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Kunapajala: A Eco-friendly Biofertilizer of Indian Origin And Its Relevance

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Abstract:

Increasing human population, particularly in developing countries urges for more food production. In modern period, farming community is more inclined towards chemical-based agriculture. However, its charm is now placed on the descending spirals because of hazardous impacts on health of soil containing both flora and fauna. Under such circumstances, a trend is discernible to adopt organic farming and provided guidelines through their treatise. One of these, Surapala's Vrikshayurveda (10^{th}-14^{th} Century AD.) is a masterpiece which included information on biofertilizers using plant and animal remains. The sage Surapala advised the farmers to employ 'Kunapajala' in agriculture sustaining their lives. This ancient biofertilizer, although time-tested, is employed on experimental basis by the Indian scientists. The present authors reviewed all such literary sources validating their scientific claims and to find out any relevance in modern period. The subject matter is dilated in view of its insights, benefits, probable modifications, etc. and relevance in modern period addressing agro-climatic zones of India.

Key Words: Kunipajala, Organic Liquid Biofertilizer, Vrikshayurveda.

Introduction:

Organic agriculture generally based upon use of organic manures, organic mulching, bio-pesticides, etc. and adoption of eco-friendly practices. Organic products and various organic conventional formulations are also associated with it in the form indigenous technical knowledge. Kunapajala is one of them traditional liquid formulation produced using plant and animal sources through fermentation. The earliest mention of this formulation is found in the treatise *viz*., Surapala's Vrikshyurveda developed during 10^{th}-14^{th} Centuries (Sadhale, 1996). It contains 60 pages in the form of 325 verses in Devnagari script. It is written neatly in uniform hand and each line contains generally six lines (rarely five to seven).

Vrikshayurveda forms a part of Ayurvedic history and thought as a separate subject because of its extensive nature and importance. Sharangadhara (1283-1301 AD.) was a scholar in the court of King Hammira of Sakambhari-desa (present Bundelkhand, India). Similarly, it is also noted in 'Lokopakara', a treatise by the poet Chavundaraya (about 1025 AD.) in Karnataka (*cf*.Iyengar, 1950; Ayangarya, 2006). The term 'Kunapajala is meant as 'smelling like a dead body, stinking' and Jala as water (liquid). The term is appropriated so because it involves fermentation of animal remains (e.g. flesh, marrow, etc.) inclusive some plant parts. This compound is generally nourishing for plants. It attracted attention of modern research scholars and being implemented with some modifications. The present authors thought it worth to review in the present time and to know its relevance. Earlier researches have been critically examined to arrive at concrete conclusion.

Systematic Enumeration:

(I) Preparation of Kunapajala:

Verses 101 to 106 state the procedure to prepare the compound *viz*., Kunapajala according to Sage Surapala as the following:

(1) The excreta, marrow of bones, brain, flesh and blood or a boar mixed with water and stored (Verse: 101).

(2) Fat, marrow and flesh of fish, ram and goat, and other horned animals should be gathered and stored (Verse: 102).

(3) The above contents should be boiled after mixing with water. It should be stored in an oiled pot and sufficient quantity of husk to be added in it (Verse: 103).

(4) Oil-cake using seeds Sesame (*Sesamum indicum* L.) and honey should be added after cooking (roasting) it in an iron pot (Verse: 104).

(5) The above contents should be taken randomly. These should be placed, one by one, in a pot in a warm place by a competent person (Verse: 105).

(6) The ancient sages and sage Surapala thought 'Kunapajala' highly nourishing for trees (Verse: 106).

In later verse, sage Surapala also mentioned wastes (excreta) from other animals e.g. cow, cat, birds, elephant, deer, etc. He thus permitted some flexibility to the farming community while preparing 'Kunapajala' as per one's convenience. The Sage Surapala also mentioned other sources for flesh, marrow from deer, pig, sheep, goat and rhinoceros (cf. Verses: 171-174). He has also not made clear about fixed amount of these contents.

