Effect of Panchgavya on crop ecosystem

Abstract

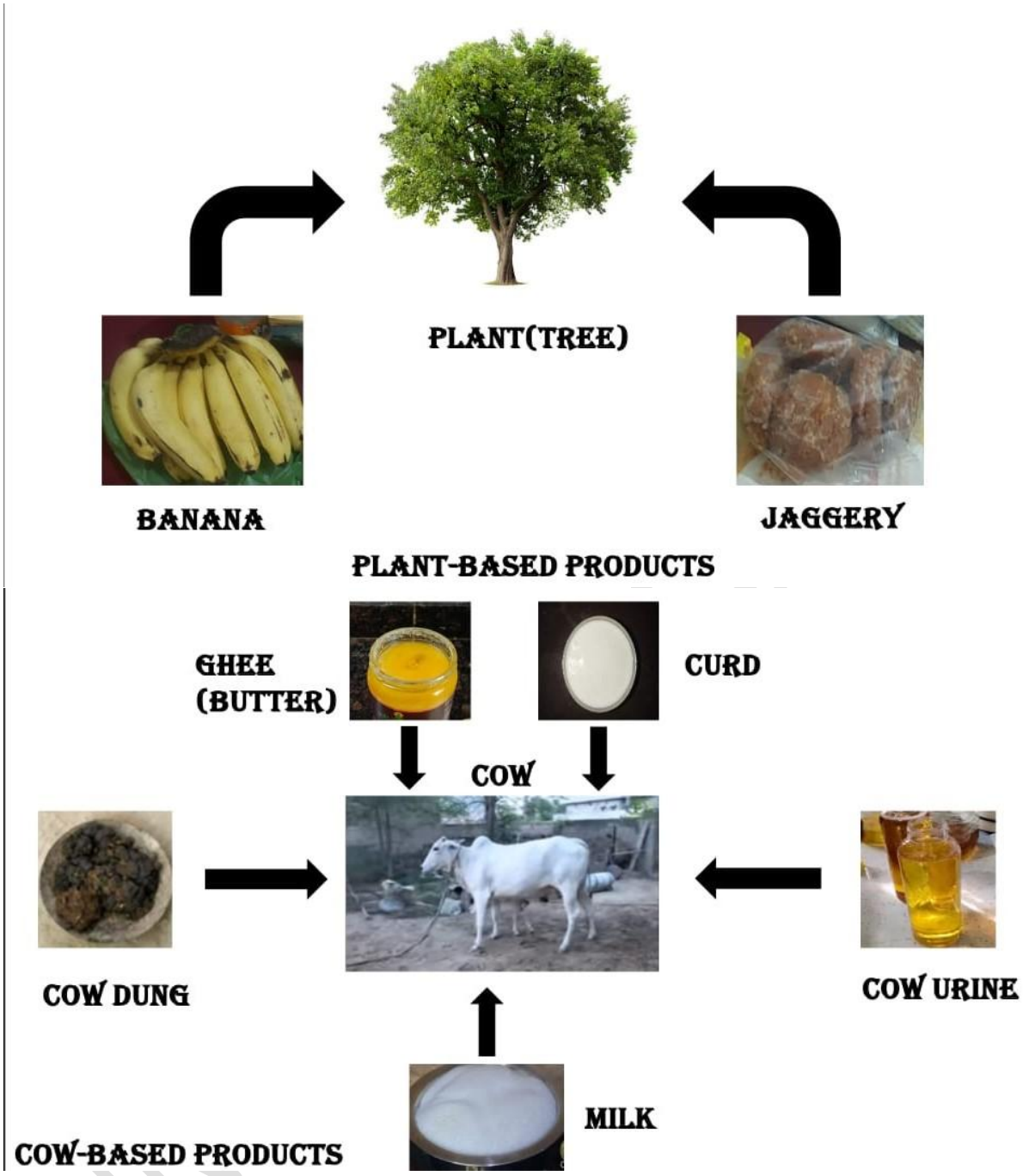
Panchagavya, a traditional organic formulation derived from cow products, has gained recognition for its potential agricultural benefits. This review paper focuses on the influence of panchagavya application on ecosystem dynamics, focusing on soil health, plant growth, and microbial communities.Panchagavya, an ancient agricultural practice rooted in Indian traditions, has garnered increasing attention in recent years for its potential to revolutionize modern farming. Comprising five key ingredients sourced from cows—milk, curd, ghee, cow urine, and cow dung—panchagavya is hailed as a holistic approach to agriculture that not only enhances crop yields but also promotes environmental sustainability and animal welfare.The composition of panchagavya is simple yet potent. The five ingredients are carefully mixed and allowed to ferment, promoting the growth of beneficial microorganisms. These microorganisms are a key component of panchagavya's efficacy, as they play a pivotal role in soil enrichment and plant health. Panchgavya has many health benefits also as all elements used in it responds individually in various diseases. This review gives an observation on effect of panchgavya on soil fertility and plant growth in detail.

