REVIEW ARTICLE

Cosmic Farming: A Ray of Hope for Sustainable Horticulture Production and Health Security

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DOI: 10.18811/ijpen.v6i04.1

Abstract

Soil fertility and environmental quality are critical and crucial for survival of humanity at the planet earth. Agrochemicals based farming over 5-6 decades has badly affected the soil biology and environmental ecology in many regions of the world. Ultimately the three basic elements of Nature *i.e.,* soil, water and air have been polluted. Now it is well established that any amount of agrochemicals pumped in cannot restore soil fertility as well as sustainable agriculture production. It is only possible by mediating everlasting sources of energy. Cosmic farming, being promoted by us is based on systematic and synergistic mediating of everlasting source of energy by few simple techniques. Since human body is a mini replica of cosmos, hence food produced and consumed in consonance of natures' gesture without use of agrochemicals will be *Sattvik,* full of nutrition and therapeutic values. Horticultural crops are well suited for cosmic production and consumption. The same technique is equally effective for all crops and in each ecological situation. Looking at the current plight of small and marginal farmers and pathetic situation of indigenous cow both can be addressed with assertive promotion of cosmic farming even in remote villages with enormous implications.

Keywords: Agnihotra, Aura Energy, Aurogreen, Cosmic Energy, Resonance Point.

International Journal of Plant and Environment (2020); **ISSN:** 2454-1117 (Print), 2455-202X (Online)

Introduction

Energy in agriculture is based from fossil fuel and imported sources which is dwindling and becoming expensive to the government, farmers and to the society. Indiscriminate use of agrochemicals and many other factors have adversely impacted soil biology and environmental ecology (Pathak and Ram, 2004). Sir Albert Howard, regarded as promoter of organic farming in recent decades, has rightly emphasized that, agricultural research has been misused to make the farmers not a producer of healthy and nutritious food, but more export bandit. Farmers have been taught how be profiteer at the expense of posterity, how to transfer capital in the shape of soil fertility and the reserves of his livestock to his profit and loss account. But the soil fertility does not continue forever, eventually the land is worn out; real farming dies (Howard, 2004). As alternative of chemical led agriculture; two systems *i.e.,* conservation agriculture (CA) that pertains with in situ or ex situ recycling of crop residues directly or indirectly after feeding to cattle through dung and urine in the field. While *Jaivik* (organic) agriculture, pertains with integration of compatible organic techniques from "Organic Farming systems"to meet the current challenges. These two systems are being promoted for more than 2 decades with promising responses, but there are number of apprehensions in mind of farmers, policy makers and to the society (Pathak, 2019).

Cosmic Farming

Cosmic energy is the fundamental source of plant growth. The Vedic answer is that cosmic energy is behind all mysteries of nature. It is available through primitive micro-organisms in soil as also to the living cells. Therefore, plants have capacity to produce all food elements needed for their growth, without feeding them specific elements. Plant cells can transmutate one element into another as per need through biologically active soil (Tomkins and Bird, 2004).

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How to cite this article: Pathak, R.K., & Ram, R.A. (2020). Cosmic Farming: A Ray of Hope for Sustainable Horticulture Production and Health Security. International Journal of Plant and Environment 6(4): 225-240.

Source of support: Nil

Conflict of interest: None

Submitted: 26/09/2020 **Accepted:** 28/10/2020 **Published:** 30/12/2020

Farming practiced in consonance of energy mediated through nature's gesture without use of a gram of agrochemicals is now being promoted as Cosmic Farming (Pathak, 2019).

Apprehensions in Acceptance of Cosmic Farming

- Can with organic farming, country will be able to feed ever growing population with shrinking natural resources?
- Can country in one go strive for organic cultivation?
- Are there are enough organic biomass available for conversion of entire area as organic?
- Is organic produced commodities are better nutritive with high therapeutic values?
- Can pests and diseases be managed with organic techniques?
- Are organic farming practices are ecofriendly and cost effective?
- Are there are enough market for organic produce?

After over two decades experience, we are confident cosmic farming is cost effective, eco-friendly and affordable technology for everyone, everywhere and is capable of addressing following issues (Pathak, 2019).

Issues to be Addressed

Cosmic farming is a cost effective, affordable technology which can address:

- Continous improvement in physical, chemical and biological properties of soil.
- Improvement in soil organic carbon (SOC) content.
- Input generation at the farm/cosmic village.
- Par excellence produce quality (*Sattvik*), full of nutrition and therapeutic values.
- Cost effective and ecofriendly technology.
- Well suited for small and marginal farmers of the country.
- Helpful maintenance of natural resources to hand over to coming generations.

Source of Cosmic Energy

Great sea of energy from cosmos through earth, solar, lunar, planets and *Akash* are available to everyone anywhere. Interestingly these energies are free, highly beneficial. These energies can be mediated by everyone with some basic skill up gradation and apathy for wellbeing of humanity. Cosmic energy through stars, planets are available all the time, while solar energy is only available in day hours. These energies are infinite non-polluting renewable source (Tomkins and Bird, 2004).

After working over two decades, we are of the view that for sustainable horticulture, one has to conceive a farming system approach based on ancient wisdom, which can enhance the rhizosphere and biosphere simultaneously, can assure sustainable production.

- Enormous amount of cosmic energy through *Panch Mahabhutas* (Earth, Water, Fire, Air, lunar and space) are freely available.
- Ancestors respected *Panch Mahabhutas* and these provided free energy for wellbeing of mankind.
- Cosmic energy is available all time, while solar energy in the day hours.
- Sun is a giant power house-infinite, non-polluting source and freely available.
- Mediating one per cent of solar energy can meet world's energy need.
- Soil microbes, cow and Agnihotra have capacity to mediate harness cosmic and solar energy.
- Natural resources *i.e.,* soil, water, air, bio diversity of flora and fauna are available as grace of Cosmos.
- With little support and skill up gradation, every farmer can be tuned and trained to mediate these energies for the wellbeing of humanity.

It is pertinent to mention that nature has made elaborate arrangement to mediate cosmic energy for welfare of humanity. One should know techniques for mediation of cosmic energy and mindset (Ram and Pathak, 2017).

Nature's Gesture to Mediate Cosmic Energy

- Beneficial microbial consortia, many soil dwellers including earthworms have capacity to mediate cosmic energy.
- Specific bacteria solublizers for all elements utilized by the plants.
- Nodules in leguminous and few other biological N- fixture (BNF) plants have specific bacteria capable of mediating free N available in the biosphere.
- Millions of stomata beneath foliage are busy in inhaling carbon dioxide and exhaling oxygen essential for survival of human being and other living one.
- Chlorophyll in foliage mediates solar energy in process of photosynthesis, the basic step in preparation of food needed for survival of everyone.
- Without plants, we cannot breathe, nor drink and eat.
- Cow with hump (pyramid shape), belly is mini replica of cosmos and horns have capacity to mediate cosmic energy.

Things to ponder: Cosmic energy is fundamental source of energy. Strange to believe that all around us, great seas of energy of the cosmos in the form sun, planets including earth are freely available. Unlike chemicals sold in the commerce, this energy is free, and it isn't toxic; it's highly beneficial. One has to respect these energies and mediate through different means, for saving humanity at this crucial juncture. In fact, ancestors respected these sources and utilized their free gesture for welfare of humanity**.** Cosmic energy is the source or cause of production. Cosmic energy is manifestation of solar energy in different forms *i.e.,* through microbes, plants and cow (Pathak, 2019).

Unfortunately, owing to get quick return, we have been squandering the natural resources made available by nature for supporting healthy and happy life at the planet earth. On deep thinking, it is apparent that due apathy for high production, the three basic elements *i.e.,* soil, water and nearby air has been polluted/contaminated but owing to distance sun and space (Aakash), are in pure form. Few simple techniques which have been standardized by us and are being promoted as cosmic farming can again show a way for sustainable agriculture particularly for horticultural crop production.

Suitable Agricultural Practices to Mediate Cosmic Energy

- Use of Biodynamic calender for different farming activities.
- Habitat development through intensive plantation of different kinds of plants including, those belonging to biological nitrogen fixtures (BNF) group.
- Practice of mulching whenever, whereever possible as thumb rule.
- Management of few cows with hump and use of their products.
- Enhancing soil humus formation by crop rotation and other practices and its maintenance.
- If possible, integration with Homa Organic Farmingand use of Agnihotra ash will have synergisticc impact resolving pollution of the three basic elements and boosting many other activities associated with crop production.

Use of Biodynamic (BD) Balendar

Farming in ancient times was based on consonance of planetary movement for centuries. Ancient people have in depth knowledge; even prediction of rain was possible (Saxena *et al.*, 2009). Somehow this knowledge has been lost. In recent

decades, use of BD-calendar is being advocated by Bio-dynamic associations in many countries with promising response. Sun light is essential for food formation through photosynthesis, but moon light is equally essential for plant growth. Every heavenly body like Sun, Moon, planets and stars, has a pronounced influence upon plant performance and human behaviour. In fact, plant life develops in the harmonious interplay between Earth and Sun. Moon as satellite is closest to the earth and completes its orbit in a shortest duration of 27 days in a month. Hence, it is advisable to take its benefits for improving quality production (Thun, 2001).

As thumb rule, sun is in ascending and descending phase for six months in a year, while moon is in ascending and descending phase around 15 days in a month; the same trend is observed every day in nature. From early morning to late afternoon earth breathe above ground; while since late afternoon to early morning earth breathe below ground strongly.

