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Review Article

Review on Panchagavya

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Abstract

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 Panchagavya can play a major role in organic farming.

Keywords: Panchagavya, crop production, organic farming.

Introduction

Panchagavya is an organic product derived from five products evolving from cow, and it has been used in Indian medicine since time immemorial. ``I have modified this Panchagavya by adding a few more ingredients and the modified version has a lot of beneficial effects on a variety of crops and livestock", said Dr. K. Natarajan, President of the Rural Community Action Centre (RCAC), a non-governmental organization, actively engaged in promoting the concepts of organic farming and bio-diesel in the rural areas of Tamil Nadu.

An allopathic medical practitioner with deep conviction in ecological farming and sustainable agriculture, Dr. Natarajan combined his traditional knowledge and wisdom on the value of cow's products and medicinal herbs to develop this Panchagavya. He has done extensive research with his Panchagavya on various crops, animals and even earthworms. His findings have been validated by leading research institutes in the country, and he was awarded the prestigious "Srishti Sanman" by a leading developmental organization in Ahmedabad.

"The present form of Panchagavya is a single organic input, which can act as a growth-promoter and immunity booster. It is essentially a product containing 4 kg gobar gas slurry, 1 kg fresh cow dung, 3 litres of cow urine, 2 litres of cow's milk, 2 litres of cow's curd, 1 kg cow's ghee, 3 litres of sugarcane juice, 12 ripe bananas, 3 litres of tender coconut water, and 2 litres of toddy (if available). This will make about 20 litres of Panchakavya. The concoction is stored in a wide-mouthed earthen pot or concrete tank in open. Sufficient shade should be provided, and the contents should be stirred twice a day, both in the morning and the evening. In seven days, the modified Panchagavya will be ready, and it can be diluted before use on plants and animals," says Dr. Natarajan.

Tharmaraj *et* al., (2011) says Panchagavya, a Vedic formulation for increased productivity, disease resistance in plants and potential of utilizing Panchagavya as biofertilizer was tested on various pulses *Vigna radiate, Vigna mungo, Arachis hypogea, Cyanopsis tetragonoloba. Lablab purpureus, Cicer arietinum* and the cereal *Oryza sativa* var. ponni by growing in soil amended with dried traditional and seaweed based Panchagavya. Experimental seedling recorded higher rates of linear growth of both shoots

and roots as compared to controls and that too maximum growth was observed in seedling grown in soil amended with seaweed based Panchagavya at low concentration (1:100; Panchagavya; soil). A similar observation was made on the number of leaves produced, leaf area, number of root nodules formed in the pulses by rhizobia and increased the levels of all the enzymes. The cost of production of a litre of Panchagavya is around Rs. 35, and it can be brought down substantially if the farmers use their own cows' products. The Panchagavya is diluted to three per cent and sprayed on crops to get the best results. Three litres of Panchagavya is diluted with 100 litres of water and sprayed over crops to get rid of pests and diseases and also get higher yields.

Seeds can be soaked and seedlings can be dipped in 3 per cent solution of Panchagavya for about 30 minutes before sowing to get good results from the crops. Various crops such as rice, a variety of vegetables, fruit crops such as mango, banana, guava, acid lime cash crops such as sugarcane, turmeric, jasmine and moringa and plantation crops have responded extremely well to application of Panchagavya. Earthworms grew faster and produced more vermi-compost when treated with this solution. "When sprayed with Panchagavya, the plants produce larger leaves, and develop denser canopy. The stem produces lateral shoots and much more sturdy branches to bear heavy yields. The rooting is profuse and dense, and penetrating to deep layers. Roots helps in better intake of nutrients and water. Plants are able to stand protracted drought conditions, and needed less than a third of the irrigation in regular times," explains Dr. Natarajan. The Panchagavya has been field-tested by a network of organic farmers in the country.

Panchagavya has several beneficial effects on animals and fish as well. When fed to cows at 200 ml per day, they turned healthier and produced milk with high fat content. Their rate of conception increased, and the various common ailments were completely cured.

Similar effects were found in sheep and goats. When mixed with the poultry feed or drinking water at the rate of 5 ml per bird per day, the birds became disease-free and healthy. They laid larger eggs for longer periods. In the broilers, the weight gain was impressive and the feed to weight conversion ratio improved. In the fishponds, the addition of Panchagavya increased the growth of phyto and zoo plankton, which contributed to improved fish feed availability and thus increased fish growth, according to Mr. Natarajan.

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The Panchagavya is an organic product derived from five products evolving from cow, and it has been used in Indian medicine since time immemorial of allopathic medical practitioner with deep conviction in ecological farming, sustainable agriculture, traditional knowledge and wisdom of the value Panchagavya and utilized to cultivate medicinal herbs. Various crops such as rice, a variety of vegetables, fruit crops such as mango, banana, guava, acid lime cash crops such as sugarcane, turmeric, jasmine and moringa and plantation crops have responded extremely well to application of Panchakavya. “ sprayed with Panchakavya, the plants produce larger leaves, and develop denser canopy. The stem produces lateral shoots and much more sturdy branches to bear heavy yields. The rooting is profuse and dense, and penetrating to deep layers. Roots helps in better intake of nutrients and water. Plants are able to stand protracted drought conditions, and needed less than a third of the irrigation in regular times," the Panchakavya has been field-tested by a network of organic farmers in the country.

Vallimayil and Sekar (2012) reported to Panchagavya is an organic product blended from five different cow products, commonly applied to crop plants in organic farming. It is used as foliar spray, soil application and seed treatment. It can act as growth promoter and immunity booster. Effects of application of panchagavya in the form of seed treatment and foliar

spray to Southern Sunnhemp Mosaic Virus infected sunnhemp plants were studied. Growth and biochemical parameters studied showed better growth in panchagavya treated plants. Various concentrations from virus infected plants were tested on cluster bean a local lesion assay host for this virus. Panchagavya treated plants showed lesser viral intensity than control. The effect of foliar spray of panchagavya on virus concentration in the local lession host also studied, by inoculating the plants with virus of different time intervals after foliar spray. A significant change in viral concentration was observed.

Vimalendran and Wahab, (2013) were used to effect of inorganic fertilizer in combination with panchagavya information is limited in babycorn and needs field investigation. Hence, the field experiments were conducted at Faculty of Agriculture, Annamalai University, Chidambaram during, July-September, 2008 and January-March, 2009 to study the effect of foliar spray of panchagavya on the growth and yield of babycorn cv. CoBC 1. The experiments were laid out in Randomized Block Design with fourteen treatments replicated thrice. The treatments included different levels of nutrients and foliar application of panchagavya (3 and 4%) at various stages of babycorn. The results revealed that four sprays of three percent panchagavya at 15, 25, 35 and 45 Days After Sowing (DAS) along with 100% Recommended Dose of Fertilizers (RDF) recorded the highest fresh babycorn yield (7439 and 7476 kg ha-1, in 2008 and 2009, respectively) followed by 3 sprays of 3% panchagavya along with 100% recommended dose of fertilizers (7226 kg ha-1 2008 and 7262 kg ha-1 in 2009).

Panchagavya is an organic formulation made from cow goods. The usage of fermented organic formulations with supportive beneficial microorganisms as foliar nourishment has been come into the picture of modern agriculture for giving rise to good quality non residue protected food (Galindo *et al*., 2007). Consequences of panchagavya application are superior growth, yield and quality of crops. This liquid organic solution is prepared from cow dung, urine, milk, curd, ghee, legume flour and jaggary. It provides macro nutrients, essential micro nutrients, many vitamins, required aminoacids, growth promoting substances and beneficial microorganisms for plants well growth. Organic farmers of Tamil Nadu are preparing this foliar nutriment as a home-grown product and it is used widely for field and vegetable crops. Keeping these in view, field investigations were carried out to study the effect of foliar spray of panchagavya on the growth and yield of babycorn.

Panchagavya means "mixture of five products (cowdung, cow urine, milk, ghee and curd) of cow.Of these, the three direct constituents are cowdung, urine, milk and the two derived products are curd and ghee. It has been used intraditional Indianrituals throughout history. It is also called cowpathy treatment based on products obtained from cows used in Ayurvedic medicine and of religious significance for Hindus. Panchgavya is also used as fertilizers and pesticides in agricultural operations. Panchagavya is an organic product recommended for crop improvement in organic agriculture (Sangeetha and Thevanathan, 2010). In Sanskrit, Panchagavya means the blend of five products obtained from cow. Each individual of these five products is called ‘Gavya’ and together termed as ‘Panchagavya’.

