

Neem as Biopesticide

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Introduction:

Neem plant is considered the most useful traditional plant in India. The various properties of different parts of the neem tree are used mainly as insecticide, fertilizer, manure, soil conditioner, urea coating agent, fumigant, etc. In the recent era the major challenge is to increase food production and safeguard food from pest without harming the environment. Since the last decades, pesticides have become an integral component in sustainable agriculture and modern cultural practices. The use of chemical pesticides and fertilizers are ineliminable. The natural pesticides from *Azadirachta indica* are considered less harmful, biodegradable, least persistent, less toxic to the non-target organism and also economic. Fruitful results of the application of formulated neem-based products in agriculture will provide a cost-effective technology to the farming community.

Neem (*Azadirachta indica*) is commonly called 'Indian Lilac' and belongs to the family Meliaceae, subfamily Meloideae and tribe Melieae. It is an evergreen, tall, fast-growing tree having height of 25m and 2.5m in girth which has an attractive crown of deep green foliage and honey-scented flowers. Neem is the most versatile, multifarious tree of tropics, with immense potential. It possesses maximum useful non-wood products (leaves, bark, flowers, fruits, seed, gum, oil and neem cake) than any other tree species.

Applications:

In addition to its medical applications, neem has aroused interest in many other areas. In the cosmetics and hygiene sector, neem is used in the composition of face masks, lotions, sunscreens, soaps, and toothpastes. Products derived from neem can contribute to sustainable development and the resolution of pest control problems in agriculture. These products

benefit from the natural properties of neem as a powerful insect growth regulator (IGR) that also affects many other organisms (such as nematodes and fungi) and can act as a plant fertilizer.

The use of neem in agriculture is not a new practice. In India, the traditional farming system employed neem extracts for pest management and to supply nutrients to plants. Scientific research has shown that neem is safe for workers, with no handling risks, and can be used throughout the entire crop production cycle.

Neem has proven used as a fertilizer, with the organic and inorganic compounds present in the plant material acting to improve soil quality and enhance the quality and quantity of crops. The waste remaining after extraction of the oil from neem seeds (neem seed cake) can be used as a biofertilizer, providing the macronutrients essential for plant growth.

Nitrogen is one of the main nutrients required by plants for their development, and urea is the main source of nitrogen fertilizer used worldwide to supply the nitrogen demand of crops. The control of urea hydrolysis and nitrification is one of the principal strategies employed to avoid nitrogen losses in agriculture. Neem has demonstrated activity as a nitrification inhibitor, helping to slow the bacterial activity that is responsible for denitrification, hence decreasing the loss of urea from the soil.

Due to their compositional complexity, neem-based products can act as anti-feedants, growth regulators, sterilants, anti-oviposition, insecticide, antifungal and repellents. Other factors that have stimulated the use of neem-based products for pest control in agriculture are ecological and toxicological aspects (low toxicity to non-target organisms), as well as economic aspects.

These features of neem support its contribution to organic agricultural production systems that are more sustainable and do not generate chemical residues (plants and crops are grown without the use of any agrochemicals). This method also helps to maintain soil productivity, ensuring longer production times. Organic agriculture can be a viable alternative production method for farmers, but there are numerous challenges to overcome. A key to success is to be open to new approaches, and in this respect neem products can effectively contribute to organic agriculture, being used as organic pesticides and as soil

fertilizers. In addition, growing concerns about conventional agriculture and the demand for products that do not generate waste justify increased adoption of the use of biopesticides by farmers, which contributes to the growth of organic agriculture.

Commercial products derived from Neem:

Beyond all the possible pesticides and pharmaceuticals, neem provides many useful and valuable commonplace materials. For instance, oil extracted from the seeds goes into soaps, waxes and lubricants, as well as into fuels for lighting and heating. The solid residue left after the oil is removed from the kernels is employed as a fertilizer and soil amendment. In addition, wood from the trees is valued for construction, cabinetry, and fuel. The bark is tapped for gum and extracted for tannins and dental-care products. The leaves are sometimes used for emergency livestock feed. And the profuse flowers are a prized source of honey.

Table 1: Neem product and its manufactured companies

Table 1		
Neem applications and commercial products available worldwide.		
Application	Product	Manufacturer
Fertilizer	Ozoneem Cake [®]	Ozone Biotech (India)
	Plan "B" Organics – Neem Cake [®]	Plan "B" Organics (USA)
	Fortuneem Cake [®]	Fortune Biotech (USA)
	Bio Neem Oil Foliar [®]	FUSA – Fertilizers of the USA
	Neem Cake [®]	Unibell Corporation (Russia)
	Ozoneem Coat [®]	Ozone Biotech (India)
	Parker Neem Coat [®]	Parker Neem (India)
	Neem Urea Guard [®]	Neemex (India)
	Fortuneem Coat [®]	Fortune Biotech (USA)
		<i>Azadirachtin-based products</i>

Pest/Insect management by neem product:



Neem oil works in a number of different ways. The oil forms a coating on the insect's body, blocking the breathing openings and suffocating the insect. It also has a repellent effect on certain insects and mites. Neem oil prevents the germination and penetration of some fungal spores. In one study, researchers discovered that one percent neem oil treatment was effective in managing powdery mildew on hydrangeas, lilacs and phlox.

More than 60 insect pests may be affected by azadirachtin including aphids, beetles, caterpillars, lace bugs, leafhoppers, leafminers, mealybugs, psyllids, thrips and whiteflies. Due to its insect growth regulating properties, it is most effective against the immature stages of insects. For example, the immature larvae of many species in the Lepidoptera family (moths and butterflies) are particularly sensitive to azadirachtin. Neem products may be registered for use on certain fruits, herbs and vegetables in addition to ornaments. For edible crops, some neem-based products may be used up to the day of harvest.

Benefits of neem as biopesticide:

1. Neem Pesticide is a natural product, absolutely nontoxic, 100% biodegradable and eco-friendly.
2. It is suited for mixing with other synthetic pesticides and in fact, enhances their action.
3. None or a lesser quantity of synthetic pesticides needs to be used, thereby reducing the environmental load.
4. Several synthetic pesticides being single chemical compounds cause easy development of resistant species of pests. Neem consists of several compounds; hence development of resistance is impossible.
5. Neem does not destroy natural predators and parasites of pests, thereby allowing these natural enemies to keep a check on the pest population.
6. Neem also has systemic action and seedlings can absorb and accumulate the neem compounds to make the whole plant pest resistant.
7. Neem has a broad spectrum of action active on more than 200 species of pests.
8. Neem is harmless to non-target and beneficial organisms like pollinators, honey bees, mammals and other vertebrates.