In general, cosmic forces are much energetic in ascending phase of sun and moon above ground, while these activities below ground are much pronounced in their descending phase. Hence, crop activities associated with above and below ground should be adhered to the rhythms of nature to get benefit of cosmic energy (Steiner, 1997). It has been experienced that moon passing in front of a particular Zodiac Constellation enables the element forces to impact much strongly into plant parts. Steiner gave the name "etherised formative forms" which are associated with four segments of the Zodiac constellation as indicated in Table 1.

It has been experienced that moon passing in front of constellations enables, the particular elements work much stronger, thereby influence in positive way. In fact, this is the basis for taking benefits in quality production in all crops (Peter, 2004).

There are certain positive and negative days as per moon's movement in a month. If exact adaptation of biodynamic calendar is not possible, then as thumb rule four days in a month *i.e.,* two node (*Rahu* and *Ketu*), and two days *i.e.,* Apogee (moon farthest to earth), and Perigee (moon closest to earth), need to be avoided for any new crop activities. Use of calendar is non-monetary input, require some experience. Food produced from such living soil has not only more nutrition but increased life forces (Steiner, 1997*)*. In a trial on okra recorded highest yield (125.00 q ha^{-1}) when crop was sown during the time of moon opposite to Saturn and on fruit day (Pathak *et al*., 2010).

Habitat Development

It is only the chlorophyll in foliage has capacity of miracle of food production through photosynthesis and exhaling oxygen essential for survival of everyone. In fact, there is "A Fascinating Account of the Physical, Emotional and Spiritual Relations between Plants and Man (Tomkins and Bird, 2004b).

The energy of sunlight is mediated by foliage of plant canopy and the under-growth plants and selected microbes. The leaves also break up the rainfall into fine spray so that it can easily be dealt with the litter which provide the last line of defence of the precious soil. Associating crops is cheap and effective option for mediating cosmic energy, N from biosphere and mobilization of elements from deeper horizon of soil. If suitable crops are combined, mixed cultivation can prove much efficient to mediate cosmic energy, and thereby enhance soil fertility, better water use. All these will lead to a higher total yield per unit area and time (Ghosh, 2002).

Since nitrogen is required in large quantity for growth and development of crops per unit area compared to other nutrients. For this, nature has made elaborate arrangement by providing over 78 per cent free N in the biosphere. There are large number of plants of leguminous and many other, possess specific bacteria, known as biological N-fixtures' (BNF) plants. These are capable of mediating atmospheric nitrogen through microbial transformation by specific symbiotic and non-symbiotic bacteria. Biomass obtained from plants could be utilized for cattle feeding, composting, green leaf manuring and particularly for mulching. The root act as water pump, with water acting as a universal solvent, raising elements from root to leaf, evaporating and falling back on earth to act as once more medium for this chain (Bourguignon, 2002).

As thumb rule, for annual crops one should practice crop rotation while for perennial plants, crop association need to be encouraged. Few simple practices such as adoption of cover crops, inter crops, green manures, green leaf manuring or occasional practice of growing multi crops as Aurogreen crops are effective options to a cosmic farmer. Aurogreen is mixture of number of quick growing crops, which can cover the land quickly, provide lot of biomass. In this combination of 10-15 crops of different groups *i.e.,* legumes, cereals, oilseeds, fibres and few aromatic crops are grown together for a limited duration of 6-8 weeks and smothered on soil surface. Preference is given to the crops which are available with in farmer or can be obtained in the local markets. The list should include legumes (6 kg), cereals (2 kg), oil seeds and fibre (1 kg) each along with 200 g of aromatic plants such as coriander, fenugreek, chilli etc. per acre of area.

These are mixed and treated with bio-enhancers *viz.,* Beejamrita/ Panchagavya before sowing. Since lot of biomass and intensive roots are needed, hence if possible after seed treatment it should be sown in the afternoon on leaf or root

Table 1: Interaction of basic element, Zodiac constellation and it impact on plant's part.

Basic element	*Zodiac constellation*	*Logic*	*Plant part*	*Crops*
Earth	Taurus, Virgo, Capricorn	Growth occurs in under ground	Corms, Tubers, Rhizome, Root	Carrot, Radish, Onion, Garlic, Potato etc.
Water	Cancer, Scorpio, Pieces	Contains more than 70 percent water	Leaf and stem	Cabbage, Kale, Spinach, Lettuce, Asparagus, etc.
Air/light	Gemini, Libra, Aquarius	Light is essential for flower initiation	Flower crops	Broccoli, Brussels, Rose, Jasmine, Marigold etc.
Fire/ warmth	Aries, Leo, Sagittarius	Warmth essential for development of fruit and seed	Fruit and Seed crops	Tomato, Okra, Brinjal, Beans, Pea etc.

days of biodynamic calendar. After 50 - 60 days of growth, crops should be smothered on ground and drenched with Jeevamrita @ 5 per cent for quick decomposition. Aromatic crops enhance possibility of encouragement of predators, parasites and pollinators in the area.

Basic Components of Cosmic Farming

Soil

In Vedas, soil has been respected as "Mother" and human beings as her sons. Even on today earth is recognized as Annapurna –meaning thereby that all elements needed by plants can be obtained from soil. The soil conducts many functions which help stabilize climate. If there is healthy soil, with plants flourishing on it, then it can sequence large amount of carbon-if the soil is left bare and continuously tilled, it leads to soil desertification. Keeping the soil healthy benefits those who farm it. Healthier the soil with more plants and organic matter have more carbon. Living soil is one of basis of cosmic farming. Life, in the basic form of microbes, has been companion of earth since its inception. It has close bond between the environment of the earth and the microscopic organisms thriving upon it. Within soil procreating in high concentrations, the bacteria and fungi ensure soil fertility by recycling the elements in the chemical laboratory that constitutes their bodies, making them available to plants. As nitrogen is converted into nitrate, phosphorus is solubilised into phosphate, sulphur to sulphate, chlorine to chloride, boron to borate and so on through elements (Ghosh, 2002).

Soil in upper horizon might be deficient in certain elements, but in deeper horizon, all elements present in non-available forms. Interaction of plants roots duly supplemented with earthworms and many more soil dwellers play important role in upward movement of element and their conversion in available form. In fact, soil fertility and production of crops is dependent upon soil humus. Quality humus production takes place through decomposition of organic biomass duly supplemented with animal wastes. Few simple practices such as incorporation of biomass, crop rotation, inclusion of legumes in the system, mulching and its drenching with bio-enhancers are helpful in enhancement and maintenance of humus in the soil. All efforts need to be concentrated for formation of quality humus and its maintenance which is a prerequisite for soil fertility, crop quality, sound animal and human health (Bourguignon, 2002; Ghosh, 2002).

Soil Food Web

The soil food web is essential community of organisms that live in the soil in close harmony. Every farm has its own soil web. Healthy soils contain massive population of bacteria, fungi, protozoa, nematodes, soil arthropods and earthworms. A teaspoon of fertile soil may contain between 100 million to one billion microbial lives. Fungi and bacteria in soil have considerably more nitrogen in their bodies than other organisms. Nutrient cycling happens when other sets of soil organisms are present to consume the nutrient rich bacteria and fungi and release nutrients to plants in available forms. These rapid interactions and countless exchanges of nutrients between soil organisms occur in the rhizosphere where highest concentrations of organisms exist because root exudates provide food for bacteria and fungi (Ghosh, 2002). It is close, intelligent and intense symbiosis between soil and plants. Plants provide nutrients to soil, which are utilized by soil bio-life in return and it supply of all elements which are utilized by plants for their satisfactory performance. A strong connection exists between a fertile soil and healthy crops, healthy animals and last but not least, healthy human beings must be made known far and wide.

One of the main reasons of insect pest occurrence at the farm is poor soil health. Poor soil aeration always encourage**s** disease in crops. Insects and fungi are not the real cause of plant disease but only attack unsuitable varieties or crops imperfectly grown. In fertile land; soil and the plant come into gear in two ways simultaneously. In establishing and maintaining these contacts humus is essential. Certain soil fungi directly connect the humus in the soil with the roots of the crop. These fungus tissues may contain as much as 10 per cent of nitrogen in the form of protein, which is digested in the active roots and carried by the transpiration current to the seat of carbon assimilation in the green leaves (Tomkins and Bird, 2004a).

The other soil organisms are also involved in nutrient recycling. Nitrogen fixing bacteria convert atmospheric nitrogen into useable form as they colonize in the roots of legumes. Mycorrhizal fungi colonize root systems of other crops such as vegetables like onion, maize, sorghum etc. In doing so, these specialized fungi recycle nutrients by secreting enzymes that solubilise calcium phosphate and pump the phosphorus directly to the plants, thus making an otherwise unavailable element now available to plants. Mycorrhizae association with crops play beneficial role for crops by aiding in disease suppression and moisture absorption. This situation can be viewed from Fig. 1.

In natural soil web, when agrochemicals are not used (Ingham, 2000), whenever there is any intervention of agrochemicals in the soil, it causes some disturbances in the soil web which has been ignored in the recent decades. Working with unhealthy, dying or dead soils cannot be deemed as sound farming under any way.

There is close, intelligent and intense symbiosis between soil and plants. Plants provide nutrients to soil, which are utilized by soil bio life and in return these, supply of all elements in available forms which are taken by plants for their satisfactory performance. In fact, a strong connection exists between a fertile soil and healthy crops, healthy animals and lost but not least, healthy human beings must be made known conveyed to everyone. One of the chief causes of disease in plants is bad soil management. Poor soil aeration always encourages disease in crops. Insects and fungi are not the real cause of plant disease but only attack unsuitable varieties or crops imperfectly grown. In fertile land; soil and the plant come into gear in two ways simultaneously. In establishing and maintaining these contacts humus is essential. Certain soil fungi directly connect the humus in the soil with the roots of the crop (Ghosh, 2002).