Sharangadhara also confirmed recommendation by Sage Surapala opined to have any animal waste to prepare 'Kunapajala'. He made reference even to sources like Blackgram [*Vigna mungo* (L.) Hepper], ghee, milk and honey. However, he specified incubation of boiled 'Kunapajala' for two weeks period.

The treatise viz., Vishvavallabha is compiled by Chakrapani Mishra (1577 D.) (*cf*.Sadhale, 2004) wherein he provided procedure to prepare 'Kunapajala' in Chapter VII as the following:

(1) Fat, marrow, skin, blood along with narrow secretion of ram, sheep, deer, fish, etc. should be mixed with water and cooked on fire. Milk and cold water should be added after proper cooking (Verse: 2).

(2) Oilcake of Sesame seeds (*Sesamum indicum* L.), honey and ghee should be added to it. Then the pot should be removed from the fire. It should be placed in a warm place for 15 days. This compound is nourishing for trees (Verse: 3).

Recommendation by the sage Sharangadhara appear to have been followed by Chakrapani Mishra.

It is to be noted further that the principles of Kunapajala also evoked in other ancient texts e.g. Kautilya's Arthashastra (4th Century BCE), Brihat Samhia (6th Century CE) and Charaka Samhita (4th Century BCE.) (*cf*.Sharma, 2019). The sage Parashara (4th Century CE) also informed about organic liquid manures but not explicitly as 'Kanapajala'.

Modifications of Kanapajala:

The authors who paid attention on 'Kunapajala' (*cf*.Sadhale, 1966; Majumdar, 1935) also pointed out flexibility regarding contents to be used for preparation of Kunapajala. This trend has been also picked up belatedly by research scholars (Narayan, 2006; Ali *et al*., 2012; Nene, 2012, Thakur, 2018, Naik, *et al*., 2022). Another modification of application of Kunapajala along with Panchagavya has been also on record. Panchagavya consists products from cow such as cow dung, cow urine, cow milk, curd and ghee (Nene, 2018; Ankad *et al*., 2017; Sarkar *et al*., 2014). These attempts also yielded good results. Nene (1999) explained that Kunapajala

might also be prepared by using plant-based products as a raw material without animal flesh. This leads to categorization into two: (i) Herbal and (ii) Non-herbal. The farmer one is also called 'Shasyagavya'. Thus, over the course of time, alteration or modification in Kunapajala preparation is reported.

Barriers In Adopting Kunapajala:

(i) Absence of standardized guidelines limits adoption on commercial basis, (ii) To establish quality control measures and microbial composition analyses in necessary to ensure consistency in its agricultural use. (iii) There are inconsistencies in formulation, efficacy and rates of application. (iv) Regulatory frameworks is essential to be revised to accommodate traditional biofertilizers within organic certification program. (v) Many farmers are unaware about benefits of Kunapajala. Therefore, training programmes are essential for farmers especially by governments (*cf.* Thakur *et al*., 2025).

Future Directions:

(i) Field trials on large scale on various benefits or impacts of Kunapajala in comparison to conventional fertilizers should be exhibited, (ii) Standardized protocols and formulations should be projected, (iii) Integration of Kunapajala into regenerative farming and agroforestry is also necessary, (iv) There should be attempts to reveal impacts on tree-crop interactions. (v) Interdisciplinary research, bridging agroecology, microbiology, environmental policy will play a key role to disclose its full potential in modern farming systems (cf. Thakur et al., 2025).

Key Insights And Benefits From Kunapajala:

(1) Formulation of liquid organic fertilizer composed from decomposed plant and animal remains can be utilized for enhancing agricultural produce.

(2) Anaerobic fermentation process enhances microbial activity and thereby leads to improved soil health and availability of nutrients.

(3) Useful to counter soil degradation and excessive use of chemical fertilizers.

(4) Significantly enhances flowering, fruiting and disease resistance of various crop species.

(5) Apart from being organic fertilizer, it aids in soil conservation, plant health restoration and pest management.

