THE RAINCOAT PACKAGE
FOR SOIL, PLANT, ANIMAL AND HUMAN HEALTH

IDEASS INDIA

Innovation for Development and South-South Cooperation

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Introduction

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The Raincoat Package is a kit developed by the Herbal Folklore Research Centre (HFRC), Tirupati, India, for treating soil, plants, animals and human beings with parts of the Neem plant (Azadirachta indica A Juss). Neem is a large evergreen tree that grows 10 to 11 metres tall. It bears small white flowers in auxiliary branches and green or yellow fruits, each containing one seed; the seed contains up to 40% essential oil. All parts of the tree possess healing properties.

Indians have known about the medicinal properties of Neem since time immemorial: it is a sacred tree, commonly used during religious ceremonies. In the Vedas, Neem was called the sarvaroganivarini ("one that cures all ailments and ills"). Mythology also focuses on its curative properties, and people worship the tree to avert ill luck and diseases. The earliest Sanskrit medical writings refer to the benefit of Neem fruits, seeds, oils, leaves, roots and bark, each of which have been used in the Indian Ayurvedic, Siddha and Unani systems of medicines to combat skin disorders, stomach ulcers, chicken pox, leprosy, jaundice, boils, wounds, heat rash and other ailments. During epidemics people take baths in water boiled with **Neem leaves** to ward off illness. Neem plant parts are widely used by indigenous people for treating mother earth, plants, animals and human beings alike. Neem is such a common and useful tree in tropical regions that rural and tribal populations in India call it "the village pharmacy".

Modern medicine has confirmed Neem's curative power. Its leaves, flowers, seeds, bark and oil are used for a variety of purposes, and the tree's presence has been deemed helpful for soil and air. The use of Neem in agriculture can also serve as an alternative to chemical pesticides. Treatment methods and dosages vary only according to who or what is using the plant for what purposes.

Dr. S. Vedavathy has worked for years with tribal groups in India to strengthen their traditional knowledge base through awareness programs and training in practical applications for indigenous knowledge. A decade ago, when there were still relatively few sources of information and field studies on traditional innovations, she observed the groups' innovative uses of the wonder tree Neem. Between 1994 and 1997, with the financial assistance of Canada's International Development Research Centre (IDRC), she documented the local health traditions and folk wisdom of the indigenous people in the Chittoor district in the state of Andhra Pradesh, India, focussing on the importance of Neem for both agriculture and primary health care. The innovative and multiple uses of the Neem plant led her to develop the Raincoat Package.

There is no other compound, whether synthetic or natural, with as many and such safe applications as Neem has. Its use forms part of the traditional knowledge of tribal groups and rural communities in India and ought to be more widely known, as Neem is low-cost, widely available and socially responsible.

Just as a raincoat may be used to protect any thing from rain, the Raincoat Package developed by the HFRC provides for all kinds of uses for the Neem plant. One Raincoat Package contains all five parts of the Neem tree, i.e. bark, root, fruit, flower and leaves. All that is required are expanded and innovative ways to use the plant parts for particular conditions. The Raincoat Package uses the Neem seeds to combat insects and other pests, and Neem leaves to protect grain in storage, while the residual material is used as a biofertilizer (compost) for crops. In addition, the seed extract, oil and leaves are used for treating itch (scabies), cuts, scrapes, rashes and inflammations in a traditional manner. The Raincoat Package has been used with excellent results in rural areas of the Tirupati District for plant protection: it is eco-friendly, low-cost and multi-purpose.

What problem does it solve?

The Raincoat Package covers multiple uses of the various parts of the Neem tree. It is suitable for use in developing countries because it is farm-based and cost-effective and can be replicated easily by farmers. The package belongs to an holistic tradition which involves healing the soil as well as people and plants; it has a wide range of activity and no side effects.

It promotes the use of Neem's decorticated seed extract to combat many types of insects and pests. Field trials conducted at the Herbal Folklore Research Centre (HFRC) farm produced good results using Neem to fight the main pests attacking cabbage (caterpillar), eggplant (caterpillar, grasshoppers), red pepper (caterpillar), Ambretta (caterpillar, beetles) and major pests of Leguminosae and Cucurbitaceae. Use of the Raincoat Package stops further regeneration of the pests and inhibits larval development and spore germination of fungi.

