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BUREAU OF INDIAN STANDARDS

Doc. No. : PRTD/AR/**PF:03**	Issue No. : 2	Issue Date 30 Sept. 2020	**Report of Action Research**

1.	**Action Research Project No.** *(as assigned by PRTD)*	AR/0042
2.	**Title of the Action Research Project**	**A STUDY ON DRIP IRRIGATION SYSTEM FOR ORGANIC AGRICULTURE**
3.	**Name & Designation of Officer**	**A. ARIVAZHAGAN, Sc-C**
4.	**Employee No.**	062022
5.	**Deptt./BO/RO & Place of Posting**	SROL, CHENNAI
6.	**Date of Approval of the Project**	8 SEPTEMBER 2020
7.	**Objective of the Project**	The objective of this study is to draw an outline of a standardized organic fertilizer filtering technique from farmers and manufacturers and to utilize the information for preparation of a BIS Standard/Code of practice to enable drip irrigation suitable for organic farming.
8.	**Report of Action Research Activities**	Attached
9.	**Conclusion & Recommendations**	Based on the study and observations, a standardized procedure for filtration of jeevamrut (cow dung based organic fertilizer) for use in drip irrigation is presented. It is recommended that the quality of jeevamrut filtrate may be tested for equivalency with solid fertilizer and also filtration procedure for other organic fertilizers may also be standardized.
10.	**Any other relevant information**	Preliminary Draft Code of Practice attached in the appendix - Prevention of Clogging in Drip Irrigation System in Organic Fertigation - Filtration techniques for Jeevamrut.

Arivazhagan 30/03/21

Sign. of Officer with Date

HSROL 30/03/2021

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ACTION RESEARCH PROJECT REPORT

A STUDY ON DRIP IRRIGATION SYSTEM FOR ORGANIC AGRICULTURE

STANDARDIZATION OF FILTRATION PROCESS

Prevention of Clogging in Drip Irrigation System in Organic Fertigation - Filtration techniques for Jeevamrut - Code of Practice

p draft.

By

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CONTENTS

CHAPTER I

INTRODUCTION

1.1 ORGANIC FARMING - AN INTRODUCTION

Agriculture is the most important livelihood strategy in India, with two thirds of the county's workforce depending on farming. The Green Revolution in the 50s and 60s may have allowed our farmers to better their yields, but it also brought with it the evils of using pesticides and chemical fertilizers.

Over the years, they have been incorporated into conventional farming methods, bringing with them a host of problems. They are not only found to be toxic to humans by increasing the risk of getting cancers, but they also cause pollution, degradation of soil and water, and poison domestic animals.In such a situation where we come across numerous reports of pesticide-related health problems, building consumer awareness on safe food would be a win-win situation for both consumers and farmers.

According to the International Federation of Organic Agriculture Movements (IFOAM),

> "Organic agriculture is a production system that sustains the health of soils, ecosystems, and people. It relies on ecological processes, biodiversity, and cycles adapted to local conditions, rather than the use of inputs with adverse effects." **[Suman Singh, 2020].**

- According to FSSAI,'organic farming' is a system of farm design and management to create an ecosystem of agriculture production without the use of synthetic external inputs such as chemical fertilisers, pesticides and synthetic hormones or genetically modified organisms.
- Organic farm produce means the produce obtained from organic agriculture, while organic food means food products that have been produced in accordance with specified standards for organic production.

Organic products are grown under a system of agriculture without the use of chemical fertilizers and pesticides with an environmentally and socially responsible approach. This is a method of farming that works at grass root level preserving the reproductive and regenerative capacity of the soil, good plant nutrition, and sound soil management, produces nutritious food rich in vitality which has resistance to diseases. **[tnau.ac.in]**

1.2 ORGANIC FARMING IN INDIA

India introduced the organic farming policy in 2001. India is bestowed with lot of potential to produce all varieties of organic products due to its various agro climatic conditions. In several parts of the country, the inherited tradition of organic farming is an added advantage. This holds promise for the organic producers to tap the market which is growing steadily in the domestic and export sector.

Even though India has very small organic area under cultivation, it is being ranked 1st in terms of total number of producers and 8th in terms of World's Organic Agricultural land as per 2020 data (Source: FIBL & IFOAM Year Book, 2020). India has over 1.9 million farmers as of March 2020, which is 1.3 per cent of 146 million agricultural landholders. In addition, there are farmers who are not certified and hence not counted, especially by-default organic farmers in hilly, tribal and rain-fed regions. Sikkim is the FIRST Indian state to have become fully organic. [Source:PIB]

Organically grown banana plantation in Tamilnadu bearing around 300 fruits

1.3 GOVERNMENT POLICIES PROMOTING ORGANIC FARMING

The APEDA, Ministry of Commerce & Industries, Government of India is implementing the National Programme for Organic Production (NPOP). The programme involves the accreditation of Certification Bodies, standards for organic production, promotion of organic farming and marketing etc.

The 2.78 million ha was covered under organic farming in India is about two per cent of the 140.1 million ha net sown area in the country. Of this, 1.94 million ha is under National Programme for Organic Production (NPOP); 0.59 million ha under Paramparagat Krishi Vikas Yojna (PKVY);

0.07 million ha under Mission Organic Value Chain Development for North Eastern Regions (MOVCDNER) and 0.17 million ha under state schemes or non-schemes. This shows that NPOP scheme covers about 70 per cent of the organic area of the country, of which 30 per cent is under conversion. PKVY and MOVCDNER schemes started in 2015-16 and cover 21.5 per cent and 2.6 per cent of the total organic area in the country. The remaining 6.1 per cent of area under organic cultivation is either under a state scheme or not related to any scheme. During 2015-16 to 2018-19, around 96 per cent of total certified organic food production was under NPOP certification and the remaining four per cent was under Participatory Guarantee System (PGS) of certification. [Source : Operational Guidelines Of Pradhan Mantri Krishi Sinchayee Yojana]

1.4 PROBLEMS IN IMPLEMENTING ORGANIC FARMING

About 2.78 million hectare of farmland was under organic cultivation as of March 2020, according to the Union Ministry of Agriculture and Farmers' Welfare. This is two per cent of the 140.1 million ha net sown area in the country. Hence only a fraction of area is covered under organic cultivation. Some states have either developed or are still in the process of forming organic brands such as MP Organic, Organic Rajasthan, Nasik Organic, Bastar Naturals, Kerala Naturals, Jaivik Jharkhand, Naga Organic, Organic Arunachal, Organic Manipur, Tripura Organic and Five Rivers by Punjab.

A few states have taken the lead in improving organic farming coverage, as a major part of this area is concentrated only in a handful of states. Currently, only around 12 states — Madhya Pradesh, Gujarat, Telangana, Sikkim, Bihar, Karnataka, Odisha, Rajasthan, Uttarakhand, Chhattisgarh, Tamil Nadu and Uttar Pradesh — have their own state organic certification agencies accredited by Agricultural and Processed Food Products Export Development Authority (APEDA).

Lack of awareness on organic cultivation techniques and manuring, high initial investment, increased water requirement per crop are the major constraints in implementing organic farming in India.

1.5 MICRO IRRIGATION AND ITS SIGNIFICANCE

India is facing the twin challenge of water scarcity and population explosion. The ongoing water crisis has affected nearly 600 million people and is expected to worsen further as the country's population is touted to increase to 1.6 billion by 2050. The continued irrigation through traditional practices since the introduction of Green revolution in the 1960's, however, has begun to show its ill effects on groundwater quality and height, water logging, soil salinity, soil health, crop productivity, partial factor productivity and cost economics of farm practices. This is where micro-irrigation assumes significance. In the age of climate change and water scarcity, micro-irrigation can help increase crop yield and decrease water, fertiliser and labour requirements.

