

Review Article

Application of Liquid Manures on Growth of Various Crops: A Review

Priyanka Maity, Robin Rijal and Adesh Kumar*

Department of Plant Pathology, School of Agriculture, Lovely Professional University,
Phagwara (Punjab), India-144411

*Corresponding author

ABSTRACT

Unscientific use of pesticides and synthetic fertilizers in agricultural field will leads to various health hazards and environmental issues. To save our environment and our crops we have to follow ecofriendly and sustainable agriculture. Minimizing the use of harmful chemicals and fertilizers will reduce the ratio of this type of problems. Liquid manure are rich source of micro and macro nutrients, it consist of growth promoting factors like auxin, gibberelins and beneficial microorganism which promote the plant growth and providing immunity in the plant. Organic farming is one the solution for this generation to reduce all the hazards. We have plenty of this organic resources present in India and the extract from these resources can be utilized to improve the soil health in respect of physical, chemical, biological properties of soil and will help in obtaining good yield. This review article is associated with the application of three popularly useable organic supplement Panchagavya, Jeevamrut and Compost tea on Spinach. In India, Use of Panchgavya had been maintained in the 'Vedas' which has specified the use of 'Panchgavya' in the field of Agriculture. The efficiency and efficacy of some cowpathy like Panchagavya, Jeevamrit and composttea will enhance the biological efficiency of crop plant and improve soil health in organic farming. It will enhance the productivity of different crops and suppressing the growth of various plant pathogens by producing antibacterial and antifungal compounds.

Keywords

Productivity,
Panchyagavya,
Jeevamrut,
Compost tea,
Microorganism,
Antibacterial,
Antifungal

Introduction

The concept of biofertilizer is mentioned in Vrikshyaurveda under the generic name 'kunapajala' by Surpala (1000 AD). Application of liquid bio-fertilizers plays an important role in organic farming leading to green food production which is safer, healthier and tastier. Now a days organic agriculture plays a vital role in terms of nutrition, prevent environmental pollution etc. Organic manures are the best natural soil amendment, because it contain high amount of nitrogen (Bok *et al.*, 2006). Panchagavya, jeevamrut and compost tea proved

to be efficient plant growth stimulants. Panchyagabya shows huge potential as an organic fertilizer and pesticide (Dhama *et al.*, 2005; Kumar *et al.*, 2005). Jeevamrut is one of the important component of Zero Budget Natural Farming (ZBNF) (BishalChakraborty *et al.*, 2019). Jeevumrut is extremely cost effective for the grower (FAO, 2016).

Compost Tea can be prepared by two methods Non Aerated Method and Aerated methods. Non Aerated method has greater impact on plant growth and disease control (Weltzien *et al.*, 1991; Cronin *et al.*, 1996;

Scheuerelland Mahaffee 2006). These liquid fertilizers can be used as foliar spray, soil drenching and seedling treatment. Sandy loam soil is best suited for Spinach, pH range should be in 6.6 to 6.8 (Van Antwerpen *et al.*, 2000; Bok *et al.*, 2006).

Panchagavya is an organic product which plays an important role for providing growth and immunity in plant. Panchagavya contain all the essential macro nutrients such as N, P, K and and beneficial micro nutrients which is essential for plant and growth hormone viz IAA and GA which is essential for plant growth (Selvaraj *et al.*, 2007).