Keywords: soil fertility, panchgavya, plant growth, microorganisms

Introduction:

India is a traditionally rich country with its roots embedded in nature a cow is worshipped as Gaumata due to its nourishing nature panchagavya is an ayurvedic system of medicine obtained by using ghee, urine, dung and curd it is derived from two words panch stands for five and gavya stands for the product obtained from cow(Kumar and Singh, 2020). Each gavya exerts and benefits mankind against various diseasespanchagavya is also called as cowpathy, which basically utilizes five cow products as they all have medicinal properties and panchagavya is also usedby making different combinations with herbs which are beneficial for curing diseases such as rheumatoid, alopecia,arthritis and allergies,by adding a few more ingredients the modified version has many beneficial effects on variety of crops and livestock. The concept of "Panchagavya" stands as a testament to the harmonious relationship between humans, nature, and livestock (Kumar and Singh, 2020). Panchagavya acts as an immunity booster and it also act as a growth promoter in human body.It increases the growth and development of plants and zoo plankton.The historical roots of panchagavya can be traced back to traditional Indian texts where the cow has held a revered status as a symbol of life-giving sustenance.The Vedic scriptures extol the cow's significance,

emphasizing its role as a provider of nourishment and resources. Panchagavya, as a concoction of these quintessential cow products is believed to possess innate properties that can enrich soil, promote plant growth and even contribute to human well-being. It offersnumerous advantageous applications in agriculture and organic farming serving as a high-quality natural fertilizer and biopesticide.It also functions as an alternative energy source with significant medicinal properties bio-fertilizers and pest repellents. cow urine and dung play a crucial role in rejuvenating soil micro-nutrients and fertility which results in the production of food that is free from the health risks associated with chemical fertilizers and pesticides.Among all fertilizers worldwide none are as cost-effective and safe as dung fertilizer.Furthermore, cow dung and urine serve as valuable alternative energy sources, generating biogas and fuel.Incorporating cow dung into agriculture is vital for preserving soil quality and plays a key role in augmenting the earthworm population and facilitating the cultivation of fertile soil.Traditional Indian literature mentions various medicinal benefits associated with panchgavya there is a scarcity of scientific evidence to substantiate these claims from ancient texts.To address this gap the Ministry of Science and Technology under the Government of India has introduced a national initiative called the Scientific Validation and Research on Panchgavya (SVAROP) program. Tahis program's primary objective is to scientifically validate the efficacy, safety, and attributes of panchgavya products the program involves comprehensive studies that explore the activity, effectiveness, safety profile, toxicity and public acceptance of both panchgavya and other products derived from cows.The current review focused on examining the composition of each panchgavya product along with its potential health benefits and medicinal properties all of which are analyzed based on the existing scientific evidence available (Kuldeep *et al*., 2013). Panchagavya, an organic product holds the promise of significantly contributing to the enhancement of plant growth and immune defense the biochemical characteristics of panchagavya unveil its abundant content of vital nutrients such as nitrogen (N), phosphorus (P), potassium (K) as well as essential micronutrients necessary for plant health, moreover it contains growth hormones like indole-3-acetic acid (IAA) and gibberellic acid (GA) that are crucial for supporting crop development.



Picture 1 : products used in panchgavya.