1.6 MICRO IRRIGATION - IN DETAIL

Micro irrigation is a modern method of irrigation; by this method water is irrigated through drippers, sprinklers, foggers and by other emitters on surface or subsurface of the land. Major components of a micro irrigation system is as follows: Water source, pumping devices (motor and pump), ball valves, fertigation equipments, filters, control valves, PVC joining accessories (Main and sub main) and emitters.

In this system water is applied drop by drop nearer the root zone area of the crop. The drippers are fixed based on the spacing of crop. Many different types of emitters are available in the market. They are classified as Inline drippers, on line drippers, Micro tubes, Pressed compensated drippers.

1.7 BENEFITS OF ADOPTING MICRO IRRIGATION

Micro-irrigation can increase yields and decrease water, fertiliser and labour requirements. By applying water directly to the root zone, the practice reduces loss of water through conveyance, run-off, deep percolation and evaporation. These losses are unavoidable in traditional irrigation practices; micro-irrigation, through its water-saving approach, has paved the way for higher water use efficiency of around 75-95 per cent.

Micro-irrigation goes beyond effective irrigation; from decreasing input cost to enhancing the productivity and quality of the crop, there are several case studies showcasing benefits to the farmers that outweigh the cost of installation of micro-irrigation systems. Another resource saving practice possible through micro-irrigation is fertigation, which comprises combining water and fertiliser application through irrigation. Fertigation results in balanced nutrient application, reduced fertiliser requirement of around 7 to 42 per cent (thus, saving expenditure cost incurred by farmer), higher nutrient uptake and nutrient use efficiency.

Hence microirrigation benefits include increase in the water use efficiency up to 80-90% owing to reduced water requirement, about 30% less consumption of electricity per hectare and up to 30% decrease in fertiliser consumption which translates into significant cost savings. Controlled application of water and fertiliser has resulted in increasing the productivity of the crops by 50%. All these boost farmer income levels by more than 40%.

It is quite apparent that in the present scenario, vertical expansion of agricultural lands is not possible. Therefore, in order to increase the yield and productivity, we have to focus on degraded and waste lands.

Micro-irrigation provides this opportunity. A national-level survey undertaken for the Union government showed that farmers were able to bring

519.43 hectares of degraded land under cultivation through the technique. It also helped use saline water for irrigation without causing salinity or osmotic stress to plants.

Significant electricity savings — on an average 30.5 per cent — have been estimated and high fertilizer-use efficiency reported, resulting in an average consumption reduction of 28.5 per cent, according to a Federation of Indian Chambers of Commerce and Industry report.

Another advantage is maintenance of optimum soil moisture conditions that help increase overall productivity and profitability. Across various studies, it has been found that the adoption of micro-irrigation systems helped boost the yield of fruit as well as vegetable crops.

The productivity for fruit crops increased 42.3 per cent and that of vegetable crops by 52.8 per cent. There was an average reduction of 31.9 per cent in irrigation cost thorough higher water use efficiency. Another gain has been the adaptation of diverse cropping patterns. [Source : https://www.downtoearth.org.in/blog/agriculture/micro-irrigation-the-way-ahead-for-sustainable-agriculture-73153]

1.8 GOVERNMENT INITIATIVES TO PROMOTE MICRO IRRIGATION

Sensing the significance and probable benefits of the process to double the farmers' income along with agricultural sustainability and environmental quality, the Union government launched a comprehensive flagship programme called Pradhan Mantri Krishi Sinchai Yojana or "more crop per drop".

Under the programme, financial assistance of up to 55 per cent is available for small and marginal farmers and 45 per cent for other farmers for adoption of micro-irrigation systems. The funding pattern between the Union governments and the state government's share since November 2015 has been 60:40 for all states except the North East and the Himalayan states, for which the funding pattern is 90:10.

1.9 DRIP IRRIGATION

Drip irrigation is the most suitable micro irrigation method for wider spacing crops. It is the most effective practice with water use efficiency of around 85-90 per cent. Hence the Drip Irrigation System becomes a gift for dry land cultivation where water is the major limiting factor. Further, this is cost effective in all respects like labour for irrigation, weeding & cost of fertilizer application.

Advantages of drip irrigation system

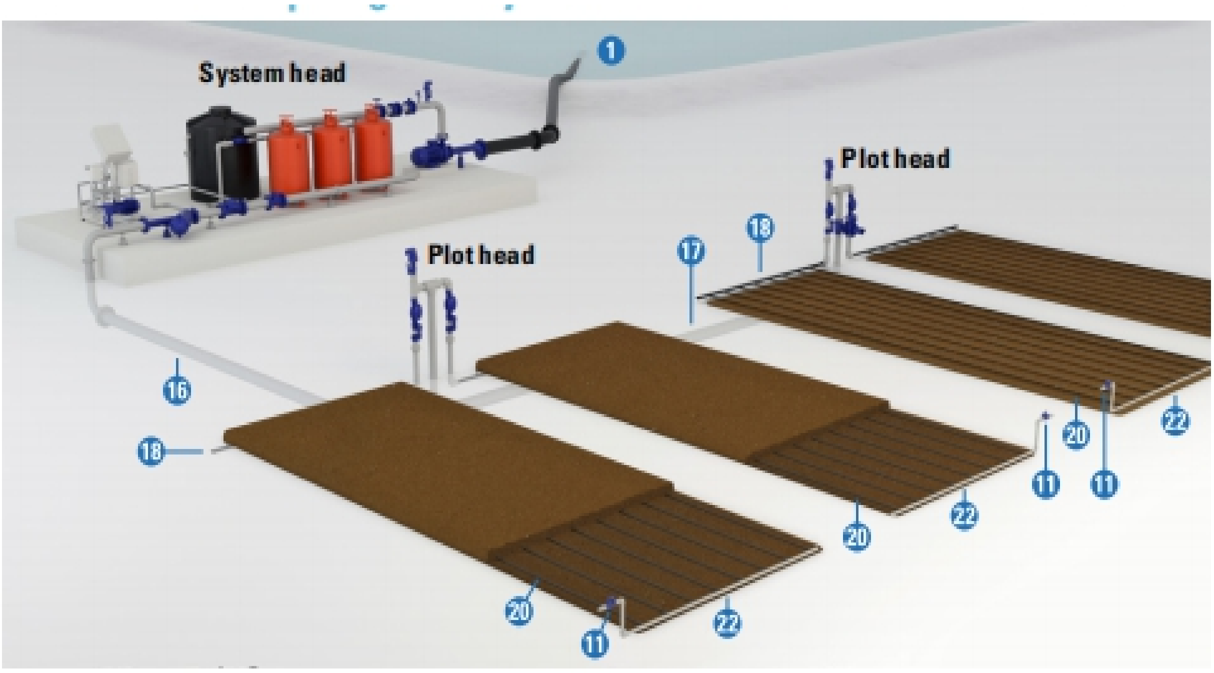
Reduced water use and Reduced pest problems