According to hindu dharma, Panchagavya has an significant effect.It can be used for the preparation of Ayurvedic medicine and as an organic fertilizer for crop production and pesticide for crop management purpose (Dhama *et al.*, 2005). Panchagavya means combination of five products i.e cow dung, cow urine, ghee, milk and curd. Individually each five products are called Gavya and together it is called panchagavya. Panchagavya has a significant effect in terms of quality of fruit and vegetable production. It can be used as a foliar spray, soil drenching and seed treatment (Natarajan *et al.*, 2002). Jeevamrut contain several beneficial microorganisms which are activated in soil by the application of jeevamrut. The microorganisms such as phosphorus solubilizing bacteria, Azotobacter, Azospirillum, nitrogen fixing bacteria and potash solubilizing bacteria like Bacillus silicus are present in cow dung which is the constituents of jeevamrut (Ramprasad *et al.*, 2009). Compost tea contains several living microorganisms which can stimulate plant growth and induce disease resistance (Scheuerell *et al.*, 2002). Compost tea can be prepared by two method i.e. aerated method and non-aerated method. Aerated method contain maximum oxygen condition during

processing whereas non aerated method contain low amount of oxygen during tea extraction (Ingham *et al.*, 2005).

Components are used to prepare: Panchagavya, Jeevamrut, and Compost Tea

Panchagavya, Jeevamrut are made up of urine, cow milk, cow dung, ghee in different proportion and this substance shows different role on the crop. These are given in Table 1.

Effect of liquid manure on soil fertility

Liquid manures contain macro and micro nutrients, which improves soil fertility.

Beneficial microorganisms and micronutrients enhance soil health.

Liquid manure control pest and disease attack.

It improves water holding capacity of soil.

It promotes the plant growth and providing immunity in the plant system. Various beneficial metabolites such as organic acid, hydrogen peroxide and antibiotics are produced by microorganisms which are effective against various pathogenic microorganisms (Solanki *et al.*, 2015).

Liquid manure increase organic carbon content of soil which act as carbon and energy source for microbes and quick buildup of heterotrophic micro-flora and fauna (Table 2).

Benefits of Panchyagavya application

Panchagavya has a wide range of benefits on soil, plant, human and animal. In the field of agriculture it plays an important role in crop production and crop management like Integrated Nutrient Management (INM), Integrated Pest Management (IPM) and Integrated Disease Management (IDM) (Perumal *et al.*, 2006).

Panchagavya and its effect on soil health

Panchagavya increases soil fertility by improving Organic Matter, Micro and Macro nutrient in soil and increase the beneficial microbial population of the soil. It also increases the nutrient uptake capacity of the plant due to more solubilisation in the soil. Panchagavya has shown its effect on maintaining Soil Aggregate stability and increasing soil porosity. It also helps to maintain the neutral pH level of the soil.

According to Beulah (2001) the beneficial microorganisms present into panchagavya improved the sustainability of agriculture as the microbial population present at the rhizosphere zone which influence the crop yield and plant growth (Beulah *et al.*, 2001).

Impact of panchagavya on growth and yield attributes

Application of liquid manure it can produce bigger leaves and denser canopy. It will help to promote photosynthetic activity for enhancing biological efficiency of plant. Panchagavya helps the roots to spread into deeper layer of soil so that it can uptake more nutrients from soil.

Better plant growth helps to increase the photosynthesis system and enable synthesis of maximum photosynthates and metabolites (Ktyal *et al.*, 2003).

There are many beneficial result has been observed after the application of panchagavya on commercial field crops and vegetables. Is contains more nutrient contents than FYM and Vermicompost also show some insect repellent effect.

Application of Panchagavya on various seeds has shown positive impact on germination index, germination percentage, length of root

and shoot, also dry and fresh weight of the seedlings (Kaushik *et al.*, 1994) (Table 3–6).

Panchagavya: Impact on organic farming

It is very important to apply natural organic product like Panchagavya to produce harmful chemical free crops. When we convert a land from Inorganic to Organic system, we will observe yield reduction under normal condition. But Panchagavya has the power to make up the yield level of all crops from the very first year when the land is converted into Organic from Inorganic system. It also improves the shelf life and taste of the grains, fruits and vegetables (Borgohain *et al.*, 2020).

Impact of Panchagavya on insect and pest management

Panchagavya shows its greater beneficial effect in reducing the disease and insect attack and work as a pest- repellent (Swaminathan *et al.*, 2007).