It is generally admitted that chemicals and salts introduced into the soil through agrochemicals, turn the soil sterile: soil organisms perish; earthworms and many other soil dwellers disappear; the soil becomes dead. On this substratum crops are grown. In fact, insect pest occurrences are symptoms of a failing crop, are indication of reduction of aura energy of rhizosphere

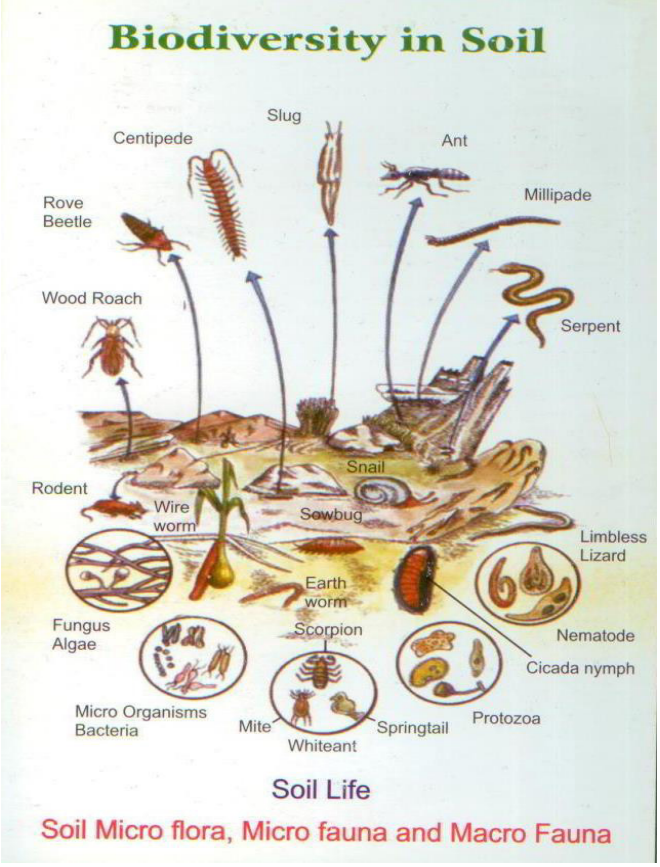

Fig. 1: View of micro flora and fauna of fertile soil

Lesson learnt

- There is intense & intelligent relation between Plants and Rhizosphere.
- Conventional agericulture (CA) has disturbed this relation.
- Depletion of soil bio-life,birds, pollinators', predators and parasites.
- With CA, there is domination of pathogenic microbes.
- Hence, soil erosion, diseases, pests and many other problems.
- Main cause for reduction in soil fertility, yield & quality of produce.
- Only high soil humus can produce healthy food

not the cause (Tomkins and Bird, 2004a). These can be easily managed with humus and optimum plant nutrition.

Air

Air is important element to plants and human being. It is evident that plants obtain around 94 per cent element (carbon and oxygen 44 per cent each, and 6 per cent of hydrogen) from the biosphere. Soil fauna is not only important for water circulation but is equally important for oxygen which is necessary in the soil because plants can assimilate only oxidized forms of most of the elements. For instance, nitrogen is not assailable by plants as ammonia but as nitrate, sulphur as sulphate, and phosphorus as phosphates. These transformations are done by specific soil microbes (Ghosh, 2002).

Poorly aerated soils lead to the development of anaerobic microbes; these transform nitrates back into ammonia, sulphates into sulphur and phosphates back to phosphorus. With this depletion, there is no possibility for plants to grow and the use of fertilizers becomes obligatory.

Water

Water is next to air and one of the important elements needed by plants and human being. But due to mismanagement, almost 50 per cent of rainfalls runs of carrying the life sustaining soil with it. It is true that rainfall comes pouring down within a few rainy days in the monsoon season. These downpours act as a source of destruction rather than anything else. Since ancient time, people had regarded water as a divinity, a being with great strength and vigour, to be revered. Owing to indiscriminate use of agrochemicals and many other factors, no water is safe for drinking and even it is adversely impacting farming in many ways. Shree Paranjpe promoter of Homa Therapy stated in an article written in 2002 regarding water quality. He emphasized that water resources on earth surface are finding difficult to absorb energy from sun (due to pollution). This will result in depletion of marine life and imbalance in nature what is being experienced now a days' in most of the regions. In continuation of this, he suggested that if Homa Farming is practiced on massive scale, the atmosphere is healed and the water resources get purified, leading to better absorption of sun's rays' (Paranjpe, 2004). Activities like massive plantation of selected trees, plants, arresting of rain water in field, water bodies through appropriate structure by involving large number of people, promoting *Homa Jaivik Krishi* and regular placement of Agnihotra ash in water bodies and production and use of bio-enhancers are effective tool to enhance soil humus important ions in quality production.

Cow

Cow is special creature at the planet earth and is considered the mainstay symbol of purification, health, wealth and prosperity. It is pertinent to record that indigenous breed of cow (*Bos indicus*), with hump and horns have capacity to mediate cosmic energy. The hump of cow supplements the length of spine (Nene, 2003, Pathak and Ram, 2003, 2012).

Things to ponder-It is interesting to record that in general leftover materials from human consumption such as *bhusa* (wheat straw), paddy straw, sugarcane leaves, grasses, cakes, *chuni*, choker etc. are fed to cow; but in return cows provide three direct products *i.e.,* dung, urine and milk. All these are of much use in agriculture and human health. It is praiseworthy to note that even after consumption of chemically loaded materials; all cow products are free from any contaminations. This conversion is not possible by any industry or laboratory (Pathak, 2019).

Characteristics of Bio-enhancers

These are potent source for all macro and micro nutrients. Presence of plant growth promoting factors like indole acetic acid, gibberellins, and cytokinin's etc. sustains abiotic and biotic stresses in plants. Its use in insect pest management is also effective. Their efficacy is influenced by inputs used and method of preparation. It is also used for seed storage, seed/seedling treatment, enhancing organic wastes decomposition, improving soil fertility and crop productivity and could be an

effective and potent tool for fertigation (Pathak and Ram, 2013).

Vrikshayurveda, composed between 6,000 BC, is testimony for importance of cow in agriculture. Vedic literature has outlined and systematized agricultural practice that recommend use of Panchagavya (mixture of the five products of cow in a specific ratio) and Kunapajala (decomposed products of fish or animals in liquid form), to enhance the biological properties of soil and thereby plants' health. In consonance of these two products, it is praise worthy that most of organic promoters in different parts of regions are using cow- based products with encouraging responses (Saxena *et al*., 2009). Looking their impact, we have given a generic name as bio-enhancer (bio-means living and enhancer, promoting crop activities (Ram and Pathak, 2017).

Bio-enhancer

Basically, bio-enhancers are prepared by fermenting cow products over specific duration. For improving quality few other ingredients are also used in few bioenhancers. Specific bioenhancers are available for all crop activities. Bio-enhancers have impact to improve soil fertility, crop productivity and quality, insect, pest and disease management. It is pertinent to record that these are potent source of all macro, micro nutrients, trace elements, PGPR activities, immunity enhancer and sustain abiotic and biotic stresses (Pathak and Ram, 2013). These can be easily prepared by every farmer as per need. The main bio-enhancers which are commonly used in organic farming are Beejamrita, Jeevamrita, Panchagavya, Amritpani, Vermiwash etc (Ram and Pathak, 2019a,b). Assertive promotion of bio-enhancers will have many implications in cosmic farming.

After visualizing the impact on few crops, methods of preparation, nutrient status and elucidation of microbial profiling for most of bio-enhancers have been compiled by ICAR-CISH, Lucknow, India in a book on Bio- enhancers (Ram and Pathak, 2017). At present the main bio-enhancers which are in use by the farmers are Amritpani, Beejamrita, Jeevamrita, and Panchgavaya.

Characteristics of Bio-enhancers

- Potent source for all macro, micro and trace elements needed by plants.
- Presence of plant growth promoting factors like indol acetic acid, gibberellins, and cytokinins etc.
- Enhances immunity of plants for abiotic and biotic stresses.
- Effective in insect pests and disease management.
- Used for seed storage, seed/seedling treatment, enhancing organic wastes decomposition, improving soil fertility and crop productivity.
- Can be prepared as per need of the crop, thus dependence on market forces can be avovided.
- Could be an effective and potent tool for fertigation and drenching on mulches.
- Well suited to small and marginal farmers facing procurement of inputs as per crop need.
- Efficacy of bio-enhances is influenced by inputs used and method of preparation.

Bio-enhancers can be used for all crop activities. It is pertinent to mention that, it is not possible to combine all these attributes in any single product. But with simple basic facilities and few days training, farmers can be equipped to prepare bio- enhancers as per requirement. To get additive/synergistic impact few selected bio- enhancers can be integrated at different crop stages. Systematic research and validation will have many implications in nutrient plant management (Pathak, 2019).

It has been experienced that for all crop activities, specific bio-enhancers are available and is used in different organic farming systems. It is advocated that farmers should prepare and use it for different activities without depending upon any agencies as summarized in Table 2.

Looking role of bio-enhancers for different crop activities, systematic studies on elucidation of microbial profiling of bio enhancers have been done for number of years at ICAR-CISH, Lucknow by Ram *et al*. (2018a,b) have been summarized in Table 3.

