COW BASED PRODUCTS FOR SUSTAINABLE AGRICULTURE- A REVIEW

ABSTRACT

Food safety is of prime importance at present because, consumption of food products with chemical residues above the threshold levels is causing dreadful diseases in living beings and deteriorating the soil health too. The current global scenario firmly emphasizes the need to adopt agricultural practices which are ecologically safe for sustainable food production. Hence, it is necessary to adopt organic farming which improves the health of Agro-ecosystems besides providing safe food and conserving the soil fertility and soil biota. Cow based products along with organic manures can be used in organic farming as an alternative to chemical fertilizers which helps in growth of the crop and provides eco-safety food.

Introduction

At present ever increasing population is exerting immense pressure on agriculture to meet their nutritional food requirement across the world. In order to achieve the food demand of growing population, dependance on chemical fertilizers to achieve higher productivity has increased enormously. Usage of chemical fertilizers continuously since green revolution has been reached a plateau and the soil fertility status has been decreasing due to over dosage. Besides decreased fertility status of soil, harmful chemical residues are accumulated in the harvested produce, which is causing unnamed diseases in living beings. Therefore, it is necessary to adopt ecofriendly cultivation practices to conserve the nature. Usage of cow based products *viz.*, panchagavya, beejamrutha and jeevamrutha as an alternative to chemical fertilizers, along with other organic manures can be a viable option to produce safe harvestable yield and also to improve the soil health.

Panchagavya, Jeevamruth and Beejamruth are cheaper ecofriendly organic preparations made by cow products namely dung, urine, milk, curd and ghee (Boraiah, *et al.*, 2017). Curd provides lactobacillus which acts as a catalyst in the digestion of organic wastes. Ghee provides vitamin A and B, calcium and fat (Saritha and Vijayakumari, 2013). Cow urine has many beneficial properties particularly in the areas of agriculture and therapeutics. Cow urine contents are water 95%, urea 2.5%, minerals, salt, hormones, and enzymes 2.5%. It also contains iron, calcium, phosphorus, salts, carbonic acid, potash, nitrogen, ammonia, manganese, iron, sulphur, phosphates, potassium, urea, uric acid, amino acids, enzymes,

cytokine, and lactose (Bhadauria, 2002). The use of organic liquid products such as Panchagavya, Beejamrutha and Jeevamrutha results in higher growth, yield and quality of crops (Neelima*et al.*, 2011). Panchagavya meansmixture of five products (cow dung, cow urine, milk, ghee, and curd) of the cow. Of these, the three direct constituents are cow dung, urine, milk and the two derived products are curd and ghee (Singh *et al.*, 2018). Panchagavya is an organic product recommended for the improvement in organic agriculture (Sangeetha and Thevanathan, 2010). In Sanskrit literature, Panchagavya means the blend of five products obtained from cow. Each of these five products are called 'Gavya' and together termed as 'Panchagavya.' 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 a seed treatment (Natarajan, 2002). Use of chemical fertilizers and pesticides in agriculture fields led to environmental degradation and hence as an alternative to chemicals, panchagavyais being used to improve crop establishment and health (Shakuntala *et al*., 2012). In panchagavya, cow dung acts as a medium for the growth of beneficial microbes and milk provides protein, fat, carbohydrate, amino acid and calcium. Panchagavya also contains bio fertilizers such as *Azospirillum, Azotobacter, Phosphobacteria,* and *Pseudomonas* were found beside *Lactobacillus* (Yadav and Lourduraj, 2005). It also contains growth regulatory substances such as Indole Acetic Acid (IAA), Gibberellic Acid (GA3) and Cytokinin.

Beejamrutha and jeevamrutha contains macro nutrients, essential micro nutrients, many vitamins, essential amino acids, growth promoting factors like IAA, GA and beneficial microorganisms(Gadewar*et al.*, 2013). Jeevamruta is a rich bio-formulation containing consortia of microbes (Kumar *et al.,* 2018). The word Jeevamruta refers to life (jeeva) supporting holy liquid (amruth)(Dhanoji*et al.*, 2018).Jeevamrutha was prepared by cow urine,dung,gram flour,jaggery and water (Sornalatha *et al.,* 2018). Jeevamruth promotes immense biological activity in soil and makes the nutrients available to crop (Boraiah, *et al.,* 2017).Jeevamrutha is abeneficial liquid bio-enhancer which promotes soil productivity, growth and yield of plant (Kumar *et al.*, 2018).

Beejamrutha, a mix of cow dung, cow urine, water, lime and a handful of soil, a totally organic product helpful for the plant growth and protects the crop from harmful soil-borne and seed-borne pathogens. Smearing the seeds with beejamrutha before sowing control many diseases that attack the plant right from its seedling stage. At times, saplings are dipped in the beejamrutha before being transplanted(Sreenivasa *et al.,* 2009). Beejamrutha protect the crop from soil borne and seed borne pathogens and it improves seed germination also (Boraiah, *et al.,* 2017).

The cost of inorganic fertilizers is increasing immensely to an extent that they are out of reach of small and marginal farmers. With the continuous usage of inorganic fertilizers and insecticides, the population of beneficial organisms in soil will decrease and natural regeneration of nutrition in the soil cease. Soil becomes barren and soil fertility decreases. The use of fermented liquid manures in such situation is, therefore practically a paying proposal. In these liquid manures, beneficial organisms survive and are helpful in phosphate solubilization, nitrogen fixation etc. Application of these organic liquid formulations will enhance the soil microbial activity and population to a larger extent. This in turn has a positive effect on growth and yield of crops (Boraiah, *et al.*, 2017).

