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An Effective Production, Distribution and Performance Analysis of Jeevamirtham towards the Smart Agronomy for Plants and Crops

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ABSTRACT

Background: Agriculture not only provides food for the living beings, it also maintains the environmental balance in the globe. Water management and manure supply management to the plants and crops is the important factors to be considered for healthy and heavy yielding. Manures plays major role in the effective agriculture process. Both non organic and organic manures are effectively utilized by the farmers now a day. By considering the soil, air, water and the entire environmental safety, feeding non organic manure has been slowed down by the formers and governments. Hence, the only chance remains are the traditional organic manure feeding for the effective growth and yielding. Many organic manure has been proposed and tested by many researchers for its effectiveness on all plants and crops. Among all the organic manures tested, one organic manure "Jeevamirtham" have provided best results in almost allplants and crops. Preparation and feeding of Jeevamirtham is a tedious and time consumingprocess and it needs high man power and water source. Hence, to handle this Jeevamirtham, the traditional method of manure feeding needs help from technology.

Methods: To satisfy the needs of agriculture activities, a smart method of organic manure preparation and feeding has been proposed and tested in this work. This new method consists of automatic mixer, jeevamirtham producing tank, slurry pump and distribution setup. It is a semi-automated method which provides manure to individual plant and crop in equal volume.

Result: This proposed method is capable of producing 3000 litres of Jeevamirtham in 72 hours of time and supplies almost equally to all plants and crops in the field. Further, this new method has achieved notable improvements in plant growth, yielding, disease resistance, draught resistance, 95% of fertility with longer life time in various soil environments. The PM also has an improvement of 2-4% in the yielding with comparatively small quantity of water, time and manpower requirement than all other existing methods.

Key words: Agriculture, Farmers, Jeevamirtham, Organic manure, Yielding.

INTRODUCTION

Agriculture and its allied activities sector are the main contributor of any nation's economy and wealth. About 60% of peoples have been doing agriculture activities, about 18% of gross domestic product (GDP) rate have been from the agriculture and its allied activities sector in India. Traditional methods are not enough to produce the required amount of yields and hence chemical based agriculture methods have been found and utilized (Goklany, 2002). Recent survey for the past three decades indicates that, the agriculture yields become double because of the utilization of chemical festicides (Jnanesha *et al.,* 2024). Further the survey also says that the arable land area reduces to low lelvel and erosive land area also increases due to the excessive utilization of non-organic (chemical) fertilizers. Organic agriculture prevents the society from toxic chemicals and water, soil and air pollution (Boraiah *et al.,* 2017). Jeevamirtham is the best alternative solution for chemical fertilizers. Fretilizer in the form of liquid will be easily feeded to the plants and crops in a balanced way and will play a major roll in the plant growth and yielding than chemical fertilizers (Kulkarni and Gargelwar, 2019). A detailed study and analysis has been done for Sasyamrutha, panchagavya and jeevamirtha. The jeevamirtham was found good in microbial content, nutrients and agents related to plant growth, yielding and fertility (Chakraborty and Sarkar, 2019). Jeevamirtham with fish amino acids have been combinedly tested by Jnanesha *et al.* (2024) for plant growth and found better results than chemical fertilizers. Jeevamirtha and panchagavya has