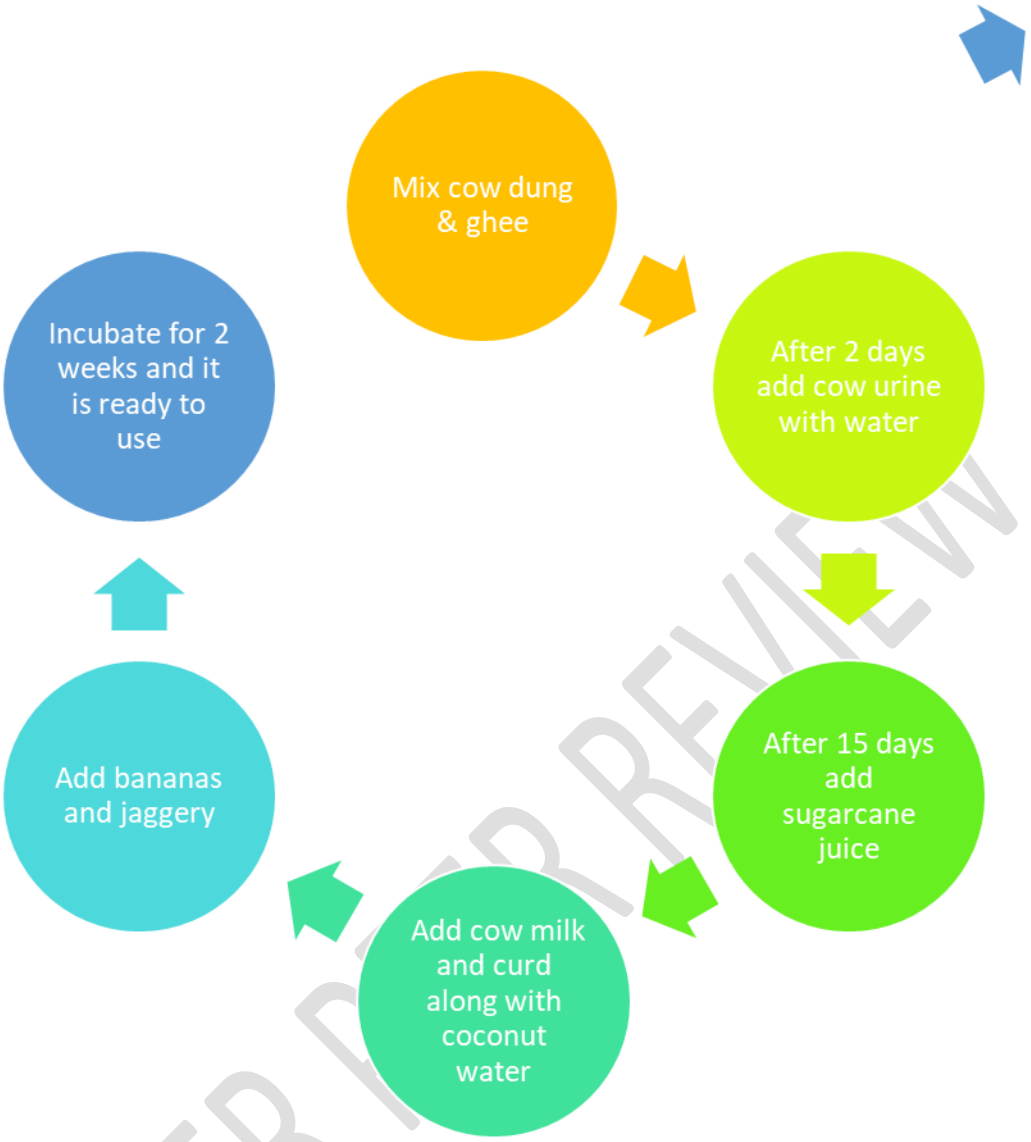
Table 1. Composition and ingredients used in panchgavya

SR.NO	Ingredients required	Compositionforpreparation ofpanchagavya
1.	Cow butter(ghee)	250 g
2.	Cow urine	1.5 L
3.	Cow dung	2.5 kg
4.	Cow curd	1 L
5.	Cow milk	1 L
6.	Sugarcane juice	1.5 L
7.	Banana	1 dozen

Preparation –

1. Thoroughly combine 1 kg of cow ghee and 7 kg of fresh cow dung.
2. After 2 days add three kgs of cow dung with 10L of water.
3. Stir well during every morning and evening for a week.
4. Add 3 L of sugarcane juice and 2 L of cow milk.
5. Add 2L of cow curd and 3 L of coconut water.
6. Add 12 ripe bananas and 100 g of yeast.

