

Neem Tree Morphology and Oil Content

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The neem tree *Azadirachta indica* A. Juss. (Meliaceae), is a tropical evergreen related to mahogany. Native to east India and Burma, it grows in much of Southeast Asia and west Africa; a few trees have recently been planted in the Caribbean and several Central American countries, including México. The people of India have long revered the neem tree; for centuries, millions have cleaned their teeth with neem twigs, smeared skin disorders with neem-leaf juice, taken neem tea as a tonic, and placed neem leaves in their beds, books, grain bins, cupboards, and closets to keep away troublesome bugs. Trees will reach up to 30 m tall with limbs reaching half as wide. The shiny dark green pinnately compound leaves are up to 30 cm long. Each leaf has 10–12 serrated leaflets that are 7 cm long by 2.5 cm wide. It will grow where rainfall is as little, and thrives in areas that experience extreme heat of up to 48°C. Even some of the most cautious researchers are saying that neem deserves to be called a “wonder plant.”

The neem tree, was introduced to Baja California Sur, México, in 1989 by a group of private producers dedicated to organic horticulture in San José del Cabo. The first trees were brought from the Philippines (Leos and Salazar 1992; Osuna 2000), and in 1992, this species was introduced to Yaqui Valley, Sonora, México (Moreno 1996). Since 1994, trees have been planted in small areas along roadsides, as a windbreak. Neem populations planted in Southern, Sonora, México, have phenotypic and quality differences, fruits are heterogeneous in size and form, and oil content and quality is variable. The objective of this study was to characterize 216 trees in a collection at the Instituto Tecnológico Agropecuario, in Southern Sonora Mexico.

MATERIALS AND METHODS

This study was conducted in Instituto Tecnológico Agropecuario (ITA) No. 21, now ITVY, during 2004–2005. ITVY is located in the Yaqui Valley in Southern Sonora, México. Yaqui Valley, geographically is located between the parallels 27°00' and 28°26' N, and between the meridians 108°55' and 111°02' W, an elevation of 40 m above sea level. The Yaqui Valley is composed of 235,000 ha of irrigated land lying between the Sierra Madre and the Gulf of California. Farms are irrigated from reservoirs on the Yaqui and Mayo Rivers and from some 700 public and private irrigation wells. The neem nursery was planted in July, 2000; consists of 216 trees in a square plantation of 7×7 m (Fig. 1). Characteristics analyzed included tree height, stem diameter, branching type, leaf color, fruit size, weight, form, kernel proportion, oil content, and fatty acid profile.

Seed was obtained from northern and southern India from 5 provinces. Kernel percentage was calculated on this material and fatty acid determinations were made.

RESULTS AND DISCUSSION

The neem tree plantations located in Southern Sonora, México show significant contrast in morphology and oil content. In the 11 selected trees, tree height varied from 3.5 to 5.0 m, weight of 10 fruits from 3.5 to 7.75 g, kernel percentage from 21.1% to 31.9%, and oil content from 15.4% to 24.5% (Table 1). Proximal analysis of seeds from Yaqui Valley is presented in Table 2.

In seed from India, maximum oil content was obtained in seed from Hizar. Seed oil content in most of the proveniences was not consistently correlated with seed morphology (data not shown). Average percent of fatty acid content was oleic acid 45.6%, linoleic acid 16.8%, palmitic acid 17.21%, stearic acid 15.2%, and linolenic acid 1.3%.



Fig. 1. Neem tree nursery with 216 trees in a square plantation of 7×7 m were characterized and selected in Yaqui Valley, Sonora, México.

The results indicated that the trees evaluated have a high genetic variation identified by differences in height, branching type, leaf form, and color. Fruit form, size, weight, kernal proportion, composition, and oil content were also variable. In agreement with Kaura et al. (1998), seed morphology (seed length and seed weight) and oil content was studied in *Azadirachta indica* from five provinces of northern and western India. Trees with wide ranges of girths were considered for study. Maximum average oil content was observed in trees from Hisar province. Seed oil content in most of the provinces was not consistently and significantly correlated with morphological parameters of seeds. Tree age had no significant effect on oil yield. This is important in order to improve neem populations; better fruits produce oils of higher quality and uniform plantations produce stable oils. Fruit weights were dissimilar for each tree. The fruits weight was contrasting, it could be an important component in tree yield potential; average fruit weight ranged from 0.775 g (tree 24) to 0.325 g (tree 61). The kernal weight as percent of fruit weight ranged from 31.9% (tree 69) to 21.1% (tree 39), which corresponded to oil content values of 23.8% and 15.4%, respectively (Table 1). The fatty acid profile analyses of contrasting samples showed no differences; most fatty acids showed average values: oleic acid, 45.5%; linoleic acid, 16.8%; palmitic acid, 17.2%; stearic acid, 15.2%; and linolenic acid, 1.3% (Table 2). The protein content in the fruit was 12.9% (moist) and 14.3% (dry) (Table 3).

Table 1. Tree height, growth rate and fruit and kernal characteristics of selected neem trees in Yaqui Valley, ITVY, Bácum, Sonora, México, 2005.

Tree	Tree height (cm)	Growth rate (cm/month)	10 fruit wt. (g)	Kernal (%)	Oil content (%)
01-06	4.0	8.3	4.0	25.4	21.6
02-15	4.3	9.0	3.8	25.2	20.0
03-24	5.1	10.6	7.8	23.8	22.5
04-39	5.0	10.4	4.1	21.1	15.4
05-48	4.5	9.4	4.2	25.3	20.6
06-53	5.0	10.4	4.4	22.2	18.7
07-57	5.5	11.5	5.0	20.9	16.4
08-61	3.5	7.3	3.2	28.1	23.1
09-67	4.2	8.6	5.1	30.3	24.5
10-68	5.0	10.4	3.6	31.3	23.8
11-69	5.0	10.4	4.9	31.9	23.8
Average	4.6	9.7	4.6	26.0	21.0

Table 2. Fatty acids profile in contrasting samples of seeds neem.

Kernal content (%)	Fatty acid %				
	Oleic	Linoleic	Palmitic	Stearic	Linolenic
30	45.73	18.44	18.21	15.70	1.33
25	45.73	18.72	17.93	15.03	1.25
20	44.99	16.55	18.33	17.02	1.49
Average	45.55	16.77	17.21	15.23	1.33

Table 3. Proximal analysis of neem seed.

Basis	Concentration (%)					
	Protein	Moisture	Ash	Fat	Fiber	NFE ^z
Moist	12.9	9.66	5.08	23.1	30.4	18.8
Dry	14.3	0.00	6.42	25.6	33.7	20.0

^zNitrogen free extract.

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