Perusal of Table 3 reveals that all the preparations contained good population of beneficial microbes which could be utilized for different farming activities. Numbers of bio-enhancers being used in different organic farming systems on the basis of cow-based formulations, Biosol, Cow Pat Pit, and *Panchagavya* are much potent with respect to microbial profiling and their effectively. Panchagavya can be prepared within four weeks while other takes longer time and few specific conditions. Recent studies with *Panchagavya* have shown encouraging activities with presence of potential microbial consortia. *Bacillus amyloliquefaciens* (P8), isolated has PGP properties such as Zn, P, K-solubilization, Siderophore, HCN, Amylase and IAA activities. In addition, it has also has shown bio-control activities against plant pathogenic fungi including *Fusarium*, *Ceratocystis*, *Pythium*) and *Colletorichum*. Regular preparation and use of Panchagavya will have many implications in cosmic production of horticultural crops (Ram *et al*., 2018a,b, 2020; Ram, 2019).

Table 2: Crop activities and perspective use of bio-enhancers

S.N.	*Crop activity*	*Suitable bio-enhancer*
1.	Seed/plant parts treatment	Amritpani/Beejamrita/CPP (cow pat pit)/cow urine + dung powder + Agnihotra ash etc.
2.	Enhancing decomposition of biomass	Jeevamrita/CPP/Panchagavya/ Agnihotra ash water etc.
3.	Enhancing nutritive value of compost	CPP/Agnihotra ash enriched water, Biosol/ Vermi wash/ Panchagavya etc.
4.	Enhancing soil fertility	Amritpani/Jeevamrita/CPP/Biosol/Kunapajala/Panchagavya etc.
5.	Improvement in crop vigour	Panchagavya/Kunapajala/Biosol/Vermi wash etc.
6.	Enhancing biotic & abiotic stress	CPP/Biosol/Kunapajala, Panchagavya, Vermi wash etc.
7.	Insect pest management	Kunapajala/vermi wash/biosol/ panchagavya, Biodynamic liquid pesticideetc.
8.	Seed/grain storage	Agnihotra ash/Panchagavya

Table 3: Microbial profiling of various bio-enhancers

	Population (cfuml^{-1})									
Microorganisms	*Panchagavya*	*Amrit Pani*	*Beejamrita*	*Jeevamrita*	*Biodynamic liquid pesticide*	*BD-500*	*BD-501*	*Cow Pat Pit*	*Vermi Wash*	*Homa Biosol*
Bacteria	62.50×10^7	5.49×10^8	26.15×10^8	324.20×10^7	9×10^8	3.75×10^8	1.75×10^8	16.68×10^8	3.65×10^8	31.39×10^8
Fungi	0.20×10^5	0.046×10^6	0.20×10^5	1.20×10^7	2.73×10^8	6.983×10^5	11.33×10^5	8.33×10^5	-	30×10^2
Actinomycetes	2.2×10^6	1.31×10^7	84.15×10^7	3.10×10^6	2.64×10^8	15.5×10^6	3.35×10^6	13.13×10^6	3.65×10^8	33.1×10^6
Pseudomonas	47.00×10^6	1.53×10^7	16.67×10^6	5.09×10^7	1.86×10^8	1.3×10^6	4.9×10^6	6.8×10^6	0.07×10^8	105.6×10^5
Rhizobium	2.43×10^6	3.03×10^6	2.39×10^6	75.10×10^6	0.28×10^7	3.89×10^5	24.25×10^5	8.40×10^6	0.06×10^8	12.25×10^5
p-solubilizing microbes	3.20×10^6	4.80×10^6	6.77×10^6	5.04×10^6	3.53×10^6	22.48×10^5	49×10^5	28.57×10^6	0.14×10^8	2.96×10^4
Azotobacter	0.14×10^6	0.001×10^7	0.415×10^6	1.12×10^5	8.5×10^6	Nil	Nil	224×10^6	$.007 \times 10^8$	11.04×10^4
Azospirillum	1.03×10^5	-	13.67×10^6	0.01×10^5	1×10^6	6×10^7	4.8×10^7	31.00×10^6	3.65×10^8	-

Panchgavaya is prepared from five cow products *i.e.*, dung, urine, milk, curd and ghee by fermenting for specific duration. For improving quality and its efficacy, few more products such as sugarcane juice, coconut water, toddy and ripe banana are added. Preparation is rich in macro and micronutrients, auxins, gibberellins, and microbial fauna and acts as tonic to enrich soil, induce plant vigour with quality production. *Panchgavaya* play potential role in plant growth enhance immunity for biotic and abiotic stress. When suitably mixed and fermented over specific duration, has exciting effect. In beginning pioneer work has been done by a medical doctor, Natrajan (2003), which was subsequently studied by TNAU, Tamil Nadu, India and by other institutes. Its positive effects on growth and productivity have been documented by many workers. The preparation is rich in nutrients, auxins, gibberellins, and microbial fauna which act as tonic to enrich the soil to induce plant vigour and quality production. It is equally effective in all types of plants, animals, goat, sheep, poultry etc.

Now, it is evident that bio-enhancers could play important role in cosmic nutrient management. Its regular use will improve soil fertility, crop productivity and produce quality. These could be a potential tool for fertigation which is becoming important to enhance quality production in most of the crops. Since bio-enhancers are used in limited quantity as starter, cannot meet the entire nutrient requirement of the crop. These catalyse quick decomposition of biomass; hence incorporation of enough biomass, preferably a combination of monocot and dicot duly supplemented with animal products will enhance soil bio-life and hence humus formation and its maintenance, essential component for improving soil fertility and crop productivity. Combined with compost and frequent use of bio-enhancer can address many challenges particularly in horticultural crops and will be helpful to show a way for sustainable production through cosmic resources.

Need of Cosmic Farming in Horticultural Crops

Horticultural crops are grown for high production, nutritive, therapeutic and aesthetic values. These crops are suited for production in variable production conditions *i.e.,* commercial, kitchen, backyard, court yard, roof top, indoor house, front of house, pool, different kinds of structures, even around the house, over huts and nearby by compost pits and many more situations. There is minimum gap between farms to fork in most of the crops. Most of these are used in fresh condition or extraction of juice. Trend for local consumption and export has increased in recent decades. Horticultural crops could be potential tool to mediate cosmic energy which is available in country in plenty. Looking strength of country "Cosmic production and consumption" of horticultural foods will have many implications in resolving number of crises being faced by humanity. These can be helpful in enhancing health of malnourished/undernourished, pregnant women and enhancing earning of farming communities and other people associated at different stages from production to post harvest handling and marketing.

Homa Organic Farming

Krishna ordained "All beings are evolved from food; production of food is dependent on rain; rain ensures from sacrifice, and sacrifice is rooted in prescribed action. Know, that prescribed

action has its origin in the Vedas, and the Vedas proceed from the Indestructible (Good); hence the all -pervading Infinite is always present in sacrifice and the Vedas proceed from sacrifice (Bhagawad Gita, ch-3, 14-15).

Homa is a Sanskrit word used as synonymously with *Yajnya*. It is the technical term from the Vedic science of bioenergy denoting the process of removing the toxic conditions of the atmosphere through agency of fire. The most basic Homa (*Yajnya*) is called Agnihotra and is tuned to the biorhythm of sunrise/sunset. Regular performance of Agnihotra establishes the healing energies necessary for a healthy environment. Agnihotra fire ceremony is a technique to heal the Earth. Environment: purify air, land, and water resources using healing fires. These healing fires have profound healing effects on all life forms including agriculture. This ancient technology continued for thousands of years. In Gita, there is a verse indicating that Brahma, creator of humanity, performed *Yajnya*, before creation of humanity (ch.3-10).

It is pertinent to mention that environmetal pollution is one of the major problem, currently humanity is facing.Most of international efforts could not proovide any solution. As alternative, this calls to see ancient history of farming. It is pertinent to mention that our ancestors were fully aware that with most of human activities, environment is polluted. Hence, Yajnya was mandatory with every family has been emphasized in Vedas, ancient most body of knowledge known to human being. Somehow, with advent of foreign invadors right from 14th centuary, the great culture of this country was hampered. But, on introspection there are number of evidence that assertive promotion of Homa Organic Farming can provide an viable alternative.

Agni means- fire and Hotra means -purification. It is antidote for pollution control ancient science of healing. Historical perspective of Agnihotra, that there is reference that Bhagvan Ram used to perform Agnihotra daily. On the day of crown ceremony both mother Sita and Shree Ram performed Agnihotra. Agnihotra is a gift to humanity from ancient- most Vedic Sciences of bio energy, medicine, agriculture and climate engineering. Somehow, due to few problems mass adaptation has been ignored. It is well accepted that environmental pollution has become one of the major problems for survival of humanity at the planet earth. Most of international efforts have not given expected impacts.

On deep pondering of history, it is apparent that nature has its own way and play major role for resolving any crises faced by the humanity. Param Sadguru Shree Gajanan, who is said to be incarnation for New Age to save Planet Earth, and known as Son of Man, took birth as "Kalki Avatar. With his dedicated efforts, standardized cheap, effective technique from Aakalkot, Shivapuri, Sholapur, Maharashtra, India with long experience to combat environmental pollution problem. After getting convinced its impact for humanity, he entrusted its further dissemination to a select group of people to the universe. He standardized simple technique which is based on locally available inputs and can be performed by everyone now has spread in the universe as the Homa therapy (Mulay, 2009).