Flow chart representing preparation of panchgavya



Picture 2: Potential effects of panchagavya on plant growth based on traditional knowledge and anecdotal evidence:

- Nutrient supply: Panchagavya contains various nutrients, including nitrogen, phosphorus and potassium, along with micronutrients.These nutrients can be absorbed by plants which promotes their growth and development (Avudaithai *et al*., 2010).
- Microbial activity: Panchagavya contains certain beneficial microorganisms that can enhance the soil's microbial diversity these microbes may assist in nutrient cycling and make essential nutrients more available to plants (Reddy*et al*., 2014).
- Enhanced root development: Some proponents of panchagavya suggest that it promotes root development which can lead to improved nutrient and water uptake by

plants stronger root systems can also make plants more resilient to environmental stress.

- Disease resistance: The beneficial microorganisms in panchagavya may help suppress harmful pathogens reducing the risk of plant diseases this can lead to healthier and more vigorous plant growth (Kumar *et al*., 2014).
- Stress tolerance: Panchagavya is often used as a foliar spray, and proponents claim that it can help plants tolerate environmental stressors like drought, heat and pests(Panchal *et al*., 2017).
- Improved flowering and fruit setting: Increased flowering and better fruit setting when panchagavya is used potentially leading to higher yields.
- Enhanced nutrient absorption: Panchagavya may promote the absorption of nutrients by plants through mechanisms such as improved root mycorrhizal associations these associations can facilitate the uptake of nutrients from the soil.
- Reduced chemical dependency: The use of panchagavya is often associated with organic farming practices which aim to reduce the reliance on synthetic chemicals and pesticides this can contribute to overall plant health and sustainability (Avudaithai *et al*., 2010).
- It's important to note that the effects of Panchagavya on plant growth can vary depending on factors such as soil type, crop type, application method and specific formulation of panchagavya used.

Table 2 : Various growth parameters of different crops after the application of panchgavya.

Crops	Groups	Plant height(cm)	Branches Height	Fruit length (cm)	No. of pods	Pods length (cm)	No. of seeds pods	Weight of seeds (g)	Yield Plant (g)	References
Capsicum Frutesces	Control Panchagavya 3%	75.20 89.33	21.55 28.66	24.55 79.11	--- ---	--- ---	--- ---		41.57 167	ALI, et al.,
Raphanus Sativus	Control Panchagavya 3%	26.75 ---	14.0 ---	--- ---	--- ---	--- ---	--- ---		66.8 77.4	Chavda, et al., (2013
Capsicum Annum	Control Panchagavya 3%	3.55 11.60	1.73 2.88	1.73 2.88	--- ---	--- ---	--- ---	1.73 2.88	6.74	Anal K. Jha Prasad (201
Lycopersicon Esculentum	Control Panchagavya 3%	58.28 66.91	3.94 5.40	11.43 12.74	--- ---	--- ---	--- ---	37.98 47.23	24645 31612	Khanna (20
Allium Cepa	Control Panchagavya 3%	1.8 5.2	--- ---	13.90 0.57	--- ---	--- ---	--- ---		0.44 1.33	satya et al.,
Abelmoschus Esculentus	Control Panchagavya 3%	131.7 ---	--- ---	--- ---	--- ---	--- ---	--- ---	25.67 3.92	0.268 65.43	Suchitra Ra (2017)

