neem cake as organic fertilizers. The increased value for germination rate, peak value and mean daily germination was recorded by treating with 50 g neem seed cake in one liter of water for both the species. The result are in support with the findings of Shivakumar *et al*. (2011) who reported that with the application of neem seed cake in finger millet increased the productivity and maintenance of soil fertility. Rahi and Patil (2018) found that best germination and seedling attributes were produced in the medium containing combination of 200g of FYM and 37 g of seed cake along soil and sand). The results are in similarity with the findings of Kareem *et al*. (1989) who reported that significantly highest root and shoot growth indexes indicated that soaking seeds of rice variety IR36 and IR42 in neem extract and neem cake treatment increased seedling vigour and viability of the seeds. Sultana and Ghaffar (2010) found that amendment of soil with oil cakes had significant effect on seed germination, seedling mortality and plant size of bottle gourd, bitter gourd and cucumber.

In the present study it is also observed that with the increase in concentration of both neem and pongamia seed cake leachate, the declining trend of germination attributes was recorded for pongamia and rosewood seeds. Similar kind of observation was also recorded by Chaturvedi and kumar (2012), where an increasing trend from 1 % concentration to 2 % was observed, but a declining trend at higher concentrations of 3 % deoiled cake was noticed and in turn reduced the growth of tomato crop. This may be the confirmation of toxic effect of the cake that manifests prominently in higher concentrations and affects the yield of the plants. In this study the least values for all the germination parameters are recorded for treatment T_5 (250 g pongamia cake leachate) in both the species. Our results are in conformity with the findings of Prabhu *et al. (*2002) who indicated that despite a rich source of protein (CP, 28-34 %), pongamia cake was found to be slightly bitter in taste and toxic owing to the presence of flavonoid (Karanjin).

Farmers in the tropics have adopted the use of inorganic fertilizers but intensive use of this over time has been reported to constitute a setback to soil. Since it pollutes the underground water resources and increases soil acidity. However, using organic manures is giving more importance because of less chemical residues and their effect on soil health and environment. Nutrient supply through oil-based cakes which is a form of organic manure will not only reduce the dependence on chemical fertilizers but also improve the soil structure, encourage the growth and activity of beneficial organisms in the soil, alleviate the deficiency of secondary and micronutrients and sustain higher productivity due to improved soil health.

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