Neem it is not harmful to the environment the way synthetic pesticides are: it deters pests without killing them. At the same time it is a source of food for useful insects like bees, and for birds. It also increases the presence of earth worms in the soil.

The Neem tree removes toxicity from unhealthy air, and its shade prevents the occurrence of many diseases. Areas where many Neem trees grow have lower incidences of malaria and fevers of diverse etiology. It is a long-held belief that Neem helps control environmental pollution.

Dry Neem leaves, when burned, emit smoke that serves as an insect repellent. This is an application used especially in rainy seasons when cattle and buffalo are bothered by large numbers of flies.

The Raincoat Package also includes methods for grain storage. The leftover Neem extract is used for controlling soil-borne pests, especially nematodes, and as bio-fertiliser to improve soil structure and enrich the plant nutrient base.

Finally, Neem is also useful for curing skin ailments in both human beings and animals. The Raincoat Package demonstrates its use in ways that can be easily adopted by farmers.

Neem has a bitter taste. The bitterness is due to an array of complex compounds called " triterpenes" or more specifically "limonoids". Nearly 100 protolimonoids, limonoids or tetranortriterpenoids and some nonterpinoid constituents have been isolated from various parts of the Neem tree (Jones et al., 1989; Koul et al, 1990) and others continue to be isolated. The most important bioactive principal is azadirachtin; at least ten other limonoids have properties that inhibit insect growth (Saxena, 1989; Schmutterer, 1990).

• IMPORTANT PHYTOCHEMICALS IN NEEM

The Neem tree has many unique compounds that have been identified, and others that are as yet unidentified. The identified compounds include:

- Nimbin – anti-inflammatory, anti-pyretic, antihistamine, anti fungal
- Nimbidin – antibacterial, anti-ulcer, anti-arrhythmic, anti fungal
- Nimbidol – anti-tubercular, anti-protozoal, anti-pyretic
- Gedunin – vasodilator, anti-malarial, anti-fungal
- Sodium nimbinate – diuretic, spermicide, anti-arthritic
- Quercetin – antiprotozoal
- Salannin – repellent
- Azadirachtin – repellent, anti-feedant

• PHYSICAL COMPOSITION OF FRESH NEEM LEAVES

Water	59.4%
Protein	7.1%
Fat	1.0%
Fibre	6.2%
Carbohydrates	22.9%
Minerals	3.4%
Calorific value	1290 Kcal/Kg

• VALUES PER 100g:

Calcium	510 Mg
Phosphorous	800 Mg
Iron	17 Mg
Thiamine	0.04 Mg
Niacin	1.40 Mg
VitaminC	218 Mg
Carotene	1 998 Mg
Glutamic acid	73.30 Mg
Tyrosine	31.50 Mg
Aspartic acid	15.50 Mg
Alanine	6.40 Mg
Proline	4.00 Mg
Glutamine	1.00 Mg

Source: Neem Foundation, 1997

The raincoat package in practice

• PEST CONTROL

The introduction of agricultural chemicals in developing countries has often had extremely negative effects, including poisoning and environmental degradation.

Modern research demonstrates that Neem is very effective for pest control. Neem leaves, fruits and seeds are effectively used as a deterrent for many pests. Unlike artificial chemicals, which kill insects that may be useful for eating crop pests, Neem extract does not usually kill insect pests immediately. Instead, it alters the feeding or life cycle of the insect until it is no longer able to live or reproduce. This means that Neem extract takes time to work if the pest attack is severe, and works best as a preventive treatment for the soil and plants. Harmful insects avoid the plants treated with Neem extract, which acts as a screen or raincoat. No harmful residues remain in the soil and environment.

The rain coat preparation is very simple and low-cost, accessible to low-income farmers. It requires ordinary farm equipment like sprayers, a mixer, grinder, mortar and pestle. A presser for extracting the oil is more costly, but selling the oil can be a good source of income. Two ten-year-old trees provide enough pesticide for a normal-sized kitchen herbal garden.