Fig. 1: Cow based products for sustainable agriculture

Effect of cowbased products on crop growth parameters

Pinjari (2007) reported that all the growth parameters *viz.*, plant height, number of functional leaves and dry matter accumulation at different crop stages in the different plant parts at 60, 90 DAS and at harvest significantly influenced during both year of study with 3 per cent Panchagavya spray on sweet corn and at 30 DAS, all the growth characters remained unaffected due to the application of growth stimulates. Ramesh *et al.* (2018) revealed that foliar spray of 5 per cent jeevamrutha at 20, 40 and 60 DAS recorded significantly higher

plant height, leaf area index and dry matter production of maize as compared to control and other treatments.

(Shariff and Sajjan, 2017) reported that in green gram, application of FYM (33.33%) + vermicompost (33.33 %) + glyricidia leaf manure (33.33%) equivalent to 100% RDF and foliar spray of 3 per cent panchagavya at flower initiation and 15 DAF has recorded significantly higher plant height, number of branches per plant, number of trifoliate leaves and dry matter accumulation at harvest over the other treatments.Panchagavya was tested for different crops such as turmeric, paddy, onion, ginger, sugarcane, banana, vegetables and curry leaf and it was found that it enhanced the growth, vigor of crops, resistance to pest and diseases and improvement of keeping the quality of vegetables and fruits (Natarajan, 2002). A field experiment was conducted by Ramesh *et al.* (2013) during rice fallow season 2012 in Tamil Nadu and the results of the experiment showed that seed soaking with 3 per cent panchagavya + foliar spray of 3 per cent panchagavya twice (30 and 40 DAS) recorded significantly higher plant height, leaf area index (LAI), dry matter production (DMP), number of branches per plant in rice fallow black gram. Biogas slurry with panchagavya combination was found to be 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). Application of jeevamrutha at the rate of 1000 L ha^{-1} and panchagavya at the rate of 7.5 per cent recorded significantly higher growth parameters like number of branches, number of leaves and leaf area index of cowpea as compared to control (Sutar *et al*., 2019). Dasarathan*et al.*(2018)conducted an experiment on influence of panchagavya on the invigoration of seed germination and meristic changes in *Abelmoschus esculentus*plants and found that application of panchagavya at 4 per cent and 5 per cent concentration high germination and meristic growth as compared to control. A field study conducted in Coimbatore, Tamil Nadu showed that by increasing the concentration of panchagavya, the number of leaves, shoot length and root length of tomato, French beans and lady's finger increases. The root length and shoot length were found to be higher in plants treated with 8 per centpanchagavya solution as compared to other concentrations and control. The germination per centage was also found to be maximum in all the three crop seeds soaked with panchagavya and water in the ratio 1:1 as compared to the control (Gayathri *et al.*, 2015). Suresh *et al*. (2011) reported that foliar application of panchagavya resulted in significant improvement in plant height, number of branches per plant as compared to NPK and control. Hence, they concluded that 3 percent panchagavya foliar spray given at 15^{th}, 25^{th}, 35^{th} and 45^{th} days of sowing is suitable for obtaining higher

growth and yield in black gram. In a field study conducted at Coimbatore, Tamil Nadu, it was found that significantly highest shoot length, length of internode, diameter of internode, number of leaves and leaf surface area of*Dolichus lablab* were higher with 10:3 per cent vermiwash: panchagavya treated plants as compared to chemical fertilizer application and control (Maheshwari *et al.,* 2016).Rajesh and Jayakumar (2013) reported that highest morphological parameters such as plant height, number of leaves, fresh weight, and dry weight of *Abelmoschus esculentus* (L.) were recorded in the plants sprayed with 3 per cent concentration of panchagavya as compared to control as well as other concentrations of panchaghavya. Application of jeevamrutha and panchagavya at different levels has resulted in significantly higher growth parameters. Soil application of jeevamrutha @ 1000 lha^{-1} and foliar spray of panchagavya @ 7.5percent at 20, 40 and 60 days after sowing recorded significantly higher growth parameters likemore number of branches, number of leaves, leaf area and leaf area index. Enhanced growth parameters due to interaction of jeevamrutha and panchagavya might be due to synergistic effect of Rhizobacteria with Panchagavya spray and soil application of Jeevamrutha which could have helped in translocation of carbohydrates to developing root nodules as reported by Sait and Mehmet Kibritci (2016) and Velmurgan and Mahendran (2015) (Reshma *et al.,* 2018). Among different concentrations, 2 per cent panchagavya seed treatment recorded maximum root and shoot length for maize and paddy whereas maximum root length of cotton and Ladies finger was also recorded with 2 per cent panchagavya seed treatment. Black gram has higher root length at 1 per cent panchagavya while highest shoot length was recorded at 2 per cent panchagavya (Sathiyadevi*et al.,* 2019). Vennila and Jayanthi (2008) revealed that application of 100 per cent recommended dose of fertilizer along with Panchagavya spray (2%) significantly increased the okra plant height and dry matter production. In radish, Seed treatment + foliar application of panchagavya at the rate of 3 per cent recorded highest plant height and higher number of leaves as compared to other treatments (Velmurugan, 2005). Soil treatment with RDF+ beejamruth (seed treatment) + jeevamruth (soil application) + panchagavya (3% foliar spray) showed improvement in plant height, root length and dry matter in tomato as compared to other treatments and control (Nileema *et al.,* 2011).Highest plant height, number of branches per plant and root nodules were recorded with application of panchagavya (3%) at 15 days after flowering on chickpea which might be due to the growth enzymes present in panchagavya that would have favored rapid cell division and multiplication (Patil *et al.*, 2012). The short-term plant growth test with *Cajanus cajan* seeds treated with panchagavya showed enhanced root length and shoot length, dry mass and leaf area after 15 days of sowing compared to other manures (Leo *et al.,*