The literatures on Vedic (Vrkshayurveda) depict organizations of the practices that the farmers practice Panchagavya at field level. It has a place, in a theoretical framework and also has certain plant growth stimulants. Panchagavya plays an important role in the quality of fruits and vegetables. It is used as a foliar spray, soil application along with irrigation, as well as seed treatment (Natarajan, 2002). Farmers in South India practice Panchagavya for sustainable agriculture. Use of chemical fertilizers and pesticides in agriculture fields led to environmental degradation and hence as an alternative to chemicals. Panchagavya is also being sought to improve crop establishment and health (Shakuntala et al., 2012).

Therefore, Panchagavya has played a significant role in providing resistance to pests and diseases, resulting in increased overall yields (Tharmaraj et al., 2011). Panchagavya possess the properties of fertilizers and bio pesticides (Sireesha, 2013). Panchagavya has resulted in positive effect on growth and productivity of crops as reported by Somasundaram et al. (2003). In Veda, cow's urine was compared to the nectar. In substrata several medicinal properties of cow's urine have been mentioned and are known to cause weight loss, reversal of certain cardiac and kidney problems, indigestion, stomachache, edema, etc. Cow urine has a unique place in Ayurvedha and has been described in Sushrita Sumhita and Ashtanga Sangraha to be most

effective substances secretion of animal origin with innumerable therapeutic values. It has been recognized as water of life or Amrita (beverages of immortality) the nectar of the God. In India drinking of cow urine has been practiced for thousands of years. Panchakavya is a term used in Ayurveda to describe five important substances obtained from cow namely urine, dung, milk, ghee and curd. A number of formulations continuous use of pesticides resulted in the development of integrated pest management (IPM) and organic farming . Heavy use of chemicals in agriculture has weakened the ecological base addition to degradation of soil, water resources and quality of food. At this juncture a keen awareness has sprung of the adoption of "organic farming" as a remedy to cure. Organic agriculture is low cost and chemical free fertilizers. It is very essential to development a strong workable and compatible package of nutrient management through organic resources for various crops based on scientific facts, local conditions and economic viability (Kannaiyan, 2000).

The current global scenario firmly emphasizes the need to adult eco-friendly agricultural practices for sustainable agriculture. Chemical agriculture has made an adverse impact of the health-care of not only soil but also the beneficial soil microbial communities and the plants cultivated in these soil. This eventually has lead to a high demand organic produce by the present day health conscious society and sporadic attempts are being made by farmers all over the world to detoxify. The land by switching over to organic farming dispenses with chemical fertilizers, pesticides, fungicides and herbicides. In India, organic farming was a well developed and systematized agricultural practice during the past and this "ancient wisdom" obtained through Indian knowledge systems such as Vedas, specify the use of Panchakavya in agriculture. Panchakavya is a foliar nutrition prepared by organic growers of Tamilnadu and widely used for various agricultural and horticultural crops. In Sanskrit, Panchakavya means a combination of five products obtained from cow. When suitably mixed and used, these have miraculous effects. In the present study a preliminary attempt has been made to find out the effect of Panchakavya spray on the growth, biochemical and yield parameters of *Abelmoschus esculentus* (L.) Moench.

Farmers in South India practice Panchagavya for sustainable agriculture . Use of chemical fertilizers and pesticides in agriculture fields led to environmental degradation and hence as an alternative to chemicals. Panchagavya is also being sought to improve crop establishment and health . Therefore, Panchagavya has played a significant role in providing resistance to pests and diseases, resulting in increased overall yields (Tharmaraj *et al.,* 2011). Panchagavya possess the properties of fertilizers and bio pesticides (Sireesha, 2013). Panchagavya has resulted in positive effect on growth and productivity of crops as reported by Somasundaram et al. (2007).

Ali *et* al., (2011) was experiment and designed with three treatments on three replications, with the view to studying the effect of Panchagavya and Sarifibani, liquid organic manure on the yield of green gram, *Vigna radiata*, chilli, *Capsicum frutescens* (Chili) and mustard, *Brassica campestris.* Their efficacy were compared by studying the yield contributing characters like plant height, primary branch, secondary branch plant , number of seed fruit, fruit length, weight of JOO seed, yield plant, yield and experimental observation recorded that the Sarifibani and Panchagavya treated crops were higher than the control. A liquid manure specifically Sarifibani used in this study was pre-analysed to study the variation in microbial population between two Sarifibani sample prepared by using raw materials (Cow dung and Cow urine) obtained from two different source of cow breed (i.e., Native breed and Jersey breed) and the best source of breed was selected for the further research work Meanwhile the effect of organic farming practice in soil health was also studied by analysing the basic parameters of soil in the field were the research was conducted. The result shows increased microbial population, oxidisable organic carbon, nitrogen, phosphate, potash. The pH and E.C were found to be close to neutral.

Srimathi *et al.,* (2013) were studied on organic seed fortification with Jatropha curcas and *Pongamia pinnata* using ‘Panchagavya ’at one, two, three, four and five per cent concentrations with the three different soaking durations revealed that Panchagavya at 2 and 5% with the soaking duration of 16 and 8 h were superior than the control and other concentrations in terms of germination and seedling vigour for *Jatropha curcas* and Pongamia pinnata respectively.

Rajesh *et* al., (2013) were undergoing the field experiment was conducted to find the variation in growth, biochemical and yield parameters of black gram under different concentrations (control, 1, 3, 5, 7.5 and 10%) of Panchagavya, and all the parameters were increased in 3% concentration. Since there was increase in growth and yield at low concentration of Panchagavya, it is recommended that the Panchagavya can be used for spray after diluted properly.

Heavy use of chemicals in agriculture has weakened the ecological base in addition to degradation of soil, water resources and quality of the food. At this juncture, a keen awareness has sprung on the adoption of "organic farming" as a remedy to cure the ills of modern chemical agriculture (kanniyan, 2000). It is very much essential to develop a strong workable and compatible package of nutrient management through organic resources for various crops based on scientific facts, local conditions and economic viability. Panchagavya is a foliar nutrition prepared by organic growers of Tamil Nadu and used widely for various agricultural and horticultural crops. In Sanskrit, Panchagavya means a combination of five products obtained from cow. When suitably mixed and used, these have miraculous effects. Panchagavya is used in different means such as foliar spray, soil application along with irrigation water, seed or seedling treatment *etc*. For foliar spray 3% concentration is being adopted by organic farmers using hand-operated sprayers with high pore sized nozzle (Natarajan, 2002).

The biofertilizer potential of Panchagavya prepared in the traditional way and a modified preparation amended with seaweed extract have been evaluated for their fertilizer potential using the pulses *viz*., *Vigna radiata, Vigna mungo, Arachis hypogea, Cyamopsis tetragonoloba, Lablab purpureus, Cicer arietinum* and the cereal *Oryza sativa* var. *ponni* as the experimental plants (Thevanathan *et al*., 2005).

Some farmers in the southern parts of India use a modified Panchagavya that contains many other plant products to boost fermentation and to support the growth of beneficial microorganisms. Similarly, soils amended with Panchagavya (both traditional and seaweed based) promoted the production of lateral roots, leaves, leaflets and the growth of lamina in all the experimental plants, as compared to control. The seedlings produced leaves which had 93% more surface area than that of their respective controls. Percent increase over control in the leaf area of the seedlings *of Vigna radiata, Vigna mungo, Arachis hypogea, Cyamopsis tetragonoloba* and *Cicer arietinum* grown in soil amended with seaweed based Panchagavya at a ratio of 1: 100 (v/v) was 27%, 35%, 46%, 140% and 37% respectively. Increased production of lateral roots would provide more surface area for absorption of water and minerals by the experimental seedlings than their controls. Similarly, large number of leaves or leaflets with greater surface area could be construed as an indication of enhanced photosynthetic efficiency in plants grown in soil amended with Panchagavya. The effect was marked in the seedlings grown in soil amended with low levels of seaweed based Panchagavya (Panchagavya: soil; 1: 100). The effect was more pronounced in *Arachis hypogea.* Even the use of traditional Panchagavya as manure was able to increase nodule formation by nearly 18% to 62% (Subramaniyan, 2005)

Importance of panchagavya

In 1950, James F. Martin of USA made a liquid catalyst (living water) from milking cow, using dung, sea water and yeast and it was claimed that it was capable of greening degraded land (Vivekanadan et al ., 1998) Cows ghee had been used in ancient and medieval times (Kautilya 321-296 BC and Someshwara Deve 1126 AD) for managing seedling health. The ghee contains vitamin A, Vitamin B, Calcium, fat and also glycosides, which protects cut wounds from infection. Cows curd is rich in microbes (*Lactobacillus*) that are responsible for fermentation (Chandha, 1996).