Homa Therapy, outside India was intensively promoted by Shree *Vasant* V. Paranjpe, who established Fivefold Path Mission on direction of Gajanan in 1972 in U.S.A. As a result, now millions of people in different parts of the world are practicing Agnihotra daily to take benefits of spiritual and material happiness. It has spread in more than 100 countries scattered in all continents of the world. Agnihotra is major component in Homa therapy. It is a gift to humanity from ancient- most Vedic Sciences of bio energy, medicine, agriculture and climate engineering. It is the process of purification of the atmosphere through the agency of fire, prepared in specific shape and size of copper pyramid tuned to the biorhythm of sunrise/sunset. A simple technique which can be practiced by every citizen of the world has been standardized for addressing pollution. Paranjpe (1989, 2004) took it to entire world as on today it is practiced for human health and agriculture in more than 100 countries. It is praiseworthy that with intensive efforts 'What has been done and what can be done' has been reviewed by Berk (2018, 2020).

The major strength of Homa Therapy is Agnihotra. It is science of pyramidology, burning of organic substances (cow dung patties, cow ghee with unbroken rice), bio rhythm of nature *i.e.*, sunrise and sunset, electromagnetic effect of chanting specific Mantras.

Tremendous amounts of energy are gathered around the Agnihotra copper pyramid just at Agnihotra time. A magnetic type field is created, one which neutralizes negative energies and reinforces positive energies. Therefore, a positive pattern is created by one who does Agnihotra merely by his/her performance.

When Agnihotra is performed, smoke gathers particles of harmful radiation from the atmosphere and on very subtle level neutralizes their radioactive effect. Nothing is destroyed, merely changed from one form to another form.

There are two basic energy systems in the physical world: Heat and Sound. In performing Agnihotra, these two energies *i.e.*, the heat of the fire and sound of chanting specific Mantras, are combined to achieve the desired, physical, physiological & spiritual benefits for humanity (Narang, 2004).

In Agnihotra fire there is not just energy from the fire, but subtle energies are generated or thrust into the atmosphere by the fire. Observance of strict discipline and use quality of materials (cow dung cakes, cow ghee, and brown rice), sonic power of chanting specific mantras at right time of sunrise and sunset of the place are essential discipline needs to be adhered. Much healing energy emanates from the Agnihotra pyramid.

Effect of Agnihotra

If plants are kept in Homa atmosphere where vibration of Agnihotra pyramid fire are maintained, one can actually see growth of plants and its vigour. Plants receive nutrition from Agnihotra atmosphere, become happy and grow well. Just as Agnihotra pyramid fire gives nourishment to plant; it provides the same for human life and animals.

The sun brings and takes the energy, which makes all conditions conductive to an antipollution change. It calms the world. The pyramid act as generator and the fire is turbine. The cow dung, ghee and rice then interact to form a composition which is thrust, surrounds, neutralizers and s the material. This is how the Agnihotra fire physically heals the atmosphere.

Materials required in Agnihotra

It is matter of great concern that regular performance of Agnihotra is possible by every family in the world. Materials

required for Agnihotra can be arranged anywhere in the world with little efforts.

Pyramid: Pyramid made from copper is universally acknowledged for its excellent conduction of electricity and heat. The pyramid shape is widely experienced to generate and store a special energy field, which possess bacteriostatic properties. The inverted pyramid shape *allows* controlled generation and multidimensional dissipation of energy in the vicinity. It acts as a generator of unusual energy fields and spreads in its surrounding areas wherever Resonance Point (RP) has been established. The dimensions of the pyramid are: 14.50 cm x 14.50 cm at the top, 5.25 x 5.25 cm at the bottom and 6.25 cm in height with three steps.

Rice: Rice is widely grown in all part of the world. Brown *i.e.*, unpolished, unbroken rice (*Akshata*) is used for performance of Agnihotra. Highly polished rice loses nutritional value and hence brown rice is used. If rice is broken, the subtle energy structure is disturbed and it is not fit for Agnihotra healing fire. If organically produced rice is available, it is to be preferred.

Dried cow dung cakes: Cow dung is treated as medicine in all ancient culture whether they may be Indians of North or South Americans, Scandinavians, East or West Europeans, Africans and Asians. Cow's dung contains menthol, phenol, formalin, phosphoric acid, potash, ammonia, indole, and nitrogen. Pan cake like patties is prepared and dried in sun. Agnihotra fire is prepared with these dried cow dung patties.

Cow Ghee: Cow ghee comprises of glycerol number of saturated and unsaturated fatty acids such as steric acid, oleic acid, linolenic acid, palmitic acid, myristic acid and lauric acid. When ghee is burnt along with other materials in prescribed disciplines, it becomes much more energetic. Ghee is a very special medicinal substance. It helps in rapid combustion of the materials and keeps the fire alight. On combustion and oxidation, these form hydrocarbons, aldehydes and formaldehyde responsible for fragrance and purification of the area by minimizing pathogenic bacteria.

Agnihotra Timings

The time component of Agnihotra is one of the most essential aspects to be observed. Light radiated by sun at sunrise and sunset is termed as diffused light in the sky which has great ecological significance. Since sun at the rise or set becomes near to horizon in transverse/ oblique position, solar rays have to cover a longer distance to reach to the earth and in this course solar rays (electromagnetic waves) of visible spectrum of lower wave lengths *i.e.*, violet, indigo, and blue and probably ultraviolet, X-rays and Y-rays are scattered and lost in the atmosphere. The other visible rays of higher wavelengths *i.e.*, yellow, orange, red and infra-red of invisible spectrum reach to the earth and the sky looks yellowish red at the time of sunrise and sunset.

How to prepare Agnihotra fire?

- Place a flat piece of dried cow dung cake at the bottom of the copper pyramid.
- Arrange pieces which have been coated with ghee in the pyramid in such a manner as that allow free air to pass.
- Apply a little ghee on the small piece of cake and light it and insert in the mid of pyramid.
- Soon all the dung in the pyramid will catch fire.
- One can use a hand fan to blow the air and help the flame. However, do not blow through the mouth to avoid bacteria from the mouth getting into the fire.
- Do not use any mineral oil or similar material to start the fire. At sunrise and sunset a good flames should be ready in the pyramid.

Agnihotra Process

- Take a few grains of rice in a dish or in left palm and apply a few drops of ghee.
- Exactly at sunrise utter the first mantra and after the word *SWAHA* add a few grains of rice by right hand (as little as one can hold in the pinch of your fingers will be sufficient) in the fire.
- Utter the second Mantra and after the word *SWAHA* add a few grains of rice by right hand in the fire.

Agnihotra Mantras

There are vibrations that exist everywhere. It is only vibrations when someone tries to understand deep into it. Where there is vibration there is also sound. These vibrations exist for everything, so anything can be activated, controlled or changed by Mantras. When one utters the Mantra with a pure mind into the pyramid at Agnihotra time, the ash gets energized from cosmic energy retains that energy and healing properties of the ash become more powerful (Berk, 2018).

Agnihotra Mantras

At Sunrise

*Soory'aya Sw'ah'a,*Soory'aya Idam Na Mama

(Add the first portion of rice mixed with ghee into the fire)

Praj'apataye Sw'ah'a, *Praj'apatayeIdam Na Mama*

(Add the second portion of rice mixed with ghee into the fire)

This completes morning Agnihotra.

At Sunset

Agnaye Sw'ah'a, *Agnaye Idam Na Mama*

(Add the first portion of rice mixed with ghee into the fire)

Praj'apataye Sw'ah'a, Praja'patayeIdam Na Mama

This completes evening Agnihotra

(a' is pronounced like a in 'father')

Glimpse of performance of Agnihotra has been depicted in Fig. 2.

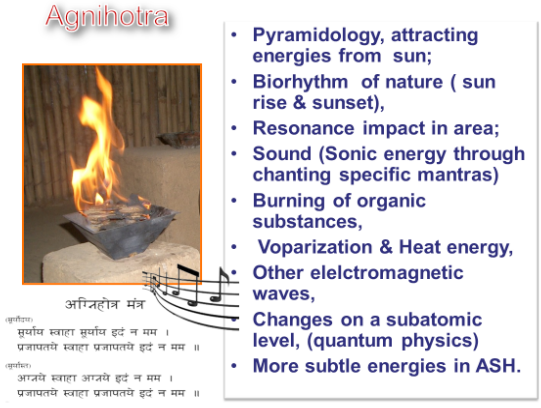

Fig. 2: View of Agnihotra performance

It creates pollution free healing atmosphere. Just, before the next Agnihotra collect the ash and keep it in a glass or earthen container. It can be used for plants or making folk medicines.

Homa Therapy in Agriculture

Resonance point- A special configuration of Homa Pyramids is installed to activate a Resonance point on a Homa Farm. It requires in all 10 Pyramids which are charged with special Mantras, one in the beginning of Homa therapy. With establishment of Resonance Point, up to 80 hectares area can be managed by with one person efforts with exciting results. The Resonance Point, act as cosmic energy harnessing centre connecting farm with environment, elements and the cosmos. Agnihotra tuned to biorhythms of sun and moon cycles and the positions of constellations in the Zodiac need to be performed by observing full discipline as advocated. These performances will heal the atmosphere and the healed atmosphere heals the plant, animal and human life (Johnson and Heschel, 2009). Glimpse of science of resonance and its impact has been depicted in Fig. 3.

Area where in Resonance Point has been established becomes cosmic area and when Agnihotra is performed energy from Agnihotra pyramids travels to four pyramids established at the outer periphery and shoots up to 12 km above ground, collects subtle energy which returns back in pyramid and deposited at ash. The Agnihotra ash is full of subtle energy used for number of purposes as discussed.