2013). (Jayachitra and Abirami, 2016) from Tamil Nadu reported that the morphological parameters such as plant height, fresh weight, and dry weight of Macrotyloma uniflorum increasused with the age of the plant. The highest morphological parameters of *Macrotyloma uniflorum* (L.) were recorded in the plants sprayed with 3 per cent concentration of panchagavya when compared with control as well as other concentrations.Parmar *et al.*(2020) revealed that among different treatments application of panchagavya at the rate of 3 per cent spray at 25 days after transplanting recorded maximum growth characters like plant height and number of branches of tomato.

Effect of cowbased products on yield and yield parameters of various crops

Ali *et al.*(2011) observedthe effect of panchagavya on yield of green gram (*Vigna radiata*), chilli (*Capsicum frutescence*) and mustard (*Brassica campestris*). Their efficacy was compared by studying the yield contributing characters like plant height, primary branches, secondary branches per plant, number of seeds per fruit, fruit length, the weight of seed, yield per plant, yield per m^2 and found that all theseobservationsare higher than the control with application of panchagavya.Swaminathan *et al*. (2007) concluded that application of Panchagavya at 3 per cent as foliar spray on 15, 25, and 40 days after sowing (DAS) on black gram recorded the highest grain yield. Significantly highest number of cob ha^{-1}, cob yield, straw yield and biological yield of sweet corn were recorded with application of 3 per cent panchagavya and amrutpani through irrigation water over the control during both years (Pinjari*et al.*, 2007). Yield and yield attributes were improved due to application of both jeevamrutha and panchagavya to Cowpea. Higher grain yield and haulm yield were recorded with the soil application of jeevamrutha @1000 lha^{-1} and foliar spray of panchagavya @ 7.5 percent. Yield increased significantly due to better yield attributing characters *viz.*, significant increase in number of pods per plant, seeds per pod, pod length, seed weight per plant,100 seed weight (Reshma *et al.*, 2018). Panchal *et al.*(2017) conducted a field experiment during *rabi*, and reported that among different treatments, foliar spray of panchagavya @ 4 per cent at branching and flowering stage showed higher seed yield and stover yield.Application of panchagavya and vermicompost combination had given the highest pod yield of French bean variety Ooty-2 which was 36 per cent higher than the conventional method (Selvaraj, 2003). Significantly higher number of seeds per pod and grain yield in green gram were recorded with application of panchagavya 3 per cent as compared to other treatments (Somasundram*et al.*, 2007). The highest yield parameters such as number of fruits per plant and fruit weight of *Abelmoschus esculentus* (L.) Moench were recorded in the plants sprayed with 3 per cent concentration of panchagavya when compared with control as well as other concentrations

(Rajesh and Jayakumar, 2013).Highest stick yield of moringa was recorded with application of poultry manure + neem cake + Panchagavya (Beaulah 2001). Highest cob length, cob width, individual cob weight and baby corn yield were recorded with RDF+ 4 sprays of 3 per cent panchagavya at 15, 25, 35 and 45 days after sowing. This might be due to adequate supply of nutrients at different growth stages of the crop as well as presence of growth regulators in panchagavya contributing to higher yield and yield parameters (Vimalendran and Wahab, 2013). Higher capsicum yield per hectare was recorded with application of jeevamrutha as compared to control (Boraiah*et al.,* 2017). The beneficial effects of Jeevamrut reported by Palekar (2006), Vasanthkumar (2006) and Devakumar *et al*., (2008) was attributed to higher microbial load and growth harmones which might have enhanced the soil biomass thereby sustaining the availability and uptake of applied as well as native soil nutrients which ultimately resulted in better growth and yield of crops. Use of panchagavyaat the rate of 3 per cent as seed treatment has enhanced the parameters like number of flowers per plant and total yield per plant(Rao *et al.,* 2015). Kumawat *et al.* (2010) showed that foliar application of neem plus panchagavya at branching and flowering increased yield of crops in Groundnut-Cumin and Cluster bean-Cumin cropping systems. The increase in yield in cluster bean and cumin was 64 and 199 per cent, respectively, under cluster bean-cumin system as compared to other treatments. While groundnut and cumin yield were 118 and 156 per cent higher, respectively, under groundnut-cumin system.Vijakumari*et al.* (2012)reported that soybean seeds soaked in panchagavya (1%) + humic acid (1%) + micro herbal fertilizer (1%) for 8 hours recorded higher pods per plant and seeds per plant as compared to that of other treatments. Results of an experiment conducted in sweet corn by Waghmode*et al.* (2015) showed that cow urine spray at the rate of 10 per cent and panchagavya (3%) at grand growth period and tasselling stage recorded higher fresh cob yield and fresh grain weight per plant, dry grain weight per plant, cob girth and cob length as compared to other treatments. Gopal *et al.* (2017) showed that significantly highest seed yield, straw yield and biological yield in black gram were recorded with panchagavya 4 per cent spray as compared to other treatments. (Krishnaprabu, 2015) conducted an experiment at Annamalai University and showed that higher number of pods per plant, 1000 seed weight and grain yield of greengram were recorded with foliar spray of Panchagavya as compared to other treatments however, it was at par with foliar spray of 19:19:19 and Jeevamrutha. The per cent increase in yield with these treatments over control was 47, 44 and 38, respectively. Ramesh *et al.* (2015) reported that foliar spray of 5 per cent jeevamrutha at 20, 40 and 60 DAS recorded significantly higher cob length, cob girth, number of grains per cob, grain yield and stover yield of maize and it