Table explanation - In *Capsicum frutesces*application of panchgavya (3%) increased plant height (89.33 cm) as compared to control (75.20 cm) (Ali et al., 2011). Similarly, branch height was higher with application of panchgavya (3%) by 28.66 cm as compared to control (21.55 cm). Likewise, fruit length was higher by 79.11 cm with application of panchgavya (3%) as compared to control (24.55 cm). Yield in Capsicum frutesces was higher (167 g) as compared to control (41.57 g) with panchgavya treatment @ 3%.In *Raphanus sativus* plant yield was reported more by (Sharma*et al*., 2013). In *Capsicum annum*(Anal and Jha, 2011) reported an increase in plant height by 11.60 cm, branches length by 2.88 cm, fruit length 2.88 cm and seed weight also increased. (Khanna*et al.,* 2018) observed increase in plant height, branches length, fruit length, weight of seeds and yield by application of 3% panchagavya in *Lycopersicon esculentum* there was an increase in plant height and yield in *Allium cepa* observed by (Prakash*et al*., 2022).It was observed by (Rakesh *et al*., 2017) an increase in yield in *Abelmoschus esculentus* from 0.268 cm to 65.43 cm. In oil seed crop *Brassica campestris (*Ali *et al*.,2011) observed an increase in plant height from 82.97 cm to 94.33 cm, in branches length increased from 7.33 cm to 8.57 cm and yield was also increased.

Effect of panchagavya on soil fertility

Panchagavya has a major role in enhancing soil fertility status by increasing natural and beneficial microbes it also enhances water holding capacity of plants as it acts as organic manure plants with panchagavya application also shown the mechanism of increase in nutrient uptake however, it's important to note that scientific research on panchagavya's effects is limited and the results can vary depending on factors such as soil type, crop variety and application methods.

Here are some potential effects of panchagavya on soil fertility:

Available nutrients in the rhizosphere: It is also clear that panchgavya solution added to the soil significantly affects the availability of P the impact of panchgavya solution on the availability of P was more significant in the early days of treatment (up to 5 DAA), diminished steadily with time and diminished to a level comparable to the control at harvest however, it was discovered that throughout the whole crop growth period, the availability of Fe, Zn, Mn, and Cu was much higher than the control Evidently, applying panchgavya to the soil at a rate

of 3 l/m2 improved the availability of P, Fe, Cu, Zn, and Mn at all panchgavya levels (Kumawat *et al.,* 2012).

Nutrient enrichment: Panchagavya contains various nutrients and microorganisms. The organic matter in cow dung and urine can provide essential nutrients like nitrogen, phosphorus, and potassium to the soil, which are important for plant growth. The use of panchgavya at 6% foliar spray and Jivamrut as a soil treatment at 500 l/ha led to the highest absorption of N by kernel (55.74 kg/ha), which was noted. Additionally, compared to the other treatments, it exhibited a much greater absorption of N by haulm (49.65 kg/ha). One of the significant chemicals in panchagavya and jivamrut that was readily accessible to the plants and directly influenced the nitrogen content of leaves was the uric acid-rich cow urine, which was readily soluble and liquid in form. Due to the cosmic energy generated by stirring the stock solution, panchagavya corrects imbalances in physical, chemical, and biological processes (Patel *et al.,* 2018).

Microbial activity: Cow dung and urine are rich sources of beneficial microorganisms. When panchagavya is applied to the soil, it can enhance the microbial activity in the rhizosphere (the region around plant roots). These microbes can break down organic matter, release nutrients, and improve soil structure. (Mathivanan et al., 2006). The total microbial count, residual soil fertility, including the amount of P, K, and OC (organic carbon) that is accessible, as well as the overall number of viable bacteria in the soils, are all significantly improved. It can thus be suggested as a different source of nutrients for organic farming (Patel *et al.,* 2018).

Soil conditioning: Panchagavya can help improve soil structure and water-holding capacity. It encourages the formation of soil aggregates, which can enhance aeration and drainage in the soil.

Disease suppression: Some studies suggest that panchagavya may have disease-suppressing properties due to the presence of beneficial microorganisms. These microbes can compete with harmful pathogens, reducing the incidence of plant diseases.

Pest control: Panchagavya may act as a natural pest repellent. The odours and compounds from cow urine and dung may deter certain pests, reducing the need for chemical pesticides.

PH balance: Cow urine is known to have alkaline properties. When incorporated into acidic soils, it can help balance the pH, making the soil more suitable for a wider range of crops.

Enhanced nutrient absorption: Panchagavya may improve the nutrient absorption capacity of plant roots by promoting mycorrhizal associations. Mycorrhizal fungi form symbiotic relationships with plant roots, facilitating the uptake of nutrients from the soil.