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been tested for cow pea in red sandy loam soil and found growth improvement in terms of number of leaves, height, width and fertility (Udaratta and Ramagopal, 2023a). Information about various organic preparations have been studied for the improvement of microbial properties by Reshma Sutar *et al.* (2019). Thermochemical organic manure production for the purpose of reducing the waste materials in the agriculture land has been tested by Udaratta and Ramagopal (2022). Screening and identification of precursors related to the formation of liquid organic fertilizers (Jeevamirtham) has been done by using Plackett - Burman Design (PBD) by Vaish *et al.* (2020). Optimization in the utilization of precursors has been analysed and implamented by Jnanesha *et al.* (2024) and the Jeevamirtham Germination index has been found good. Meene *et al.* (2023) tested for the effect of application of organic and inorganic manures on soybean and also tested for the plant growth and yield. They found good results for organic manure application.The study by Ram *et al.* (2023) provides information about the usage and importance of cow dung and related components are played major roll in producing higher amount of microbial agents. The application of jeevamirtham in the pomegranate plants has been tested and found satisfactory results in terms of plant growth and yielding (Choudhary *et al.,* 2023). Kumar *et al.* (2023) found that, frequent feeding of organic manure can improve the soil fertility and productivity. Application of jeevamirtham has been tested along with three other organic manures for the microbial content, plant growth, yielding and soil fertility (Udaratta and Ramagopal, 2023b). Dosage of jeevamirtham (150 litres per acre recorded higher sennoside content in leaves) for the improvement of growth and yielding of Senna has been tested by Jacob *et al.* (2021) and found excellent results. Somdutt *et al.* (2023) studied about the usage of jeevamirtham, panchagavyam and Beejamirtham to plant and crop and found increase in growth and yield. Further, to boost the growth of agriculture, it is very clear and necessary to consider the maximum utilization of commonly used organic manures (Jeevamirtham, Beejamirtham and Ganajeevamirtham). To utilize these manures effectively, farmers are in desperate need of technology support. Many methods of smart farming with technical support have been proposed and tested for the effective preparation and utilization of organic manures. One such method is the semi-automatic preparation and feeding of organic manure (Jeevamirtham) to individual plant and crop as per the actual requirement towards effective growth and yielding. Jeevamirtham has been prepared by mixing five important ingredients with water. They are, Cow dung, Cow urine, Jaggery, Gram flour and a small amount of Soil from the land site where the Jeevamirtham is going to be utilized. The exact amount of above said ingredients for a volume of 200 literJeevamirtham is as follows. 10 Kilograms of Cow dung, 10 liters of Cow urine, 2 Kilograms of jaggery, 2 Kilograms of pulse or gram flour, handful of soil from the farm land and enough amount of water. The prepared jeevamirtham is having potassium, zinc, copper and iron in it. Each litre of Jeevamirtham will have 0.04 grams of nitrogen, 0.04 grams of phosphorus and 0.28 grams of potassium in it. Jaggery increases the immunity of the plant and crop, increases the fertility level of plant and crop and it also increases the drought resistance of plant and crop. Further, Jeevamirtham enhances the uptake of nitrogen (N), phosphorus (P) and potassium (K) of plants and crops. Carbon (C) along with N, P, K and other essential micronutrients increases the microbial count and other useful bacteria in soil. Jeevamirtham has 1.48% of N, 0.28% of P and 0.32% of K. It improves the pH level of the soil. Jeevamirtham prepared by the existing methods have the pH value ranging between 5.5 to 7.1, which is a neutral level for all plant and crop growing environment. Jeevamirtham can be prepared based on the requirement of farmers at any time by using the above combination. Many manual and semiautomatic methods have been proposed and tested by researchers for Jeevamirtham. All the methods tested are in desperate need of man power for preparation, storing and delivering to the plants and crops equally. Manual feeding of manure will not satisfy the equal distribution. Many methods tested for automatic preparation of Jeevamirtham and manual distribution to farms. Hence, it is very clear that, no method is tested so far for the automatic preparation and distribution of Jeevamirtham to the farms.

MATERIALS AND METHODS

Study area

The pre sent study has been experimented and tested during June 2023 - June 2024 at Jakkarpalayam village in Kinathukadavu Taluk, Coimbatore district.

Experimental details

The proposed semi-automated system consists of three stages. First is the input with motor and Gear system for mixing the ingredients of Jeevamirtham : cowdung, Jaggery, gram flour and soil. Second is the Jeevamirtham filer for storing the mixture from stage one to around 72 hours, filter it and deliver it as Jeevamirtham when ready. Third and final stage is the output stage with motor and pressure pump to supply the Jeevamirtham to the required area. Here the filter used is Pruthviraj Tank medium size manufactured by Suchet Agro LLP, Pune. The motor with Gear and shaft with circular plate mixer is designed to mix around 50 kilo Grams of mixture with in the short period of 3 - 5 minutes. Further, the output Jeevamirtham is feeded to the main pipe line of water irrigation in a proportion of 01:0.1 (water:Jeevamirtham) equally to all the required areas through pressure pump to drip irrigation lines. This system has been implemented and tested for its automatic and equal supply of Jeevamirtham to all kind of plants and crops. Especially this setup has been tested in a large area planted with Coconut tree and Papaya plant and found

excellent results in growth, fighting against various conditions and better yielding. The complete setup of the proposed method of Jeevamirtham preparation and distribution has been shown in Fig 1.

