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Comparative Assessment of Seed Characters and Oil Content in *Simarouba glauca* Accessions

Aswini D, R Gokul, M Sangareswari Nagajothi, P Bhuvanesh, A Balasubramanian and P Sudha

Forest College and Research Institute, Mettupalayam, Coimbatore, Tamilnadu 641301

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ABSTRACT

A study was carried out to compare the growth and seed characters of *Simarouba glauca* accessions. The study characterized fruit and seed characters viz., Fresh and dry seed weight, Seed length and diameter, Seed coat and kernel weight and finally oil content of seeds among 20 accessions of *Simarouba*. The results revealed that fresh 100 fruits weight was highest (388.02 g) in FC&RI 13 and lowest (210.02 g) in FC&RI 18 accession. Considering 100 seed weight, both fresh and dry seed weight were registered to be maximum in FC&RI 10 when compared to all accessions observed. Seed biometric measurements revealed that maximum seed length (0.85cm) was observed in FC&RI 5 and minimum (0.68 cm) was in FC&RI 4. Seed coat content was highest (55.91 g) in FC&RI 18 and the lowest (31.61 g) in FC&RI 5. The seed kernel weight was highest (35.05 g) in FC&RI 12 and the lowest (23.8 g) was observed in FC&RI 5, the average kernel content of all 20 accessions was observed to be 28.89 g.The oil content of *Simarouba glauca* accessions varied from 35% to 58%. The maximum oil content 58% was observed in FC&RI 15 followed by FC&RI 10 (57.80%). The minimum oil content (35%) was observed in FC&RI 11 followed by FC&RI 19 (37%). Hence, FC&RI15 has considered the best accession in terms of oil yield, FC&RI 12 was best in terms of kernel weight and FC&RI 10 has considered best in terms of 100 seed weight in the 20 accession utilized in this study.

Key Words:

Biodiesel, Oil content,
Simarouba, Tree borne oilseeds

INTRODUCTION

India is a fast growing economy and is facing the challenge of meeting a rapidly increasing demand for energy. India's energy security would remain vulnerable until alternative fuels to substitute/supplement petro-based fuels are developed based on indigenously produced renewable feedstocks. In India, National Biofuel Policy (2016) has the indicative target of 20% blending of Biofuel with commercial diesel and petrol. In recent years biodiesel obtained from oils of *Jatropha curcas* (Tiwari et al. 2007; Rao et al. 2008), *Pongamia pinnata* (Raheman and Phadatare 2004; Rao et al. 2008), *Madhuca indica*

(Puhan et al. 2005a & 2005b; Ghadge and Raheman 2006), *Azadirachta indica* (Rao et al. 2008) have been successfully proven as potential feed stocks under Indian conditions. It is commonly known as paradise treeand it belongs to the family of Simaroubaceae. It is exotic tree introduced in 1960's. It is a multipurpose tree capable of growing on the degraded soils and can be adapted to a wide range of temperatures (10-45°C) and altitudes up to 1000 m above sea level. The flowering occurs annually in December and continuous up to flowering February. The drupelets turn black (in pink variety) and greenish yellow (in green variety), when they are ready for harvest during April - May. The gestation period of tree is 6-7 yrs. Simarouba seeds are found to be economically important as they contain 60-75 % oil can be used in making vegetable fat or margarine. Simarouba was a rich source of fat having melting point of about 29°C. The major green energy components and their sources from Simarouba were biodiesel from seeds, ethanol from fruit pulps, biogas from fruit pulp, oil cake, leaf litter and thermal power from leaf litters, shell, unwanted branches etc. Apart from edible purposes, it could be a promising ingredient in the manufacture of soaps, lubricants, paints, polishes and pharmaceuticals (Joshi et al. 2003). Hence, with this back drop the following study envisaged to explore the potential of simarouba seeds for biodiesel production.

MATERIALS AND METHODS

Source of sample

Fruits were collected from different *Simarouba glauca* accessions at FC&RI, Mettupalayam, Coimbatore. Study includes accessions of FCRI1, FCRI2, FCRI3, FCRI4, FCRI5, FCRI6, FCRI7, FCRI8, FCRI9, FCRI10, FCRI11, FCRI 12, FCRI 13, FCRI 14, FCRI 15, FCRI 16, FCRI 17, FCRI 18, FCRI 19 and FCRI 20. Ten year old accessions were selected and its height was measured using Ravi Altimeter from bottom to top of the tree and expressed in terms of meter (m).Girth of the tree was measured using measuring tape at GBH level. It was converted to diameter using the formula $d=g/\pi$ expressed in terms of centimeter (cm).

Sample preparation

Fruits and seeds were collected from 20 Simarouba accessions. Cleaning was done to remove the foreign materials like stones, stick, stems, leaves etc in the samples. The freshly collected ripe berries/fruits were dipped in water tank. The fresh fruitlet contains 60% of pulp. Flushy pulp and mucilaginous substances were scrapped away by rubbing with waste gunny bags and sand. The fruits were sun-dried and kept in jute bags and allowed to dry under ambient room conditions (27-32°C, 75-80% RH) to get equilibrium moisture.