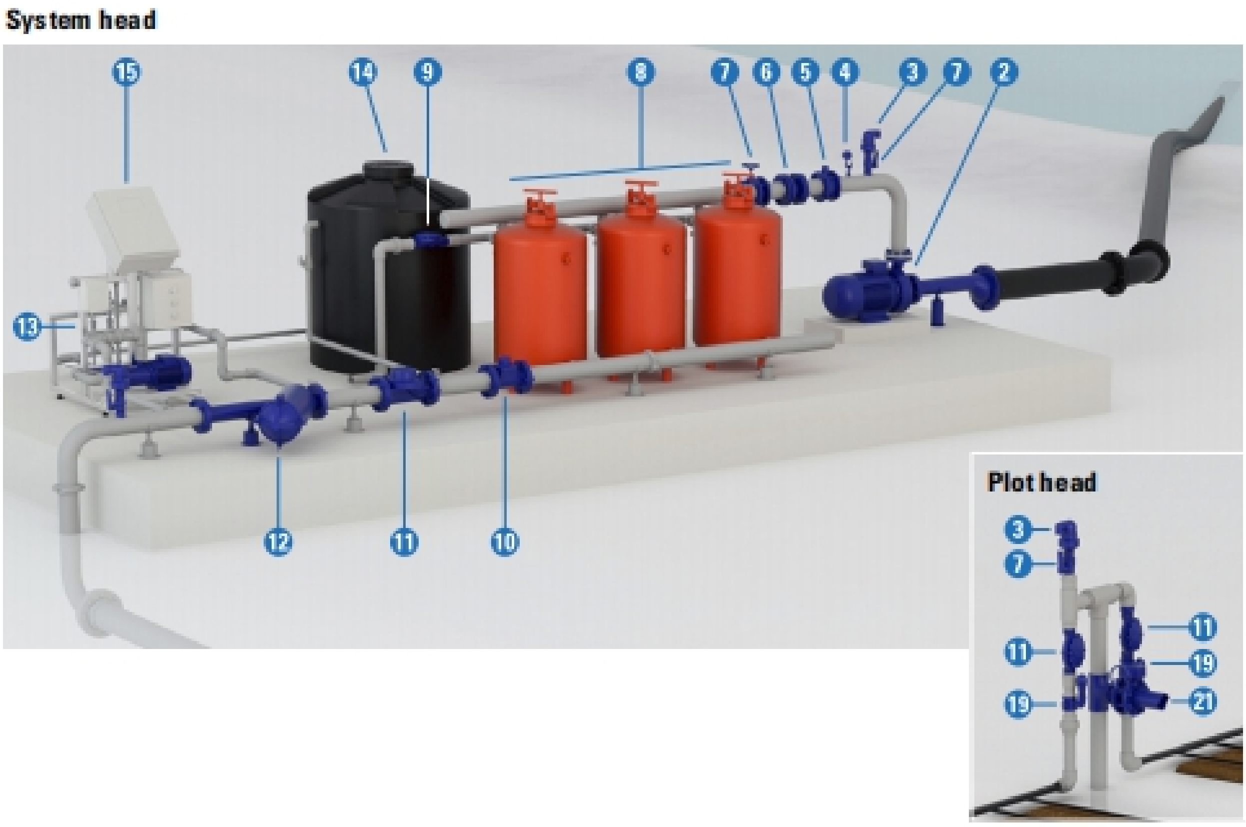
Joint management of irrigation and fertilization - Fertigation technology can be easily adopted using drip systems, thereby Efficient use of fertilisers

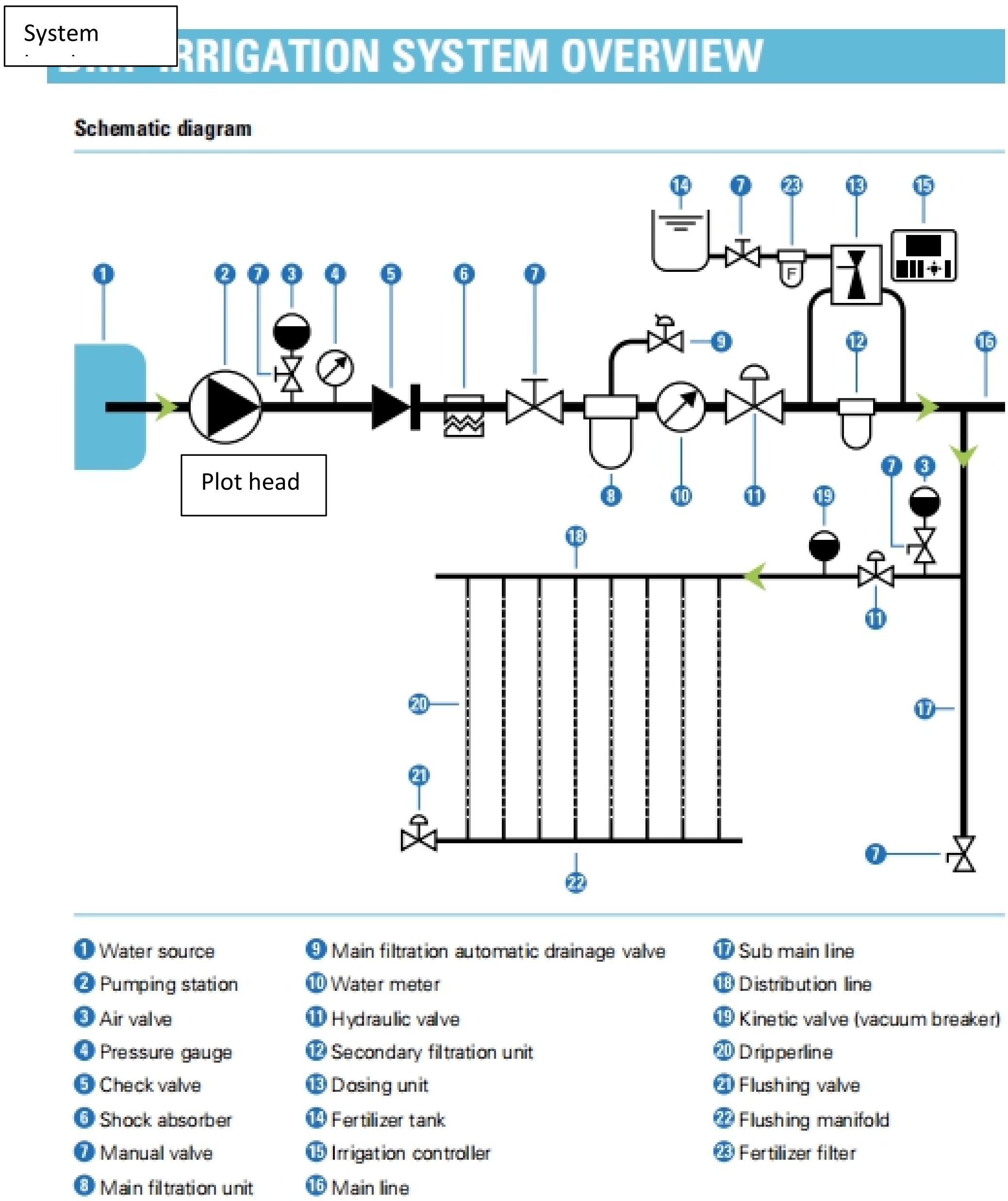
Suitable for all types of soil

Saving in labour and field preparation cost

1.10 COMPONENTS OF DRIP IRRIGATION







(Source : NETAFIM INDIA PVT LTD)

1.11 OBJECTIVE AND SIGNIFICANCE OF THE PRESENT STUDY - DRIP IRRIGATION SYSTEM FOR ORGANIC FARMING

It is quite evident that the importance of micro-irrigation to achieve sustainability in Indian agriculture cannot be neglected. But using water conserving drip irrigation method to produce pesticide free safe organic food is a major challenge in front of the Indian farming community.

This is because Chemical fertilizers dissolve readily in water and do not normally form clogs. Even the suspended particles in water are easily removed by strainers/filters in drip irrigation. There occurs no problem in the flow of fertiliser mixed water at any level. Thus drip irrigation suits well for conventional inorganic farming. BIS provides technical standards for every single element of drip irrigation system thus improving the quality of irrigation equipment and we have huge number of licencees who manufacture such equipment well suited for chemical fertigation.

Organic farming uses natural pesticides like pyrethrin, neem bars, and natural fertilizers especially animal wastes (particularly cow-dung) which tend to form clogs when dissolved in water. The suspended particles are large sized and the density of fertilizer mixed water is too high to penetrate through the conventional filters used in normal drip irrigation systems. The following figure shows collection of cow-dung for preparation of organic liquid injection.

