INTRODUCTION

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Agriculture is means of livelihood for millions of people throughout the world. In India, crops are chiefly dependent on rainfall and fertilizers. India is not only self-sufficient in food production but also has a substantial reserve. The practice of application of chemical fertilizers started with the green revolution and in the recent years importance is given to organic fertilizer. This is due to the toxic effect of chemical pesticides and fertilizers on human health and awareness of its impact on the environment. Green revolution lead to intensified agriculture to meet the ever increasing demand for food and fiber, which is a practice at great cost to the environment resulting in continuous lose of natural ecosystems, ground water depletion, pollution and other environmental degradation.

India is the third largest producer and consumer of chemical fertilizers in the world. Heavy use of chemicals in agriculture has weakened the ecological balance, in addition to the degradation of soil; water resources and quality of the food. The increasing cost of fertilizers, unavailability of fertilizers, growing ecological concern and the people's interest in consuming the organic food have forced the farmers to try organic fertilizers in the form of compost and bio-fertilizers.

Environmental and human health problems related to the use of synthetic pesticides have created an increasing pressure against their use. In recent years, non-chemical alternative for pest control have been developed and modern pesticides have become safer and more specific. Technical

development of the application equipment has also improved to enable their proper application. However, their proper professional use has not always been transferred satisfactorily to field practice. The prevalence of pesticide resistance among the plant pathogen is a common phenomenon, therefore, to achieve better results; the concentration of the pesticides has to be increased. The need for newer and more potent pesticide increases. While, 40 years ago pesticides were required only in grams or milliliters to achieve the same or better result (Pimentel *et al*., 1991). Synthetic pesticides have undergone development process to match today's requirements. They have become less toxic for humans, though not necessarily for the environment, they have become more specific to act as a useful contribution within an integrated pest management concept and they have become more powerful. Pesticides are generally profitable, their use does not always promise yield for example, even with the tenfold increase in insecticide use in the United States from 1945 to 1989, the total crop losses from insect damage have nearly doubled from 7% to 13%. This rise in crop losses to insect is, in part, caused by changes in agricultural practices, for instance the continuous production of corn, replacing the older form of rotating corn with other crops, has resulted in nearly fourfold increase in corn losses to insect, despite a thousand fold increase in insecticide used in corn production (Pimentel *et al*.,1991).

Alternative approach to pest control is the concept of integrated pest management (IPM), where synthetic pesticides are only applied as a last resort and is now considered common practice in professional agriculture. The non-

chemical alternatives include cultural practices, use of resistant varieties, creation of an environment favorable for natural enemies of pests, and use of biological products and agents, including beneficial insects. Most benefits of pesticides are based only on direct crop returns. Such assessment does not include the indirect environmental and economic costs associated with pesticide application.

Pesticides are used to control organisms that are considered to be harmful, for example they are used to kill mosquito that can transmit potentially deadly disease like filariasis, yellow fever and malaria. They can also kill beneficial insects like honey bees, wasps, butterflies or ants.

The indiscriminate use of chemical pesticides in modern agriculture resulted in the development of several problems such as pesticide resistant insects, resurgences of target and non-target pest, destruction of beneficial organism like honey bee, pollinators, and pesticide residues in food and fodder. The awareness about the health and environmental problems due to the continuous use of pesticides resulted in the development of integrated pest management (IPM) and organic farming (Thomas *et al.*, 2001; Prabhu, 2004).

Organic agriculture is low cost and chemical free practice. It is very essential to develop a strong workable and compatible package of nutrient management through organic resource for various crops based on scientific facts, local conditions and economic viability (Kannaiyan, 2000). The current global scenario firmly emphasizes need to adopt eco-friendly agricultural practices for sustainable agriculture.

Cow, often called Kamadhenu, has been considered as a sacred animal in India. Right from ancient period, various products of cow have been employed in medicine. In Veda, cow's urine was compared to the nectar. In Susrut Samhitha, 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, stomach ache, edema, etc (Dharma *et al.,* 2005*)*. Cow urine enhances the immune competence and improves general health of an individual; prevent the free radicals formation and act as anti-aging factor; reduces apoptosis in lymphocytes and helps them to survive; and efficiently repairs the damaged DNA, therefore is effective for the cancer therapy. Cowpathy is an old system of medicine mentioned in ancient Indian literature (Ayurveda) as *Panchgavya Chikitsa*. The ayurvedic medicines of animal origin are mainly prepared from *Panchgavya* in India. The Cow scientifically known as *Bostaurus indicus* is considered as the sacred and most veneered animal. This is because of the therapeutic benefits obtained from its products. All the products of cow like urine, milk, dung, curd and ghee, collectively known as "Panchagavya" are the chief ingredient in ayurvedic medicine. They are used to treat a wide range of health conditions since ancient times.

Ancient literatures like *Bhav Prakash Nighantu, Sushruta Samhita* and *Astanga Sangrah* described cow urine as the most effective secretion with various therapeutic uses with antibacterial and antifungal properties. Cow urine acts as an effective agent against a wide range of Gram negative and Gram positive bacteria (Anitha Rao *et al.,* 2016).