The mixer setup for Jeevamirtham preparation is the main part of this proposed system shown in Fig 2. It consists of concrete tank, gear setup with motor, steel shaft with metal blades at the bottom. The internal view of mixer has been shown in Fig 3. Here, the mixer blade arrangement has been designed with special care. It consists of three metal blades to mix the ingredients properly. All the three blades have been positioned with 1200 shift in order to mix the Cow dung properly.

Further, the speed of mixture has been controlled by gear system with automatic panel board and timer for required time of operation.

RESULTS AND DISCUSSION

The proposed method (PM) has been tested for Microbial load with different organic liquid manures. Microbes formation in terms of Colony forming unit per millilitre (cfu/ml) has been tested with Bacteria (Azotobacter, Vesicular Arbuscular Mycorrhiza (VAM)/ Phosphate Solubilizing Bacteria (PSB) and Nitrogen fixing Bacteria -allprovides support for recycling of soil system and water for soil system, they also estabilish a bond between soil particles to form the requred soil structure which improves the soil quality), fungi (It is a microorganism, which create yeasts for plants and crops), actinomycetes (Producers of various biocontrol agents, plant growth supporting chemicals and various antibiotics), phosphate solubilizing organisms (Production of organic acids. Further the acid supports the miniraliozation of phosphorous in the soil) and Free living n2 - fixers (used to fix the molecular Nitrogen available in the environment and without affecting the routine process of individual plants) for Panchagavyam, Beejamrutham, Biodigested Product, Jeevamirtham (TM - Traditional Method) and Jeevamirtham (PM - Proposed Method) and tabulated in Table 1. The colony count found has been comparitively good for the proposed method than all other methods.

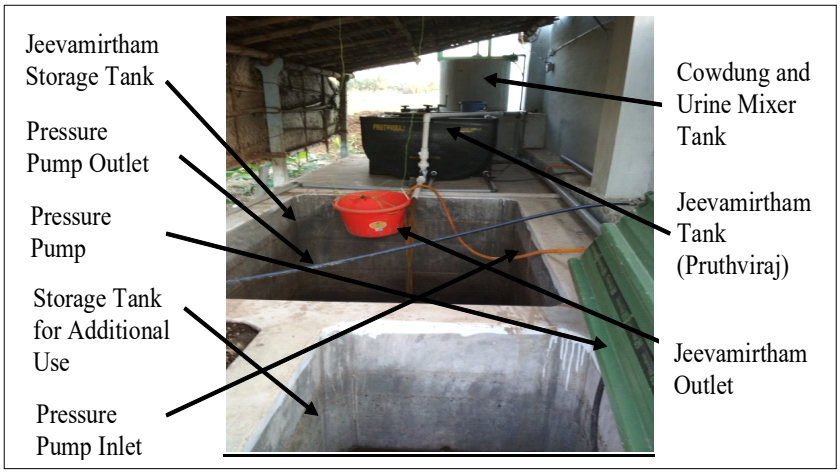


Fig 1: Complete setup for jeevamirtham preparation and distribution.



Fig 2: Block representation of mixer setup (Cowdung, urine, jaggery, soil and gram flour).