It's important to mention that while panchagavya has been used traditionally and anecdotally for centuries, scientific research on its efficacy is still ongoing, and results can vary based on specific conditions. Farmers often use it as a part of integrated nutrient management practices along with other organic and conventional inputs. Additionally, panchagavya should be applied in appropriate quantities and in accordance with recommended agricultural practices to avoid overuse, which can lead to nutrient imbalances or other issues. Farmers are encouraged to consult with local agricultural experts and conduct soil tests to determine the best approach for their specific circumstances.

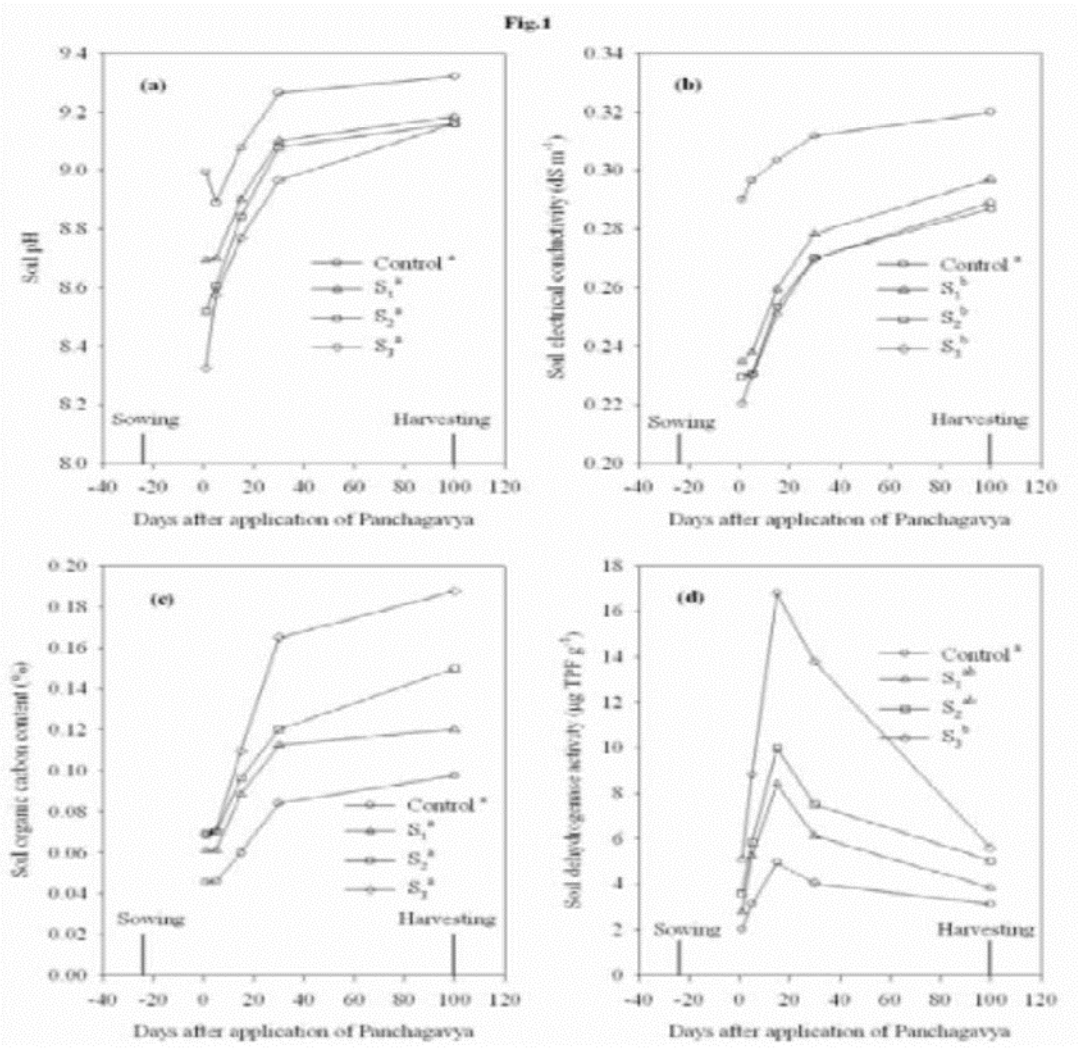


Fig 1. Effect of panchgavya on (a) soil pH, (b) soil electrical conductivity, (c) soil organic carbon content, and (d) soil dehydrogenase activity in the rhizosphere of groundnut; S1, S2, and S3 represents soil application of panchgavya @ 1 l/m2, 2 l/ m2, and 3 l/ m2 row length, respectively The legends in sub-figures with dissimilar superscript are significantly different and vice-versa (Tukey's test, $p<0.05$) (Kumawat *et al*., 2013).

Soil reaction and electrical conductivity: The groundnut rhizosphere's pH and electrical conductivity (EC) at various growth stages as influenced by panchgavya solution (Fig. 1a, b) demonstrated that a gradual increase in its level from 1 to 3 l/m2 momentarily decreased the pH of the rhizosphere during the first five days of the DAA. In a similar vein, EC was much lower than pH in comparison to control. The lowering of pH and EC remained the same up to 5 DAA, after which the differences became very insignificant at harvest. Its low pH (4.35) caused the rhizosphere's pH to decrease when panchgavya was applied. Additionally, the panchgavya solution's fermentation resulted in the production of certain organic acids that lower pH (Kumawat *et al*., 2013).

