

Neem in Agriculture & Healthcare – An Overview

By Usha Rao

Growing up in Chennai, South India, it seemed like there were always neem trees around. My grandparents designed their house so as not to cut down a large, beautiful neem tree. It was the largest and oldest of many, whose branches shaded us from the searing summer sun while we played, whose twigs formed toothbrushes for some of the local folk and whose leaves my mother used on us as a soft brush to relieve the intense itching of chicken pox. It was our *sthal* or sacred tree and when it finally succumbed to a cyclone, it fell “with love”, my mother said, breaking just a tiny part of the compound wall – it was supposed to have been over 100 years old.

What makes neem (*Azadirachta Indica*) so special? It is a medium to large tree, native to the forests of South India that now grows throughout Africa and Asia, parts of Australia and the United States (Florida, Texas & Hawaii). It is a drought resistant evergreen with pinnate leaves and belongs to the family Meliaceae. It blooms in South India from April and the fruits are harvested from June to August. The flowers are small and white, sweet smelling but bitter in taste and the edible, bitter fruit is pale green and about 3/4 inch long. The flowers are cooked and eaten by some communities during their Indian New Year as a ritual to purify one's system. Every part of the tree - the bark, leaves, flowers, seeds - has a use. In agriculture, healing and medicine. Since it is the fruits, leaves and pruned branches that are used, it is a tree of renewable resources that also plays an important part in reforestation and wasteland restoration programs.

The story of neem in India goes back to the Vedic Period (2000 – 4000 BC). Ancient Indian texts refer to Neem as *Sarva Roga Nivarini*, “the curer of all ailments.” It is referred to as *The Village Pharmacy*, a sacred tree whose religious ties are rooted (as with most things sacred) in very practical matters. Neem has anti bacterial, anti fungal, anti feedant, anti inflammatory and anti parasitic properties to name a few. Mahatma Gandhi is said to have chewed 4-5 fresh young leaves every day. Neem oil, leaves, bark and gum are used in Ayurvedic and Unani medicinal preparations to this day. The leaves, flowers and oil are bitter. Citing from *The Neem Foundation* - “the bitterness is due to an array of complex compounds called “triterpenes” or more specifically “limonoids”. Nearly 100 protolimonoids, limonoids or tetranortriterpenoids, pentanortriterpenoids, hexanortriterpenoids and some nonterpenoid constituents have been isolated from various parts of the Neem tree (Jones et al. 1989, Koul et al., 1990); still more are being isolated. The most important bioactive principal is azadirachtin; at least 10 other limonoids possess insect growth regulating activity (Saxena 1989, Schmutterer 1990). Neem oil and its isolates - nimbidin, nimbiol and nimbin inhibit fungal growth on humans and animals. Neem leaf extracts and teas can treat malaria. The anti-malarial action is attributable to gedunin, a limonoid”.

The beauty of pure neem oil is that, with all limonoids present, they act synergistically to produce the required effect, whether it be as a pest deterrent, fungicide, anti inflammatory, analgesic, anti-viral etc. Indian farmers have long known that an insect would rather starve than feed again from foliage treated with neem oil. Once it has ingested the oil, an adult cannot reproduce; larvae cannot molt. In 1959, Heinrich Schmutterer, a German entomologist was witness to neem's anti-feedant activity when he observed, during a plague of migratory locusts in the Sudan, that the only untouched foliage amidst the devastation were those of the neem trees. His observations are credited with bringing neem to the west and research all around the world especially in the USA, India, Canada, Germany and Israel. This has resulted in the manufacture of a number of neem based or azadirachtin formulations that are specifically targeted for insecticidal or fungicidal use. Azadirachtin “exhibits antifeedant, insect repellent and insect sterilization properties. It is so potent that quantities as low as 1 ppm will totally repel certain insects. It interferes with ecdysone, the key insect molting hormone and prevents larvae and pupae from completing the molting process. Insects treated with Azadirachtin during the larval and pupal stages, comprising 60-70 percent of their lives, generally die within 3 - 14 days. Unlike chemical insecticides, it works on the insect's hormonal system, not on the digestive or nervous system, and does not lead to development of resistance in future generations”.²

Neem oil isn't harmful to beneficials like ladybugs and lacewings though some concern has been expressed about beneficials that have dined on pests that have come in contact with neem. This has to be substantiated. It is recommended not to spray while honey bees are feeding – while adult bees seem to be immune, at certain doses azadirachtin could lead to metamorphosis disturbances and to the death of bee larvae (Rembold et al., 1980; Mordue and Blackwell, 1993; Naumann and Isman, 1996). At the same time, in another test, neem treated bees produced three times as much pollen and twice as much honey as untreated bees. (Liu, et al., 1989). There is positive, ongoing research to control varroa mites with neem oil. In most agricultural applications, the recommended dilution ratio is 0.5% - 1%, a relatively weak solution. In orchards

it can be used as high as 4% without any harmful effects to foliage.