Banana Wilt can be controlled by the application of Panchagavya . Tomato Wilt can be controlled by the soil drenching of Maha Panchagavya Slurry @10%. It is also found that Panchagavya is superior to Carbendazim in increasing the fruit yield and suppressing the Plant Disease Index of Tomato (Selvaraj, *et al.*, 2007).

Jeevamrut

It is organic liquid manure which is an excellent source of nitrogen, phosphorus, potassium, natural carbon and lot of other micronutrients which are required for plant.

Benefits of jeevamrut

Jeevamrut increase the microbial count and beneficial bacteria in soil. Application of jeevamrut will help to increase earthworm

population in soil. Earthworm leads to increase the porous quality of soil and also improve aeration, water holding capacity of soil. It can uptake minerals from deep layer of soil.

Benefits of compost tea

Compost teas are normally defined as brewed and water extracts of composted materials (Ingham *et al.*, 2000).

Teas prepared from Vermicompost also have the same beneficial microorganism and also same chemical components of solid vermicomposts. During the time of “brewing” several factors like beneficial microorganisms, soluble mineral nutrients, fulvic and humic acids, plant growth regulators and plant growth hormones are probably extracted in to the tea from the solid compost (Edwards *et al.*, 2006).

The main objectives for which compost teas are being used in agriculture are

It helps to develop resistance for disease or suppress the disease which promote better crop health and reduce pesticide application, It provides nutrients for better plant growth as well as reduce the fertilizer requirements and production cost.

Increase beneficial soil microorganism and also works on the betterment of water retention capacity, depth of rooting, soil structure and plant growth.

Restricting pathogens growth.

Helps to stimulate natural plant defense system.(Scheuerell *et al.*, 2003; Kelley *et al.*, 2004 ; Grobe *et al.*, 2003)

Plant disease suppression

There are numbers of research are preset on the impact of traditional compost on plant disease reduction. General mechanism for

suppression of plant pathogens mainly based on the competition for nutrient and energy, antagonistic behavior in between pathogen and other microorganisms. More specifically suppression may occur due to competition for pathogen infection sites, or destruction of pathogen propagules such as spores(Edwards *et al.*, 2006).

Disease occur due to plant and soil borne pathogens are suppressed by biological interaction in dynamic environment .there are several mechanism by which these interaction are happening. These mechanisms are as follows-

Antibiosis: Antibiotics produced by some beneficial microorganism or other substances which are toxic for the pathogen like ‘*Pseudomonas florescent*’ strain ‘CHAO’ produces Pyoluteorin and Hydrogen cyanide 2, 4- diacetylphloroglucinol, which effect the growth of various pathogens (Hass *et al.*, 2005; Weltzien *et al.*, 1991; Handelsman *et al.*, 1996).

Competition –the beneficial microorganisms which are present in a growth medium, they have the tendency to compete with pathogen for food source Hoitink *et al.*, 1993).

Induced resistance: some of the beneficial microbes use to colonize on plant foliage or roots that increase resistance or plant tolerance to the plants against infection cause by pathogens by turning on the genes(Hass *et al.*, 2005).

Parasitism: Some of the beneficial microbes show parasitic effect, they can feed on specific pathogens. Trichoderma species secrete specific enzymes that help in digesting the cell wall of some fungal pathogens (Handelsman *et al.*, 1996).

In Improvement of soil structure and plant

vitality Compost tea is comprises of humic acids and other nutrients such as C and N, a large and diverse community of microbes that improve soil and maintain healthy plant growth. Effects of compost tea does not last for long time and frequent applications are required to replenish plant or soil surface with beneficial microbes and/or nutrient (Scheuerell *et al.*, 2002; Ingham *et al.*, 2005; Brinton *et al.*, 1995).