Panchagavya has got reference in the scripts of Vedas (divine scripts of Indian wisdom) and Vrkshayurveda (Vrksha means plant and ayurveda means health system). The texts on Vrkshayurveda as systematization of the practices that the farmers followed at field level, placed in a theoretical frame work and it defined certain plant growth stimulants, among them Panchagavya was an important one that enhanced the biological efficiency of crop plants and quality of fruits and vegetables (Natarajan, 2002).

The positive effect of panchagavya on growth and productivity of crops has been reviewed and documented by (Somasundaram *et al.,* 2007).

Effect of panchagavya spray on growth parameters

Vennila *et al.,* (2008) revealed that application of 100% recommended dose of fertilizer along with Panchagavya spray (2%) significantly increased the okra plant height (131.7 cm) and dry matter production (5.90 g plant^{-1}). Biogas slurry with Panchagavya combination is adjudged as the best organic nutrition practice for sustainability of maize-sunflower-green gram system by its overall performance on growth, productivity, quality of crops, soil health and economics Somasundharam *et al* ., (2007). Panchagavya was tested for different crops such as turmeric, paddy, onion, gingely, sugarcane, banana, vegetables and curry leaf and it was found that it enhanced the growth, vigour of crops, resistance to pest and diseases and improvement of keeping quality of vegetables and fruits (Natarajan, 2002).

Xu Hl (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. The Panchagavya is rich in such EMOs.

Effect of panchagavya spray on yield and yield attributes

Mohanalakshmi *et al.,* (2008) revealed that application of poultry manure (5 t ha^{-1}) + Panchgavya (3%) in aswagandha exhibited significantly superior performance by registering the highest root yield of 1354.50 kg ha^{-1}. Vennila *et al.,* (2008) revealed that application of 100 per cent recommended dose of fertilizer along with panchagavya spray (2%) significantly increased the number of fruits per plant, fruit weight g fruit^{-1} and fruit yield q ha^{-1} of okra. Swaminathan *et al.(2007)* concluded that application of Panchagavya at 3% as foliar spray on 15, 25, and 40 days after sowing (DAS) on black gram recorded the highest grain yield of 1195 kg ha^{-1} Kanimozhi (2003) revealed that application of Panchagavya at 4 per cent spray was found to be superior in respect of root yield (2.5 times kg/plot) when compared to control in *Coleus forskohili.* Foliar spray of Panchagavya at 3 percent on 15, 25, 40 and 50 DAS with no fertilizers was the most effective low cost technology in terms of grain yield of greengram Somasundharam *et al* ., (2007). Panchagavya and vermicompost combination has given the highest pod yield of French bean variety Ooty 2, which was 36 percent higher than the conventional method Selvaraj (2003) The treatment combinations of poultry manure + neem cake + Panchagavya increased the stick yield of moringa Beaulah (2002). Balasubramanian *et al* ., (2001). In Panchagavya, Effective Micro Organisms (EMO) 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)* and that improved the soil quality, growth and yield of sweet corn, which was equal to or higher than what was obtained from chemical fertilizers Somasundharam et al ., (2007). In Jasmine, spraying two rounds of Panchagavya, one before the flower initiation and another during bud setting phase ensured continuous flowering and in annual moringa, spraying doubled the stick yield besides giving resistance to pests and diseases. Panchagavya sprayed on 25 and 40 DAS advanced the paddy harvest by 10 days (Vivekanandan *et al.,* 1998).

Effect of panchagavya spray on nutrient uptake

Presence of macro (N, P, K and Ca) and micro (Zn, Fe, Cu, Mn) nutrients besides total reducing sugars (glucose) were observed in Panchagavya. Chemolithotrops and autotropic nitrifiers (ammonifers and nitrifers) present in panchagavya which colonize in the leaves increase the ammonia uptake and enhance the total N supply Beaulah (2001) reported that the secondary and micronutrients (Ca, S and Fe), macronutrients (NPK) contents of leaves and pods of annual moringa were superior under poultry manure + neem cake + Panchagavya treatments. Higher nutrient uptake and nutrient use efficiency in both main and ratoon crops of annual moringa were also observed. Similarly, the quality parameters *viz.,* crude fibers, protein, ascorbic acid**,** carotene content and shelf life

were also higher under organic manure applied with Panchagavya spray.

Influence of panchagavya spray on soil fertility

Microbial flora of soil plays an important role in soil health. The microorganisms present in the rhizospheres environment around the roots influence the plant growth and crop yield. The beneficial microorganisms from Panchagavya and their establishment in the soil improved the sustainability of agriculture.

Review India is the second most populous country in the world. With the increasing population, the cultivable land resource is shrinking day to day. To meet the food, fibre, fuel, fodder and other needs of the growing population, the productivity of agricultural land and soil health needs to be improved. Green Revolution in the post independence era has shown path to developing countries for self-sufficiency in food but sustaining agricultural production against the finite natural resource base demands has to be shifted from the "resource degrading" chemical agriculture to a "resource protective" biological or organic agriculture. The vegetable crops have been well advocated in solving the problem of food security. They are rich source of minerals, vitamins, fibre and contain a fair amount of protein as well as carbohydrates. In addition to local market demand vegetables have the potential for both domestic and export market. The vegetable production of our country before independence was merely 15 million tonnes and now it is about 146.55 million tonnes during 2011- 12,accounting 11.4% share of World vegetable production (Rai and Pandey, 2012). Although India is the second largest producer of vegetables next only to China in World, the productivity of different vegetables in our country is comparatively lower than the World's average productivity. Again the per capita availability of vegetable (210g/head/day) is still behind the recommended quantity (285g /head /day). Our demand by 2020 will be around 250 million tonnes. Thus due to the rapid growth of the population with reduction in land, in order to feed the population, the only solution is the vertical expansion or by increasing the productivity per unit area per unit time as the potential available land and water resources and of technology still remain unexploited. Our strategy should be produced more vegetables from less land, less water with less pesticides and with less detrimental to soil and environment as well. Organic vegetable cultivation offers one of the most sustainable farming systems with recurring benefits to only longterm soil health but provides a lasting stability in production by importing better resistance against various biotic and abiotic stresses.

Organic vegetables fetch a premium price of 10%-50% over conventional products. Market of organic products is growing at faster rate (20%) as compared to conventional ones (5%). This growth rate is highest in Japan, USA, Australia and EU. Export preference of organic vegetables offers a great scope to a country like India, which has inculcated the skill of growing organically since time immemorial. Judicious plant nutrition and efficient plant protection enhances yield and quality in most of the crops. The present farming by and large depends on the use of chemical fertilizers, pesticides and growth regulators for enhancing crop productivity. It is a well documented fact that increased dependence on agro-chemicals including fertilizers has led to several ill effects on soil and the environment. Maintaining good soil health is a prerequisite for sustaining higher productivity under intensive agricultural production system. Soil health is the continued capacity of soil to function as a vital living system within ecosystem and land use boundaries to sustain the biological productivity. Increasing awareness of environmental impact of conventional high input intensive farming system has led to a move towards alternatives. The organic (biological/ecological) approach is one of the alternatives to conventional production system currently being advocated (Subbarao et al., 2007). Considering the potential environmental benefits of organic production and its compatibility with integrated farming approaches, quality of food and sustainability, organic agriculture is considered as a viable alternative for sustainable agricultural development (Ramesh et al.,2005)