Hence the major constraint of implementing drip irrigation for organic farming is filtering the organic fertilizer. Thus, the objective of this study is to draw an outline of a standardized filtering technique from organic farmers and drip irrigation equipment manufacturers and to utilize the information for preparing a BIS Standard/Code of practice to enable drip irrigation suitable for organic farming.

CHAPTER II

REVIEW OF RELATED LITERATURE

Extensive Literature review on use of drip irrigation for organic farming was made to understand the functioning of existing drip irrigation system. Existing BIS standards for drip irrigation system were also analysed. BIS licencees and manufacturers of Drip irrigation equipments were identified. This helped to get the preliminary information about the objective.

2.1 REVIEW ON INTRODUCTION AND DEVELOPMENT OF MICRO IRRIGATION TECHNIQUES

Experiments with micro – irrigation technology were first conducted in Germany in the 1860s where water was pumped through clay pipes for irrigation. Research done by E.B. House at Colorado State University in 1913 concluded that the technology was too expensive to be used commercially and no further studies were done till the 1920s **(CICR Report, 2011).**

Use of perforated pipes (Germany, 1920s) was one of the major breakthroughs in the industry. However, current micro – irrigation technology relates to the work of Symcha Blass of Israel in the 1930s.He accidentally discovered the concept when a farmer drew his attention to a large tree that showed a much more rigorous growth than other trees in the area because it received water from a leaking faucet nearby. Based on this observation, he developed the first patented drip irrigation system and subsequently took major steps in the development of his idea with the advent of cheap plastics in 1950s after the World War II. The availability of low cost plastic pipe for water delivery lines helped popularise the use of drip irrigation systems. **(Vaibhav Bhamoriya, 2014)**

From Israel the drip irrigation concept spread to Australia, North America and South Africa by the late 1960s and eventually throughout the world. The development of LDPE (Low density poly ethylene), HDPE (High density poly ethylene) and LLDPE (Low linear density poly ethylene) in 1977, suitable and economical material, resulted in the sudden growth of micro – irrigation industry. The large scale use of drip irrigation system started in 1970s in Australia, Israel,Mexico, New Zealand, South Africa and USA to irrigate vegetables and orchards and its coverage was reported as 56,000 ha then **(Kulkarni et al, 2006).**

In India, the use of drip irrigation started in 1970 with experiments in Tamil Nadu Agricultural University in Coimbatore. Drip irrigation system was first installed at Patidar Farms in village Jodpur Madhya Pradesh) in 1971 and inaugurated by the then Deputy Chief Minister. The area under drip irrigation has increased from 1500 ha in 1985 to 70,859 ha in 1991-92 and further to 0.5 million ha in 2003 **(INCID 1994; GOI 2004 as mentioned in Narayanamoorthy 2006).**

2.2 STUDIES ON ORGANIC FARMING AND DRIP IRRIGATION

Ali Montazar et al 2019 explored the viability of drip irrigation for organic spinach production and the management of spinach downy mildew disease in California. The experiment was conducted over two crop seasons at the University of California Desert Research and Extension Center located in the low desert of California. Various combinations of dripline spacings and installation depths were assessed and compared with sprinkler irrigation as control treatment. Comprehensive data collection was carried out to fully understand the differences between the irrigation treatments. Statistical analysis indicated very strong evidence for an overall effect of the irrigation system on spinach fresh yields, while the number of driplines in bed had a significant impact on the shoot biomass yield. The developed canopy crop curves revealed that the leaf density of drip irrigation treatments was slightly behind (1–4 days, depending on the irrigation treatment and crop season) that of the sprinkler irrigation treatment in time. The results also demonstrated an overall effect of irrigation treatment on downy mildew, in which downy mildew incidence was lower in plots irrigated by drips following emergence when compared to the sprinkler. The study concluded that drip irrigation has the potential to be used to produce organic spinach, conserve water, enhance the efficiency of water use, and manage downy mildew, but further work is required to optimize system design, irrigation, and nitrogen management practices, as well as strategies to maintain productivity and economic viability of utilizing drip irrigation for spinach.

Waldir Aparecido Marouelli et al. conducted a study to evaluate the influence of both sprinkler and drip irrigation systems on the organic production of the tomato, cultivar Duradouro, when cultivated both as a single crop and intercropped with coriander. The experiment was carried out in the Distrito Federal, Brazil, using a randomized block design with six replications and a 2 x 2 factorial arrangement for the treatments. There was no significant interaction between the factors of irrigation system and cropping system. The productivity and mass of the tomato fruits were not affected by the treatments, but for the coriander, productivity was higher under the sprinkler system. Drip irrigation hindered the development of late blight (Phytophthora infestans) and reduced the percentage of rotten fruit, whereas the incidence of powdery mildew (Leveillula taurica) and infestation by the tomato leafminer (Tuta absoluta) were higher under the sprinkler system. The volume of soil exploited by the roots of tomato plants was higher with the sprinkler system, while the water productivity index with the drip system was 47% higher than with the sprinkler system. Firmer fruits were produced under drip irrigation. The cultivation system had a significant effect on the occurrence of insect pests, with the tomato intercropped with coriander showing a lower percentage of damaged fruit due to the Tomato Leafminer and to Spodoptera eridania.

A study was conducted to Study the performance of pulse drip irrigation in organic agriculture for potato crop in sandy soils for saving water, saving fertilizers, increasing yield of potato, increasing the energy use efficiency, improving potato quality, decreasing the costs and increasing income under Egyptian growing conditions. factors (two drip irrigation systems, three water application rates and three types for pulse irrigation) For such purpose, the field was carried out during two summer growing seasons 2006 and 2007, in Abo-Ghaleb farm, Cairo- Alex. Rood, 60 Km away from Cairo and the soil is sandy. The experiment was carried out to study the effect of two irrigation systems (surface and subsurface drip irrigation and three water application rates (50, 75 and 100% from actual irrigation requirements) and three types for pulse irrigation (2 times per day, 3 times per day and 4 times per day and time-off between pulses was 30 minutes) with continuous drip irrigation (one time per day). The study concluded that to get maximum yield, best quality characters of potato tuber and net income, we must apply pulse technique on 4 pulses at 100 % from actual water requirements under subsurface drip irrigation. **(Abdelghany A R E, 2009)**

The filltration system removes “large” solid particles in suspension in the water. Different types of filters are used based on the type of particles in the water. Media filters (often containing angular sand) are used with surface water when large amounts of organic matter (live or dead) need to be filtered out. Screen filters or disk filters may be used with groundwater. A 200-mesh screen or equivalent is considered adequate for drip irrigation. When the water contains sand, a sand separator should be used.**(Simonne, 2012)**

Rapid clogging may occur when no filter or the incorrect type of filter is used. A filter needs to be cleaned when the difference in pressure across the filter (measured before and after the filter) is greater than 5–8 psi. A drip-irrigation system should never be operated without a filter even if the filter requires frequent cleaning. Failure to use a filter will result in clogged driptape emitters, often resulting in poor uniformity and sometimes in crop loss. The filter should be cleaned as often as needed. Efforts should be made to understand the cause of the rapid clogging, and remediation for the problem should be developed.**(Simonne, 2012)**

The presence of the filter after the point of fertilizer injection means totally soluble fertilizers must be used. Otherwise fertilizer particles may contribute to filter clogging. Conventional growers may use two types of fertilizer materials: ready-to-use true solutions or dissolved granular fertilizer. Ready-to-use solutions are easily injected. However, granular fertilizers are sometimes coated with a thin layer of oil to prevent dusting. Upon dissolution of the fertilizer granules, an oily film may form at the surface of the solution. Injecting the oily film together with the fertilizer may contribute to filter and emitter clogging. Certified organic fertilizers are seldom true solutions (they may be suspensions or dilute colloidal solutions), and may also contribute to filter clogging. Consequently, the actual fertilizer rate applied may be reduced by the amount of fertilizer particles trapped by the filter. In both cases, small-scale trials may be needed to assess the clogging risk of each fertilizer material used.**(Simonne, 2012)**

Thiripurasundari et al., 2015 observed that Organic farming improves the soil's biological properties such as supply and retention of soil nutrients and promotes favourable chemical reactions, production of clean foods, improves the soil physical properties such as granulation and good tilth, good aeration and easy root penetration, improves water holding capacity in sustaining production system which is largely dependent on on-farm resources.