Many ayurvedic physicians are using panchakavya for all human diseases. They say that it cures many diseases like cancer and diabetes and also potentiates the action of other drugs also. Panchakavya was widely tested in many labs across the country and trials were conducted in many crops by agricultural scientists especially the Tamil Nadu Agricultural University has gone deep into the panchakavya up to the molecular level under the guidance of Dr. E.Vadivel, Director of extension Education and Dr. K. Ramasamy, former Director of plant molecular biology. They have conducted many trials in all crops. They have documented, published, and presented many scientific papers in Indian and International Organic Farming Seminars. A scientific paper on panchakavya presented at the "International Seminars On Vedic Agriculture At Delhi'' was well received and evoked much interest in other scientists now the T.N.A.U. is manufacturing panchakavya and selling it under the brand name T.N.A.U. panchakavya.

Many useful elements have been found in panchakavya like urea, uric acid and minerals, bioactive substances and hormones like urokinase, epithelium growth factor, colony stimulating factor, growth hormone, erythropoietin gonadotropins, kallikrin, trypsin inhibitor, Allantoin, etc (Gosavi and Jhon 2012; Sathasivam *et al.,* 2010).

Herbicide can be used to clear road side weeds, trees and bush. They can also kill invasive weeds that may cause environmental damage. Bio-chemical factors of the host plant have been reported to play a vital role in the

resistance to various insect and disease pests (Panda and Khush, 1995) and relatively resistant varieties of plants contain higher amount of secondary metabolites inherently (Dhaliwal and Dilawari, 1993). The use of plants, plant material or crude plant extracts (botanical insecticides) for the protection of crops and stored products from insect pests is probably as old as crop protection itself. Indeed, prior to the development and commercial success of synthetic insecticides, insecticides of botanical origin were used against crop pests. The combination of efficacy, speed of action, ease of use and low cost of the synthetic insecticides (organochlorines, organophosphates, carbamates and later the pyrethroids and neonicotinoids) drove many botanicals to near obscurity in most industrialized countries. Twenty years after synthetic insecticides were firmly entrenched in modern agricultural production, documented and suspected issues of widespread environmental contamination, toxicity to non-target organisms and most importantly, negative effects on human health led to a resurgence in natural means of pest control, including intensified searches for new sources of botanical insecticides.

A number of factors support the argument that botanical insecticides should be of greatest benefit in developing countries, particularly those in tropical and subtropical zones. In many countries in South-east Asia, Latin America and Africa there is long standing indigenous knowledge, if not local practice, of using plants and plant extracts for mitigating pests. When economic forces made conventional (imported) pesticides less affordable for cocoa farmers in Cameroon, they turned to using extracts of local plant species, used either alone or mixed with conventional products. The local

plants namely banga, *Cannabis sativa* and tobacco, *Nicotiana tabacum* were found within cocoa plantations, making them readily available as bio-pesticides. Following the loss of subsidies on chemical pesticides and fertilizers and devaluation of the local currency, the proportion of growers producing cocoa without the use of synthetic pesticides rose from 6 to 33%.

Herbal pesticides are very useful in sustainable agricultural practices to control pest and disease. Spraying herbal pesticides has a preventive measure before the onset of pest and diseases and is an effective method of controlling pest and diseases. Different types of herbal pesticides have to be administered to the plants at different stages of the crop. Similar form of herbal pesticides should not be used more than twice or thrice for the same crop as the pest gain resistance. The spraying of herbal pesticides not only controls the pest and disease but also provides good nutrient to the plants.

While economic benefits from the use of locally prepared plants are encouraging, the greatest benefit from the use of these materials may well be in terms of human health. The vast majority of acute human poisonings from pesticides occur in developing countries; in some regions they are a major cause of mortality. Farmers frequently use highly toxic insecticides, yet few had any knowledge of the dangers of those products and they received no warnings from vendors. In many developing countries, farmers are illiterate.

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 (Subbarao, 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 literature (*Vrikshayurveda*) have clearly outlined a systematized agricultural practice that insisted on the use of 'panchakavya'- 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 panchakavya in organic farming (Gomathynayagam, 2001). In recent years, the crude extracts of seaweeds or the marine macroalgae have been shown to possess bio-stimulant, bio-fertilizer and antimicrobial properties (Borowitzka and Borowitzka, 1988; Robles-Centeno and Ballantine, 1999; Selvaraju, 2002).

Neem is a key ingredient in non-pesticide management (NPM) providing a natural alternative to synthetic pesticides. Neem does not directly kill insects but acts as an anti-feedant, repellent and egg- laying deterrent, protecting the crop from damage (Ganguli, 2002). The complex triterpenoid *Azadirachtin*, present in the seeds of the *Azadirachta* is a potent insect growth

regulator and feeding deterrent, with minimal mammalian toxicity and environmental persistence.

Neem is usually used against many insect pest including weevils, Sitophilus spp., khapra beetles, grain borer (Golob and Webley, 1980; Saxena *et al.*, 1989). Sweet basil, *Ocimum basilicum* natural pesticides are concerned with effects on insects. Leaves and seeds are rich in essential oils which are repellent, toxic or growth inhibitory to many insects. Plants or crude extracts can also be used against many other organisms (Grainge and Ahmed, 1988).

Plants have evolved a wide variety of chemical compounds which are known as secondary metabolites were flavonoids, volatiles oil, tannins, saponins, glycosides, alkaloids and resins for protecting plants against pests. Therefore, these compounds were used in the production of pesticides.

The present study was undertaken to evaluate the effect of panchakavya on the growth and yield of crops and soil fertility. The aim of the present study would be to enhance the efficacy of panchakavya by adding various adjuvants. It would also include the study of the physicochemical properties and microbial load of panchakavya and its antimicrobial properties against plant pathogens.