Organic agriculture is a system that relies on ecosystem management rather than external agricultural inputs. It is a system that begins to eliminate the use of synthetic inputs such as synthetic fertilizers, pesticides, veterinary drugs, genetically modified seeds and breeds, preservatives, additives and irradiation. These are replaced with site specific management practices that maintain and increase long

term soil fertility and quality of the environment (Subbarao et al., 2007). Organic agriculture is a holistic production management system in preference to the use of off- farm inputs taking into account that regional conditions require locally adapted systems which promotes and enhances agroecosystem health, including bio-diversity, biological activities which is accomplished by using wherever possible agronomic, biological and mechanical methods as opposed to using synthetic nutrients to fulfill any specific function within the system (FAO,1999). Organic system produced significant improvement in quality of soil mainly bulk density, maximum water holding capacity, infiltration rate, organic carbon, available nitrogen, phosphorus and potassium (Babalad et al.,2009). In Indian agriculture, the yield gap in various crops still remains large even after following the best management practices. Also the agricultural lands continue to shrink and there is a greater threat to global environment and soil resources in the form of erosion of biodiversity and climate change marching towards desertification and environmental pollution. Hence, there is now a great concern to maintain soil health and protect environment by popularizing eco friendly and cost effective organics. Using organic sources like farm yard manure, compost, vermicompost, sheep and goat manure in combination with liquid organic manures like cow urine, panchagavya, vermiwash, bio-digested liquid, jeevamrut etc deserves priority for sustained production and better on farm resource utilization. With this background a review has been made to study the effect of organic nutrients on growth, yield ,quality, nutrient uptake, soil properties, available soil nutrients of vegetables. Effect of Organic nutrient management practices on growth parameters of vegetables Combined application of organics to chilli crop mainly FYM(50%) + poultry manure(50%), vermicompost (50%) + poultry manure(50%), FYM(50%) + neem cake(50%) and poultry manure@7.5 t ha -1 recorded significantly higher plant height, number of branches per plant and leaf area (Thimma Naik, 2006). Application of glyricidia loppings @ 10 t ha -1 , crop residues @ 10 t ha -1 along with FYM+organic solutions significantly increased the growth parameters of chilli compared to inorganic fertilizers (Yadahalli, 2008). Along with organic manures, combined inoculation of Azospirillum(AZUS10) and PSB isolate(PSB7) produced synergistic effect and resulted in increased root length, shoot length, stem girth, number of leaves and number of branches in solanaceous crop plants (Vasanthakumar, 2003). Among the different organic manure treatments, okra responded well to the application of FYM @20 t ha -1 (Premsekhar and Rajashree, 2009). Plant height, number of branches per plant, leaf area and leaf area index in chilli were significantly higher at all growth stages due to application of vermicompost@2.0 t ha -1 or biogas spent slurry/FYM/redgram stalk (Shashidhara, 2000).

Application of recommended nitrogen through different organic sources significantly enhanced the growth and yield of tomato. Among the different organic sources, substitution of 100 percent N through FYM recorded higher plant height, number of branches plant -1 and yield which was comparable with that of 100 percent RDN through urea (Kannan et al., 2006). A study on tomato var Parbhani Yashashri at MAU, Parbhani showed that significantly higher growth parameters of tomato on a slightly alkaline soil with organic mode of plant nutrition through various combinations of neem cake and vermicompost and was found superior to chemical fertilizers alone. A higher number of branches and fruit yield with the combination of 50 percent N through neem cake and 50 percent N through vermicompost were recorded (Sable et al., 2007). Application of green manure (sunnhemp) + neem cake @2 t ha -1 +Azospirillum @ 2 kg ha -1 + burnt ash(crop residue) + phosphobacteria recorded higher growth parameters like plant height, plant spread, number of branches per plant of chilli over RDF alone (Bharathi et al., 2011). Significant improvement in vegetative characters such as plant height and number of leaves per plant in brinjal was recorded when compared to recommended rate of N fertilizer due to inoculation of Azotobacter+Azospirillum with 75 kg N ha -1(Wange and Kale, 2004). In greengram, plant growth parameters viz., shoot and root length and number of leaves plant-1 at 45 DAS were significantly increased due to inoculation of Psolubilizing fungal strains along with rock phosphate application (Chandrashekhar, 2003).

In soybean, plant height, number of branches plant -1, leaf area index and dry matter accumulation were found to be higher with the application of crop residues @ 5 t ha -1 +FYM@ 5 t ha -1 over FYM@ 5 t ha -1 (Dash et al., 2005). The growth parameters of chilli viz., plant height, number of branches, leaf area, leaf area index and dry matter production in various

plant parts were significantly higher with combined application of organic compost and FYM (Sunitha, 2000). The growth parameters of chilli were significantly higher with the inoculation of biological nitrogen fixers mainly Azospirillum and Azotobacter (Khan et al., 2011).

Effect of Organic nutrient management practices on yield and yield parameters of vegetables Application of vermicompost @ 2.5 t ha -1 along with vermiwash :water 1:1 spray registered significantly maximum dry chilli yield (George,2006). (Singh et al., 1997) registered higher fruit yield per plant in chilli with the application of vermicompost@ 10 t ha -1. Application of organic based nutrients mainly biogas slurry+FYM, vermicompost+FYM and vermicompost alone recorded maximum fruit size and more number of fruits plant-1 in tomato (Renuka and Ravishankar,1998). Highest number of fruits per plant, fruit weight, fruit length and fruit diameter of chilli was obtained by applying vermicompost alone as compared to inorganic fertilizers (Yadav and Vijayakumari, 2003). Combined application of organics to chilli crop mainly FYM(50%) + poultry manure(50%), vermicompost (50%) + poultry manure(50%), FYM(50%) + neem cake(50%) and poultry manure@7.5 t ha -1 recorded significantly higher dry fruit yield (Thimma Naik, 2006). Studies at bijapur showed that application of compost and poultry manure recorded significantly higher bulb yield of onion and were on par with each other and with application of recommended chemical fertilizer. In a integrated crop management studies at Dharwad, significantly higher chilli yield was observed with application of vermicompost@ 2.5t ha -1+ neem cake @250 kg ha -1 without application of recommended dose of fertilizers (Gundannavar et al., 2007). . Field studies at Dharwad under rainfed conditions showed that combined application of enriched compost, poultry manure and green leaf manure(Gliricidia) each one third equivalent to recommended 100 kg N ha -1 produced significantly higher dry chilli yield and yield parameters as compared to their individual application(Babalad et al.,2009). In okra, significantly higher number of fruits per plant and fruit yield was observed with application of 4 t ha -1 compost, split applied twice at planting and 5 weeks after planting as compared to recommended N dose through inorganic fertilizer (Akambi et al,.2005). Effect of Organic nutrient management practices on quality parameteeters of vegetables Application of recommended dose of nitrogen in the form of poultry manure recorded highest pH, total soluble solids, titrable acidity, reducing sugar, non-reducing sugar, crude protein and ascorbic acid content in tomato fruit (Prabakaran and Pichai, 2002). Dipping the chilli seedlings root in beejamruth, soil application of jeevamruth(500 l ha -1) at 10 DAT and foliar application of panchagavya @ 3% at the time of flowering recorded higher ascorbic acid and capsaicin content in chilli fruits (Sreenivasa et al., 2010). Oleoresin per cent in chilli increased by 13.89, 6.80, 3.70 and 2.30 percent with application of poultry manure(7.5 t ha -1), vermicompost(10 t ha -1), FYM(50%) + vermicompost(50%), FYM(50%) + neem cake(50%) over RDF alone (Thimma Naik, 2006). Application of green manure (sunnhemp) + neem cake @2 t ha -1 +Azospirillum @ 2 kg ha -1 + burnt ash(crop residue) + phosphobacteria recorded highest oleoresin content and capsanthin content over RDF alone(Bharathi et al., 2011). Vermiwash application had a positive effect in bringing colour to tomato fruits, since nitrogen is the main component for synthesis of lycopene along with other micronutrients (Adams, 1986). Organically grown tomato has higher content of vitamin C, vitamin A and potassium over conventionally grown tomato (Pither and Hall, 1990).