was found on par with 5 per cent beejamrutha application at 20, 40 and 60 DAS. They also opined that higher availability of growth promoting substances like IAA, GA, cytokinin, kinetin, essential plant nutrients and effective microorganisms which were present in jeevamrutha and beejamrutha may directly influenced the photosynthetic activity and assimilate partitioning from source to sink and might have resulted in higher grain yield of maize (Manoj *et al.,* 2020).Application of FYM (33.33%) + vermicompost (33.33 %) + glyricidia leaf manure (33.33%) equivalent to 100% RDF and foliar spray of 3 per cent panchagavya at flower initiation and 15 DAF has recorded significantly higher number of pods per plant, pod length, number of seeds per pod, seed yield per plant, 100 seed weight, protein content and seed yield per hectare (Shariff and Sajjan, 2017). (Loganathan and Wahab, 2014) reported that combined application of recommended dose of fertilizers and 4 sprays of 3 per cent panchagavya at 15, 25, 35 and 45 DAS resulted in higher green cob yield and fodder yield of baby corn when compared to sole application of recommended dose of fertilizers.With the application of jeevamrutha @ 600 L ha^{-1} three times through irrigation water higher green cob yield and fodder yield of sweet corn were recorded by Safiullah *et al.* (2018).Application of recommended dose of fertilizers along with soaking of seeds in 3 per cent panchagavya and 3 per cent panchagavya spray at tillering and jointing stage resulted in higher number of tillers, spike length, number of grains, grain yieldand straw yield of wheat than recommended dose of fertilizers application alone (Pagar *et al.,* 2016). Higher ear head length, ear head weight, seed yield, thousand seed weight of foxtail millet were recorded with application of 3 per cent panchagavyaand increase in yield was to the extent of 13 per cent over control (Atish *et al.*, 2019).Combined application of panchagavya at 4 per cent as foliar spray and jeevamrutha at 500 L ha^{-1} as soil application recorded significantly higher pod yield and haulm yield over the recommended dose of fertilizers treatment in groundnut (Patel *et al*., 2018).Seed soaking with 3 per cent panchagavya + foliar spray of 3 per cent panchagavya twice (30 and 40 DAS) significantly recorded higher number of branches per plant, pod length, number of pods per plant, number of seeds per pod, grain and haulm yields in rice fallow black gram as compared to control (Ramesh *et al.,* 2013). Choudhary *et al.* (2017) reported that in black gram, application of 4 per cent panchagavya at branching and flowering stages documented significantly higher number of pods per plant, number of seeds per pod, test weight, seed yield and straw yield over control. Higher number of pods per plant, number of seeds per pod, test weight, seed yield and straw yield of green gram were recorded with the application of FYM @ 12 kg N equivalent at land preparation + Panchagavya @ 8 kg N equivalent through irrigation water at 30 DAS and 45 DAS in equal

splits (Chongre*et al*., 2019). (Sutar *et al.,* 2019) reported that higher yield attributes like number of pods per plant, number of seeds per pod, seed weight, grain yield and haulm yield of cowpea were recorded with application of jeevamrutha at the rate of 1000 L ha^{-1} and panchagavya at the rate of 7.5 per cent as compared to control. Higher yield parameters such as number of fruits per plant and fruit weight of okra were recorded in the plants sprayed with 3 per cent concentration of panchagavya as compared with control and other concentrations (1, 5 and 7%) (Rakesh *et al*., 2017). Among the various treatments, foliar spray of 5 per centjeevamrutha on 20, 40 and 60 DAS registered significantly higher cob length, cob girth, hundred grains weight, grain yield, stover yield and harvest index over the other treatments. Higher availability of growth promoting substances such as IAA, GA, cytokinin, kinetin, essential plant nutrients, effective microorganisms were present in jeevamrutha that directly influenced LAI, increased photosynthetic activity and assimilate partitioning from source to sink might be attributed to increased yield attributes in this treatment (Ramesh *et al.*, 2018).Application of NPK 50 per cent + Vermicompost + Panchagavya 3 per cent + Jeevamrutha 5 per cent recorded significantly higher grain yield and straw yield as compared to control and other treatments in rice cultivar DRR Dhan-39 (Sharadha and Sujathamma, 2018).In *Abelmoschus esculentus* treatment with panchagavyarecorded higher number of flowers, flower length, number of fresh vegetables and weight of vegetables as compared to the plants which were grown on vermicompost and control alone (Vinnoli *et al.,* 2018).