Ranganatha et al., 2001 observed that in India, still farmers face several constraints in practicing organic farming like more cost and risk involvement in getting organic manure (vermicompost, oil cakes etc), transportation of green manure, lack of ready packages for growing rice organically and lack of knowledge on crop rotation, water management and a few complete organic farming practices were the major constraints faced by a 60.00 per cent of the small farmers to practice organic farming.

Sivaraj et al, 2017 revealed that majority of the certified organic farmers in Tamilnadu faced constraints such as inadequate availability of organic inputs in time (68.89 %), scarcity of irrigation water (64.45 %), lack of quality training on organic farming practices (60.00 %), limited experts in preparation of organic inputs (58.89 %) etc.

Narayanamoorthy, 2006 research states that India has more than 140 million hectares (ha) of net cultivated area, and around 45 per cent of the area is irrigated. As of now, just about nine million ha is under micro-irrigation, of which drip irrigated area is about four million ha. The theoretical potential for micro-irrigation in the country is about 70 million hectares.

Narayanamoorthy, 2009 research shows that sprinkler irrigation can use 30-40% less water, while drip can use about 40-60% less water as compared to flood irrigation methods. It also reduces weed problems, soil erosion and cost of cultivation substantially, especially in labour-intensive operations. The reduction in water consumption in micro-irrigation also reduces the energy use (electricity) that is required to lift water from irrigation wells.

2.3 BIS STANDARDS/CODE OF PRACTICES FOR DRIP IRRIGATION SYSTEM

1. IS 11711 : 1986 Recommended criteria for adoptability of different irrigation methods

2. IS 10799 : 1999 Irrigation equipment - Design, installation and field evaluation of micro irrigation systems - Code of practice

3. IS 12785 : 1994 Irrigation equipment - Strainer - Type filters - Specification

4. IS 14606: 1998 Irrigation Equipment - Media Filters - Specification
5. IS 14743 : 1999 Irrigation equipment - Hydrocyclone filters - Specification
6. IS 12786 : 1989 Irrigation equipment - Polyethylene pipes for irrigation laterals - Specification
7. IS 13487 : 1992 Irrigation equipment - Emitters - Specification
8. IS 13488 : 2008 Irrigation equipment - Emitting pipe systems - Specification
9. IS 16627 : 2017 Agro Textiles — High Density Polyethylene (HDPE) Laminated woven Lay Flat Tube for Use in Mains and Submains of Drip Irrigation System — Specification
10. IS 14791 : 2009 Prevention And Treatment of Blockage Problem in Drip Irrigation System - Code of Practice

DETAILED ANALYSIS OF AVAILABLE STANDARDS

1. IS 11711 : 1986 Recommended criteria for adoptability of different irrigation methods

This standard explains different methods of irrigation and recommends criteria for adopting different irrigation methods. Accordingly Irrigation water may be applied to crops by flooding it on the surface, by applying it below the soil surface, by spraying it under pressure or by applying it in drops. The correct method of application of irrigation varies with the source of water, type of soil, topography of the land and the crop to be irrigated. To facilitate the adoption of a particular method of irrigation this standard has been prepared. The standard recommends the use of drip irrigation for widely spaced crops like potato and other vegetables and fruit trees and for maximum water economy where surface irrigation methods cannot be successfully implemented, like in areas with water scarcity and salt problems. As this method operates on a much lower line pressure, it provides a saving in energy requirement as compared to sprinkler irrigation. This makes it most suitable for those crops which require frequent watering.

2. IS 10799 : 1999 Irrigation equipment - Design, installation and field evaluation of micro irrigation systems - Code of practice

This standard specifies guidelines for installation procedures for different type of micro irrigation like drip, sprinkler, sub-surface and bubble irrigation systems. This provides spacing guidelines for emitters, filtration techniques according to the need, treatment of water to prevent clogging and cleaning procedures.

3. IS 12785 : 1994 Irrigation equipment - Strainer - Type filters - Specification

In drip irrigation system, the drippers have small narrow passages. Hence there is always the hazard of blocking or clogging by impurities present in the irrigation water. This necessitates the use of filters for an efficient and trouble-free operation of the drippers. A strainer type filter is an appliance containing one or more filtering elements, used for separating suspended solids from the water flowing through the appliance and collecting them on the face of the filter element. The requirement of strainer-type filters intended for operation with drip irrigation systems have been specified in this standard. This standard specifies the general construction requirements and test methods for strainer type filters. This standard does not cover filtration ability, efficiency and capacity (quality of filtered water, time of operation before strainer becomes completely clogged, etc), nor does it deal with strainer-type filters that have integral automatic flushing devices.

4. IS 14606: 1998 Irrigation Equipment - Media Filters - Specification

A media filter is basically a tank filled with sand or Gravel of appropriate size and grade. Media filters are especially suitable for micro-irrigation systems because they are three dimensional filter. Media filters are often used with Emitting pipe-systems and with emitter systems, particularly where the water is from a surface source such as stream or reservoir. Media filters serve to remove fine suspended organic and inorganic solids such as algae. soil particles. and organic debris. Media filters are cleaned by Backwashing (by reversing the direction of flow of water through the media). Media filters should be followed by a strainer filter to protect against the possibility of the filter sand finding its way into the irrigation system. This standard specifies the general construction requirements and test method for media filters.

5. IS 14743 : 1999 Irrigation equipment - Hydrocyclone filters - Specification

A hydrocyclone is combination of a vertical conical vessel having tangential inlet, centrally located rising up outlet and an underflow chamber or collecting tank for sand removed from water. Hydrocyclone are essentially used to separate sand from a tube well water or silt from river water for micro irrigation. Due to this basic function to separate the sand/heavy particles, that entrained with water flow, by process of centrifugal separation, it is also called sand separator. Water enters the hydrocyclone through a tangential inlet and creates cyclonic spiral motion of water inside the body of the hydrocyclone filter, causes centrifugal force which pushes the sand and other suspended solids heavier than water to the body walls. This creates 'vortex' which impulses the sand and heavy particles downward through cone into the underflow chamber of collecting tank located below the cone. The clean water rises up in spiral motion to the outlet. Thus the head loss between the hydrocyclone inlet and its outlet is indispensable. The centrifugal energy gained from the head (inlet pressure) is used to create centrifugal force to achieve the process of centrifugal separation. This standard specifies the general constructional requirements and test methods of the hydrocyclone filters, intended for operation in agricultural irrigation systems.

6. IS 12786 : 1989 Irrigation equipment - Polyethylene pipes for irrigation laterals - Specification

This standard lays down mechanical and functional requirements for polyethylene pipes of outside diameter from 12 mm up to 32 mm to be used for irrigation laterals, that is, branch supply lines on which sprayers or drippers or emitters are mounted directly or by means of a fitting or formed in the pipe during production. This also gives selection criteria of irrigation laterals.

7. IS 13487 : 1992 Irrigation equipment - Emitters - Specification

Emitter is a device fitted to an irrigation lateral and intended to emit water in the form of drops or continuous flow at emission rates not exceeding 15 litres per hour per outlet except during flushing. This standard specifies mechanical and functional requirements of irrigation emitters, test methods and the data to be supplied by the manufacturer to permit correct installation and operation in the field. It applies to emitters, with or without pressure regulation, intended for irrigation; it does not apply to emitters which form an integral part of the pipe during manufacture as well as microtubes.