Agnihotra fires along with several hours of *Om Tryambakam Homa* are performed daily, with more hours of *Om Tryambakam Homa* on full moon and new moon days are effective tool to purify, every component, the soil, water and nearby environment. Agnihotra ash is power full tool to cosmic farmer.

Things to ponder- Homa therapy is unique technology, capable of simultaneously encourage all production factors *i.e.*, soil biology (soil bio life, enhancing N-fixing, P-solubilizing microbes, discouraging pathogenic organisms), water quality, its availability, improving the environmental ecology of biosphere including predators, parasites, birds and cattle productivity (Pathak, 2019).

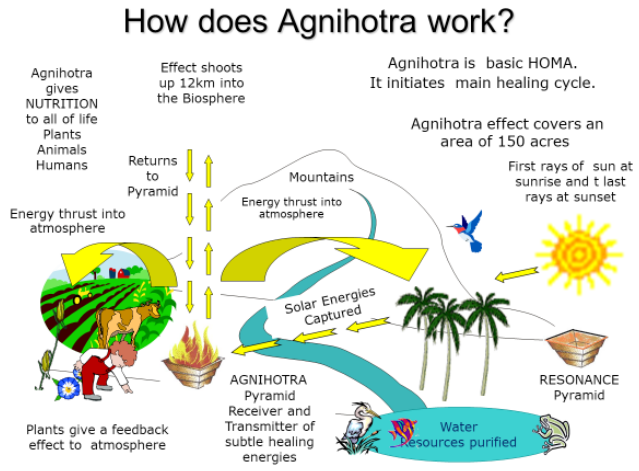

Fig. 3: View of impact of resonance point to mediate cosmic energy

Agnihotra and Plants

The ghee which is used in performance of Agnihotra is thrust into the atmosphere and attaches itself to the molecular structure of the soil, allowing the soil to retain more moisture. Plants grown in Agnihotra biosphere are better able to withstand droughts. Agnihotra causes a change in the cellular structure of plant, which sends more nutrients to the fruits and less to the leaves, stem and roots. Performance of Agnihotra in the garden yields fruits and vegetables are superior.

The ash obtained in performance of Agnihotra is full of subtle energy with therapeutic values. It is used in powder form or enriched water and a potent bio enhancer, known as Biosol a potent bio-enhancer. Agnihotra ash is used for seed storage, treatment of seed/seedling, enhance soil fertility, water quality, availability, and manage pest and disease in plants.

Use of Agnihotra ash

Agnihotra ash has miraculous healing properties, which can be used in every aspect of human lives. It can be used to trat physical ailments in humans and animals. It can be applied in agriculture to grow pure, nutritious, Homa Organic produce. Agnihotra ash itself has the properties of all elements- Earth, Air, Fire, Water and Ether. Some field experiences of Agnihotra ash are.

- Agnihotra ash has been observed to be rich source of microbes *i.e.*, P-solubilizers and N-fixtures hence are effective to release soluble phosphates from the soil and make them bio available (Berde *et al*., 2017).
- Agnihotra ash can is mixed with organic mulch all-round the tree trunk. It will help in quick decomposition of mulches and provide desired nutrients required by the plants.
- In perennial fruits mulching can be done with its own dropped foliage. It is advisable that some legumes is sown in the orchard where some solar radiation is available, mix with dropped foliage and make a thick mulch leaving tree trunk and drench it with Agnihotra ash water/Biosol.
- An excellent plant food can be made by making a solution of Agnihotra ash+ cow urine and water. For this, incorporate one Kg Agnihotra ash + 5 liters cow urine in 200 liters water. Incubate the mixture for three days and stir it thrice a day. After filtration Agnihotra enriched water can be used as foliar spray or drenching on mulches.
- This will be helpful in quick decomposition of non decomposed material and improve nutritive value of compost.
- Agnihotra ash is placed in a gunny bag and kept at main water source used for irrigation of field or orchard.
- One kg Agnihotra ash is placed at weekly interval in wells/ ponds used for irrigation of field. This will be helpful in improving in water quality and also availability.
- A thick tree paste can be prepared by incorporating cow dung+ cow urine+ Agnihotra ash and clay.

A potent bioformulation is prepared basically Agnihotra ash as base material along with few organic ingredients in Homa atmosphere which is known as Biosol, which has been dealt.

Biosol

It is one of the most potent bio-enhancer developed by Gloria and named as "Gloria Biosol" from Peru, South America (Weir

2009). It is prepared after serious of operations and processes in Agnihotra environment. It leads to biodegradation of organic substances *i.e.*, cow dung, cow urine, vermi compost, Agnihotra ash along with a Shree Yantra in a biodigester. It takes four weeks in preparation. It is a powerful bio food and bio fertilizer for plants with high rich in nutrients and other rich source of beneficial microbial populations.

For preparation of Biosol a rigid bio digester of 200-1000 litres capacity is used. In these two outlets one for release of air at top and the other at bottom are made to get the Biosol. At base one Shree Yantra facing upward is placed. A mixture of cow dung, vermi compost, cow urine and Agnihotra ash mixed in water is placed and properly sealed. At weekly interval upper valve is opened to release the gas. In this way in four weeks Biosol is ready. If properly stored can be used for six months. Normally it is diluted with water (1:10-15) times, sprayed on plants at monthly intervals. Its soil application also has been found effective (Pathak, 2019).

In preliminary study at UAS, Dharwad, India, Biosol has been observed to be rich source of beneficial bacteria, fungi, actinomycetes, N-fixers, P-solubilizers. Impact of Biosol has been reported in cabbage and tomato. Enhanced availability of nitrogen phosphorus, potash, Cu, Zn, Mn, Fe, dehydrogenase and phosphatase in soil has been reported. Similarly, enhancement in yield and quality with respect to ascorbic acid, lycopene, total free phenols, total sugars have been observed. Besides these attributes, reduction in leaf spot and fruit borer in tomato and in cabbage black rot, black spot, head borer, diamond black moth etc. have been reported.

Biosol rich source of macro and micro nutrients and other growth promoting factors and have better response as compared to other bio enhancers with many benefits. But its soil application has also been found effective (YouTube Link: https: www.youtube.com/chanel/UCL1W-cEC5OcE_49KFXeOgiw, Facebook Link: HTTPs://www.facebook.com/proghort.journal.3).

Impact of Biosol on Crops

- Foliar & soil application of biosol have been observed to have better impact than alone.
- Soil application of Biosol increased root nodules maximally as compared to other Homa treatments and control.
- Rust incidence and insect attack were significantly low (10-30 per cent) with foliar application of Biosol.
- Soil applications of Biosol have been observed to improve soil biological properties including soil enzymes such as dehydrogenase and phosphatases.
- Invariably significant impact on crop yield, quality parameters, macro and micro nutrient contents of produce.

Use of Biosol along with Homa ashes, especially Agnihotra ash provides a promising supplement at very low cost, affordable technology, even by the marginal farmers.

There are number of experiences with Homa Therapy and use of Agnihotra ash that improvement in water quality with respect to its biological properties, its availability and even mitigation of drought can be addressed by massive performance of Homa (Berk, 2020). In one study, on effect of application of Homa ash for enhancing soil fertility revealed interesting observations. Addition of one per cent ash resulted in increase in activities of nitrogen fixers and phosphate solubilising microbes, while reduction in pathogenic fungal flora. Ratio of positive to negative micro-organisms was 100:0; soil contained only effective micro-organisms after the treatment with Agnihotra ash (Berde *et al*., 2017).

In fact, systematic research of Homa Organic farming has not been done at any institution but with efforts of members of Fivefold Path Mission few individuals and institutions got interesting results which on various crops as summarized.

Use of Biosol along with Homa ashes, especially Agnihotra ash provides a promising supplement at a very low cost, affordable technology, even by the marginal farmers (Fig. 4).

Effect of Homa Organic Farming on Plants

In Homa farming, there are two components *i.e.*, Homa atmosphere and use of Agnihotra ash, both are synergistically interwoven to give desired results. If plants are kept, where vibration of pyramid fire are maintained, one can watch impact of subtle energy on plant growth and its performance. When Homa is done, its smoke goes to leaves, act as catalyst to enhance chlorophyll, thereby enhanced photosynthesis, which results in better yield of crops.

Benefits of Homa Organic Farming

- Rejuvenation all kind of soils *i.e.*, acidic, alkaline, barren etc.
- Prevention, control eradication of plagues and diseases in all crops with short and long vegetative cycles.
- Cereals like rice, corn, wheat, millets etc.
- Vegetables like tomato, onion, cabbage, cucumber, cauliflower, beans, potato etc.
- Fruits like banana, mango, orange, lemon, papaya, pineapple, apple, pomegranate, guava etc.
- Nuts like peanut, walnut, cashew nut, coconut etc.
- Coffee, cocoa, cotton, etc.
- Forest trees & Pastures
- Crops become superior in quantity, taste, texture, colour and dieses resistance.
- Homa Therapy controls and eradicates weeds.
- Homa Technology is cheap and no agrochemicals are required.
- Homa improves the health of cattle and no vaccinations are required.