(6) Vegetation growth increased.

(7) The microbial consortia stimulate cell division and elongation (Shreekant *et al*., 2024).

(8) These microbes enhance nutritional assimilation and promote meristematic area and biomass accumulation.

(9) Through cooking and fermentation of the raw materials of Kunapajala, fat, carbohydrates and protein and broken down well into simple products resulting thereby in quicker and greater availability of nutrients to plants.

(10) It uplifts the agricultural activity.

(11) Use of Kunapajal and Panchagavya combining in different ratios is also found yielding better results. These help better utilization of leaf nitrogen, efficient photosynthetic activity and yield improvement (*cf.* Thakur *et al*., 2025; Shreekant *et al*., 2024; Sarkar *et al*., 2014).

Scientific Benefits From Kunapajala:

(1) Crop produce increased by natural plant growth regulators.

(2) Reduction in susceptibility to pests and diseases by strengthening plant immunity.

(3) Encouragement to beneficial activities of microbes.

(4) Enhancement of nutrient retention and soil structure. (*cf*. Thakur *et al*., 2025).

Results And Discussion:

Sustainable agriculture and soil fertility have been lent support by organic amendments like the fermented biofertilizers. Surapala's Vrikshayurveda (Sadhale, 1966) contained valuable guidelines on this line (Nene, 2012). The biofertilizer suggested by Surapala is named as 'Kunapajala'. This formulation is aimed at promoting long-term soil health by enhancing microbial activity and nutrient cycling (Lal, 2004). Kunapajala is scientifically validated for its efficacy to sustain soil management (Chakraborty *et al*., 2019). Its microbial richness and enzymatic potential demonstrated its role as a bio-stimulant and biofertilizer (Thakur *et al*., 2022). Kunapajala thus represented a sustainable eco-friendly biofertilizer which aligned with modern regenerative agriculture enhance soil microbial diversity, help to improve nutrient cycling and supported plant resilience thereby rendering it as an effective alternative to synthetic fertilizers (Lal, 2004), Kunapajala offered a scientifically tested environmentally restorative alternative which help integrate ancient wisdom with agro-ecological innovations.

Maintenance of biodiversity, enhancement of biological activities by preserving the natural flora and fauna of soil, optimization of complexity of flora and fauna along with abiotic production factors in food grain production ecosystems, revitalization and restoration of overall soil health, etc. have been a central focus while extending the principles of Kunapajala. Even by application of Kunapajala wasteland can be converted into productive and sustainable land by improving the biological, physical and chemical parameters of the soils. Kunapajala thus plays a crucial role in the overall growth and development of crops, apart from providing resistance to them against a variety of pests and diseases. However, popularization of this ancient biotechnological advancement is the dire necessity of the hour for sustainable development of Indian agriculture and may be rendered, in future, for its global acceptance and relevance.

Chemical agriculture has culminated into an adverse impact on the healthcare of not only soil but also the beneficial soil microbial communities and the plants that are being cultivated in these soils. Therefore, the present global scenario obviously emphasizes the need to adopt eco-friendly agricultural practices for sustainable agriculture. Organic farming was systematized and developed since ancient times in India. Vedas and other ancient lexicons specify the use of 'Panchagavya' and 'Kunapajala' in agriculture for improving soil and plant health. These two manures are also validated for their beneficial applications. Some concrete protocols are, however, should be developed looking at the agro-climatic factors prevailing in India and also elsewhere.

The excessive and unscientific practices of intensive farming with injudicious use of chemicals exerted a major setback in agricultural activity in recent times in India. There is a need a paradigm shift towards eco-friendly organic approach. The present authors, therefore, urges for scientific approach. The present authors, therefore, urges for scientific testing through multi-crop, multi-locational research trials and scientific analysis of the quality and efficacy of liquid organic formulations such as the Kunapajala and its combination with panchagavya. The observations based on experimentations by the ancient Indian sages and scholars thus can be extended further for welfare of mankind.

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