Dehydrogenase activity and soil organic carbon: The investigated soil had a low level of SOC (0.08%). As a result, the SOC of the groundnut rhizosphere rose significantly with panchgavya (Fig 1c). The groundnut rhizosphere's SOC content increased dramatically after 5 DAA, with the largest rise being recorded at 3 l/m2. Despite this, SOC did not considerably improve at its fluctuating levels throughout 1 to 5 DAA. Soils treated with panchgavya were observed with lowest dehydrogenase activity was depicted at 15 DAA (Fig 1d) (Kumawat *et al*., 2013).

Health benefits of Panchagavya:

Indian breeds of cows are separate species in both look and traits, Cows are the foundation of Indian culture and life in the countryside cattle wealth represents the economy, which maintains our lives as well as biodiversity. Internal administration of antimony sulfide and cow urine is used to treat malignant jaundice Athletes feet: It has a treatment for athletes' feet. It has been noticed that those who clean the cow milk stable barefoot do not get Athletes foot. Immunostimulant Cow's urine contains immunostimulant properties in both plants and animals. Anticonvulsant agent, Cow urine concoction (CUC) is a popular herbal treatment in Nigeria made from cow urine and plants. More than fifty chemicals CUC contains chemicals that have been discovered. Its significance Anticonvulsant and other pharmacological effects on blood sugar levels (Dhama *et al.,* 2005). Incision followed by washing with cow's urine is recommended for sebaceous cysts (large swellings that release a fatty liquid when ruptured). Another treatment consists of a surgical incision and fat excision. Panchagavya performs as a disinfection and preventative agent, and hence it cleans the air and panchagavya has all of the therapeutic components. As a result, it is natural and universal medication that supplies nutrient deficiencies and decreases disease enhanced bodily elements, and it is the quality of the urine, which aids in the treatment of even the most severe diseases. Cow urine includes 24 different kinds of salts. Cow urine remedies are used to treat a variety of ailments diseases. Cow pee contains 95% water and