Determination of hundred seed weight was computed as per ISTA (1993). Fresh and dried seed as well as fruit were measured using electronic top pan balance. Seed length and breadth was measured using venier calliper (Mitutoyo, Japan) with an accuracy of 0.02 mm from the tip of the seed to the bottom of the seed expressed in centimetre.

Fruits were decorticated to obtain oil content. Seed shell and kernel were measured using electronic top pan balance. The oil content was extracted using Soxhlet apparatus according to the method described by AOAC (1970) with petroleum ether (boiling point 60-80°C) and expressed in percentage.

RESULT AND DISCUSSION

The study includes fruit and seed characters *viz*., seed length and diameter, fresh and dry seed weight, seed coat and kernel weight and finally oil content of seeds. Accessions collected for study has the diameter range from 40.85cm to 12.73cm. The highest DBH and height was witnessed in FCRI 17 with the value of 40.85cm and 9.37m. The next best DBH observed in FCRI 16 (36.21cm), FCRI 19 (34.61cm) and the least diameter was observed in FCRI 3 (12.73cm) which is tabulated in table 1.

Freshly collected fruits were evaluated for initial weight from selected 20 *Simarouba accessions*. 100 fruit weight was maximum (388.02g) in the FCRI 13. Highest pulp content of (2.93g) was recorded in FCRI 13 followed by FCRI 11 and very minimum was observed in FCRI 5, eventually it resulted in high percentage of oil content. Subsequently the pulp and kernel were separated and dried. In fresh and dry seed weight, highest value was bagged by FCRI 10 (137.27g and 103.69g) which was followed by FCRI 5, FCRI 12 with small variation in their weight. Dalal et al. (2005) said that, the seeds of different genotypes were highly polymorphic for seed length, seed width and 100 seed weight.

Sivasamy (1991) and Kumaran et al. (2003) reported that pungam seeds collected from different six agro-climatic zones of Tamil Nadu recorded greater variation for seed size and seed shape. Similar to this, simarouba seeds also registered with varied Seed length and seed diameter were measured in collected accessions. FCRI 5 figured with best seed length (0.85cm) and diameter (0.49cm) compared to all other collected accessions. Despite, lowest seed length and diameter (0.71 and 0.38 cm) was observed in FCRI 4. Even though FCRI 10 measured with maximum 100 seed weight it recorded the minimum seed length and seed diameter. Contrary to this, Abraham et al. (2010) observed that significant positive correlation between 100 seed weight with seed length, seed breadth and seed thickness.

In simarouba, seed coat and kernel ratio place major role to determine oil content. Hence, seed coat estimation was done in all twenty collected accessions. The lowest seed coat registered in FCRI 5 preceded by FCRI 10 (33.24g) and FCRI 3 (39.86g). Likewise the highest seed coat was recorded in FCRI 18 (55.91g) succeeded by FCRI 14 and FCRI 16 (53.15g). FCRI 5, was registered with highest kernel and lowest seed coat, with maximum oil content of 58 percent (%). Similarly, FCRI 16, FCRI 10, FCRI 3 registered lower seed coat and higher kernel content.Even then FCRI 16 recorded higher seed coat of 53.75g it possesses maximum oil content of 55.4 percent (%).Very minimum oil content of 37(%) observed in FCRI 11, Hence it compress of 50.92g of kernel and lower kernel content of 25.5g.This results shows that, FCRI 5 gives maximum oil content in selected 20 accessions which is having highest kernel content, lowest seed coat weight. Holistically the maximum kernel weight resulted in maximum oil content. Mishra et al. (2012) confirmed that *Simarouba glauca* seeds contain about 40 % kernel and 55 -65% oil and the oil cake being rich in nitrogen (7.7 to 8.1%), phosphorus (1.07%) and potash (1.24%) could be used as valuable organic manure.

Sridharan et al. (1998) and Kaura et al. (1998) observed high degree of variation in neem oil content for seeds collected from different locations in Tamil Nadu. The oil content ranged from 36 to 53 per cent. In Jojoba, considerable variations in oil content due to different genotypes have also been documented (Naqvi et al. 1990; Suganuma 1999; Cappillino et al. 2003). Even then FCRI 16 recorded highest seed coat, it showed kernel weight next to FCRI 5, and so it recorded the maximum oil content.

CONCLUSION

Among investigated 20 accession, FCRI 5, FCRI 16, FCRI 6, FCRI 10, FCRI 3 showed higher oil content comparing to all other accession. So these accessions can be recommended for oil extraction purposes. Accession namely FCRI 19, FCRI 11, FCRI 12, FCRI 7, FCRI 18 evidenced with lesser kernel and oil content but it possess higher seed coat. These accessions can be used for value added by product namely fertilizers, manures and pesticides. In conclusion, for the use of *Simarouba glauca*, FCRI 5 accession to be widely accepted as a feedstock for the production of biodiesel, further investigation is still required, especially on ways to improve conversion efficiency.

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