Effect of Organic nutrient management practices on nutrient uptake Vermicompost besides being a rich source of micronutrients also acts as chelating agent and regulates the availability of metallic micronutrients to the plants and increases the plant growth and yield by providing nutrients in the available form and based on crop demand. Application of organics viz., FYM@ 10 t ha -1 resulted in higher fruit yield and uptake of nutrients like N,P,K,Ca,S and Fe over RDF alone (Kattimani, 2004). Effect of liquid organic manures on growth, yield parameters and yield Panchagavya applied @ 3 percent spray 4 times with poultry manure augmented the yield in okra which was comparable to inorganic nutrient application with pesticide spray (Lourduraj et al., 2005).The interaction between humic acid and bread yeast spray in brinjal significantly increased plant height, branch number, total chlorophyll, mineral content (N,P,K) in leaves, the yield in terms of fruit number plant-1 , fruit length, fruit diameter, fruit weight, plant yield and total yield (Sarhan et al., 2011). Humic acid source positively affected both germination and harvesting, enhancing root length and biomass in broad bean. Humic acid caused significant

increase of fresh and dry weights of broad bean roots. foliar application of humic acid@ 2 g l -1 increased N% and protein% of seeds and recorded higher plant height, plant dry weight , pod diameter, fresh seeds weight pod-1, number of fresh seeds pod-1, green pod yield, seeds weight dry pod-1, dry seed yield, N,P and protein percent of pea seeds. Effect of organic nutrient management on soil properties A study on effect of FYM on soil pH revealed that soil pH decreased from 7.99 to 7.65 with each increment of FYM, the soil pH reduced significantly due to organic acid production during its decomposition (Patil et al, 2003)

The pH of the sodic soil was reduced significantly with application of FYM @ 5 t ha-1 which was on par with the value that had been reduced by 50 percent gypsum requirement. Similarly, EC was also found to be reduced significantly by application of FYM (Rathod et al.,2003). Application of organic manures and crop residues like FYM, press mud compost, wheat straw and sugarcane trash@ 5 t ha -1 reduced the bulk density over the control in vertisols (Bonde et al., 2004). The maximum water holding capacity of soil decreased with application of fly ash while it was increased due to increasing level of FYM (Patil et al., 2003). (Halemani et al., 2004). Reported at Dharwad, application of FYM@ 10 t ha -1 decreased the bulk density, increased the infiltration rate and water holding capacity of soil. Effect of organic nutrient management on available soil nitrogen, phosphorus and potassium Higher levels of available nitrogen, phosphorus and potassium was observed with application of either vermicompost alone or in combination with FYM in deep vertisols (Balaji,1994). FYM treated plots showed an increase in available phosphorus than inorganic fertilizers which was due to the coating of sesquioxides by organic materials that reduced phosphorus fixing capacity of soil (Bharadwaj and Omanwar,.1994). Application of organic manures such as FYM,vermicompost, crop residues enhanced the soil available nitrogen, phosphorus and potassium as compared to recommended dose of fertilizers (Patil et al.,2003). The vermicompost application significantly improved available P,K and DTPA-extractable Zn,Fe ad Mn content in the soil after harvest(Singh et al., 1997). Effect of organic nutrient management on soil enzymes (Nath and Yadav, 2011) reported that application of FYM,coir pith waste, pressmud, digested sludge and poultry manure equivalent to 120 kg N ha -1 showed higher activity of dehydrogense and alkaline phosphatase activity.

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 log10 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 (GA3), Cytokinin and essential plant nutrients from panchakavya 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).

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. 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*. Perumal *et al.,* (2006) reported that presence of growth regulatory substances such as Indole Acetic Acid (IAA), Gibberlic Acid (GA3), 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. Review of current trends in organic practices showed improved yields in crops of rainfed areas in India, especially during drought years (Ramesh *et al*., 2005). Studies have shown increased yields where the farmer has used organic practices (Ramesh *et al*., 2005) in crops like chilli, 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, andBokashi 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, 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).

India is one the most populated and fast globalized developed country in this world. Its need more energy likewise power, food, education, money and lost but not least the clean environment. The written history of agriculture in India dates back to the Rig-Veda, written about 1100 BC. Today, India ranks second worldwide in farm output. Agriculture and allied sectors like forestry and fisheries accounted for 13.7% of the GDP (Gross Domestic Product) on 2013, about 50% of the total workforce. The economic contribution of agriculture to India's GDP is steadily declining with the country's broad-based economic growth. Still, agriculture is demographically the broadest economic sector and plays a significant role in the overall socio-economic fabric of India.

As Per the 2010 FAO world agriculture statistics, India is the world's largest producer of many fresh fruits and vegetables, milk, major spices, select fresh meats, select fibrous crops such as jute, several staples such as millets and castor oil seed. India is the second largest producer of wheat and rice, the world's major food staples. India is also the world's second or third largest producer of several dry fruits, agriculture-based textile raw materials, roots and tuber crops, pulses, farmed fish, eggs, coconut, sugarcane and numerous vegetables. India ranked within the world's five largest producers of over 80% of agricultural produce items, including many cash crops such as coffee and cotton, in 2010. India is also one of the world's fifth largest producers of livestock and poultry meat, with one of the fastest growth rates, as of 2011.

One report from 2008 claimed India's population is growing faster than its ability to produce rice, wheat, cereals and other pulses. Other recent studies claim India can easily feed its growing population, plus produce wheat and rice for global exports, if it can reduce food staple spoilage, improve its infrastructure and raise its farm productivity to those achieved by other developing countries such as Brazil and China.

In fiscal year ending June 2011, with a normal monsoon season, Indian agriculture accomplished an all-time record production of 85.9 million tonnes of wheat, a 6.4% increase from a year earlier. Rice output in India also hit a new record at 95.3 million tonnes, a 7% increase from the year earlier. Lentils and many other food staples production also increased year over year. In Indian farmers produced about 71 kilograms of wheat and 80 kilograms of rice for every member of Indian population in 2011. The per capita supply of rice every year in India is now higher than the per capita consumption of rice every year in Japan.

In recent days farmers facing many problems like – insufficient fertilizer for cost variation of petroleum products (Naphtha), insufficient level of good quality of seed in this fast growing agriculture many companies were produce many types of seed but quality of seed was questioned, insufficient labour, lack of technology and deficit equipment. The major crises of nitrogen fertilizers demanding and pay higher amount of money farmer community fully. These fertilizers were produce soil infertility, salinity and agricultural plantation totally suffered. They were creating major crises affected to day to day life of farmer.

The Panchagavya is a single organic input, which can act as a growth-promoter and immunity booster (Natarajan. K., 2003). It is essentially a product containing 4 kg gobar gas slurry, 1 kg fresh cow dung, 3 litres of cow urine, 2 litres of cow's milk, 2 litres of cow's curd, 1 kg cow's ghee, 3 litres of sugarcane juice, 12 ripe bananas, 3 litres of tender coconut water, and 2 litres of toddy (if available). This will make about 20 litres of Panchakavya. The concoction is stored in a wide-mouthed earthen pot or concrete tank in open. Sufficient shade should be provided, and the contents should be stirred twice a day, both in the morning and the evening. In seven days, the modified Panchakavya will be ready, and it can be diluted before use on plants.

The cost of production of a litre of Panchagavya is around Rs. 35, and it can be brought down substantially if the farmers use their own cows' products. The Panchakavya is diluted to three per cent and sprayed on crops to get the best results. Three

litres of Panchakavya is diluted with 100 litres of water and sprayed over crops to get rid of pests and diseases and also get higher yields. Seeds can be soaked and seedlings can be dipped in 3 per cent solution of Panchakavya for about 30 minutes before sowing to get good results from the crops and plantation crops have responded extremely well to application of Panchakavya. Earthworms grew faster and produced more vermicompost when treated with this solution and the plants produce larger leaves, and develop denser canopy. The stem produces lateral shoots and much more sturdy branches to bear heavy yields. The pancha kavya is a one of the most important organic product it contain nutrients and bioenzymes.

Indian system of medicines, especially *Ayurved*, has been using cow-urine for betterment of physical and mental health of mankind since thousands o years. Ancient texts and literature recommend use of *gomutra* for variety of conditions and ailments including gastric troubles, wounds, injuries, skin disorders, diabetes, etc. Cowurine is considered to be the most effective animal origin substance having intrinsic property of general health improvement. It is considered to be the most useful medicinal component of *Panchagavya*. (*Panchagavya* is a term used in *Ayurved* to describe five important substances obtained from cow namely urine, dung, milk, ghee and curd.) Many formulations mentioned in *Ayurved* describe the use of *Panchagavya* components either alone or in combination with drugs of herbal, animal or mineral origin. However, scientific data are not available regarding pharmacological aspects of cow urine nor are there any scientific data, which could corroborate the claims. Therefore, as a part of broader investigations to verify the claimed utility of cow urine, it was thought worthwhile to study its analgesic activity using experimental animals.