8. IS 13488 : 2008 Irrigation equipment - Emitting pipe systems - Specification

Emitting pipe is a continuous pipe, hose or tubing with perforation or other hydraulic devices, formed or integrated in the pipe, hose or tubing during production and intended to emit water in the form of drops or continuous flow, at nominal emission rates not exceeding 8 l/h per emitting unit at nominal test pressure. This standard specifies the mechanical and functional requirements of the emitting pipes and their fittings, test methods and the data to be supplied by the manufacturer to facilitate correct installation and operation in the field.

9. IS 16627 : 2017 Agro Textiles — High Density Polyethylene (HDPE) Laminated woven Lay Flat Tube for Use in Mains and Submains of Drip Irrigation System — Specification

Drip irrigation systems using HDPE/PVC pipes as main lines have limitation of installation at undulated surfaces, cost and storage constrains, etc. This Standard gives constructional, performance and other requirements for the flexible, foldable, light weight, easy to install drip irrigation system so that farmers with low resources (having small land holding) can take advantage of the drip technique. In areas where land is undulated, these lay flat tubes can be installed very easily. HDPE laminated woven lay flat tube can be install single-handedly by a farmer, by using manual hand-held tool. Secondly, these lay flat tubes are usually supplied in lengths of 100 m which enable the farmers to incur lesser cost for accessories like clamps, joiners to increase length as compare to HDPE/PVC pipes.

10. IS 14791 : 2009 Prevention And Treatment of Blockage Problem in Drip Irrigation System - Code of Practice

The drip irrigation line/emitters or system is considered to be partially or fully blocked/clogged due to mineral, organic matter or scale from pipes when the emission rate through the emitters is reduced or there is non-uniformity of water distribution or there is total stoppage of emission in drip system or when large number of emitters are blocked provided there is normal operation in other components of drip system. This standard specifies the guidelines for prevention and treatment of blockage problems in drip irrigation system. It provides guidelines for water sampling for total suspended solids, pH, electrical conductivity, checking the presence of oil and guidelines for removal of oil from irrigation water as these factors will affect the free flow of water in the system. It features the possible causes of blockage and recommends ways to eliminate the blockages through physical treatments, pre-screening, filtering and chemical treatment to avoid precipitation of salts in drip system, flushing techniques for cleaning etc.,

2.4 SUMMARY

From the detailed analysis of the literature, it is evident that **organic certification rules, drip irrigation practices and organic manures are different in different countries. It is largely dependent on soil type and availability of manures. It is also certain that Indian organic agriculture is mainly dependent on cow dung based manure though other manures are also used.** On analysis of available BIS Standards, it is understood that all the available standards are suitable for normal operation of drip irrigation system for farming using chemical fertilizers. None of the Standards addresses the use of organic fertilizers in drip irrigation system. Hence it was planned to proceed the current project with initial field study of organic farms using drip irrigation. The findings are explained in the following chapter.

CHAPTER III

METHODOLOGY

For the purpose of the project, the following Methodology was adopted.

- Field visit to organic farms in Tamilnadu
- Collection of Data from farmers by Questionnaire
- Visit to Irrigation equipment manufacturing units
- Collection of Data from Manufacturers
- Formulation of p-draft

3.1 FIELD VISIT TO THE FOLLOWING ORGANIC FARMS IN TAMILNADU WERE DONE

S. No	Name and Address of the Organic farm using Drip Irrigation
1	Kasturi Organic farm, Kootupuliyamaram road, Semmedu, Tamilnadu
2	Sathguru Sannathi Organic farm, Vettaikaranpudur, Aanaimalai, Tamilnadu
3	Kishore Organic farm, Madukkarai Thottam, Deenampalayam, Tamilnadu
4	Kriya Green farms, Semmedu, Tamilnadu
5	Velangadu Thottam - organic farms Muttathu vayal, Kootupuliyamaram road, Semmedu, Tamilnadu
6	Ennai mill Thottam - organic farms, Iruttupallam, Pollachi, Tamilnadu
7	Sampath Kumar organic farms, Jakkarpalayam, Tamilnadu
8	Senthil Kumar Organic farms, Kondaegowndan palayam, Coimbatore, Tamilnadu
9	Nagarathinam organic farms, Seethavanam and maruthavanam, Thondamuthur, Tamilnadu
10	Kittusamy Organic farm, Thiraniyampatti, Ariyampalayam , Musiri, Trichy, Tamilnadu
11	Rajamani Organic farm, Kanchipuram, Tamilnadu

Observations :

1. There are differences in schedule of manuring, type & composition of organic fertilizer used and filtration techniques from farm to farm and district to district. Standardised guidelines for organic filtration and fertigation are not available.

2. Most of the farmers used cow-dung based organic manure.

3. They did not use single filter for straining the organic manure liquid (like chemical fertilizer filters). Instead they followed different filtration procedures to make the organic liquid suitable for injection in drip irrigation system to avoid clogging. This is because the filtration of organic manure is a tedious process and time consuming. **A single filter or a series of different type of filters are not efficient in filtering the manure. The longevity and bio-resistance of such filters are still questionable. Hence majority of the farmers used their own techniques of filtration and fertigation.**

To verify whether same techniques are followed all over tamilnadu, the following Questionnaire was prepared and sent to certified organic farmers in Tamilnadu.

VISIT AND DISCUSSION WITH THE ORGANIC FARMERS

<u>QUESSIONNAIRE FOR FARMERS</u>

S.No	Question	Response
1	Name of the farmer with Address and contact number & email.	
2	Address of farmland	
3	Is organic farming applied with drip irrigation ? If yes, provide the area under	

	organic farming + drip irrigation (preferably in acres)	
4	What are the crops grown in your organic farm by drip irrigation ?	
5	What are the fertilizers used ? (both solid and liquid)	
6	Do you add organic fertilizer through drip irrigation?	Yes / No.
7	Problems faced in using drip irrigation for organic fertilization	
8	How do you liquefy the solid fertilizers?	
9	Do you inject fertilizer at a single point or multiple points in the drip irrigation system? Select the point(s) of injection.	Single / Multiple points 1. Source 2. Main filtration unit 3. Secondary filtration unit 4. Other point __________
10	Do you filter the fertilizer before injection into the system? How ?	

11	Does the available filter efficiently filters the organic fertilizer ? If No, what alternate filter do you use ?	
12	Do you use any special or self made filters for organic fertilizer? If yes, what is the material used? Kindly explain in detail.	
13	Is your filter single use or multi-use filter ?	
14	At what point in the drip irrigation system, the filter is installed?	
15	How do you know there is a need to change the filter ? How often do you change the filter?	
16	Where do clogs occur often ?	Mainline/connectors/emitters etc….?
17	Are you satisfied with the performance of the self made/existing filter ? If No, Why ?	
18	What is the approximate cost of the self made filter ?	

19	Do you think there should be a BIS Standardized filter for organic fertilizer ? Why ?	
20	Any other details you think that would be useful for standardizing the drip irrigation system for organic farming.	

3.2 FIELD VISIT TO MANUFACTURING UNIT:

For the purpose of better understanding the issue from manufacturers side, field visit to NETAFIM IRRIGATION INDIA PVT. LTD in Chengalpet district of Tamilnadu was made. Discussion with quality control personnel, installation & maintenance service providers to farmers were done. Further based on the observations, Questionnaire was prepared and sent to irrigation equipment manufacturing units.

Data collection from manufacturers

BIS licencees for drip irrigation equipment were identified and required data was collected from them using the questionnaire that follows the list of manufacturers contacted.

