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Panchagavya: A Multidimensional Review Article through the Lens of an Agriculture Scholar

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Authors' contributions

This work was carried out in collaboration among all authors. Author LB designed the study, performed the analysis, wrote the protocol and wrote the first draft of the manuscript. Authors HB and BK managed the analyses of the study. Authors AKD and UP managed the literature searches. All authors read and approved the final manuscript.

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Review Article

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ABSTRACT

Traditional agriculture has been generally considered everywhere as a joint effort of man and cattle. In recent past, a great deal of importance has been given to individual animal product and formulation. Among the liquid formulations, the most widely used is Panchagavya. This traditional organic input has been mentioned in Ayurveda, prepared by using five components derived from cow *viz*. milk, curd, ghee, urine, dung and all these five products are individually called 'Gavya' and collectively termed as 'Panchagavya' [1]. Besides these five components, enriched panchagavya also contains some additional components like coconut water, sugarcane juice or jaggery, banana and toddy. Coconut water is a cheaper substitute for kinetin which helps in increasing the chlorophyll content of rice. It plays a crucial role in each and every component of crop management like integrated nutrient management [2], integrated pest management disease management. Panchagavya also has a great impact on human and animal health. It holds an important place in Ayurvedic medicine due to its disease curing properties. Ancient Indian scriptures such as *Bhel*

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Sanhita, Kashyap Sanhita, Charak Sanhita, Sushrut Sanhita hail about the glory of the mixture of cow's five essences- the panchagavya. It is believed that consumption of panchagavya results in removal of physical as well as mental disorders and acts as an enhancer of physical strength and life span.

Keywords: Panchagavya; sustainability; liquid formulation; organic farming.

1. INTRODUCTION

The current global scenario firmly emphasizes the need to adopt eco-friendly agricultural practices for sustainable food production. As alternative, number of organic farming systems or traditional agriculture methods such as Biodynamic farming, Natural farming, Panchagavya farming, Rishi krishi, Jaivik krishi, Homa organic Farming etc. emerged in different parts of the country (India). Traditional agriculture has been generally considered everywhere as a joint effort of man and cattle. In recent past, a great deal of importance has been given to individual animal product and formulation. Among the formulations, the most widely mentioned is Panchagavya. It has been a common preparation since ancient times mainly for human and animal health and its use in agriculture was reported first time by Natarajan (2003) [3] in his book "Book on Panchagavya". This traditional organic input has been mentioned in Ayurveda, prepared by using five components derived from cow *viz.* milk, curd, ghee, urine, dung and all these five products are individually called 'Gavya' and collectively termed as 'Panchagavya' [4]. Devakumar *et al.* in 2008 [5] observed the presence of naturally occurring beneficial microorganisms, predominantly bacteria, yeast, actinomycetes, photosynthetic bacteria and certain fungi in organic liquid manures like panchagavya [2]. The positive impact of Panchgavya alone or in combination with various organic nutrient management practices has been found in various crops. *Panchagavya* application is found to be more profitable than recommended fertilizer application and chemical spray [6,7]. The *Ayurvedacharyas* prescribe *Panchgavya* as the apex of total health, both physiological as well as psychological.

2. PROPERTIES OF GAVYA

2.1 Cow Dung

Cow dung had been used by Kautilya (321-296 BC), Varahamihira (505-587 AD), Surapala (1000 AD) and Someshwara Deva (1126 AD) as reported by Nene (1999). It consists of 22 numbers of different beneficial bacteria, fungi and other microorganisms. Cow dung has 82% water and 18% solid matter (minerals 0.1%, ash 2.4 %, organic manure 14.6%, Ca and Mg 0.4%, SO_3 0.05%, Silica 1.5%, N 0.5%, P 0.2% and K 0.5%) [4].

2.2 Cow's Urine

Cow's urine is rich in urea and acted both as nutrient as well as growth hormone [8].

2.3 Cow's Milk

Cow's milk also had been used by farmers in ancient times and reported to be an excellent sticker and spreader. It also acts as a good medium for saprophytic bacteria and virus inhibitor (Nene, 1999). Cow's milk contains protein, fat, carbohydrate, amino acid, calcium, hydrogen, lactic acid and also *Lactobacillus* bacterium. Many micro organisms could ferment either five or six carbon sugars, but the *Lactobacillus* bacterium could ferment both five and six carbon sugars [8].