The PM has also been tested for nutrient status with different organic liquid manures for pH (7 normal - pure water, > 7 alkaline and < 7 acidic), soluble salt (Calcium, sodium, sulfate, bicarbonate and potassium salts available in the soil which causes electric conductivity), total nitrogen percent (It is for the better growth and reproduction, direct application will be polluting the air, water and soil), total phosphorus (ppm) (It is used for the cell division and expansion for growth. It is also very much important for seedlings and small plants), total potassium (ppm) (It supports the exchanging process of water vapor, oxygen and carbon dioxide. Further it also supports for the good yielding), total zinc (ppm) (It supports for the required reactions in the plant metabolism. It improves the protein, carbohydrate and chlorophyll growth), Total Copper (ppm) (It is an important micronutrient for the plants and crops. It supports to produce required enzyme and few coenzymes for the healthy development of plant metabolism), Total Iron (ppm) (Production of chlorophyll and certain enzymes. It also produces antibody against color related diseases for plants and crops), total manganese (ppm) (Very important for plant growth and yielding, it also supports for effective greenhouse process) and tabulated in Table 2. The resulted values of all parameters are comparatively good for PM.

Further, the PM for Jeevamirtham preparation and feeding has also been tested along with manual manure

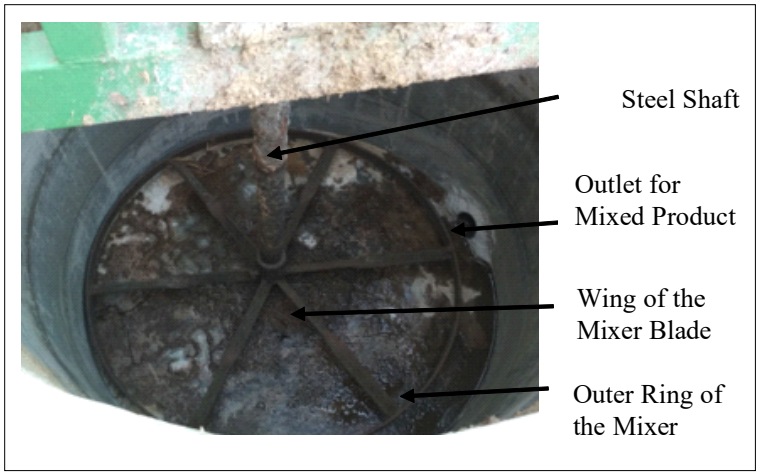


Fig 3: Internal view of mixer.

Table 1: Microbial load in different organic manures.

Organisms	Colony count (cfu/ml)				
	Panchagavyam	Beejamrutham	Biodigested product	Jeevamirtham (TM)	Jeevamirtham (PM)
Bacteria	2.61×10^{6}	1.54×10^{6}	1.29×10^{6}	2.04×10^{6}	2.05×10^{6}
Fungi	1.8×10^{4}	1.05×10^{4}	0.92×10^{4}	1.38×10^{4}	1.40×10^{4}
Actinomycetes	4.2×10^{3}	6.8×10^{3}	3.0×10^{3}	3.6×10^{3}	3.5×10^{3}
Phosphate solubilizing organisms	5.7×10^{2}	2.7×10^{2}	1.0×10^{2}	4.5×10^{2}	4.6×10^{2}
Free living n2 - fixers	2.7×10^{2}	3.1×10^{2}	2.1×10^{2}	5.0×10^{2}	5.1×10^{2}

Table 2: Nutrient details of various organic manures.

Parameter	Panchagavyam	Beejamrutham	Biodigested product	Jeevamirtham (TM)	Jeevamirtham (PM)
pH	6.82	8.2	7.29	7.07	7.05
Soluble salt	1.88	5.5	1.09	3.4	3.00
Total nitrogen	0.1	40	255	770	690
Total phosphorus	175.4	155.4	79	166	168
Total potassium	194.1	252	42	126	131
Total zinc	1.27	2.96	0.52	4.29	4.10
Total copper	0.38	0.52	1.24	1.58	1.60
Total iron	29.71	15.35	9.6	282	250
Total manganese	1.84	3.32	8.3	10.7	11.34

feeding (Traditional method TM), manual Jeevamirtham preparation and manual supply method (MJMSM) and manual Jeevamirtham preparation with automatic supply by mixing the manure directly to the water source method (MJASDM) for its effectiveness on growth, yielding, drought resistance, strength in fighting against various diseases and fertility. Among all the methods tested, the PM has produced good results in all the aspects. The PM has been tested for 100 papaya plants. Results obtained has been given in the form of percentage in all the aspects tested and tabulated in Table 3. From the resulted values, it is clear that the proposed smart method of Jeevamirtham preparation and equal distribution has improved the growth, yielding, fertility level, disease resistance and drought resistance in a much better way than the all existing practices available.