Reported study on application of Panchagavya on various crops

Application on Tomato plant

Shakila and Anburani (2008) as well as Ramesh *et al.* (2015) applied 3% panchagavya solution on tomato plant at 25 DATP over no spray. First flowering at 26 days and 50 % flowering (29.67 days) was observed by the application of it. The early and 50 % flowering in tomato plant due to the presence of high amount of proline amino acid present in milk, as a constitute of panchagavya (Shakila *et al.*, 2008). Similarly the presence of higher amount of endogenous proline enhance auxin and cytokinin toward early flowering in tomato, chilli, okra, cowpea by Mathews *et al.*, (2017).

Application on Chilli plant

Chilli seeds were soaked in 3% panchagavya solution for half an hour and sown on nursery. After 73 DAP first spray of 3% panchagavya solution was given to plant. Every 20 days interval spray was given to plant till the harvesting. The first flowering was observed after 8th day of planting. It was observed that the application of panchagavya enhance the parameters like number of branches per plant, number of flower per plant and total yield per plant (Rao *et al.*, 2015).

Application on Baby corn plant

Recommended dose of fertilizer and panchagavya solution was given to baby corn plant. Cob length, number of cob per plant and cob girth was give advantageous result by foliar spray of panchagavya and recommended dose of nutrients. The highest yield of baby corn viz cob length (25.40, 26.66 cm), cob width (4.44, 4.46 cm) and individual cob weight (28.02, 26.69 g) were observed under RDF + 4 spray of 3% panchagavya at 15, 25, 35 and 45 DAS. Application of RDF and panchagavya spray at different stage of crop growth leads to more extensive root system and better photosynthetic activity on plant (Vimalendran *et al.*, 2013).

Studies on the application of Jeevamrut on various crops

The beneficial effects of Jeevamrut reported by Palekar (2006), Vasanthkumar (2006) and Devakumar *et al.*, (2008) was attributed to higher microbial load and growth hormones which might have enhanced the soil biomass thereby sustaining the availability and uptake of applied as well as native soil nutrients which ultimately resulted in better growth and yield of crops. Significant differences in yield of capsicum per hectare were observed with application of cow urine (Palekar *et al.*, 2006; Vasanthkumar *et al.*, 2006; Devakumar *et al.*, 2008).

The yield of any crop plants depends on the assimilatory surface of the plant system. A sound source in terms of plant height, LAI, number of branches to support and the leaves are logically able to increase the dry matter and its distribution in different parts is important for determination of total yield of the crop (Krishnamurthy *et al.*, 2012). Number of fruits per plant did not differ significantly due to the interaction effect of jeevamrutha and cow urine, jeevamrut and

panchagavya and cow urine and panchagavya. Yield per hectare of capsicum did not vary significantly due to the interaction effect of jeevamrutha and cow

urine, jeevamrutha and panchagavya and cow urine and panchagavya.

Table.1 Components are used to prepare Panchagabya, Jeevamrut, and Compost Tea

Sl.no	Component	Role on plants
1	Cow urine	Various workers have studied that Cow Urine enhance immune response of plant (Kumar <i>et al.</i> , 2004, Dhama <i>et al.</i> , 2005). It has antifungal, antimicrobial and anticancer agent.
2	Cow milk	It consist of vitamin A, B complex group, vitamin C and carotenes. It has rejuvenatory health protecting properties (Dhama <i>et al.</i> , 2005a). It has Antimicrobial effects due to the presence of immunoglobulins, lactoperoxidase, lactoferrin and vitamin B ₁₂ binding protein. Antifungal activity is present due to Lactoferrin B (Bellamy <i>et al.</i> , 1994; Singh <i>et al.</i> , 2004; Dhama <i>et al.</i> , 2005a; Mete, 2009)
3	Cow curd	A lot of lactic acid producing bacteria are present in curd that produces antifungal metabolites viz, cyclic dipeptides, phenyllactic acid and 3-hydroxylated fatty acid (Dhama <i>et al.</i> , 2005)
4	Cow dung	Cow dung has anticeptic and prophylactic (disease preventive) properties (Dhama <i>et al.</i> , 2005).
5	Ghee	Cow ghee is effective in wound healing.