2.4 Cow's Ghee

Cow's ghee had been used in ancient and medieval times (Kautilya 321-296 BC and Someshwara Deve 1126-AD) for seedling health. It contains vitamin A, vitamin B, calcium and fat and also rich in glycosides which protected cut portion from infection [8].

2.5 Cow's Curd

Cow curd is rich in microbes *(Lactobacillus)* that are responsible for fermentation. Butter milk was also sprinkled on paddy to control the paddy blast disease [8].

3. PREPARATION OF PANCHAGAVYA [3]

Flow chart for preparation of Panchagavya

Mix thoroughly the fresh cow dung (7 kg) + Cow ghee (1 kg)

↓

Incubate for 2 days (mix daily once)
↓
Add cow's urine (3 l) + 10 litres of water
↓
Stir thoroughly (morning and evening, daily for 13 days)
↓
Add sugarcane juice (3 l) or jaggery mixed in water at 1:6 ratio **+** Cow milk (2 l) **+** Cow's curd (2 l) **+** Coconut water (3 l) **+** Yeast (100 g) and Ripe banana (12 Nos)
↓
Stir thoroughly thrice a day for 6 days in clock wise and anti-clockwise direction to release the gas and to oxygenate the solution
↓
Panchagavya is ready to use

Cow's products are the basic components and others are used to improve its efficacy and also to minimizes the off odour. All these items can be added to a wide mouthed mud pot, concrete tank or plastic can as per the above order. Care should be taken not to mix cow products. The products of local breeds of cow is said to have higher potency than exotic breeds. Sugarcane juice and coconut water are reported to accelerate fermentation. Besides these five components, enriched panchagavya also contains some additional components like coconut water, sugarcane juice or jaggery, banana and toddy. Coconut water is a cheaper substitute for kinetin which increases the chlorophyll content of rice [5].

4. PHYSICAL, CHEMICAL, BIOCHEMICAL AND MICROBIOLOGICAL PROPERTIES OF PANCHAGAVYA

Nutrient management through organics play a major role in maintaining soil health due to build up of soil organic matter, beneficial microbes and enzymes; besides improving soil physical, chemical and biological properties. To achieve sustainable soil fertility and crop productivity, the role of organic liquid manures like panchagavya plays a major role in improving plant growth, yield of crops and also improves soil physical, chemical and biological properties and also acts as growth promotion and yield enhancing substance, becoming popular among the farmers.

Besides these, chemolithotrops and autotropic nitrifiers (ammonifers and nitrifers) are also present in panchagavya which colonize in the leaves increased the ammonia uptake and enhance the total N supply [9].

Physico-chemical properties of Panchagavya revealed that they possess almost all the major nutrients, micro nutrients and growth hormones (IAA and GA) required for crop growth. Predominance of fermentative microorganisms like yeast and lactobacillus might be due to the combined effect of low pH, milk products and addition of jiggery or sugarcane juice as substrate for their growth.

Table 1. Physical, chemical, biochemical and microbiological properties of Panchagavya *[4], [10], [11], [12]*

Physical properties		Chemical properties		Biochemical properties		Microbiological properties (Cfu/ml)	
pH	6.82	Total N (ppm)	229	IAA (ppm)	8.5	Fungi	38800
EC (dSm^{-2})	10.22	Total P (ppm)	209	GA (ppm)	3.5	Bacteria	2610000
		Total K (ppm)	232	Acetate	60.05 to 68.28%	Lactobacillus	2260000
		Na (ppm)	90	Propionate	14.39 to 17.79%	Total anaerobes	10000
		Ca (ppm)	25	Butyrate	6.40 to 7.65%	Acid former	360
		OC	17.45%			Methanogen	250
		Total Zn	1.27 ppm			Actinomycetes	4.20 x 103
		Total Cu	0.38 ppm			Phosphate solubilising organisms	5.70 x 102
		Total Fe	29.71ppm				
		Total Mn	1.84ppm				

5. A MIXTURE OF FIVE GAVYAS WITH COUNTLESS BENEFITS

Panchagavya as an organic preparation has a versatile role on soil, plant, human and animal. Panchagavya will be the future of the modern science. As a component of crop production it plays a crucial role in each and every component of crop management like integrated nutrient management, integrated pest management disease management [10].