Effect of cowbased products on soil health and nutrient uptake

(Kumawat *et al.,* 2013) reported that in sandy soils (pH 9.2) with successive increase in panchagavya level from 1 to 3 l m^{-2} reduced the pH of the groundnut rhizosphere temporarily during initial period of 5 days after application (DAA). Similarly, EC was also reduced considerably as that of pH compared to control. These effects (reduction of pH and EC) remained so up to 5 DAA and thereafter, the differences were narrowed down and became almost negligible at harvest. The reduction in pH of rhizosphere following application of panchgavya was due to its low pH (4.35). (Chandrakala *et al.,* 2007) reported that application of beejamrutha + jeevamrutha + panchagavya recorded significantly higher uptake of N, P and K as compared to application of beejamrutha + jeevamrutha in chilli crop.(Sutar *et al.,* 2017) revealed that uptake of NPK in cowpea was higher with application of jeevamrutha at 1000 L ha^{-1} as soil application and 7.5 per cent panchagavya as foliar spray as compared to other treatments. Application of beejamrutha + jeevamrutha + vermicompost + foliar spray of panchagavya recorded significantly higher bacterial, fungal and actinomycetes population at different crop growth stages (50 DAS and at harvest) of chickpea and it was found on par

with treatments receiving beejamrutha + jeevamrutha + FYM + panchagavya and beejamrutha + jeevamrutha + FYM + vermicompost + panchagavya (Kiran *et al.,* 2015). Beaulah (2001)opined that the beneficial microorganisms from panchagavyaand their establishment in the soil improved the sustainability of agriculture as the microorganisms presenting the rhizosphere environment around the roots influence the plant growth and crop yield. Maximum number of *Rhizobium, Azospirillum and Azotobacter* population in experimental soil of *kharif* groundnut was recorded with foliar spray of panchagavya @ 4 per cent + jeevamrutha @ 500 L ha^{-1} as soil application. In addition to increased bacterial population, enhanced available phosphorus, potassium and organic carbon in the soil was also reported (Patel *et al.,* 2018). Bhanuvally*et al.* (2014) reported that with application of vermicompost (3 t ha^{-1}) + panchagavya spray at the rate of 3 per cent @ 30, 60 and 75 DAS) + liquid manure (2000 L ha^{-1}) + jeevamrutha (2000 L ha^{-1}) higher available nitrogen, phosphorus, potassium, iron, zinc, copper and manganese content in the soil were recorded under rainfed groundnut crop.Sharada (2013) documented that higher populations of soil microflora *viz.,* bacteria, fungi, actinomycetes, free living nitrogen fixers and PSB at different growth stages of greengram and *rabi* sorghum were recorded with application of organic manures + panchagavya spray as compared to RDF alone.Boraiah*et al.* (2017) found that higher nitrogen fixer's and P-solubilizers population at 60 DAT during *kharif* and summer season were recorded with application of jeevamrutha in capsicum crop as compared to other treatments. Gangadhar *et al.* (2020) revealed that in chilli, application of jeevamrutha at the rate of 2000 L ha^{-1} recorded higher microbial population (bacteria, actinomycetes, fungi and PSB) in soil during two years of the experiment as compared to microbial consortia and NCOF decomposer application.Rudragouda*et al.* (2015) reported that in cotton crop, significantly higher uptake of N, P_2O_5 and K_2O was recorded with application of EC (1/3) + VC (1/3) + gliricidia GLM (1/ 3) equivalent to RDF with foliar spray of Panchagavya @ 5 per cent over other organic combinations and was at par with (1/3) + VC (1/3) + GLM (1/3) equivalent to RDF with borax @ 0.2 per cent + $MgSO_4$ @1 per cent and RDF + FYM. The results suggested that addition of organics not only increased the availability of these nutrients in the soil, but also favored the release of nutrients from organic sources through mineralization by micro-organisms and their uptake by the crop. Application of organic liquid bio-booster like Farm yard manure, Beejamruth and Jeevamruth enhances rhizosphere mycoflora population and species diversity in organic field. The application of inorganic inputs lowers the rhizosphere mycoflora population and species diversity compared to organic field of wheat. The isolated mycoflora species belongs to genera *Aspergillus,*

Penicillium, Trichoderma, Fusarium,Rhizopus and *Cladosporium* in both organic and inorganic field. The *Acremonium* sp., *Tichodermapseudokonigii*, *Glomus* sp., *Cladosporium herbarum* and *Curvularialunata* are found in rhizosphere of organic field (Shaik and Gachande, 2013).

Conclusion:

It can be concluded that application of cow based products along with other organic manures results in better growth and productivity of agricultural crops besides it keep the soil rich in useful microbial flora. Initially when the land is converted to organic farming it results in reduced yield. But by the usage of cow based products (panchagavya, beejamrutha and jeevamrutha) in agriculture leads to increased yields because of their growth promoting nature. Cow based products can be used as an alternative to chemical fertilizer to produce residue free and safe food.

References:

Ali, M. N., Ghatak, S., Ragul, T., 2011, Biochemical analysis of Panchagavya and Sanjibani and their effect in crop yield and soil health. *Journal of Crop and Weed*. 7(2):84- 86.

Atish, Badiger, B., Shivmurty, D. and Hunje, R., 2020, Effect of foliar organic nutrients and time of application on seed yield and yield attributes of foxtail millet (*Setaria italica* L.). *Int. J. Chem. Stud.*, 8(1):1718-1721.

Beaulah, A., 2001, Growth and development of moringa (*Moringa oleifera Lam.*) under organic and inorganic systems of culture. *Ph.D. Thesis*, Tamil Nadu Agric.Univ, Coimbatore.

Bhadauria, H., 2002, Gomutra- Ek ChamatkariAushadhi (Cow urine- A Magical Therapy). *Vishwa Ayurveda Patrika*. 5:71-74.