There is growing concern over the current agricultural practices in terms of sustainability over long periods since it might cause a gradual decline in factor productivity with adverse impact on soil health and quality (Subba rao, 1999; Stockdale, 2000). It has been widely accepted that organic farming alone could serve as a holistic approach towards achieving sustainable agriculture as it is nature based, environment friendly and ensures the conservation of resources for the future. Organic farming is quite distinct in the sense that it relies on closed nutrient cycles with less dependence on off-farm inputs. Vedic literatures (*Vrikshayurveda*) have clearly outlined a systematized agricultural practice that insisted on the use of 'panchagavya' – a mixture of the five products of cow in a specific ratio to enhance the biological efficiency of crop plants and the quality of fruits and vegetables (Natarajan, 2002). Few farmers in the Southern parts of India are using a modified preparation of panchagavya in organic farming (Gomathynayagam, 2001). In recent years, the crude extracts of seaweeds or the marine macroalgae have been shown to possess biostimulant, biofertilizer and antimicrobial properties (Borowitzka and Borowitzka, 1988; Robles-Centeno and Ballantine, 1999; Selvaraju, 2002) and, many commercial preparations are available in the market under different brand names. Seaweed extracts contain minerals, vitamins, free aminoacids and polyunsaturated fatty acids in addition to growth hormones (Yamamato *et al*., 1975; Tay *et al*., 1985; Dave *et al*., 1993; Thevanathan *et al*., 1993; Tasneem Fatima *et al*., 1994; Selvi *et al*., 1999). The combined effect of panchagavya and seaweed extract on the growth and productivity of crop plants is however, not known. In this paper, we present the results of a study on the nitrate assimilation in the seedlings of some pulses and rice grown in a soil preparation amended.

The current global scenario firmly emphasizes the need to adopt eco-friendly agricultural practices for sustainable food production. The cost of inorganic fertilizers is increasing enormously to an extent that they are out of reach of small and marginal farmers. The Panchagavya, Jeevamruth and Beejamruth are ecofriendly organic preparations made from cow products. The use of organic liquid products such as Beejamruth, Jeevamruth and Panchagavya results in higher growth, yield and quality of crops. These liquid organic solutions are prepared from cow dung, urine, milk, curd, ghee, legume flour and jaggary. They contain macro nutrients, essential micro nutrients, many vitamins, essential amino acids, growth promoting factors like IAA, GA and beneficial microorganisms (Palekar, 2006; Natarajan,2007; Sreenivasa *et al.*, 2010).

Tomato is one of the important vegetable crops grown throughout the world and ranks next to potato in terms of the area but ranks first as a processing crop. The current global scenario firmly emphasizes the need to adopt eco-friendly agricultural practices for

sustainable food production. The cost of inorganic fertilizers is increasing enormously to an extent that they are out of reach of small and marginal farmers. The problems associated with the use of hazardous chemicals for crop protection, weed control and soil fertility are receiving increasing attention worldwide since pests, diseases and weeds become resistant to chemical pesticides and environmental pollution and ecological imbalances may occur. Application of organic fertilizers has been a noble and traditional practice of maintaining soil health and fertility. The use of this organic fertilizers results in higher growth, yield and quality of crops. They contain macro nutrients, essential micro nutrients, many vitamins, growth promoting factors like IAA, GA and beneficial microorganisms (Natarjan,2007; Sreenivasa et al, 2010). Organic manures can improve soil-water-plant relations through modifying bulk density, total porosity, soil water relation and consequently, increasing plant growth and water use efficiency (Obi and Ebo, 1995). Nileemas and Sreenivasa (2011) stated that application of liquid organic manure promotes biological activity in soil and enhance nutrients availability to tomato crop. Addition of organic manure to soil enhance microbial activity and increase their ability to conserve fertigation and consequently increasing their fertility and fertilizers use efficiency as a final goal (Nanwai et al, 1998)**.** Awad et al (2002). stated that organic manure contains high levels of relatively available nutrients elements, which are essentially required for plant growth, Moreover it plays an important role for improving soil physical properties. Sustainability in agroecosystems involves environmentally friendly techniques based on biological and non- chemical methods (Bonato and Ridray, 2007).

Effect of panchagavya on plants

- Plants sprayed with Panchagavya habitually produce bigger leaves and develop denser canopy.
- Branching is relatively high.
- The rooting is prolific and intense.
- The roots spread and grow into deeper layers were also observed.

Effect of panchagavya on soil fertility

- Panchagavya improves fertility status in soils by increasing macronutrients,
- micronutrients and beneficial microorganisms thus increase soil health.
- It improves water holding capacity of soils because it acts as a organic manure.
- It encourages growth and reproduction of beneficial soil microorganisms
- It increases nutrient uptake in plants and enhances plant growth.
- Effect of panchagavya on pest and diseases
- It increases immunity power in plants thereby confers resistance against pest and diseases various beneficial metabolites produced by microorganisms such as organic acids, hydrogen peroxide and antibiotics, which are effective against various pathogenic microorganisms

General Advantages of Panchagavya

- It improves soil health and fertility
- It is used against pest and diseases
- It increases yield and quality of produce
- No chemicals are used
- Eco-friendly approach
- Cost required for preparation is less
- No special techniques is required
- It gives multiple uses
- Reduces cost of cultivation by reducing chemicals like fertilizers, pesticides,
- fungicides, growth regulators etc
- Farmer friendly method

Problems, Constraints, Barriers and Difficulties in Adopting Panchagavya

Lack of awareness about its uses
Sometimes during fermentation contamination occurs
Slow action
Limited availability of its products in markets
It encourages weed growth also as it is non selective
Less utilisation by farmers
It may reduce quality of the produce sometimes

Preparation and formulation of Panchagavya
Collection of substrates

Collection of Panchagavya ingredients and container also collected and safely preserved. The substrate namely Fresh cow dung (3kg), Fresh cow urine (3 lit), Cured (1 lit), Cow ghee (1 lit), and finally 10lit capacity pot in one number.

Preparation and formulation of Panchagavya

Step I - Mix cow dung and ghee mixed thoroughly and covered clean cloth on this pot (3days).
Step II - after third day of mixer added sufficient amount of curd and urine mixed thoroughly and covered clean cloth on this pot.
Step III - adding tender coconut water and reduce the bad odur.
Step IV - the mixer will be ready for after 15 days of treatment.
Step V - the filtered material of panchagavya was formulated .
Step VI – there after formulated Panchakavya was stored in pet battles and preserved.

Isolation of Bacteraia, fungi Actinomycetes from water and sediment samples by plating technique

Panchagavya samples from each station were subjected to appropriate dilutions (10^{-2} to10^{-7}) and 0.1 ml of sample was aseptically transferred into the plates containing Potato dextrose agar with addition of mixture antibiotics, Tetracycline and Penicillin, Nutrient agar for bacteria and Actinomycetes (Kenknight's agar). The plates were incubated at respective temperatures. Control plates were also maintained.

Identification of Microorganisms

Identification of Bacteria and Actinomycetes

Identification of bacteria and Actinomycetes was done by Gram staining, LCB(Actinomycetes), Motility and Biochemical test such as IMViC tests, Urease, catalase test, TSI test, Sugar fermentation test and Coagulase test (Aneja, 2001).

Identification of Fungi

Identification of fungi was done by LCB and Biochemical test such as Sugar fermentation test.

Presentation of data

The semi permanent slides of the isolated microbes were prepared using Gram staning (Bacteria, Actinomycetes) Lactophenol Cotton Blue Staining method (Fungi) and sealed with DPX mountant.

Confirmation of Bacteria, Actinomycets and fungi

The identification of Bacteria and Actinomycetes was based on Bergey's Manual of Determinative Bacteriology (9^{th} Edition – John G. Holt *et al*., 1994). The identification of fungal taxa was based on Hyphomycetes (Subramanian, 1971), Dematiaceous Hyphomycetes and More Dematiaceous Hyphomycetes (Ellis, 1971, 1976) and Manual of soil fungi (Gilman, 1957, 1998).