5.1 Panchagavya and Its Effect on Soil Health

Panchagavya improves fertility status by increasing organic matter content, increasing macronutrients, micronutrients along with increasing nutrient uptake in plants and also encourages growth and reproduction of beneficial soil microorganisms. Panchagavya has been found to be helpful for improving soil physical properties by increasing porosity and maintaining aggregate stability. Panchagavya has a great influence on soil chemical properties as it acts as pH moderator in alkaline and acidic soil due to its neutral pH (6.82). It also enhanced nutrient status of soil and increased more uptakes of nutrients due to more solubilisation. Beaulah (2001) opined that the beneficial microorganisms from panchagavya and their establishment in the soil improved the sustainability of agriculture as the microorganisms presenting the rhizosphere environment around the roots influence the plant growth and crop yield [13].

5.2 Panchagavya and Its Impact on Growth and Yield Attributes of Field Crops and Horticultural Crops

In case of leaf, plants sprayed with panchagavya invariably produce bigger leaves and develop denser canopy. The photosynthetic system is activated for enhanced biological efficiency, enabling synthesis of maximum metabolites and photosynthates [14]. In case of stem, the trunk produces side shoots, which are sturdy and capable of carrying maximum fruits to maturity. Branching is comparatively high. In case of roots, the rooting is profuse and dense [15]. Further they remain fresh for a long time. The roots spread and grow into deeper layers were also observed. All such roots help maximum intake of nutrients and water.

There are many beneficial effects of panchagavya on field crops, horticultural crops, *i.e.,* mainly the commercial crops. Panchgavya contained higher nutrients as compared to farm yard manure (FYM) and vermicompost and also act as insect repellent. Its application on different seeds has positively influenced germination percentage, germination index, root and shoot length, also fresh and dry weight of the seedling [16]. Panchgavya applied soil had higher values of macro and micronutrients (zinc, copper and manganese), microbial activity as compared to FYM and vermicompost applied soils [17]. Application of panchgavya can be gainfully used as an alternative organic supplement in agriculture.

5.3 Panchagavya: A Promising Product in Organic Farming

It is necessary to use natural products like panchagavya to produce pesticide free food crops and hence panchagavya can play a major role in organic farming. There will be yield depression under normal circumstances, when the land is converted from inorganic systems to organic farming. The key feature of panchagavya is its efficacy to restore the yield level of all crops when the land is converted from inorganic cultural system to organic culture from the very first year. The harvest is advanced by 15 days in all the crops. It not only enhances the shelf life of vegetables, fruits and grains, but also improves the taste. By reducing or replacing costly chemical inputs, panchagavya ensures higher profit and liberates the organic farmers from loan. Application of panchagavya produce bigger leaves and develop denser canopy with increasing number of branches and produce quality food with better taste.

5.4 Panchagavya for Pest and Disease Management

Panchagavya, an organic source also proved as a beneficial in suppressing the insect pest and working as a pest-repellent [18]. Panchagavya has the capacity to control the wilt of banana [15]. Soil drenched with Maha Panchagavya (MPG) slurry at 10% has controlled the wilt of tomato successfully and it has been found to be superior to carbendazim in reducing the plant disease index and increasing the vigour of the plant and fruit yield of tomato [19]. The application of panchagavya has increased the

growth and controls the disease of *Solanum malanogens* Linn, and reduces the present disease incidences of crop. Panchagavya was also found to activate soil and to protect plants from diseases. Panchagavya spray with *Agnihotra* (fumigation in the field) recorded the least population of cutworms and highest yield of potato [19].