• GRAIN STORAGE

Grain storage is another indigenous method developed by the centre for using Neem plant parts. By mixing stored grains with properly dried leaves, pests may be kept away from grains for an entire year. More sophisticated practices may also be learned and applied, but in any case the methodology is simple and requires no machinery. A five-year-old tree is more than sufficient for providing grain storage protection for a family.

• MOSQUITO REPELLENT, FERTILIZERS AND ANIMAL FEED

Mosquito repellent, fertilizers and animal feed may be produced from materials left over from oil extraction. Eco-friendly incense sticks that repel flies and mosquitoes are easy to produce; householders as well farmers can prepare them without any costly machinery. Following the extraction of oil an excellent fertilizer as well as animal feed remain to be used at no extra cost.

• PRIMARY HEALTH CARE

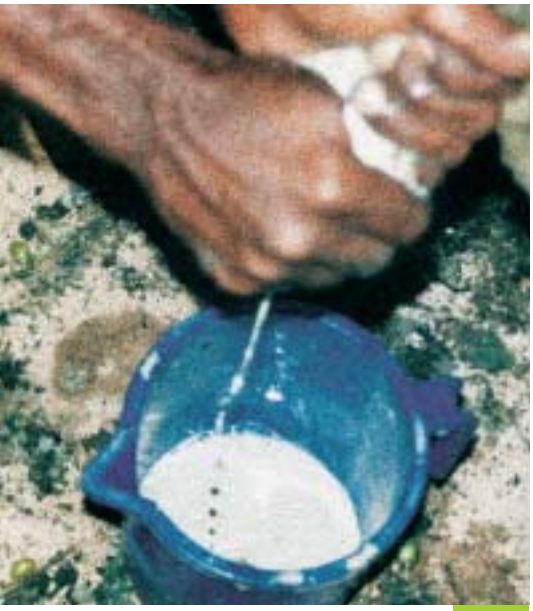
The Raincoat Package may also be used for primary health care. Neem extract is useful for treating skin disorders, heat rashes, boils, scabies, ulcers and wounds. Neem leaves also help in the treatment of vatic disorders (neuromuscular pains), according to Ayurveda. They are reported to remove toxins, purify blood and neutralize potentially harmful free radicals in the body, and to be beneficial for eye disorders and for treating insect bites. Neem fruits, which are bitter, are purgative, anti-hemorrhoidal and anthelmintic in nature. Neem flowers are astringent, anthelmintic and, of course, non-toxic, and are used to treat conditions and diseases associated with excess heat and cough formation.

Neem seeds, which are also bitter in taste, are anthelmintic, anti-leprotic and may be used as an antidote for poisons. Oil derived from crushing the seed is antidermatonic and also a powerful anthelmintic. It has a wide spectrum of action and is highly medicinal in nature.

The five parts of the Neem tree included in the Raincoat Package are useful together for any vitiated condition of the body, for skin diseases, itching, wounds, burning sensations, excess heat, and other purposes mentioned previously.

• THERAPEUTIC PURPOSES

Neem fruits, seed, oil, leaves bark and roots have uses as general antiseptics, antibacterials, treatment of urinary disorders, diarrhoea, fever, and bronchitis, skin diseases, septic sores, infected burns, hypertension and inflammatory diseases. Neem oil and its isolates – nimbidin, nimbidiol and nimbin – inhibit fungal growth on humans and animals. Neem leaf extracts and teas can treat malaria;.the anti-malarial action is attributed to gedunin, a limonoid present in the leaves. Azadirachtin or Neem extracts protect from the contact of kissing bugs and parasitic protozoan.



Neem remedies prepared in the home are simple but very effective. No machinery is required, but it is very important to know the proper way to prepare them and the correct dosages. The quality of the raw material is also very important, because the seeds become toxic if they are not properly collected and dried. With improper preparation or use, the home remedies can even be harmful.

A 5-year-old tree is sufficient for producing one family's home remedies needs.