Table.2 Vedic inputs and method of preparation

S.no	Name of the inputs	Quantity of the Components	Method of preparation
1	Panchagavya	Cow dung=1kg Cow urine=3L Cow milk=2L Curd=2g Ghee=1kg	It is a blend of five product obtained from mainly. For making Panchyagavya thoroughly mix the required quantities of ingredients and allow fermenting for 7 days.
2	Compost tea	Vermicompost =5kg Bucket =15L capacity Gunny bag=1no Rope=2-3 m length	A small gunny bags half filled (5kg) with vermicompost is handed over a bucket filled $\frac{3}{4}$ with water in a way that vermicompost remained submerged in water.
3	Jeevamirit	Cow dung=5kg Cow urine=5L Jaggary =1kg Pulse flour=1kg Fertile soil=1/2kg Water=50L	Mix all ingredients in a drum with the help of a wooden stick. Shake the mixture 2-3 times per day regularly for 5-7 days for proper fermentation.

Table.3 Biometric data of *Solanum lycopersicum* L. (tomato) in response to field trials of liquid manures

Sr. No	Test	Germination Rate (%)	Shoot length (mean cm \pm SD)	Yield (mean number of fruits Yield (mean number of fruits \pm SD))
1	Untreated control	20 (50*)	16.57 \pm 4.3	-
2	Panchagavya (Pc)	100 (100*)	67.67 \pm 11.4	4.87 \pm 1.7
3	Jeevamrut (Ja)	70 (100*)	69.87 \pm 10.8	3.17 \pm 0.9

* Seed germination were observed on 4th week after sowing
Ukale *et al.*, (2016)

Table.4 Plant growth of brinjal under different organic plant growth promoter treatments

Treatments	Plant height (cm) (Mean±S.E)	No. of branches /plant (Mean±S.E)	No. of leaves/ plant (Mean±S.E)
Control	56.8±0.3	4.6±0.1	49.3±0.1
T1-Panchagavya (3%)	68.8±0.3	6.0±0.0	70.6±0.1
T2-Panchagavya (5%)	67.1±0.2	4.9±0.1	74.8±0.1

Source: Mohan *et al.*, (2008)

Table.5 Flowering of brinjal under different organic plant growth promoter treatments

Treatments	Days to flowering (Mean±S.E)	Days to 50 percent flowering (Mean±S.E)	No of flowers per plant (Mean±S.E)	Flower drop (Mean±S.E)
Control	34.2±0.2	50.6±0.1	50.2±0.1	27.5±0.1
T1-Panchagavya (3%)	40.5±0.1	54.4±0.1	65.3±0.1	18.3±0.1
T2-Panchagavya (5%)	40.0±0.0	58.0±0.0	62.4±0.1	16.0±0.0

Source: Mohan *et al.*, (2008).

Table.6 Fruit yield of brinjal under different organic plant growth promoter treatments
Vedic inputs and method of preparation

Treatments	No. of fruits /plant (Mean±S.E)	Yield /plant (kg) (Mean±S.E)	Equivalent yield (t ha ⁻¹)
Control	22.5±0.1	0.8±0.0	14.5
T1-Panchagavya (3%)	37.3±0.1	1.4±0.0	25.8
T2-Panchagavya (5%)	37.0±0.0	1.4±0.0	28.2

Source: Mohan *et al.*, (2008).

In conclusion, the most of the soil are not responding towards productivity because indiscriminate use of synthetic fertilizers and pesticide. Under such condition buildup of soil health is urgent need. At this juncture, organic farming as a remedy to cure the ills of modern chemical agriculture.

Organic farming makes all inputs from natural materials, therefore they save the cost of fertilizers and plant protection

chemicals. The application of these liquid formulations would supplement the application of biofertilizers and they can be prepared easily by locally available materials by farmers, in rural area.

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