The Bioscan 12(1): 453-456, 2017 (Supplement on Agronomy)
AN INTERNATIONAL QUARTERLY JOURNAL OF LIFE SCIENCES
www.thebioscan.com

INFLUENCE OF NURSERY MIXTURE COMPOSITIONS ON SIMAROUBA SEEDS (*SIMAROUBA GLAUCA* DC.)

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KEYWORDS
Nursery mixture
Germination
Seedling vigour index

Received on :
10.09.2016

Accepted on :
19.01.2017

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ABSTRACT
The present investigation entitled "Influence of nursery mixture compositions on simarouba seeds (*Simarouba glauca* DC.)" was carried out during *kharif* 2014-15 at the Agricultural Research Station, Hanumanamatti, Ranebennur (Taluk), Haveri (Dist.). Among different nursery mixtures, composition of red soil + white sand + FYM (T_2) recorded significantly higher values with respect to normal seedlings (46.25%) and germination (76.25%) with significantly minimum (8.75%) abnormal seedlings. This nursery mixture composition also recorded significantly maximum root length of 20.68cm and 20.96cm and shoot length of 13.57cm 14.57cm and seedling length of 34.25cm and 35.53cm at 45 and 90 days after planting respectively. Significantly highest seedling vigour indices-I value of 1586 and 1647 and vigour indices-II value of 2611 and 2708 at 45 and 90 with days after planting respectively and also significantly highest (1.447) germination rate indices were recorded with nursery mixtures composition of red soil + white sand + FYM (T_2) at 45 days after planting.

INTRODUCTION

Simarouba (*Simarouba glauca* DC.) belongs to family Simaroubaceae**.** It is an ever green multipurpose tree, native of EL Salvador, Central America. National Bureau of Plant Genetic Resources first introduced it in 1960's to India and was grown in Research Station at Amravathi, Maharashtra. This was brought to the University of Agricultural Sciences, Bangalore in 1986 and systematic research and developmental activities began from 1992 onwards exclusively for soil conservation purpose especially for waste lands, bald hills and degraded lands. In recent years, it has attained greater importance in terms of its potential for edible oil, industrial vegetable oil and bio-fuel production. It is a versatile oil tree with productivity potential as high as 2000 kg edible oil per hectare per year with ability to establish well even in marginal and wastelands (Syamasundar and Hiremath, 2001).

Major problem in forestry seeds is the poor establishment of seedlings. Some trees produce seeds once in a life time, having dormancy and uneven emergence of seedlings, as these are an essential prerequisite for increased survival and quality in nursery. The main goal of nurseries is to produce quality seedlings with target morphological and physiological features that guarantee crop success after transplanting. Increasingly, nursery stock is produced in containers due to market demands and numerous production advantages including greater production per unit surface, faster plant growth, higher plant quality and lack of dependence on arable land.

Different manures are used in potting mixtures of which Farm Yard Manure (FYM) is prepared using cow dung, cow urine and crop waste and other dairy wastes and is a rich source of nutrients namely 13 per cent nitrogen, 11 per cent phosphorus and 11 per cent potash (Kipkosgei *et al.,* 2003). Vermicompost is a nutrient rich, microbiologically active organic amendment which results from the interactions between earthworms and microorganisms in the breakdown of organic matter and it contains 2.5 per cent nitrogen, 1.7 per cent phosphorus and 2.4 per cent potash (Hnamte *et al*., 2013). It is a stabilized, finely divided peat-like material with a low C: N ratio and high porosity and water-holding capacity that contain most nutrients in forms that are readily taken up by plants (Dominguez, 2004). Poultry manure contains 10 per cent nitrogen, 8 per cent phosphorus and 5 per cent potash (Mariakulandai and Minickam, 1975). Neem cake is added to make soil more fertile since it has an ingredient that blocks soil bacteria from converting nitrogenous compounds into nitrogen gas and it contains 2 to 5 per cent nitrogen, 0.5 to 1.0 per cent phosphorus and 1.0 to 2.0 per cent potash. Simarouba cake is rich in nitrogen (7.7 to 8.1%), phosphorus (1.07%) and potash (1.24%) and used as a fertilizer in number of crops like coffee, sugar cane, cotton and koru. Addition of press mud provide organic nutrients to plant and enhance the growth while addition of peat doesn't compact the soil and can last for years in soils, providing good aeration and water holding capacity to the soil.

The non-availability of proper nursery management technique in some forest tree species is the main problem in establishing good planting material. So, in the present study, it is planned to find out the suitable nursery mixture composition for simarouba seeds.