• NEEM OIL

Neem oil is the most commercially important product derived from the Neem plant. It is an important ingredient of many pharmaceuticals and cosmetics preparations not only in India, but also in Europe and the United States. The market demand is increasing and the selling rate is high.

In 1990, India exported about 34 tonnes of Neem oil valued at about 7 500 euro, but with improved collection and use, India could produce about 700 000 tonnes for export. In many parts of India the oil is a good income-generating resource for the rural communities. In the city of Pune, the Kadhi and Village Industries Commission developed a good market of Neem oil on a rational and organised basis. In the state of Tamil Nadu, the Mahakalasam Women's Federation and the CCD have marketed Neem oil with good economic results. In Kannyakumari NARDEP helps the local Women Self Help Group in the production and marketing of Neem oil.

Producing the oil involves breaking the seeds and separating the kernels to be pressed. The oil yield is sometimes as high as 50 percent of the weight of the kernel. The oil is composed of triglycerides of the following acids: oleic (41%), stearic (20%), linoleic (1%) and palmitic (18%). Each Neem tree produces 5 to 6 kg Neem oil in one year.

The residue of oil extraction can be successfully used in organic farming. It contains more nitrogen, phosphorus, potassium, calcium and magnesium than farmyard manure, and is widely used in India both as a fertilizer and as a pesticide that protects plants' roots from white ants and nematodes.

Results

India has about 25 million Neem trees and produces 0.5 million tonnes of Neem seeds each year. Each tree produces 5 to 6 kg of Neem oil in one year, providing a minimum income of ten euro per tree for the oil alone. Because it is so abundant in India, Neem can be used with very low cost or for free.

- **BASIC RETURNS OF THE RAINCOAT PACKAGE**

- Earth healing
- Food for earth
- Grain storage
- Pest control
- Skin and gum care

The Raincoat Package developed by the HFRC is multipurpose and environmentally friendly. It plays a key role in ensuring food security, improving human health and safeguarding the wellbeing of humans over the long term. In the future the world must look to natural ways and processes for pest and nutrient management, human health and environment conservation. The Raincoat Package provides a way to do so. The package has already been an important means of support for communities, saving them money in agriculture as well as in primary health care.

The HFRC has started small-scale production of the following products, in which Neem is the main ingredient:

- Anti-lice oil
- Anti-dandruff oil
- Cream for cracked skin on feet
- Tooth powder
- Herbal medicine for fever
- Herbal ointment for skin infections

All products have been tested and are marketed in Andra Pradesh by Suveda Herbals. Income from sales helps to maintain a free clinic run by the HFRC in the same tribal area where Dr. Vedavhaty did her field research, while the products are distributed free of charge in two allopathic dispensaries in the Tirupati area and in a homeopathic clinic in Nellore. Thus, benefits derived from community knowledge are channelled back into the communities. A next step is to organise further income-generating activities through marketing Neem products.

Simple laboratory equipment costs about 500 Euro and is sufficient for processing oils, powders and creams. The local market demand in India is good and the income provided to the communities there can be high, especially because the income for remedies and cosmetics can be fifty times higher than that obtained from selling simple Neem oil.

The HFRC staff can easily provide technical training for NGO resource persons interested in setting up a Neem laboratory and processing unit. Following a preliminary survey to identify the particular needs and conditions of the area in which the knowledge will be applied, the training itself lasts for one week.

International interest

It was in 1962 that Pradhan et al. reported the deterrent property of Neem seed kernel suspension against feeding by the desert locust Schistocerca gregaria. That marked the beginning of international research about Neem which continues until today.

Three international conferences held in Germany in 1980, 1983 and 1986 further spurred international interest in Neem. In 1983 the International Agricultural Research Institute (IARI) in New Delhi organised a national seminar on Neem in agriculture, resulting in the production of a special publication, and in 1984 it launched the Neem Newsletter. The National Research Council (United States) published extensive data about Neem in the 1992 book Neem: a tree for solving global problems.

In 1993 India hosted the World Neem Conference, while Australia organised another international conference in 1996. Around the same time the South Asian Association for Regional Cooperation (SAARC), the East-West Center in Honolulu and the International Rice Research Institute in Manila organised various meetings to explore the chemical action of Neem to combat pests.