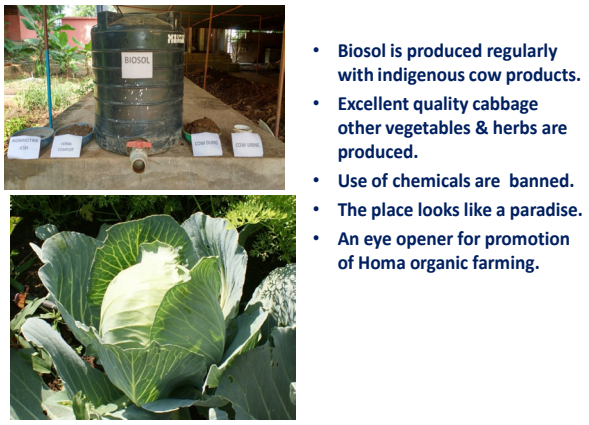

Fig. 4: View of preparation of Biosol and its impact in cabbage production Maheshwar, Khargone, MP, India

- Homa Therapy improves quality and quantity of milk.
- Earthworms and honeybees are beneficially affected by Homa and they produce more.
- It is necessary to promote Cosmic seed village to assure quality seeds to cosmic farmers.

Impact of Agnihotra on Environment

The Agnihotra is basically conceived to combat environmental pollution (Kumari *et al*., 2015). But it has been found equally effective in agriculture. They are also to be seen as science connected with aerosol science and climatic engineering. The science behind the performance of Agnihotra is to be explored and undertaken for systematic development with the aid of modern developments in science and technology. It is to be seen as scientific aids and techniques of solving environmental pollution, rejuvenating and enlivening soil and other natural resources by establishing connectivity with cosmos and the natural resources. One can grow superior crop with the help of Agnihotra farming, without chemical fertilizers, pesticides, and herbicides.

Improvement in Soil Health

Owing to different kinds of pollution, the soil in most part is sterile/ contaminated with pathogenic, and many other such problems. Soil pollution is becoming alarming and has become a major concern particularly for sustainable agriculture. Soils in many places become unable to support plants due to pollution and in some area, plants are dying due for unknown reasons. Soil need rejuvenation with Homa Therapy and other measures. Soil in Homa resonance atmosphere has better aeration, holds moisture better than any soil. When the nutritional rain comes due to the mass practice of Homa, nutrients and moisture are sustained as a unit in the soil. This makes for better quality vegetation. Homa atmosphere and Agnihotra ash, when put in the soil, help stabilize the amount of nitrogen and potassium present and enhance the solubility of phosphorus.

In Homa atmosphere the metabolic process of plants is speeded up. It is the ghee used in Agnihotra process that is the catalytic factor and on a more subtle level the mantras interacting with the combined effect of the burnt ghee and raises impact in integrated manner. This combination enters the soil after returning from the solar range. It enters the plant by, one might say, attaching itself with minerals and water absorbed by the root system of the plants. The ghee acts as a catalyst, creating a chemical reaction with the plant, aiding in enzyme and vitamin production and encouraging and increasing the cyclic rate. In other words, plants mature faster, taste better with improved shelf life (Paranjpe, 2004).

In the rejuvenated soil different types of microorganisms, starting from the level of viruses, bacteria, fungi, algae, thrive better. Thus, a healthy micro-flora and micro-fauna are created. This gives rise to a micro environment or micro-system which is comparatively less toxic to the growth of plants. The soil which has now become a living soil because of the presence of microorganisms has all the chemical components useful for life in the form of carbon, hydrogen and oxygen. Addition of Agnihotra ash results in increase in overall bacterial flora; including the effective bacteria *i.e.*, nitrogen fixers and phosphate solubilizers while reduction in the fungal flora. Stimulation of photosynthesis and plant respiration, which improves the entire oxygen cycle, is attributed to Homa atmosphere.

In a study Ash-1 collected after performing agnihotra with same materials without chanting mantras and timing Ash-2 collected after performing the agnihotra at sun rise and sun set with proper procedure. When different beneficial soil bacteria and yeast *viz*., *Bacillus* sp., *Klebsiella* sp., *Pseudomonas* sp., *Saccharomyces cerevisiae* (Baker's yeast), *Saccharomyces cerevisiae* (industrial yeast), *Saccharomyces cerevisiae* were inoculated in Nutrient Agar and Yeast extract Peptone Dextrose Agar medium containing Ash-1 and Ash-2. Growth of these microbes was recorded more in media contained Ash-2 and less in media contained Ash-1. Growth of pathogens was restricted in Ash-2 while it was observed more in Ash-1 (Ram *et al*., 2019a,b,c).

Soil in Homa resonance atmosphere has better aeration, holds moisture better than any soil. When the nutritional rain comes due to the mass practice of Homa, nutrients and moisture are sustained as a unit in the soil. This makes for better quality vegetation. Homa atmosphere and Agnihotra ash, when put in the soil, help stabilize the amount of nitrogen and potassium present and enhance the solubility of phosphorus.

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Benefits of Homa Farming

The following benefits can be assured by regular performance of Homa and use of Agnihotra ash and Biosol for different purposes in crop production.

- Rejuvenation of all kind of soils *i.e.,* saline soil, acidic soil and barren lands.
- Management of insect pest in all crops with short and long vegetative cycles.
- Increase in population of predators, parasites and birds.
- Improvement in produce taste, texture and colour.
- Improvement in health of cattle in the environment and improvement in quality and quantity of milk.
- Improvement in all production factors *viz*., soil, water, environment, earthworms, pollinators get boost through Homa atmosphere.
- Homa organic farming can be integrated with other organic farming system for better response.
- Improvement in shelf-life of produce.
- Cost effective production compared to other organic or conventional production systems.

Things to ponder- It is pertinent to mention that homa organic farming is effective to boost activity of all production factors *i.e.*, the soil its biological activities, water, air, *i.e.*, ecological activities predators, birds' parasites, pollinators, cows, plants including human beings by combating environmental pollution and many other ways (web: cosmicfarmingindia.com. Pathak, 2019).

Homa organic farming can be integrated with any organic farming systems to get additive response, but integration of

Biodynamic Farming and Homa farming will have synergistic response which can resolve the present day's crises for the wellbeing of humanity (Gaikwad, 2018; Pathak, 2019).

Plant Nutrient Management in Cosmic Production

Nutrient management in crop production has created number of problems with government, farmers and its impact on soil, water and environment is now well understood. In cosmic farming there is no need of any external chemicals. Like all living beings, plants are made up of atoms derived from the planet Earth. They are autotrophic and have the unique ability to extract their nutrients from two sources *i.e.*, the biosphere and the rhizosphere (Pathak and Ram, 2019). Plants get their nutrition quantitatively from biosphere and qualitatively from rhizosphere as summarized.

- Plants require 30 plus elements for their quality production.
- This can be provided through pollution free biosphere and humus rich soil.
- Cow urine and earthworms have trace of copper is a potent source to mediate electromagnetic energy from cosmos.
- Cow urine is a rich in nitrogen, phosphorus, potash, iron, calcium, sodium etc.
- Plants taks nutrients in oxidized, chelate and in ionic forms which is accomplished by the soil microbes.
- Chemical fertilizers currently available in the markets can hardly provide6-8 elements.
- Almost 78 per cent free N is available in the atmosphere, which can be mediated through legume and other BNF plants and specific soil microbes.
- Plenty of P and other elements in non-available forms, are present in deep soil horizon, one has to ensure their movement to upper horizon and enhance its solubility.
- Potash is a non-constituent element, burrowed from soil and returned back through bio mass.
- Provision of enough biomass and its recycling will help in meeting K requirement other esssential elements.
- Quality humus is produced by decomposition of organic and animal wastes without interference of agro-chemicals at any stage.
- Humus content in the soil is potent accumulator of cosmic energy including moisture from cosmos and has capacity to transmutate any nutrients which are deficient but required by the plants.
- Humus has great capacity to retain nutrients and releases it slowly as per neeeds of plants, thereby it assures nutrient avalibility for a long time and minimizes loss through leaching.
- Therefore, one should not worry for deficiency of any elements in the soil, all efforts should be diverted to enhance soil organic carbon and improve ecology of biosphere.

Animals eliminate excess organic phosphorus by excreting phosphorus salts in urine. It contains phosphorus solubilizing microorganisms (PSM) and phosphating bacteria to convert P into soluble forms of phosphorus which remain bound with soil. The phosphate level and other elements near the soil surfaces may be low but not too low, mycorrhizal roots may form to serve as efficient scavengers of phosphorus (Tomkins and Bird, 2004). In fact, nature has elaborate arrangement for crop nutrition through large number of microbial populations in forms of bacteria (autotrophic & heterotrophic), fungi include moulds, yeasts, mushrooms and actinomycetes and many others, all play their specific role in soil fertility management and crop production. It is important to understand that in nature both pathogenic and saprophytic microorganism exists. If farming community equipped to adopt simple practices such as multi/ poly cropping, inclusion of BNF, mulching and frequent use of bio-enhancers, combined together then these are able to enhance the activity of saprophytic microorganisms, pathogenic activity will automatically get discouraged (Ram *et al*., 2018a,b).

Things to ponder-Nutritional deficiencies, insect pest occurrence are indication of diminished 'Aura Energy' of soil and plants. There is direct correlation between soil humus and aura energy. Hence, all efforts of cosmic farmer need to be concentrated to enhance soil humus and its maintenance for quality production without a gram of agrochemicals (Pathak and Ram, 2019).

The army of working soil organisms proliferates in their proximity. Improve porosity and soils with earthworm's shows an increase in soil- air volume from 8- 30 per cent more, thereby by improving water infiltration and water holding capacity. The most striking effect of earthworms may be the stimulation of microbial activity including *Actinomycetes*, *Streptomyces*, *Azotobacter, and Azospirilium,* thereby helpful in managing soil born fungal diseases and mediating N from biosphere. Earthworms release into soil certain vitamins and similar substances which may be the B group of vitamin or free amino acids. Vermicast promote growth of plants which may be due to plant growth promoters like cytokinin and auxins present in the casts. Somehow, use of agro-chemicals has adversely impacted earthworms and many soil dwellers (Ismail, 2002).