Bhanuvally, M., Rajanaika, Mudalagiriyappa, Ramesha, Y. M. and Yogeeshappa, H., 2014, Effect of different organic sources of nutrients on physical, chemical and biological properties of soil after the harvest of groundnut (*Arachis hypogaea* L.). *Int. J. Agric Sci*., 5(2):121-126.

Boraiah, B., Devakumar, N., Shubha, S. and Palanna, K. B., 2017, Effect of Panchagavya, Jeevamrutha and Cow Urine on Beneficial Microorganisms and Yield of Capsicum (*Capsicum annuum L. var. grossum*). *International Journal of Current Microbiology and Applied Sciences,* 6(9): 3226-3234.

Chandrakala, M., Hebsur, N. S., Bidari, B. I. and Radder, B. M., 2007, Effect of FYM and fermented liquid manures on nutrients uptake by chilli (*Capsicum annum* L.) and soil nutrient status at harvest. *J. Asian Hort.*, 4(1):19-24.

Chongre, S., Mondal, R., Biswas, S., Munshi, A., Mondal, R. and Pramanick M, 2019, Effect of liquid manure on growth and yield of summer green gram (*Vigna radiata* L. Wilczek). *Curr. J. App. Sci. Technol.*, 38(6):1-7.

Choudhary, G. L., Sharma, S. K., Singh, K. P., Choudhary, S. and Bazaya, B. R., 2017, Effect of panchagavya on growth and yield of organic blackgram [*Vigna mungo* (L.) Hepper]. *Int. J. Curr. Microbiol. App. Sci*., 6(10):1627-1632.

Devakumar, N., Rao, G. G. E., Shubha, S., Imrankhan, Nagaraj and Gowda, S. B., 2008, Activities of Organic Farming Research Centre, Navile, Shimoga. *Univ. Agri. Sci.*, Bangalore, Karnataka.

Dhanoji, M. M., Meena, M. K. and Chandra, M. N., 2018, Manure and plant extracts for foliar nutrition in organic farming: A Review. *International Journal of Chemical Studies*. 6(6): 1447-1454.

Dhasarathan, P., Charumathi, S., Nagavasuda, R. K., Cholapandian, A. J. A. and Ranjitsingh, 2018, Plant Growth Promotion Using Panchagavya. *International Journal of Research and Review*, 5(10): 194-196.

Gadewar, R., Lambat, A. and Charjan, S., 2013, Efficacy of indigenous organic preparation on viability, vigour, field emergence and seed mycoflora of Mungbean. In: *Sustainable approaches for environmental conservation*, pp 31-35.

Gangadhar, K., Devakumar, N., Vishwajith, and Lavanya, G., 2020, Influence of different sources of organic manures and decomposers on enzymatic activity and microbial dynamics of rhizosphere soil of chilli (*Capsicum annum* L.). *Int. J. Curr. Microbiol.App. Sci*., 9(1):542-555.

Gayathri, V., Nesiriya, M., Karthika, A. and Jisha, S., 2015, Study on the growth of vegetable crops using panchagavya. *International Journal of Current Research*, 7(10): pp.21093-21096.

Gopal, L. C., Sharma, S. K., Sanju, C., Kendra, P. S., Kaushik, M. K. and Bazaya, B. R., 2017, Effect of panchagavya on quality, nutrient content and nutrient uptake of organic blackgram [*Vigna mungo* (L.) Hepper]. *J. Pharmacognosy and Phyto chemistry*. 6(5):1572-1575.

Jayachitra and Abirami, 2016, Changes in morphological, biochemical and yield Parameters of *Macrotyloma uniflorum* (L.) due to Panchagavya spray. *International Journal of Research in Pharmacology & Pharmacotherapeutics*. 5(2): 94-100.

Kiran, Rao, S., Reddy, V. And Shubha, S., 2015, Effect of nutrient management practices through organics on soil biological properties in organic chickpea (*Cicer arietinum*

L.) cultivation under rainfed condition. *The Ecoscan*, Special issue, Vol. VII: 183-187.

Krishnaprabu, S., 2015, Studies on Foliar Spray of Nutrients for Enhancing Productivity of Greengram. *International Journal of Innovative Research in Science, Engineering and Technology*. 4 (9): 9457-9460.

Kumar, S., Trivedi, H., Sah, R., Verma, A. K. and Yadav, A. T., 2018, Effect of different bio-enhancers on growth & yield of cauliflower (*Brassica oleracea L. Var. Botrytis*). *Journal of Pharmacognosy and Phytochemistry*, SP1: 769-772.

Kumawat, R. N., Mertia, R. S., Mahajan, S. S., 2010, Comparative performance of groundnut-cumin and clusterbean-cumin cropping systems under foliar application of panchgavya in western Rajasthan. *Annals of Arid Zone*. 49(1):31-38.

Leo, D. A. E., Praveen, K. G., Hassan, A. S. K., Abdul, R., Kishore, N., 2013, Microbiological analysis of panchagavya, vermicompost, and FYM and their effect on plant growth promotion of pigeon pea (*Cajanus cajan* L.) in India. *Org. Agr*., 3(1):23-29.

Loganathan, V. and Wahab, K., 2014, Influence of panchagavya foliar spray on the growth attributes and yield of baby corn (*Zea mays*) cv. COBC 1. *J App. Natural Sci*., 6(2):397-401.