2.5% urea. Minerals, salt, hormones, and enzymes account for 2.5% of the total. It includes salts, carbonic acid, potash, iron, calcium, phosphorus, nitrogen, ammonia, manganese, iron, sulfur, sulfuric acid, Phosphates, potassium, urea, uric acid, amino acids, and other substances enzymes, cytokines, lactose, and so forth (Bhadauria, 2002). copper has the ability to kill infections and function as an antidote. Immune enhancement may be aided by cytokines and amino acids. Gomutra is the only one who has all of these chemical traits, potentialities, and components capable of eradicating all ills Body impacts, imbalances (Chauhan, 2003). It heals certain drug-resistant germs and Viruses malignancies and other incurable illnesses. The majority of pharmaceuticals are created by distilling urine and collecting fumes. The ark (distillate) is beneficial for a variety of ailments. A variety of illnesses might be addressed. This technique is also being utilized to treat terrible illnesses. Cancer, AIDS, diabetes, and skin disorders are only a few examples. Ayurvedic medicine practitioners (from India) depicted that urine is frequently used as a treatment. It has antimicrobial properties. Antineoplatcis (anticancer), antifungal, antiviral, it is anticonvulsant, antispasmodic, and nontoxic. Improvements in those have been demonstrated or reported. afflicted with the flu, sinusitis, allergies, colds, ear infection, rheumatoid arthritis, aging, bacterial/viral infections, snake bites, chemical poisoning, chicken pox, enteritis, and other diseases like Hepatitis, leprosy, constipation, edema, baldness Obesity, stomach ulcer, depression, and heart disease are all possibilities, hypertension, burns, TB, asthma, tetanus, and other diseases Parkinson's disease, chicken pox, morning sickness, and fever Eczema tiredness, for example. It's also utilized as a diuretic and a laxative.as well as for the treatment of persistent malaria, headaches, and fever. It has been proven to be a universal remedy for blood problems. Leucorrhoea and possibly leprosy are all possibilities The cow's pee cleans the intestines and eliminates accumulated debris. As a result, ailments such as fever, mouth, and skin, Menstrual problems, asthma, giddiness, and other ailments Coughing and urine abnormalities in men are on the rise. Its frequent usage cures without any negative effects. The Panchagavya is superior; it is pungent, peppery, spicy, and warm. and brimming with all five varieties of elixirs. There is proof. It is the finest appetizer & it smoothes and nourishes the heart and contributes to man's wisdom power, as well as their physical strength power as well. It lengthens one's life and cleanses the blood of pollutants.As a result, it is universal medicine and cures. a variety of illnesses. Skin diseases: It is also highly beneficial for all types of skin disorders, such as itching, sunburns, eczema, psoriasis, acne, and so on It also softens and cleans the hair. Patients who have impaired Protein with significant biological value is required for kidney functioning to alleviate pressure on the excretory function kidney (Fulzele et al., 2003)). Diabetes, it not only prevents diabetes but also provides good sugar for diabetic people. As a result, drinking milk allows a diabetic to receive the milk proteins that are physiologically important without

running the possibility of an increase in blood glucose levels. Because of its highwater content, it may be delivered both as Food and liquids. Obesity: A low fat content helps one stay fit and avoid obesity. Milk fat's distinct physical, chemical, and biological features contribute to its digestibility. when compared to other fats. Milk reduces the proclivity. enhances the ability of fat cells to retain the day's calories, and the quantity frittered away as heat. Calcium is an important mineral. signaling substance, assisting various types of cells in determining what they must carry out (Chauhan, 2004).

Conclusion

Panchagavya, derived from cow-based products, holds immense potential in the fields of agriculture, healthcare, environmental remediation, and more. It embodies the harmonious relationship between humans, nature, and livestock, rooted in ancient Indian traditions. The use of panchagavya has demonstrated various beneficial effects on plant growth, soil fertility, livestock health, and environmental sustainability, as supported by both traditional knowledge and recent scientific research. Research in recent years has shed light on the numerous advantages of panchagavya, including its ability to enhance crop yields, improve soil health, exhibit antimicrobial properties, and promote overall well-being in humans and livestock. Additionally, it shows promise in addressing environmental challenges, such as pollution reduction and sustainable energy generation. However, several challenges and hurdles must be addressed for the effective implementation of panchagavya treatments. These include standardization and quality control, scientific validation, sustainability of ingredients, cultural and religious controversies, regulatory frameworks, allergenic potential, economic viability, waste management, and cross-cultural adaptation. Addressing these challenges will be essential for the widespread acceptance and adoption of panchagavya practices. Looking ahead, future research directions for panchagavya should focus on understanding nutrient dynamics, biological mechanisms, formulation optimization, sustainability assessment, safety and toxicity evaluations, biofortification potential, cultural and ethical aspects, technology integration, value-added product development, regulatory framework establishment, globalization, market expansion, and interdisciplinary collaboration. By exploring these avenues, panchagavya can contribute significantly to sustainable agriculture, healthcare, and environmental preservation, both in India and globally.

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