Soil selection and sterilization

Red soil was collected and it was mixed with sand in the ratio of (2:1)v/v). The sand soil mixture was sterilized at 121ºC (151bs) for two consecutive days.

Field culture method

Treatments

C-: Control
T1: 2%Panchagavya
T2: 4%Panchagavya
T3: 6%Panchagavya
T4: 8%Panchagavya
T5:10%Panchagavya

Parameters analysis

Analysis Morphological parameters
Morphological parameters such as length of plant, number of leaves, breadth of leaves, length of leaves, shoot length of /plant number of flowers/plant, root length of/plant, total length of *L.esculantum*. plants were recorded respectively for treated plants.

Analysis bio-chemical parameters

Estimation of biological compounds such as chlorophyll, protein, carbohydrate and total free amino acids, reducing sugars, were also analyzed for control, treated plants with Panchagavya.

Panchakavya is an organic product derived from five products evolving from cow,and it has been used in Indian medicine since time immemorial. ``I have modified this Panchakavya by adding a few more ingredients and the modified version has a lot of beneficial effects on a variety of crops and livestock", said Dr. K. Natarajan, President of the Rural Community Action Centre (RCAC), a non-governmental organization, actively engaged in promoting the concepts of organic farming and bio-diesel in the rural areas of Tamil Nadu.

An allopathic medical practitioner with deep conviction in ecological farming and sustainable agriculture, Dr. Natarajan combined his traditional knowledge and wisdom on the value of cow's products and medicinal herbs to develop this Panchakavya. He has done extensive research with his Panchakavya on various crops, animals and even earthworms. His findings have been validated by leading research institutes in the country, and he was awarded the prestigious "Srishti Sanman" by a leading developmental organization in Ahmedabad.

"The present form of Panchakavya is a single organic input, which can act as a growth-promoter and immunity booster. It is essentially a product containing 4 kg gobar gas slurry, 1 kg fresh cow dung, 3 litres of cow urine, 2 litres of cow's milk, 2 litres of cow's curd, 1 kg cow's ghee, 3 litres of sugarcane juice, 12 ripe bananas, 3 litres of tender coconut water, and 2 litres of toddy (if available). This will make about 20 litres of Panchakavya. The concoction is stored in a wide-mouthed earthen pot or concrete tank in open. Sufficient shade should be provided, and the contents should be stirred twice a day, both in the morning and the evening. In seven days, the modified Panchakavya will be ready, and it can be diluted before use on plants and animals," says Dr. Natarajan.

Tharmaraj *et* al., (2011) says Panchagavya, a Vedic formulation for increased productivity, disease resistance in plants and potential of utilizing Panchakavya as biofertilizer was tested on various pulses *Vigna radiate, Vigna mungo, Arachis hypogea, Cyanopsis tetragonoloba. Lablab purpureus*, *Cicer arietinum* and the cereal *Oryza sativa* var. ponni by growing in soil amended with dried traditional and seaweed based Panchagavya. Experimental seedling recorded higher rates of linear growth of both shoots and roots as compared to controls and that too maximum growth was observed in seedling grown in soil amended with seaweed based Panchakavya at low concentration (1:100; Panchagavya; soil). A similar observation was made on the number of leaves produced, leaf area, number of root nodules formed in the pulses by rhizobia and increased the levels of all the enzymes. The cost of production of a litre of Panchakavya is around Rs. 35, and it can be brought down substantially if the farmers use their own cows' products. The Panchakavya is diluted to three per cent and sprayed on crops to get the best results. Three litres of Panchakavya is diluted with 100 litres of water and sprayed over crops to get rid of pests and diseases and also get higher yields. Seeds can be soaked and seedlings can be dipped in 3 per cent solution of Panchakavya for about 30 minutes before sowing to get good results from the crops. Various crops such as rice, a variety of vegetables, fruit crops such as mango, banana, guava, acid lime cash crops such as sugarcane, turmeric, jasmine and moringa and plantation crops have responded extremely well to application of Panchakavya. Earthworms grew faster and produced more vermi-compost when treated with this solution. "When sprayed with Panchakavya, the plants produce larger leaves, and develop denser canopy. The stem produces lateral shoots and much more sturdy branches to bear heavy yields. The rooting is profuse and dense, and penetrating to deep layers. Roots helps in better intake of nutrients and water. Plants are able to stand protracted drought conditions, and needed less than a third of the irrigation in regular times," explains Dr. Natarajan. The Panchakavya has been field-tested by a network of organic farmers in the country. Panchakavya has several beneficial effects on animals and fish as well. When fed to cows at 200 ml per day, they turned healthier and produced milk with high fat content. Their rate of conception increased, and the various common ailments were completely cured.

Similar effects were found in sheep and goats. When mixed with the poultry feed or drinking water at the rate of 5 ml per bird per day, the birds became disease-free and healthy. They laid larger eggs for longer

periods. In the broilers, the weight gain was impressive and the feed to weight conversion ratio improved. In the fishponds, the addition of Panchakavya increased the growth of phyto and zoo plankton, which contributed to improved fish feed availability and thus increased fish growth, according to Mr. Natarajan.

According to Natarajan (2004) says Panchakavya has several beneficial effects on plants, animals and fish as well. When fed to cows at 200 ml per day, they turned healthier and produced milk with high fat content. Their rate of conception increased, and the various common ailments were completely cured. Similar effects were found in sheep and goats. When mixed with the poultry feed or drinking water at the rate of 5 ml per bird per day, the birds became disease-free and healthy. They laid larger eggs for longer periods. In the broilers, the weight gain was impressive and the feed to weight conversion ratio improved. In the fishponds, the addition of Panchakavya increased the growth of phyto and zoo plankton, which contributed to improved fish feed availability and thus increased fish growth.

The Panchakavya is an organic product derived from five products evolving from cow, and it has been used in Indian medicine since time immemorial of allopathic medical practitioner with deep conviction in ecological farming, sustainable agriculture, traditional knowledge and wisdom of the value Panchakavya and utilized to cultivate medicinal herbs. Various crops such as rice, a variety of vegetables, fruit crops such as mango, banana, guava, acid lime cash crops such as sugarcane, turmeric, jasmine and moringa and plantation crops have responded extremely well to application of Panchakavya. “Sprayed with Panchakavya, the plants produce larger leaves, and develop denser canopy. The stem produces lateral shoots and much more sturdy branches to bear heavy yields. The rooting is profuse and dense, and penetrating to deep layers. Roots helps in better intake of nutrients and water. Plants are able to stand protracted drought conditions, and needed less than a third of the irrigation in regular times," the Panchakavya has been field-tested by a network of organic farmers in the country.

Vallimayil and Sekar (2012) reported to Panchakavya is an organic product blended from five different cow products, commonly applied to crop plants in organic farming. It is used as foliar spray, soil application and seed treatment. It can act as growth promoter and immunity booster. Effects of application of Panchakavya in the form of seed treatment and foliar spray to Southern Sunnhemp Mosaic Virus infected sunnhemp plants were studied. Growth and biochemical parameters studied showed better growth in Panchakavya treated plants. Various concentrations from virus infected plants were tested on cluster bean a local lesion assay host for this virus. Panchakavya treated plants showed lesser viral intensity than control. The effect of foliar spray of Panchakavya on virus concentration in the local lession host also studied, by inoculating the plants with virus of different time intervals after foliar spray. A significant change in viral concentration was observed.

Vimalendran. L and K. Wahab, (2013) were used to effect of inorganic fertilizer in combination with Panchakavya information is limited in babycorn and needs field investigation. Hence, the field experiments were conducted at Faculty of Agriculture, Annamalai University, Chidambaram during, July-September, 2008 and January-March, 2009 to study the effect of foliar spray of Panchakavya on the growth and yield of babycorn cv. CoBC 1. The experiments were laid out in Randomized Block Design with fourteen treatments replicated thrice. The treatments included different levels of nutrients and foliar application of Panchakavya (3 and 4%) at various stages of babycorn. The results revealed that four sprays of three percent Panchakavya at 15, 25, 35 and 45 Days After Sowing (DAS) along with 100% Recommended Dose of Fertilizers (RDF) recorded the highest fresh babycorn yield (7439 and 7476 kg ha-1, in 2008 and 2009, respectively) followed by 3 sprays of 3% Panchakavya along with 100% recommended dose of fertilizers (7226 kg ha-1 2008 and 7262 kg ha-1 in 2009).