Maheswari, V. N., Srikumaran, M.P., Rekha, G.S., Elumalai, D. and Kaleena, P. K., 2016, Growth promoting effects of vermiwash and panchagavya on *Dolichus lablab* under field experimental conditions. *Int. J. Appl. Sci. Biotechnol.*, 4(4): 513-518.

Manoj, K. N., Uma, V. and Kiran, S. C., 2020, Significance of liquid organic manures in sustainable crop production: A review. *International Journal of Ecology and Environmental Sciences*. 2(4): 445-449.

Natarajan, K., 2002, Panchagavya: A manual. Other India Press, Mapusa, Goa, India. 33.

Nileema, S., Gore, and Sreenivasa, M. N., 2011, Influence of liquid organic manures on growth, nutrient content and yield of tomato (*Lycopersicum esculentum Mill*) in the sterilized soil. *Karnataka J. Agric. Sci.*, 24(2): 153-157.

Pagar, R. D., Jangilwad, B. D. and Chaudhary, K. M., 2016, Effect of panchagavya on growth and yield of wheat (*Triticum aestivum* L.). *Adv. Life Sci.*, 5(3):756-760.

Palekar, S., 2006, Shoonyabandovaladanaisargikakrushi pub. Swamy Anand, Agri Prakashana, Bangalore.

Panchal, P., Patel, P. H., Patel, A. G., Desai, A., 2017, Effect of panchagavya on growth, yield and economics of chickpea (*Cicer arietinum L.*). *International Journal of Chemical Studies*. 5(2):265-267.

Parmar, M. N., Patel, S. Y. and Pandey, A. K., 2020, Effect of organic spray on growth parameters of tomato (*Solanum lycopersicum* L.) cv. GT 2 under south Gujarat condition. *International Journal of Creative Research Thoughts.* 8(5): 3970-3974.

Patel, D. M., Patel, I.M., Patel, B. T., Singh, N. K. and Patel, C. K., 2018, Effect of Panchgavya and jivamrut on yield, chemical and biological properties of soil and nutrients uptake by kharif groundnut (*Arachis hypogaea* L.). *Int. J Chem. Stud.,* 6(3):804-809.

Patil, S. V., Halikatti, S. I., Hiremath, S. M., Babalad, H. B., Sreenivasa, M. N. and Hebsur, N. S., 2012, Effect of organics on growth and yield of chickpea (*Cicer arietinum* L.) in vertisols. *Karnataka J. Agri. Sci.,* 25(3):326-331.

Pinjari, S. S., 2007, Effect of integrated nutrient management and polythene mulch on the performance of sweet corn under laterate soils of Konkan. *PhD (Agri.)Thesis,* Dr. Balasaheb Sawant Konkan Krish Vidyapeeth, Dapoli, Maharashtra.

Rajesh, M. and Jayakumar, K., 2013, Changes in Morphological, Biochemical and Yield Parameters of *Abelmoschus esculents* (L.) Moench due to Panchagavya Spray. *International Journal of Modern Plant & Animal Sciences*, 1(2): 82-95.

Rakesh, S., Poonguzhali, S., Saranya, B., Suguna, S. and Jothibasu, K., 2017, Effect of panchagavya on growth and yield of *Abelmoschus esculentus* cv. Arka Anamika. *Int. J Curr. Microbiol. App. Sci.*, 6(9):3090-3097.

Ramesh, S., Sudhakar, P. and Elankavi S., 2013, Effect of foliar nutrition on growth, yield attributes and yield of rice fallow blackgram [*Vigna mungo*]. *International Journal of Development Research*. 3(2): pp.005-007.

Ramesh, S., Sudhakar, P. and Elankavi, S., 2015, Effect of liquid organic supplements on growth and yield of maize (*Zea mays* L.). *Int. J. Curr. Res.* 07(11): 23119-23122.

Ramesh, S., Sudhakar, P. and Elankavi, S., 2018, Effect of organic foliar nutrition on growth and yield of maize (*Zea mays* L.). *International Journal of Research and Analytical Reviews*. 5(3): 64z-67z.

Rao, M. R. K., Kumar, S. M. and Jha, N. K., 2015, Comparative yield analysis of Chilli (*Capsicum annuum* L.) by application of Vermicompost and Panchagavya. *Journal of Chemical and Pharmaceutical Research*, 7(9):319-323.

Reshma, S., Sujith, G. M. and Devakumar, N., 2018, Growth and yield of Cowpea [*Vigna unguiculata* (L.) Walp] as influenced by jeevamrutha and panchagavya application. *Legume Research*, 3932, 1-5.

Rudragouda, F., Channagouda, H. B., Babalad and Salimath, S.B., 2015, Effect of organic farming practices on soil properties and beneficial soil micro-organism. *International Journal of Forestry and Crop Improvement*. 6(1):1-11.

Sangeetha, V. and Thevanathan, R., 2010, Effect of Panchagavya on Nitrate Assimilation by Experimental Plants. *J. Am. Sci.* 6(2):76-82.

Safiullah, K., Durani, A., Durrani, H. and Akbar, M., 2018, Effect of Solid and Liquid Organic Manures on Growth, Yield and Economics of Sweet Corn (*Zea mays* L. Var. *Saccharata* Sturt) under South Gujarat Condition, *Int. J Pure App. Biosci.*, 6(2):567-574.

Sait, M. and Kibritci. M., 2016, Effect of nitrogen and phosphorus levels on nodulation and yield components in faba bean (*Vicia faba* L.). *Legume Research*., 39(6):991-994.