To test feasibility of above statement, a simple trail was attempted in mango orchard without use of agrochemicals. It included inter cultivation of cowpea, application BD-500 spray coupled with application of 50 kg biodynamic compost, mulching with banana leaves, drenching with cow pat pit (Pathak and Ram, 2019). Results for three years of physical, chemical and biological properties of basin soil have been presented in Table 4.

Perusal of Table 4 indicates continuous improvement in physical, chemical and biological properties of soil (Pathak *et al*., 2010).

Selected Case Studies on Cosmic Production of Horticultural Crops at ICAR-CISH, Lucknow, India

It is important to mention that Cosmic Farming is altogether a new concept being conceived by us over two decades' observations. Hence, full package has not been tried anywhere,

Table 4: Improvement in physical, chemical and biological properties of basin soils in mango orchard.

Particulars	*Initial*	*2nd year*	*3rd year*
Organic carbon (%)	0.535	0.80	1.003
P (ppm)	8.66	10.50	22.66
K (ppm)	140.00	142.50	200.5
Yeast & mould (cfu/ g)	$1.3x10^4$	$5.8x10^4$	$8.5x10^4$
Bacteria (cfu/g)	$3.7x10^6$	$4.8x10^6$	$8x1010^6$

Table 5: Comparative impact of conventional and biodynamic package with few select mango cultivars at ICAR- CISH, Lucknow, India

Cultivar	*Yield kg /tree*	*Acidity (%)*	*TSS (Brix ^{0})*
Dashehari- conventional package	56.54	0.20	17.25
Dashehari, biodynamic package	96.00	0.16	21.50
Mallika, biodynamic package	90.00	016	19.20
Amrapali, biodynamic package	35.00	0.11	21.60
Langra, biodynamic package of practice	80.00	0.18	19.20

Table 6: Economic analysis of mango cv Mallika production.

Treatments	*Cost of production (Rs./ kg)*	*Yield (kg/ ha)*	*Total production value (Rs./ha.)*	*Net profit (Rs./ha.)*	*Benefit cost ratio*
FYM(40 kg /tree)+ *Azotobacter* + *Azospirillum* + PSB (10^8 cfu/g) + Mycorrhiza (Inoculum)cfu/g)	9.24	6068.33	91025	36436.50	1.67
Biodynamic compost (30 kg/ tree) +bio-enhancers (CPP 100 g, BD – 500 and BD 501 as soil and foliar spray)	5.41	10898.67	163480	112298.67	3.19
Neem cake + Farmyard manure (20 kg each/tree) + *Azotobacter* + *Azospirillum* + PSB(x 10^8)	9.84	8175.33	122630	46056.30	1.60
Vermi compost (30 kg /tree) + *Azotobacter* + *Azospirillum* + PSB (10^8 cfu/g)	9.27	6955.67	104335	49606.67	1.90
Farmyard manure (40 kg/ tree) +bio-enhancer (Amritpani 5% soil application)	9.16	5795.33	86930	36956.30	1.74
FYM (40kg/ tree) +Green manuring (sun hemp) *Azotobacter* + *Azospirillum* + PSB (10^8 cfu/g)	7.43	8218.33	123275	68938.07	2.26
1000g N P K /tree	11.50	5353.00	80295	24623.11	1.44
CD at 5%	2.04	2565.26	38478.85	38479.04	0.78

but with a part of few of these have shown encouraging response. Just to restrict the volume of paper only few successful cases have been included (Ram and Pathak, 2016).

One systematic study conducted with biodynamic package of practice along with other soil amendments package in Mallika trees. Biodynamic package consisted of application of 30 kg/ tree biodynamic compost, 100 g of cow pat pit, BD-500 and BD-501 as soil and foliar spray. Improvement in soil organic carbon, available, N, P.K. Ca, Zn, Cu, Mn, soil bacterial population, actinomycetes, dehydrogenase, yield, total soluble solids, total carotenoids were observed better than other amendment combinations (Ram *et al.,* 2019a,b,c).

Looking initial positive response of biodynamic practices, as preliminary studies were superimposed with few mango varieties at ICAR-CISH, Lucknow, India results are summarized in Table 5.

Glance of Table 5 reveals that yield and quality of fruits in these cultivars was improved. But for acceptance as viable technology systematic research and validation on number of crops as viable option of conventional production is needed.

Economic studies of different organic production along with biodynamic production in mango variety Mallika has been done and its summary has been presented by Ram *et al.,* 2018a,b) in Table 6.

Yield of mango cv. Mallika was taken for economic analysis showed that the maximum cost of production (Rs.11.50/kg) was recorded with 1000g NPK /treeand minimum (Rs. 5.41/kg) with biodynamic compost (30 kg/ tree) + bio-enhancers (CPP 100 g, BD-500 and BD-501 as soil and foliar spray). Maximum production (10898.67 kg/ha) was recorded with biodynamic compost (30 kg/ tree) + bio-enhancers (CPP 100 gBD-500 and BD-501 as soil and foliar spray) and minimum 5353 kg/ha with 1000g NPK /tree. However, total production value was recorded maximum (Rs. 163480/ha) with biodynamic compost (30 kg/ tree) + bio-enhancers (CPP 100 g, BD-500 and BD-501 as soil and foliar spray) and minimum Rs. 80295/ha in 1000g NPK /tree. Maximum benefit cost ratio (5.10) was obtained with biodynamic compost (30 kg/tree) +bio-enhancers (CPP 100 g, BD-500 and BD-501 as soil and foliar spray) minimum (2.84) in FYM (40 kg/ tree + *Azotobacter* + *Azospirillum* + PSB (10^8 cfu/g) + mycorrhiza (inoculums) (Ram *et al.,* 2019a,b,c).

Tips for Cosmic Nutrient Management in Horticultural Crop

- Treatment of seed/seedling and plant parts before sowing/ transplanting with Beejamrita/ Panchagavya.
- Application of vermi compost/ BD compost - 3-5 t/ha during initial years in annual crops.
- In fruits trees incorporation of 20-30 kg vermi/BD compost/ tree in the trenches along with mulches and drenching with Jeevamrita.
- Twice pasting of tree trunk and main branches with biodynamic tree paste.
- Application of Jeevamrita at the time of field preparation and during subsequent irrigations.
- Cultivation of pea, cow pea, horse gram or any other legumes as cover crop, inter crop. s.
- Mulching with mixed biomass available locally.

- In fruits like mango, dropped foliage, weeds and if some open space is available some legumes can be grown and its biomass may be mixed as mulching materials.
- Monthly sprays of *Panchagavya*/vermi wash/ Biosol/ CPP as per convenience for enhanced production as per crop duration (Pathak and Ram, 2019).

Application of compost will be required during initial years. After enhancement of soil organic carbon, there is no need for any compost application, all efforts need to be concentrated to enhance and maintain high carbon in the soil. Systematic research and validation of aforesaid practices as per convenience on physical, chemical and particularly biological quality of soil, its impact on production and ultimate quality of produce is need to be initiated at, few selected institutions, if possible, by involving organic farmers in the vicinity will help for its acceptance by the farming community. The time is most opportune for everyone to follow the blueprint of cosmic wisdom given through the Vedas, the most ancient wisdom known to human race. The knowledge is no monopoly of any country or community. It is the common patrimony of human race given through a language as old as creation (Paranjpe, 1977).

Conclusion

Integration of biodynamic farming and Homa Organic Farming, high quality production can be obtained in any crop in any ecological situations. Through these efforts one can provide solution to convey strong message to the farming community *i.e.,* small and marginal farmers in remote areas, who can keep few humped cows and use their products as per crop need without depending on any external inputs. By assertive promotion of this, the plight of small and marginal farmers across the country and pathetic situation of cows can move towards sustainable agriculture. Cosmic production and consumption will be instrumental in fulfilling the dream of honourable Prime Minister *"Atma Nirbhar Bharat"*. Food produced with energy derived by enhancing soil biology and environmental ecology will be "*Sattvik*" rich in nutrition, with better quality and higher therapeutic values. While those produced with energy derived by killing millions of soil microbial consortia in soil and biosphere will definitely be "*Tamsik*" poor in taste and nutrition and cause human health ailments.

For total healing of plants, animals, humans and ecosystem in general Agnihotra is a Gift from Vedas to reset the energy cycle and save planet. Looking the strength of country "Cosmic production and consumption" of horticultural commodities, if possible fresh, will have far reaching implications in resolving number of crises being faced by humanity. These can be helpful in enhancing health and earning of farming communities and other people associated at different stages from production to post harvest handling and marketing.

Things to ponder-over thousands of years, India developed sustainable farming systems. We need to return to these including maintaining at least 20 percent of natural habitat, like forest, across farms-these habitats enable essential ecosystem services like pollination. Enrich organic inputs with better nutrients and microbial activities to make soil healthy and suitable for higher production. Recycling of crop residue, mulching, frequent use of Jeevamrita during field preparation and subsequent irrigation and 4-6 times foliar spray of CPP/ *Panchagavya*/Vermi wash, without use of agrochemicals, higher production can be obtained in any crop. Building up of right microbial culture is crucial than to count N, P, and K in the organic menu. Feeding N, P, and K through chemical route, will not sustain agriculture for long what is being experienced.

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