In a report called Neem – A tree to solve global problems, the Washington-based National Research Council says: "Probably no other plant yields as many strange and varied products or has as many exploitable byproducts as the Neem.… This tree for the 21st century may usher in a new era in pest control, provide millions with inexpensive medicines, cut down the rate of human population growth and perhaps even reduce erosion, deforestation and the excessive temperatures of an overheated globe."

The Indian people feel so strongly about the importance of the plant that they introduced it in other countries, both in Africa (in the tropical belt from Somalia to Mauritania), and in some South Pacific Islands. In Malaysia and the Philippines there are large-scale plantations. About 50 000 trees were planted near Mecca to provide shade for pilgrims.

There are projects for Neem cultivation sponsored by UNIDO, UNEP, GTZ and the Friedrich-Naumann Foundation, in recognition of its usefulness at both the ecological and economical levels. CARE, USAID and AFGRO are founding programmes for Neem cultivation in South Asia, Africa and Central and South America. There are large-scale plantations of Neem in Nicaragua, Honduras, Cuba and the Dominican Republic

In 1992 the El Buchal cooperative in Dahajuro, Venezuela began a project to cultivate 11 000 Neem trees providing fruits and seeds as products. The project is now involving city people living nearby who are planting Neem trees in the schools, in gardens and on the streets.
In Kenya the Director of the Wamirithu Herbal Clinic started to use Neem as a remedy for ulcers (80% of cases cured), gout (cured in one week), pneumonia (cured in 3 weeks), chest-related diseases (cured in 3 days) and malaria (cured in one week), all of which are excellent results. In Gambia tomato plants matured several weeks earlier and had more numerous and larger branches when mulched with Neem leaves. Because of its valuable firewood, Neem has become the most important plantation species in northern Nigeria. Charcoal made from Neem wood is of excellent quality.

In many part of Asia Neem honey fetches a high price and people and NGOs are promoting apiculture through the planting of Neem trees. Neem leaves have been used as mulch in tobacco fields in the Jaffna district of Sri Lanka. In Nepal BIRD is promoting the cultivation of Neem in Terai for a future organic farming development programme. BIRD is also interested in income-generating activities related to Neem products. In Bangladesh COE (an Italian NGO) is including Neem among the more important income-generating and health-promoting plants, to be cultivated and used by the poorest rural communities, as part of a project funded by the Italian Ministry of Foreign Affairs in cooperation with the NGO DALIT. COE is focusing field research on Neem, which in India is conducted by Dr. Maria Pia Macchi as part of a project initiated in 2002 by the Italian Ministry of Foreign Affairs for the valorisation of local health traditions in Asia, Africa and South America.

Adopting the raincoat package in other countries

The Neem tree can be cultivated in arid, semi-arid, wet-tropical, tropical and sub-tropical regions. The root is able to glean nutrients and moisture even from highly-leached sandy soils. The species has a very wide capacity to adapt and is highly tolerant of different soil and climatic conditions. It requires no irrigation, fertiliser or other special care.

The Neem tree increases the fertility and water-holding capacity of the soil, as it has a unique property of calcium mining which neutralizes acidic soils. The tree has been successfully employed for reforestation of dry localities and bare ravines, checking soil erosion and as windbreaks.

• CONDITIONS FOR CULTIVATION

The soil pH needed for optimum growth is 6.2 and above, but the tree can also grow in acidic soils with a pH of around 5, as well as on calcareous soils with pH 8.5. In fact, the leaf litter can help to establish neutral conditions on the soil surface. The tree cannot tolerate saline soils, seasonally waterlogged soils and deep dry sand (water below 18 m).

Neem is generally found growing at an altitude between m and 1 500 m. The tree can withstand shady temperatures of up to 49°C and cannot withstand frost. Rainfall of between 450 and 1 150 mm is ideal for Neem growth, but it can also tolerate a long dry season (130 mm annual rainfall).