Saritha, M. and Vijayakumari, 2013, Influence of Selected Organic Manures on the Seed Germination and Seedling Growth of Cluster Bean. *Journal of Wollega University*, Ethiopia. 2226-7522.

Sathiyadevi, M., Suchitra, R., Arunkumar, N. And Deepika, J., 2019, Antimicrobial activity of Panchagavya and its effect on seed germination. *J. Farm Sci.*, 32(3): (358-360).

Selvaraj, N., 2003, Report on the work done on organic farming at Horticultural Research Station, TNAU, Ooty. Pp:2-5.

Shaikh, N. F. and Gachande B. D., 2013, Effect of Organic Bio-Booster and Inorganic Inputs on Rhizosphere Mycoflora Population and Species Diversity of Wheat. *International Journal of Science and Research*. 4(10): 295-302.

Shakuntala, N. M., Vasudevan, S. N., Patil S. B., Doddagoudar, S. R., Macha, R. C. M. S. I. and Vijaykumar, A. G., 2012, Organic biopriming on seed vigour inducing enzyme in paddy - An alternative to inorganics. *Ecoscan*, 1:251-257.

Sharada, 2013, Studies on nutrient management practices through organics in greengram - *rabi* sorghum cropping system. *M.Sc. (Agri.) Thesis*, Univ. Agric. Sci., Raichur, India.

Sharadha, P. and Sujathamma, P., 2018, Effect of Organic and Inorganic Fertilizers on the Quantitative and Qualitative Parameters of Rice (*Oriza sativa* L.). *Current Agriculture Research Journal*. 6(2):166-174.

Shariff, F. and Sajjan, S. A., 2017, Effect of soil amendments and organic foliar sprays on crop growth, seed yield and quality of green gram (*Vigna radiata* L.). *J. Farm Sci*., 30(2):190-194.

Singh, A. K., Pant, S. C. and Singh, A. K., 2018, Exploitation of panchagavya: A novel approach for the sustainable production of vegetable crops in Pindar valley of Uttarakhand. *Journal of Pharmacognosy and Phytochemistry*, 7(6): 199-203.

Somasundaram, E., Amanullah, M. M., Thirukkumaran, K., Chandrasekaran, R., Vaiyapuri, K. and Sathyamoorthi, K., 2007, Biochemical changes nitrogen flux and yield of crops due to organic sources of nutrients under maize based cropping system. *J Applied Sci. Res.*, 3:1724-1729

Sornalatha, S., Tamilarasi, M. and Esakkiammal, B., 2018, Efficacy of organic fertilizer on the growth and yield of (*Luffa acutangula*) Ridge Gourd based on cow products. *International Journal of Recent Research Aspects*.pp. 424-429.

Sreenivasa, M. N., Nagaraj, N. And Bhat, S. N., 2007, Beejamrutha: A source for beneficial bacteria. *Karnataka J. Agric. Sci.,* 22:(5) (1038-1040).

Suresh, R. K., Ganesh, P., Tharmaraj, K., Saranraj, P., 2011, Growth and development of blackgram (*Vigna mungo*) under foliar application of panchagavya as organic source of nutrient. *Curr. Bot.*, 2(3):09-11.

Sutar, R., Sujith, G. M. and Devkumar, N., 2019, Growth and yield of Cowpea [*Vigna unguiculata* (L.) Walp] as influenced by jeevamrutha and panchagavya application. *Legume Res*., (42):824-828.

Swaminathan, C., Swaminathan, V. and Vijayalakshmi, V., 2007, Panchagavya-Boon to Organic Farming. International Book Distributing Co., Lucknow, India.

Vasanthkumar, H. H. R., 2006, Jeevamrut slurry preparation. *Siri Samruddhi*, 4-5.

Velmurugan, M., 2005, Studies on organic farming practices on growth, yield and quality of radish (*Raphanus sativus* L.) cv. Pusa chetki. *South Indian Hort*., 53(1-6):337- 339.

Velmurgan, R. and Mahendran, P. P., 2015, Molybdenum fertilization on nodulation, yield and quality of green gram grown in the soils of southern agro-climatic zone of Tamil Nadu, India. *Legume Research*, 38(6):798-803.

Vennila, C. and Jayanthi, C., 2008, Response of Okra to integrated nutrient management. *J. Soils Crops*, 18: 36-40.

Vijakumari, B., Hiranmai, Y. R., Gowri, P. and Kandari, L. S., 2012, Effect of panchagavya, humic acid and micro herbal fertilizer on yield and post-harvest soil of soya bean (*Glycine max* L.). *Asian J. Scientific information*. 11(2):83-86.

Vimalendran, L. and Wahab, K., 2013, Effect of foliar spray of panchagavya on yield attributes, yield and economics of Baby corn. *Journal of Agronomy,* 12(2): 109-112.

Vinnoli, P., Catherine, S. and Alexander, P., 2018, A comparative study on the effect of organic fertilizer panchagavya and vermicompost on the yield of *Abelmoschus esculentus* (Ladies finger). *International Journal of Advanced Research.* 6(2): 1331-1336.

Waghmode, B. R., Sonawane, S. V., Tajane, D. S., 2015, Differential responses of yield and quality to organic manures in sweet corn [*Zea mays* (L.) *saccharata*]. *Int. J. Agri. Sci.,* 11(2):229-237.

Yadav, B. K. and Lourdraj, C. A., 2006, Effect of organic manures and Panchagavya spray on yield attributes and economics of rice (*Oryza sativa*). *Crop Res.*,31:1-5.