List of Manufacturers contacted

1. AGS IRRIGATION
Address:- 11, KALASATHAMMAN KOIL STREET,
SELAVAYAL,CHENNA, TAMILNADU PIN:-600051

2. KAVIN IRRIGAATIONS

Address:- SF.NO.892/2, SADAYAMPALAYAM,

PUNNAM POST, ARAVAKURICHI TALUK, TAMILNADU PIN:-639202

3. CENMARK AGRONOMICS PRIVATE LIMITED

Address:- CS-6 (PI), SIDCO INDUSTRIAL ESTATE,

KAPPALUR,MADURAI, TAMILNADU PIN:-625008

4. JAYAM IRRIGATION SYSTEMS

Address:- S.F. No. 186/3C, Door N0. 3/654,

DEVIYAKURICHI Post, ATTUR Tk,

DEVIYAKURICHI, TAMILNADU PIN:-636112

5. LATRO IRRIGATION

Address:- 73/1,2 PADAVATTAMAN KOVIL STREET,

KARANAI,CHENNAI, TAMILNADU PIN:-600055

6. NETAFIM IRRIGATION INDIA PVT. LTD

Address:- PLOT NO. P38/1, CENTRAL AVENUE,

DOMESTIC TARIFF AREA, MAHINDRA WORLD

CITY SUB POST OFFICE, CHENGALPET, TAMILNADU PIN:-603004

7. NAVKAAR EXTRUSIONS

Address:- Plot No.: B-4, SIDCO INDUSTRIAL ESTATE,

HOSUR,KRISHNAGIRI,HOSUR, TAMILNADU PIN:-635126

8. SIVASAKTHI IRRIGATION SYSTEMS

Address:- No. 19, KOMBAIKADU, THEDAVOOR (PO),

GANGAVALLI (TK), SALEM.,ATHUR, TAMILNADU PIN:-636116

9. DEVI IRRIGATION SYSTEMS PVT LTD.,

Address:- No. 55 & 77, MAHIA INDUSTRIAL ESTATE,

URANGANPATTI VILLAGE & TALUK,MADURAI, TAMILNADU PIN:-625020

10. JAIN IRRIGATION SYSTEMS
JAIN PLASTIC PARK, BAMBHORI,
JALGAON, MAHARASHTRA, PIN 425001

QUESSIONNAIRE FOR MANUFACTURERS

S.No	Question	Response
1	Name of the Manufacturing unit with Address	
2	Name of the person who fills this questionnaire, his designation, contact number & email.	
3	Do BIS Standards cover all the components and sub components of drip irrigation system? If no, which component needs BIS Standard ?	
4	Do you manufacture drip irrigation equipment specially suitable for organic fertilisation? If yes, how does it differ from conventional drip irrigation equipment ?	
5	Is there any difference in selling drip irrigation components (in sizes , types) for organic fertilisation and chemigation? Kindly mention the size/type of components sold/preferred by consumers in each case.	

6	Do you provide on-site installation or after sales-maintenance services to the consumers?	
7	Are the existing filters suitable for organic fertilizers? If yes, What type of filters (with capacity) are generally preferred for organic fertilization through drip irrigation? If No, what do you think , is the efficient way of filtering the organic fertilizer?	
8	What type of Valves are generally preferred for organic fertilization through drip irrigation?	
9	Mention the usual feedback and reviews/problems faced as received from the farmers after the usage of drip irrigation for organic farming.	
10	What changes can be made in the existing fertilizer tank to make it suitable for organic fertilizer?	
11	Do you think there should be a separate BIS standard for using drip irrigation system for organic farming ? Or the present system is suitable enough with proper education of farmers for efficient	

	use of the existing system for organic farming ?	
12	Any other details you think that would be useful for standardizing the drip irrigation system for organic farming.	

Finally after analysing the responses and understanding the farming practises, effort was taken to standardise the procedure of filtration of the organic liquid fertilizer and p-draft was prepared. The report of the observations are given in the following chapter and the p-draft is given in the annexure.

CHAPTER IV

ANALYSIS AND RESULTS

After visiting several organic farms and irrigation equipment manufacturing units in Tamilnadu, Questionnaire was prepared and mailed separately to farmers and manufacturers. Their responses were analysed and reported below.

1. Almost all organic farmers used cow dung based organic fertilizer (jeevamrut) for their farms.
2. Most of the manufacturers and farmers felt the need for standardising the process of filtering the organic fertilizer rather than providing a product specification for filter. This is because there will be differences in the size of the farms, quantity of fertilizer used etc., Hence Providing a Standard method for filtration is better than providing an equipment to filter the jeevamrut.

Inputs from the manufacturers and farmers practising organic farming with drip irrigation are reported below.

4.1 PREPARTION OF MANURE

Jeevamrut: Organic manure

Jeevamrut is a liquid organic manure popularly used as means of organic farming. It is considered to be an excellent source of 'natural carbon', 'biomass', 'Nitrogen', 'Phosphorous' 'Potassium' and lot of other micro nutrients required for the crops. As compared to other forms of manure, composts, vermi-compost, Jeevamrut can be prepared very quickly and has proven to be lot more effective. Usage of Jeevamrut along with other manures can also prove to be beneficial.

Jeevamrut is prepared as follows:

Jeevamrut is prepared by adding 1000 liters of water with 50 Kg Indian /desi cow dung (It has been observed that the nutrient values found in Indian breed cows is much higher than the hybrid ones) and 50 L cow urine /gomutra,to this liquid formulation add 10-12 Kg of jaggery and 10-12 Kg of gram flour /besan and banana peels. Two handfuls of soil taken from the roots of banyan tree (or any other old tree found close to the farm. This act as source of friendly bacteria and enzymes required for the good health of soil). The above ingredients should be stored in a cool place and away from sunlight. The mixture needs to be stirred couple of times (every 12 hours) for 4 days. The ingredients are fermented and Jeevamrutham is prepared for the use. This jeevamrutham can now be used within 2- 3 days of preparation. Beyond the 8th day of preparation, the bacterial colonies in the liquid start reducing. It is beneficial to do a live mulching (mulching with help of grass, hay, sugarcane straw remains etc) along with the Jeevamrut application. Mulching will help the earthworms (Gandul / Kenchua) to work in the soil till upper most layer bringing more porosity and minerals till the surface.

Composition of Jeevamrutham

Ingredients	**Proportion**
Water	1000 L
Local fresh cow dung	50 Kg
Urine	50 L
Gram flour	10 - 12 Kg
Jaggery	10 - 12 Kg
Banana peels	10 Kg or As much as possible
Soil as bioinoculant	200gm

The ingredients can be proportionally increased/decreased according to the requirement and size of the organic farm. The quality of the jeevamrutham mainly depends upon the breeds of the cow, cow urine and type of the green gram.

4.2 PROCEDURE FOR FILTRATION OF JEEVAMRUT IN DRIP IRRIGATED SMALL ORGANIC FARMS TO AVOID CLOGGING

Tank inside which the strainer is to be dropped

Strainer with jeevamrut is dropped inside tank

Jeevamrut is filled in a prefabricated PVC with mesh - 50 mesh Anti Insect porous container (called strainer). The sealed strainer with manure is dropped vertically inside a tank (Fig 2). Then the tank is filled with water. Water from the tank percolates the strainer through the net and dissolves the organic manure. It is allowed without disturbance for 6-24 hours (sedimentation time). Eventually undissolved sludge particles will remain inside the strainer while the water in the tank has dissolved fertilizer in it.

Pumping of strained solution from tank above 1 ft height from the bottom

This organic diluted solution is Pumped from the upper level of the tank (Minimum 1 foot from bottom) so that clear strained solution is extracted. Then it is passed through Screen filters into the mainline, and again filter the total fertigation water (irrigation water +Organic liquid after passing the Screen filter) through a Disc or Gravel filter. This is used for fertigation.