• VEGETATIVE PROPAGATION

Shoot cutting and air layering propagation is quite easy. The tree may also be propagated easily by root cutting.

• SEED PROPAGATION

Seeds are usually dispersed by birds under natural conditions. Seeds fall to the ground during the rainy season and have to be collected and used within two weeks. Seeds may also be collected directly from the tree when ripe and sown as soon as possible. The results are very good, as long as seeds are not left to stand for long following collection.

• NURSERY TECHNIQUES

Farmyard manure, sand and local soil should be mixed in a ratio of 1:1:3. Sowing in nursery beds should be done in drills 15 cm apart, with the seeds 2.5 cm apart in lines. They should be lightly covered with earth, since seed germinating on the surface of the bed is liable to have its radicle eaten by birds and insects. The beds should be sparingly watered and soil kept loose to prevent caking.

Seedlings may be pricked out at 15 cm x 15 cm when about two months old. They do not require shade. The seeds should germinate after a week.

Seedlings raised in the nursery can be planted out when 7 to 10 cm high. It is best to prune down the stem and roots. Planting must be done during the rainy season. Planting under thorny bushes can provide effective protection from animal damage.

• HERBAL FOLKLORE RESEARCH CENTRE (HFRC) SUPPORT

HFRC supports training to transfer technology and management skills to communities, farmers and partners to expand their knowledge, and also provides enterprise development and community-based monitoring if needed. The Centre helps cultivate Neem and disseminates information to local communities regarding the preparation and usage of the products using local resources. The Centre aims to achieve farmers' self reliance through a participatory method.

The training supports farmers in achieving self-reliance in insecticide/pesticide supply through self-help groups (SHGs). Awareness campaigns have resulted in the use of Neem kernel extract and oil for pest control in many villages. Intensive Neem seed collection was undertaken, followed by large-scale Neem planting on field bunds, community lands, watersheds and waste lands. Use of Neem as an insecticide and pesticide and replacement of chemical products was monitored and the experiences shared among villagers. The application of Neem-based products reduced the number of soil insect pests, fungi and nematodes, while the Neem residue provided nutrient enrichment.

Storage of grains using Neem has improved health and reduced costs. Gum care and skin care have become a reality where the locally-available Neem plant is used.

• TRAINING COURSE IN THE USE OF NEEM PLANT PARTS FOR THE PRIMARY HEALTH CARE OF BOTH HUMANS AND ANIMALS: 20 TRAINEES FOR 6 DAYS

Course contents: Introduction, taxonomical characters and medicinal importance, cultivation, etc., along with the preparation of Neem-based home medicines.

Schedule: During the first four days the group learns how prepare herbal powders, teas, extracts. decoctions, pastes, oils, bath powders, tablets and capsules for external and internal use for skin care (all dermatological problems, fungal, bacterial, viral, parasitic and systemic infections including allergies) and fever (viral and bacterial).
On the fifth day the trainees learn how to prepare herbal medicines (lehyam and extracts) for urinary disorders.
On the sixth day the group learns how to prepare oils, creams, paste, powder viz; toothpaste, tooth powder, hand and body lotion, for: inflammations, bone fractures, sunburn, hair care (head lice) and tooth care.

• TRAINING COURSE IN ENVIRONMENTALLY FRIENDLY AGRICULTURAL TECHNOLOGIES: 20 TRAINEES FOR 10 DAYS

Schedule: An introductory class covers Neem's chemical constituents and action and the nature of pests, with a practical demonstration of how to apply biopesticides and biofertileser to plants. During the first 5 days the trainees learn how to prepare biopesticides using Neem leaves and seeds. On the following 5 days they learn how to use Neem for grain storage and animal feed and how to prepare a biofertileser (Neem cake).

To learn more

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Innovation for Development and South-South Cooperation

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In the interested countries, ART promotes and supports national co-operation framework programmes for Governance and Local Development - ART GOLD. These Programs create an organized institutional context that allows the various national and international actors to contribute to a country's human development in co-ordinated and complementary ways. Participants include donor countries, United Nations agencies, regional governments, city and local governments, associations, universities, private sector organizations and non-governmental organizations.

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