Complete details of one year old matured papaya plant grown under various environment (Untreated arable land, Chemical fertilizer treated arable land, Panchagavyam treated arable land, Beejamrutham treated arable land, Biodigested Product treated arable land, Jeevamirtham (T) treated arable land and Jeevamirtham (PM) treated arable land) has been tabulated in Table 4 for number of leaves, thickness of stem, height of the plant, number of flowers, number of pollinated flowers, number of un ripped fruits, number of good ripped fruits and total life time with good yielding. The results obtained from the fields shows the achievement of PM in handling plants and crops in an effective manner.

Table 3: Comparison of various methods utilized for organic manure feeding.

Methods	Features	%				
		G	Y	F	DrR	DiR
TM	Direct application of cow dung to individual plants and crops. Disadvantages: Manpower, time consumption and equal distribution is not possible. Advantages: Manual feeding according to the requirement and low cost process.	91	90	92	89	92
MJMSM	Direct application of jeevamirtham to individual plants and crops. Disadvantages: Manpower, time consumption and equal distribution is not possible. Advantages: Manual feeding according to the requirement and low cost process.	92	91	93	91	93
MJASDM	Jeevamirtham has to be mixed with tank/well water and applied individual plants and crops through drip irrigation. Disadvantages: Sludge formation is possible. Advantages: Equal distribution according to the requirement.	93	93	93	91	94
PM	Jeevamirtham has been directly applied to the drip irrigation line. Disadvantages: Initial cost is high. Advantages: Automatic and equal feeding according to the requirement and low manpower requirement.	95	95	96	95	95

* G- Growth, Y- Yielding, F- Fertility, DrR- Drought resistance, DiR- Disease resistance.

Table 4: Details of a matured papaya plant grown under various environment.

Description for matured papaya plant (minimum one year old)	Nature of arable land						
	Untreated	Chemical fertilizer treated	Panchagavyam treated	Beejamrutham treated	Biodigested product treated	Jeevamirtham (T) treated	Jeevamirtham (PM) treated
No. of matured leaves	12	16	18	17	18	19	23
Thickness of stem (cm)	45	52	61	59	60	62	68
Height of the plant (cm)	191	198	207	202	210	212	218
No. of flowers	266	294	342	331	339	356	381
No. of pollinated flowers	105	127	182	174	177	194	206
No. of un ripped fruits	96	106	171	163	170	189	201
No. of good ripped fruits	91	102	165	152	160	182	195
Life time with good yielding (months)	12	12	15	16	16	18	19
Draught resistance	Moderate	Poor	Good	Good	Good	Very good	Very good
Immunity to various diseases	Moderate	Poor	Good	Good	Good	Very good	Very good
Fertility (%)	75	55	85	82	90	95	95

CONCLUSION

The proposed method (PM) has been tested for microbial load and nutrient status with different organic liquid manures and found good in fixing the molecular Nitrogen available in the environment and maintaining the pH value as stable with less soluble salt level. The PM has been tested with various volumes for various plants and crops. Especially, it has been tested for 100 Papaya plants and found excellent results in plant growth, yielding, fertility level, drought resistance and disease resistance. The proposed manure feeding method has the plant growth of about 4% higher than TM, 3% higher than MJMSM and 2% higher than MJASDM. For yielding, the proposed method has 5% higher than TM, 4% higher than MJMSM and 2% higher than MJASDM. Similarly, for fertility level, the proposed method has 4% higher than TM, 3% higher than MJMSM and 3% higher than MJASDM. Further, the proposed method has the drought resistance of 6% higher than TM, 4% higher than MJMSM and 4% higher than MJASDM. And the proposed method has the disease resistance of 5% higher than TM, 4% higher than MJMSM and 2% higher than MJASDM. Further, the PM has been tested with various soil environments and found good results in terms of plant growth, yielding, disease resistance, draught resistance, 95% of fertility with longer life time. The PM can also function with solar power support.

Conflict of interest

The authors declare that there is no conflict of interest.

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