Neem Oil is derived from the neem fruit seed. The best oil is cold pressed from the seed kernel of good quality fruit seeds that have been depulped, washed, dried and decorticated. Pure neem oil is rich in fatty acids with a strong garlicky peanutty smell that some people find offensive – others get used to it and even love it for its wonderful properties. It contains vitamin E and other essential amino acids. Studies have found percentages of these fatty acids - Palmitic acid 19.4%, Stearic acid 21.2%, Oleic acid 42.1%, Linoleic acid 14.9%, Arachidic acid 1.4% (Bringi). Percentages vary from batch to batch. The oil gets viscous at around 59 F and freezes around 54 F. Gentle thawing is the best way to liquify it without harming its properties. It is sensitive to heat and UV rays. Freezing the oil seems to preserve its properties.

There are many grades of neem oil – all the way from pure, well filtered oil with high liminoid values from good, clean seeds to low grade oil that has been pressed from fruits that fall on the road side or from poorly stored seeds where there is a danger of aflatoxin, a harmful fungus.

Other methods of extracting the oil are by expeller pressing and solvent extraction where more oil is generated from the seeds but is of a lesser quality.

Plasma Power Pvt. Ltd. in India who manufacture pure, cold pressed neem oil test their oil for azadirachtin, nimbin & salanin content and micronutrients and also for aflatoxin, heavy metals, pesticide residue, and microbiologicals to meet industry needs and demands. Different batches contain from 1700 ppm azadirachtin to 2500 ppm azadirachtin. The oil contains small amounts of nitrogen, phosphorus, potassium, and other nutrients. Tests on sucking pests of okra (aphids, jassids) and fruit borers with Plasma Neem Oil showed not only that the pests were effectively controlled but there was also higher okra yield than with the other formulations used in the experiment.

Besides agriculture, pure neem oil is used in human and animal health and care. For treating skin problems like acne, eczema, psoriasis, scabies and joint pains to name a few. And to deter mosquitos, flies, fleas, ticks, mites and head & body lice. It is also an excellent cure for mange, hot spots, scabies and other skin diseases in animals. As a moisturizer, it finds its way into creams, lotions, salves, soaps and other cosmetic products.

Once the oil is pressed the resulting seed residue is Neem Cake, used by farmers as a soil amendment to promote the slow, controlled release of nitrogen and additionally against parasitic nematodes associated with vegetable crops, wheat and fodder crops. It is harmless to earthworms - in fact earthworm populations are known to proliferate in plots treated with neem cake. Neem cake typically contains about 6% neem oil and min. 4% nitrogen, 0.5 % phosphorus and 0.5% potassium.

Neem leaf is also used as a soil amendment, nematicide and mulch in areas where there is an abundance but it is in medicinal use that the leaf and bark of the neem tree are most important. Neem Leaf extracts are used in the treatment of diabetes, arthritis, malaria, stress, insomnia to name a few and in cosmetics. Neem Bark powder and extracts are used in treating fevers and stomach problems but are best known for curing gum disease and other dental problems. Villagers in India still chew on young neem twigs to clean their teeth, with better gums and teeth than those converted to using toothpastes.

Arishta, nimba, minbaka – some of the many names neem is known by in Sanskrit, and in Persian as Azad Darakth e Hind – the Free Tree of India. This name is particularly significant at this time as after 10 years, India won a landmark battle at the European Patent Office (EPO) against a patent granted on an anti-fungal product, derived from neem. The campaign was launched by the EU Parliament's Green Party, India-based Research Foundation for Science, Technology and Ecology (RFSTE) and the International Federation of Organic Agriculture Movements (IFOAM). The EPO had initially granted the patent to the US Department of Agriculture and multinational WR Grace in 1995 for a fungicide derived from neem. However the lawsuit maintained that these qualities had been known and used in India for over 2000 years.

“Denying the patent means upholding the value of ‘traditional’ for millions of [people] not only in India but throughout the South. The free tree will stay free,” said RFSTE director, Dr Vandana Shiva.

“We are deeply gratified that through our case the EPO has recognised the intellectual achievements of the South,” said Linda Bullard, former president of IFOAM. “We were able to establish that traditional knowledge systems can be a means of establishing ‘prior art’ and thus used to destroy claims of novelty and inventiveness”. “This historic precedent must be

further developed and transposed into overall international frameworks so that this type of theft is no longer possible.”³

There is a tremendous amount of historical data and present day research on neem. It is almost impossible to document the wonders of the neem tree in one article. While trying to outline some of its properties to a friend, she countered – “Yeah, I’m sure it can also wash and wax your car!”. Well, there IS neem soap and wax content in neem oil – you never know!!

The ancient medical traditions of India. In Ayurveda, herbs are used in the correct proportion and combination to maintain balance in body and mind. Since not every herb suits every body type they have to be taken with medical advice and caution.

2 Excerpt from www.plasmaneem.com

3 BBC news report

Sources:

The Neem Foundation web site – www.neemfoundation.org

Neem, The Ultimate Herb by John Conrick

The Neem Tree – edited by H. Schmutterer