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RESEARCH ARTICLE

PANCHAGAVYA- AN ECOFRIENDLY INSECTICIDE AND ORGANIC GROWTH PROMOTER OF PLANTS

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Abstract

Panchagavya is an organic formulation, which in Sanskrit means the blend of five products obtained from cow i.e. milk, ghee, curd, dung and urine. The components like cowdung and cowurine enhances the insecticidal activity of pachagavya which can reduce the number of application hazardous chemicals on crops. It is a mixed culture of naturally occurring, beneficial microbes' mostly lactic acid bacteria (Lactobacillus), yeast (*Saccharomyces*), actinomyces (*Streptomyces*), photosynthetic bacteria (*Rhodopsuedomonas*) and certain fungi (*Aspergillus*) which promotes the growth and yield in different crops and provides high B:C ratio. So, panchagavya can be a effective organic growth-promoter for small and marginal farmers.

Introduction

Panchagavya is an organic formulation, which in Sanskrit means the blend of five products obtained from cow i.e. milk, ghee, curd, dung and urine (all these products are individually called as "Gavya" and collectively named as panchagavya). Panchagavya has got reference in the scripts of Vedas (devine scripts of Indian wisdom) and Vrikshayurveda (Natarajan, 2002). In India, use of panchagavya in organic farming is gaining popularity in recent years especially in states like Tamil Nadu and Kerala. Panchagavya requires mainly five products of cow along with certain other ingredients as listed below (Natarajan, 2002; Pathak, 2002);(1) Fresh cow dung - 7 kg; (2) Cow urine - 3 l; (3) Cow milk - 2 l; (4) Cow curd - 1 kg(5) Cow ghee - 1 kg; (6) Sugarcane juice - 3 l or 500 g jaggary; (7) Tender coconut water – 3 l; (8) Riped banana – 12 Nos.; (9) 100 g yeast + 100 g jaggary dissolved in 2 l of warm water.

Flow chart for preparation of Panchagavya (Natarajan, 2002)

Mix thoroughly the fresh cow dung (7kg) + Cow ghee (1kg)
↓
Incubate for 2 days
↓
Add cow urine (3 l) + 10 litre of water

↓
Stir properly (morning and evening, daily for 1 week)
↓
Add sugarcane juice (3 litre) or jaggery mixed in water at 1:6 ratio
+
Cow milk (2 litre)
+
Cow curd (2 litre)
+
Coconut water (3 litre)
+
Yeast (100 g) and 12-ripe banana
↓
Stir properly (morning and evening, daily for 3 weeks)
↓
Panchagavya is ready to use

All the above items can be added to a wide mouthed mud pot or concrete tank or plastic bucket as per the above order. The container should be kept open under shade. The content is to be stirred twice a day both in morning and evening. Sugarcane juice and coconut water are reported to accelerate fermentation. Toddy also accelerate fermentation and helps in minimizing the bad odour. To prepare toddy two litres of tender coconut water has to be kept in a sealed airtight plastic bottle for a week. However, 100 g of yeast powder can be made use of in case of non-availability of toddy.

Prabhu (2009) prepared panchagavya by using the ingredients viz., cowdung (5kg), cow urine (3l), cows milk (2l), curd made from cow milk (2l), ghee made from cow milk (1l), sugarcane juice (3l), tender coconut water (3l) and ripened banana (12 Nos). All the above substrates were added to a wide mouthed mud pot and kept open under shade. The contents were stirred twice a day for about 20 minutes both in the morning and evening to facilitate aerobic microbial activity.

Sangeetha and Thevanathan (2010) prepared Seaweed based panchagavya is a modified preparation containing the aqueous extract of the alga, *Sargassum wightii*. The preparation contained Cow dung - 5.0 Kg; cow urine - 3.0 L; cow milk - 2.0 L; cow curd - 2.0 L; cow ghee - 1.0 Kg; sugarcane juice - 3.0 L; tender coconut water - 3.0 L; banana - 12 nos; yeast powder -100 g; jaggery - 100 g; water - 2.0 L. The above composition gives approximately 20.0 L of panchagavya. Cow dung and cow ghee were mixed together in a 25.0 L concrete pot and kept for 3 days with intermittent stirring to exhaust methane gas. On the fourth day all the other ingredients were added to the cow dung - ghee mixture along with spores of *Lactobacillus sporogenes* (one SPOROLAC tablet having 60 million spores / tablet) and mixed thoroughly. The mouth of the container was covered with a thin cloth and kept in the open in shade. This mixture was stirred twice everyday and after 18 days, 5.0 g of the algal extract residue was added to the preparation and used in experiments. Algal extract residue was prepared by extracting 100.0 g of shade dried *Sargassum wightii* with 5.0 L of boiling water for 30 minutes. The extract was allowed to cool, filtered through a layer of muslin cloth and dried *in vacuo* and the dry residue was used.

Chemical and Biological Properties of Panchagavya

Effective Micro Organisms (EMO) in panchagavya were the mixed culture of naturally occurring, beneficial microbes' mostly lactic acid bacteria (Lactobacillus), yeast (*Saccharomyces*), actinomyces (*Streptomyces*), photosynthetic bacteria (*Rhodopsuedomonas*) and certain fungi (*Aspergillus*)(Xu, 2001;Swaminathan,*et al.* (2007).