Panchakavya is an organic formulation made from cow goods. The usage of fermented organic formulations with supportive beneficial microorganisms as foliar nourishment has been come into the picture of modern agriculture for giving rise to good quality non residue protected food (Galindo *et* al., 2007). Consequences of Panchakavya application are superior growth, yield and quality of crops. This liquid organic solution is prepared from cow dung, urine, milk, curd, ghee, legume flour and jaggary. It provides macro nutrients, essential micro nutrients,

many vitamins, required aminoacids, growth promoting substances and beneficial microorganisms for plants well growth. Organic farmers of Tamil Nadu are preparing this foliar nutriment as a home-grown product and it is used widely for field and vegetable crops. Keeping these in view, field investigations were carried out to study the effect of foliar spray of Panchakavya on the growth and yield of babycorn.

Panchakavya means "mixture of five products (cowdung, cow urine, milk, ghee and curd) of cow.Of these, the three direct constituents are cowdung, urine, milk and the two derived products are curd and ghee. It has been used intraditional Indianrituals throughout history. It is also called cowpathy treatment based on products obtained from cows used in Ayurvedic medicine and of religious significance for Hindus. Panchgavya is also used as fertilizers and pesticides in agricultural operations. Panchakavya is an organic product recommended for crop improvement in organic agriculture (Sangeetha and Thevanathan, 2010). In Sanskrit, Panchakavya means the blend of five products obtained from cow. Each individual of these five products is called ‘Gavya’ and together termed as ‘Panchagavya’.

The literatures on Vedic (Vrkshayurveda) depict organizationsof the practices that the farmers practice Panchakavya at field level. It has a place, in a theoretical framework and also has certain plant growth stimulants. Panchakavya plays an important role in the quality of fruits and vegetables. It is used as a foliar spray, soil application along with irrigation, as well as seed treatment (Natarajan, 2002). Farmers in South India practice Panchakavya for sustainable agriculture (Nayagam, 2001). Use of chemical fertilizers and pesticides in agriculture fieldsled to environmental degradation and hence as an alternative to chemicals. Panchakavya is also being sought to improve crop establishment and health (Shakuntala et al., 2012).

Therefore, Panchakavya has played a significant role in providing resistance to pests and diseases, resulting in increased overall yields (Tharmaraj et al., 2011; Sumangala and Patil, 2009). Panchakavya possess the properties of fertilizers and bio pesticides (Sireesha, 2013). Panchakavya has resulted in positive effect on growth and productivity of crops as reported by Somasundaram et al. (2003). In Veda, cow's urine was compared to the nectar. In substrata several medicinal properties of cow's urine have been mentioned and are known to cause weight loss, reversal of certain cardiac and kidney problems, indigestion, stomachache, edema, etc. Cow urine has a unique place in Ayurvedha and has been described in Sushrita Sumhita and Ashtanga Sangraha to be most effective substances secretion of animal origin with innumerable therapeutic values. It has been recognized as water of life or Amrita (beverages of immortality) the nectar of the God. In India drinking of cow urine has been practiced for thousands of years. Panchakavya is a term used in Ayurveda to describe five important substances obtained from cow namely urine, dung, milk, ghee and curd. A number of formulations continuous use of pesticides resulted in the development of integrated pest management (ipm) and organic farming (Thomas et al., 2001; Prabu, 2004). Heavy use of chemicals in agriculture has weakened the ecological base addition to degradation of soil, water resources and quality of food. At this juncture a keen awareness has sprung of the adoption of "organic farming" as a remedy to cure. Organic agriculture is low cost and chemical free fertilizers. It is very essential to development a strong workable and compatible package of nutrient management through organic resources for various crops based on scientific facts, local conditions and economic viability (Kannaiyan, 2000).

The current global scenario firmly emphasizes the need to adult eco-friendly agricultural practices for sustainable agriculture. Chemical agriculture has made an adverse impact of the health-care of not only soil but also the beneficial soil microbial communities and the plants cultivated in these soil. This eventually has lead to a high demand organic produce by the present day health conscious society and sporadic attempts are being made by farmers all over the world to detoxify. The land by switching over to organic farming dispenses with chemical fertilizers, pesticides, fungicides and herbicides. In India, organic farming was a well developed and systematized agricultural practice during the past and this "ancient wisdom" obtained through Indian knowledge systems such as Vedas, specify the use of Panchakavya in agriculture. Panchakavya is a foliar nutrition prepared by organic growers of Tamilnadu and widely used for various agricultural and horticultural crops. In Sanskrit, Panchakavya means a combination of five products obtained from cow. When suitably mixed and used, these have miraculous effects. In the present study a preliminary attempt has been made to find out the

effect of Panchakavya spray on the growth, biochemical and yield parameters of Abelmoschus esculentus (L.) Moench.

Farmers in South India practice Panchakavya for sustainable agriculture (Nayagam, 2001). Use of chemical fertilizers and pesticides in agriculture fields led to environmental degradation and hence as an alternative to chemicals. Panchakavya is also being sought to improve crop establishment and health (Shakuntala *et* al., 2012). Therefore, Panchakavya has played a significant role in providing resistance to pests and diseases, resulting in increased overall yields (Tharmaraj et al., 2011; Sumangala and Patil, 2009). Panchakavya possess the properties of fertilizers and bio pesticides (Sireesha, 2013). Panchakavya has resulted in positive effect on growth and productivity of crops as reported by Somasundaram et al. (2007).
Ali *et* al., 2011 was experiment and designed with three treatments on three replications, with the view to studying the effect of Panchakavya and Sarifibani, liquid organic manure on the yield of green gram, Vigna radiata, chilli, Capsicum frutescens (Chili) and mustard, Brassica campestris. Their efficacy were compared by studying the yield contributing characters like plant height, primary branch, secondary branch plant , number of seed fruit, fruit length, weight of JOO seed, yield plant, yield and experimental observation recorded that the Sarifibani and Panchakavya treated crops were higher than the control. A liquid manure specifically Sarifibani used in this study was pre-analysed to study the variation in microbial population between two Sarifibani sample prepared by using raw materials (Cow dung and Cow urine) obtained from two different source of cow breed (i.e., Native breed and Jersey breed) and the best source of breed was selected for the further research work Meanwhile the effect of organic farming practice in soi/health was also studied by analysing the basic parameters of soil in the field were the research was conducted. The result shows increased microbial population, oxidisable organic carbon, nitrogen, phosphate, potash. The pH and E.C were found to be close to neutral.

Among various composts viz., phosphocompost, nitrogen-enriched phosphocompost, vermicompost and phosphorus-enriched vermicompost, the mineral matter content was higher in all the enriched composts in comparison to conventional composts, the total organic carbon and water soluble carbon were lower, whereas total mineral constituents (NPK) were higher in enriched compost and vermicompost. There was no significant variation in the content of macro and micronutrients between phosphorus enriched vermicompost and the other chemically-enriched composts. However, vermicompost prepared by only earthworm inoculation was slightly better than conventional compost. The period of decomposition was almost the same (105±10 days) among the enriched composts, whereas, in case of conventional compost, the decomposition period was 175±5 days. Srimathi *et* al., (2013) were studied on organic seed fortification with Jatropha curcas and Pongamia pinnata using ‘Panchakavya ’at one, two, three, four and five per cent concentrations with the three different soaking durations revealed that Panchakavya at 2 and 5% with the soaking duration of 16 and 8 h were superior than the control and other concentrations in terms of germination and seedling vigour for Jatropha curcas and Pongamia pinnata respectively.

Rajesh *et* al., 2013 were undergoing the field experiment was conducted to find the variation in growth, biochemical and yield parameters of black gram under different concentrations (control, 1, 3, 5, 7.5 and 10%) of Panchakavya, and all the parameters were increased in 3% concentration. Since there was increase in growth and yield at low concentration of Panchakavya, it is recommended that the Panchakavya can be used for spray after diluted properly.

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