MATERIALS AND METHODS

Experiment was undertaken at Biofuel Information and

Demonstration Centre (BIDC), College of Agriculture, Hanumanamatti, Haveri district, Karnataka state during 2014-2015 to study the nursery mixture compositions on Simarouba seeds (*Simarouba glauca* DC.).The trail was laid out in Randomized Complete Block Design (RCBD) with four replications. The experiment consisted of eight treatments *viz.,* Black soil + Black sand + FYM (2:1:1) (T_1), Red soil + White sand + FYM (2:1:1) (T_2), Black soil + Black sand + Vermicompost (2:1:1) (T_3), Black soil + Black sand + Poultry manure (2:1:1) (T_4), Black soil + Black sand + Simarouba cake (2:1:1) (T_5), Black soil + Black sand + Neem cake (2:1:1) (T_6), Black soil + Black sand + Press mud (2:1:1) (T_7), Black soil + Black sand + Peat (2:1:1) (T_8).The mixtures were prepared on volume basis.

Seedlings were raised in polythene bags as per the requirement of treatments and the observations on germination components such as normal seedlings, abnormal seedlings, hard seeds and dead seeds, root, shoot and seedling length, seedling vigor index and germination rate index were recorded. The data were subjected to the analysis of variance by adopting the appropriate methods as outlined by Panse and Sukhatme (1978) and Sundararaj *et al*. (1972). The critical difference were calculated at five per cent level of significance whenever 'F' test was significant.

RESULTS AND DISCUSSION

Influence of nursery mixture compositions on normal seedlings, abnormal seedlings, dead seeds, hard seeds and germination percentage in simarouba are presented in table (1). In the present investigation the nursery mixtures composition of red soil + white sand + FYM (T_2) treatment recorded higher normal seedlings (46.25%), germination (76.25%) with minimum (8.75%) abnormal seedlings, at 45 days after planting. Similar beneficial effects of red soil + sand were obtained by Okello and Young (2000) in *Acacia drepanolobium* wherein seed germination was higher in red sandy soils. Sand has loosely aggregated particles that allow free exchange of gases between the germination medium and the embryo. Oxygen is essential for respiratory purposes in germinating seeds and oxygen uptake is proportional to the amount of metabolic activity taking place (Hartmann *et al.,* 2007). Sandy soil is the most suitable germination medium for tropical tree seed germination due to its availability, low cost, capacity to hold moisture (Spicer *et al.,* 2004). Red soil is light textured soil where as black soil is heavy textured soil. FYM plays an important role in improving soil health through its effect on amending soil physical, chemical and biological properties. It ensures proper aeration in soil and improves water holding capacity of soil and it also helps in increasing availability of phosphorus to crops by converting insoluble phosphorus forms to soluble forms apart from increasing the population of soil micro-organisms that enhances the availability of plant nutrients in the soil. FYM is non-toxic, rich in NPK and has adequate aeration and moisture for germination of seeds and hence recorded higher germination in FYM (Kokani *et al*., 2014).

The present results are in agreement with the findings of Mishra (1991) in *Dalbergia sissoo* seed in the laboratory (28-34^{0}C with sand) and under field condition (32-37^{0}C with soil + sand + FYM in 2:1:1 proportion) wherein he observed higher germination velocity. According to Bahuguna and Pyarelal

Table 1: Influence of nursery mixture composition on normal seedlings, abnormal seedlings, dead seeds, hard seeds and germination percentage in simarouba

Treatments	Normal seedlings (%)	Abormal seedlings (%)	Dead seeds (%)	Hard seeds (%)	Germination (%)
T_1- Black soil + black sand + FYM	30.00 (33.21)*	12.00 (20.26)*	18.00 (25.10)*	40.00 (39.23)*	70.00 (56.79)*
T_2- Red soil + white sand + FYM	46.25 (42.84)	08.75 (17.20)	15.00 (22.78)	30.00 (33.21)	76.25 (60.83)
T_3- Black soil + black sand + vermicompost	45.50 (42.41)	16.50 (23.96)	15.00 (22.78)	23.00 (28.65)	68.50 (55.86)
T_4- Black soil + black sand + poultry manure	38.50 (38.35)	20.00 (26.56)	14.00 (21.97)	27.50 (31.62)	66.00 (54.33)
T_5- Black soil + black sand + simarouba cake	39.00 (38.64)	16.00 (23.57)	10.00 (18.43)	35.00 (36.27)	74.00 (59.34)
T_6- Black soil + black sand + neem cake	31.50 (34.14)	15.50 (23.18)	20.00 (26.56)	33.00 (35.06)	64.50 (53.43)
T_7- Black soil + black sand + press mud	34.75 (36.12)	13.25 (21.34)	23.00 (28.65)	29.00 (32.58)	63.75 (52.98)
T_8- Black soil + black sand + peat	43.50 (41.26)	10.50 (18.90)	14.00 (21.97)	32.00 (34.44)	75.50 (60.33)
Mean	38.62 (38.42)	14.06 (22.02)	16.13 (23.67)	31.19 (33.95)	69.81 (56.67)
S.Em ±	1.82	0.91	1.05	1.58	1.26
CD at 5%	5.37	2.67	3.08	4.63	3.72