Presence of macro (N. P, K and Ca) and micro (Zn, Fe, Cu, Mn) nutrients besides total reducing sugars (glucose) in panchagavya. Chemolithotrops and autotropic nitrifiers (ammonifers and nitrifers) present in panchagavya which colonize in the leaves increased the ammonia uptake and enhance the total N supply Papen *et al*. (2002). The pH of panchagavya was lowered to 4.52 at 30 days of fermentation and this might be due to *Lactobacillus* bacteria in panchagavya, which produced more organic acids during fermentation(Mathivanan, *et al*. (2006)). Further, the authors have reported the acetate, propionate and butyrate levels in panchagavya were ranged from 60.05 to 68.28, 14.39 to 17.79 and 6.40 to 7.65 percent, respectively, during the period from 10 to 40 days of fermentation.*Lactobacillus* count was increased from 8.62 at 10 days of fermentation to 8.71 $\log_{10}$

cfu/g at 30 days of fermentation. The total volatile fatty acids (TVFA) were higher at 30 days of fermentation. The Coliforms, *Streptococci* and *Staphylococci* counts were not in detectable range.

According to Panchagavya also known to contain biofertilizers such as Azospirillum, Azotobactor, Phosphobacteria and Pseudomonas were found besides *Lactobacillus* in Panchagavya (Yadav and Lourduraj, 2005). Besides these, growth regulatory substances such as Indole Acetic Acid (IAA), Gibberlic Acid (GA_3), Cytokinin and essential plant nutrients from panchakavya (Perumal *et al.,* (2006)) which caused a tremendous influence on the growth rate in *Alium cepa* and panchagavya at 30 days of age recorded better proposition of chemical and microbial composition favourable for utilization as a growth promoter and panchagavya did not have direct antibacterial activity Mathivanan et al. (2006).

Panchagavya *Vs.* Insect control

In annual moringa sprayingsof Panchagavya doubled the stick yield besides giving resistance to pests and diseases (Vivekananda, 1999) and Boomiraj *et. al*. (2004) reported that Panchagavya was effective against leaf hopper (*Amrasca biguttula biguttula*) and white fly, (*Bemisia tabacci*) in bhendi.

panchagavya + NSKE proved as best in managing *Spodoptera litura* larvae followed by panchagavya + *Vitex nigundo* and calotropis in groundnut and soybean (Bharathi, 2005). Whereas, Neelakanth (2006) noted that panchagavya + cow urine in combination with NSKE proved next best over spinosad in controlling DBM (*Plutella xylostella*) in cabbage and shootfly in sorghum(Mudigora *et al.*(2009).

Possible growth inducing factors in Panchagavya

Beaulah *et al*. (2002) opined that the beneficial microorganisms from panchagavya and their establishment in the soil improved the sustainability of agriculture as the microorganisms present in the rhizospheres environment around the roots influence the plant growth and crop yield.

The possible reason for higher growth characters and increased height might be due to the growth enzymes present in Panchagavya which favoured rapid cell division and multiplication (Vasumathi, 2001; Sanjutha, *et al*.,2008).

Panchagavya is an organic formulation that enhances the biological efficiency of crop plants and quality of fruits and vegetables. Panchagavya is reported to contain biofertilizers like *Azospirillum*, *Azotobactor*, Phosphobacteria, *Pseudomonas* and *Lactobacillus* (Yadav and Lourduraj, 2003). Perumal *et al.,* (2006) reported that presence of growth regulatory substances such as Indole Acetic Acid (IAA), Gibberlic Acid (GA_3), Cytokinin and essential plant nutrients from panchakavya caused a tremendous influence on the growth rate in *Alium cepa.*

The positive effect of panchagavya on growth and productivity of crops has been reviewed and documented by Somasundaram and Amanullah (2007). The presence of auxin in panchagavya controls the water regulation in developing fruits of okra. Regular and uniform water supply to the developing fruits resulted in increased ascorbic acid content, Barletts index and crude protein content (Vennila and Jayanthi, 2008). Therefore, it is now considered as an efficient plant growth stimulant .

Xu (2001) reported that Effective Micro Organism (EMO) cultures could synthesize phytohormones i.e., auxins and other growth regulators that stimulated maize plant growth and they contained proactive substances that could significantly affect leaf stomatal response in maize. Leaf stomata of the EMO treated maize opened more rapidly than water treated control plants and when leaves were subjected to dehydration, the stomata closed more slowly (i.e., remained open longer) thus showed that, EMO contained bioactive substances that could have significantly affected leaf stomata response and led to increased LAI.

Panchagavya as growth promoter

In jasmine, spraying two rounds of panchagavya, one before the flower initiation and another during bud setting phase ensured continuous flowering. In annual moringa sprayings doubled the stick yield besides giving resistance to pests and diseases (Vivekananda, 1999). Review of current trends in organic practices showed improved yields in crops of rainfed areas in India, especially during drought years (Singh, *et al.*, 2001, Ramesh *et al*., 2005). Studies have shown increased yields where the farmer has used organic practices (Singh *et al*., 2001; Ramesh *et al*., 2005) in crops like chilli(Subhashini, *et al.* 2001), moringa (Beaulah *et al.*, 2002), green gram (Somasundaram *et al.* 2003) and french bean(Selvaraj, 2003). It can be concluded that Panchagavya as an organic growth-promoter for small and marginal vegetable growers (Boomathi, 2006). The cost-benefit to farmers was greatest when Panchagavya was used as a growth promoter and proved as the cheapest, while Amrit Pani, and

Bokashi were the costliest alternative input (Francis and Smith, 2006) and Higher net returns and B:C ratio were evidenced when panchagavya was included in the nutrient management strategies in crops like rice (Yadav and Lourduraj, 2006) green gram, and black gram (Swaminathan, et al. 2007). Panchagavya enhances the growth and vigour of crops, inducing resistance to pests and diseases and improving the keeping quality of vegetables and fruits (Natarajan, (2002). Panchagavya spray was also reported as effective on all the crops than the recommended nutrients and growth regulators (RFS) in terms of higher growth and productivity (Somasundaram, 2003).

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