5.5 Panchagavya for Human and Animal Health

Panchgavya therapy also called as *Cowpathy* has become popular worldwide. Only in New York City of America there are more than 1200 outlets which sell the products made of *panchgavya.* It is a living elixir of many micro organisms, bacteria, fungi, proteins, carbohydrates, fats, amino acids, vitamins, enzymes, known and unknown growth promoting factors micronutrients trace elements antioxidant and immunity enhancing factors. When taken orally by animals and human beings, the living microorganisms in the panchagavya stimulate the immune system and produce lot of antibodies against the ingested microorganisms. It acts like vaccine. This response of the body increases the immunity of animals and humans and thus helps to prevent illness and cures disease. It slows down the aging process and restores youthfulness [19]. The other factors present in panchagavya improve apetite, digestion and assimilation and elimination of toxins in the body. Thus the animals and humans become hale and healthy with shining hair and skin. It not only heal one's body but also lifts up depressed mental states thereby providing positivity, longevity and magnetic charisma. Due to such benefits of *panchgavya,* it is often called as a divine elixir by *Ayurvedacharyas*. Ancient scriptures like *bhel sanhita, kashyap sanhita, charak sanhita, sushrut sanhita, gad nigrah, ras tantra saar* and *yog ratnakar granth* hail about glory of the mix of cow's five essences – the *panchgavya*. According to the TNAU website, the magic potion can "cure arthritis within two months" and help treat several other diseases and conditions such as epilepsy and parkinson's. It can reduce blood sugar levels and enable diabetic patients to reduce the dose of anti-diabetic drugs. In the case of TB, it can reduce the duration of treatment by one month. For people with AIDS/HIV, "even though the blood tests will be positive, patients will exhibit no symptoms of AIDS and lead a normal healthy life".

6. PANCHAGAVYA: A SUSTAINABLE OPTION FOR FUTURE

The world commission for environment and development coined the definition of sustainable development in the year 1987 as 'the development which satisfies the needs of current generations without compromising the needs of future generations' (WCED 1987). Currently, there is an ever-growing range of sustainability claims and indicators. Collectively however, all fail to establish operational and practical ways to understand what sustainability actually means, and to deliver it effectively [20]. As previously stated, it is estimated that the global food demand will double over the next 50 years [21]. This means more land will need to be utilised for farming. However, it is reported that half of our planets terrestrial farmland is already being used to its full potential [20]. The majority of the earth's farmland is exploited due to the industrialised nature of our modern farming practices. Once land has been used beyond its carrying capacity, the soil very rarely regenerates back to a fertile state, leaving it barren and useless [22,23]. This is where organic agriculture with some organic formulations can be of a massive advantage to the agriculture sector. A study by Tavernier and Tolomeo (2008) states that sustainable agriculture is an approach that needs to clearly maximise economic and social benefits while at the same time maintaining environmental quality. Some researchers believe that a "large-scale shift towards organic farming with panchagavya would not only increase the world's food supply, but might be the way to eradicate hunger"

7. CHALLENGES TOWARDS ADOPTING PANCHAGAVYA

Panchgavya has the quality to improve the productivity of primary sectors like agriculture and animal husbandry apart from protecting environment, human treatment. However, it is rejected as myth or mythological adventures by certain section of people in India and abroad because of it lack of validation of procedure, product and international recognition. It is therefore necessary to blend science to make awareness among the people worldwide.

8. RECOMMENDED DOSAGE

1. **Spray system:** 3% solution was found to be most effective compared to the higher and lower concentrations investigated [23].

2. **Flow system**: The solution of panchagavya can be mixed with irrigation water at 50 litres per hectare either through drip irrigation or flow irrigation [24,25].
3. **Seed/seedling treatment**: 3% solution of panchagavya can be used to soak the seeds or dip the seedlings before planting. Soaking for 20 minutes is sufficient. Rhizomes of turmeric, ginger and sets of sugarcane can be soaked for 30 minutes before planting [26,27,28].
4. **Seed storage:** 3% of panchagavya solution can be used to dip the seeds before drying and storing them [29].

9. STORING OF PANCHAGAVYA

Panchagavya has to be kept in the shade and should cover it all times. Care should be taken that no insect falls in the mixture or lays eggs in it. To prevent this, the container should always be covered with a wire mesh or plastic cover. Panchagavya can be stored for 60 days without any effect to its quality, provided that it is kept in the shade and is being stirred twice a day. The solution thickens over time, so water must be added appropriately [19].

10. CONCLUSION

The increasing concern for environmental safety and global demand for chemical residue free food has evoked keen interest in crop producers to produce eco-friendly products. The increasing concern for environmental safety and global demand for pesticide residue free food has evoked keen interest in crop production using eco-friendly products which are easily biodegradable and do not leave any harmful toxic residues besides conserving nature. So it is necessary to use natural products like panchagavya to produce chemical residue free food crops and hence it can play a major role in organic farming.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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