*Figures in parentheses are angular transformed values

Table 2: Influence of nursery mixture compositions on root length, shoot length and seedling length (cm) at 45 and 90 days after sowing (DAS) in simarouba

Treatments	Root length (cm)		Shoot length (cm)		Seedling length (cm)	
	45 DAS	90DAS	45DAS	90DAS	45 DAS	90DAS
T_1- Black soil + black sand + FYM	16.59	17.70	10.44	10.74	27.03	28.44
T_2- Red soil + white sand + FYM	20.68	20.96	13.57	14.57	34.25	35.53
T_3- Black soil + black sand + vermicompost	18.80	19.77	13.34	13.50	32.30	33.10
T_4- Black soil + black sand + poultry manure	18.33	19.77	12.59	12.89	30.91	32.66
T_5- Black soil + black sand + simarouba cake	18.38	19.82	12.78	13.26	31.15	33.08
T_6- Black soil + black sand + neem cake	18.25	19.27	11.90	12.82	30.15	33.09
T_7- Black soil + black sand + press mud	18.33	19.63	12.55	12.86	30.88	33.49
T_8- Black soil + black sand + peat	18.65	19.85	12.91	13.28	31.56	33.19
Mean	18.50	19.59	12.53	12.97	31.03	32.82
S.Em ±	0.39	0.31	0.46	0.46	0.65	0.56
CD at 5%	1.15	0.91	1.36	1.34	1.92	1.64

Table 3: Influence of nursery mixture compositions on seedling vigour index- I (SVI- I), seedling vigour index- II (SVI- II) and Germination rate index (GRI)at 45 and 90 days after sowing (DAS) in simarouba

Treatments	SVI – I		SVI – II		GRI
	45 DAS	90 DAS	45 DAS	90 DAS	45 DAS
T_1- Black soil + black sand + FYM	813	854	1893	1992	1.024
T_2- Red soil + white sand + FYM	1586	1647	2611	2708	1.447
T_3- Black soil + black sand + vermicompost	1468	1506	2211	2267	1.434
T_4- Black soil + black sand + poultry manure	1190	1259	2038	2159	1.198
T_5- Black soil + black sand + simarouba cake	1214	1290	2304	2447	1.201
T_6- Black soil + black sand + neem cake	950	1011	1945	2070	0.966
T_7- Black soil + black sand + press mud	1076	1126	1968	2072	1.073
T_8- Black soil + black sand + peat	1373	1441	2383	2501	1.448
Mean	1209	1267	1919	2277	1.224
S.Em ±	66	65	55	54	0.060
CD at 5%	193	192	162	160	0.190

*Seedling vigour index I = Germination (%) x seedling length (cm); Seedling vigour index II = Germination (%) x seedling dry weight (mg)

(1993) addition of sand or FYM not only improves germination rate but also growth and drought tolerance of the seedlings in *Acacia auriculiformis*. The researchers Bali *et al*. (2013) also reported maximum seed germination (74%) in the FYM in combination with silt loam soil (silt loam soil + FYM) in *Terminalia bellirica* (Gaertn.) Roxb, seeds. Further, Thakur (2014) also reported that best growing medium for cultivation, sprouting, survival, growth and yield performance of *Picrorhiza kurrooa* is soil + sand + FYM (2:1:1) followed by soil + sand + vermicompost (2:1:1).

Influence of nursery mixture compositions on root length, shoot length and seedling length (cm) at 45 and 90 days after sowing (DAS) in simarouba are presented in table (2). The same potting mixture also recorded significantly higher root length of 20.68 and 20.96 cm, shoot length of 13.57 and 14.57 cm and seedling length of 34.25 and 35.53 cm at 45 and 90 days after planting respectively. This may be attributed to better water holding capacity and soil aeration for better root growth. The results are in conformity with the findings of (Ranjit *et al*., 2014). Nayital *et al*. (1995) in *Grewia optiva* observed that pure soil and sand relatively inert because they have low water holding capacity resulting into poor root growth.

The present results are in agreement with findings of Mohan kumar *et al*. (1992), the soil + FYM + sand combination as growth medium increased the seedling height and dry matter production of seedling in *Swietenia macrophylla* and *Dalbergia latifolia*. Development of healthy seedlings with nodulated roots and better growth in *Albizia lebbek* Benth were found in media composition of sand + soil + FYM by Thakur *et al*. (2000). Presently the state forest department personnel are also using the same composition of red soil, white sand and FYM (2:1:1) for preparing the potting mixture to raise the seedlings of different tree species.

The same potting mixture further recorded significantly higher seedling vigour indices-I value of 1586 and 1647 and seedling vigour indices-II value of 2611 and 2708 at 45 and 90 days after planting respectively and also significantly highest (1.447) (Table 3) germination rate indices. Increase in per cent normal seedlings, root length and shoot length was the reason behind increase in the seedling vigour index and germination rate index.

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