Filtering of source water

After Organic Liquid injection, clean water is used to wash the system for 30 minutes. Drip lines flushing should take place (according the application frequency) after every Organic liquid injection.

4.3 PROCEDURE FOR FILTRATION OF ORGANIC FERTILIZER IN DRIP IRRIGATED MEDIUM AND LARGE ORGANIC FARMS TO AVOID CLOGGING

Jeevamrut can be prepared as mentioned in 4.1. The following figure shows how a medium sized organic farm uses vertical stage by stage filtration of organic manure.

Stage by stage filteration of jeevamrut

This method involves manual monitoring and the strainer is easily damaged due to organic activities of microbes in manure. For the second time fertigation, strainer needs to changed. Since Jeevamrut has to be prepared in larger quantity and it is difficult to change strainer everytime, Some large organic farmers feel that is not suitable for them and go for an alternative and automated way of preparation. The technique is explained below.

Biodigester :

Some farmers prepare Jeevamrut in different tanks while some large farms have built Bio-digester in concrete with the following features. They claim that this novel design avoids drying of the cow dung.

Features of Bio-digester

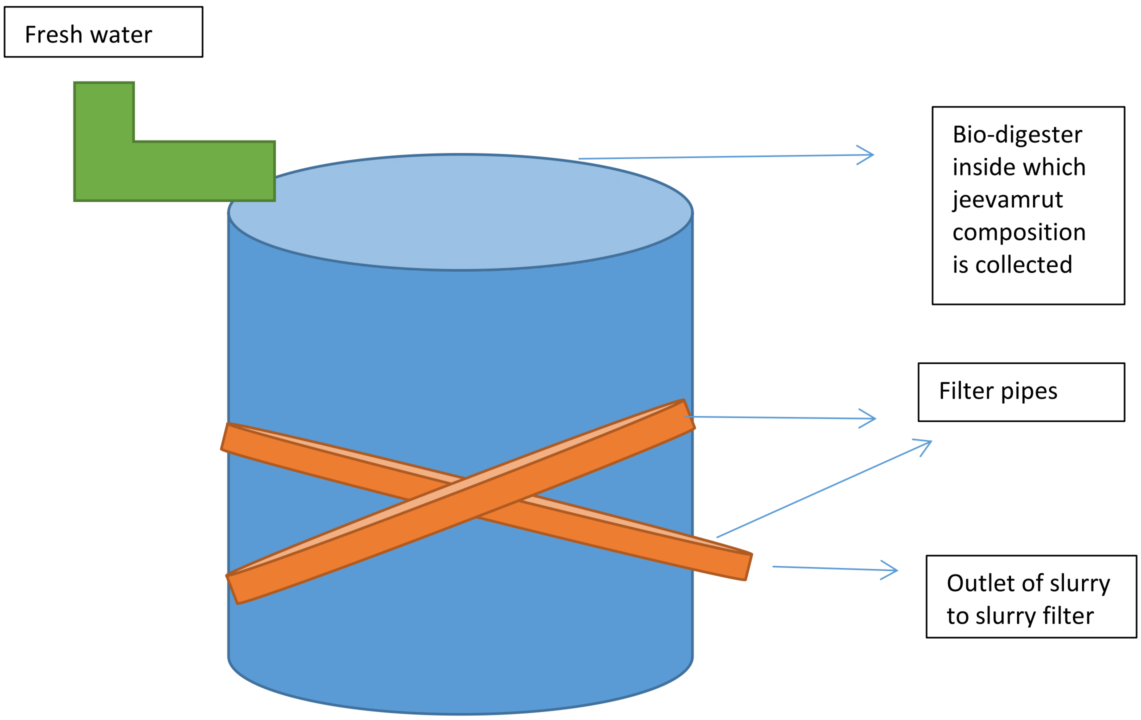
Features	**Dimensions**
Diameter	20 ft
Height	4.5 ft
Total liquid volume	38,000 L
Height at which Filter pipe is fixed inside digester	2.5 feet from bottom
Filter pipe diameter	4”
Mesh around filter pipe	1 mm
Back wash pipe diameter	2”
Material	Concrete

Filter pipe is a prefabricated PVC with 1mm SS mesh cover.

Bio - Digester - construction

The bio-digester is a concrete tank built above the ground with about 20ft diameter for 4.5 ft height. Two filter pipes - prefabricated PVC with 1mm SS mesh cover - are fitted inside the digester, end to end in both directions, at the height of 2.5 ft from the bottom. This filter pipe serves as the only outlet for the slurry.

Bio-digester



Biodigester in an organic farm

Initially 20,000 L of water is filled in the digester. Cow dung and urine are mixed and collected in the digester on a daily basis. Jaggery, Gram flour, banana peel, soil for bio-inoculation and waste decomposer are added on weekly basis. Fermentation is allowed for 30 days.

Figure showing outlet from the filter pipes fitted at 2.5 ft height

After 30 days, first batch of liquid slurry is taken out from the digester through one end of the 1 mm filter pipe.

It reaches another slurry filter (130 micron filter) for further filtration process.

Outlet from bio-digester is directed to slurry filter

The filtered organic liquid from slurry filter then is stored in another concrete underground tank as follows. This process continues till required amount of organic liquid fertilizer is collected in the underground tank.

Final filtered jeevamrut ready to be injected is stored in underground tank as follows

Once the required amount of filtered fertilizer is collected, it is pumped through 5/8” hose to reach the mainline of water supply. There it is mixed with the flowing water and reaches every crop on regular basis.

After the injection of fertilizer is completed, backwash is done to clean the filter pipe in the bio-digester.

Organically grown Papaya bearing large fruits

CHAPTER V

SUMMARY AND CONCLUSIONS

5.1 SUMMARY

The objective of this study was to draw an outline of a standardized filtering technique from organic farmers and drip irrigation equipment manufacturers and to utilize the information for preparing a BIS Standard/Code of practice to enable drip irrigation suitable for organic farming. For the purpose of the study, field visits to drip irrigated - organic farms in Tamilnadu were planned and executed. The difficulties in using drip irrigation for organic farming were identified. After observing the prevalent practices and based on requests from farmers and manufacturers, it was decided to standardize the procedure of filtration of organic manure to be used in drip irrigation without clogging of drip irrigation system. Since jeevamrut (cow-dung based manure) is widely used in India for organic farming, it was proposed to develop a BIS Code of Practice for filtration of jeevamrut suitable for use in drip irrigation system. Consecutively, the procedure for filtration of jeevamrut is standardised and presented for review as p-draft in appendix.

5.2 CONCLUSIONS

From the study, it is concluded that

5.2.1 There are differences in schedule of manuring, type & composition of organic fertilizer used and filtration techniques from farm to farm and district to district.

5.2.2 Majority of the organic farmers use jeevamrut as fertilizer.

5.2.3 Standardised guidelines for organic filtration and fertigation are not available.

5.2.4 Farmers did not use single filter for straining the organic manure liquid (like chemical fertilizer filters). Instead they followed different filtration procedures to make the organic liquid suitable for injection in drip irrigation system to avoid clogging. This is because the filtration of organic manure is a tedious process and time consuming. **A single filter or a series of different type of filters are not efficient in filtering the manure. The longevity and bio-resistance of such filters are still questionable.** Hence majority of the farmers used their own techniques of filtration and fertigation.

5.2.5 Thus as an initial effort, standardized procedure for filtration of jeevamrut only is prepared and presented for review..

CHAPTER VI

RECOMMENDATIONS

5.2 RECOMMENDATIONS

The following recommendations are made based on the findings of this study.

1. The quality of the jeevamrut filtrate should be ensured through laboratory tests. It may be tested that the filtrate still contained almost the same quantity of plant nutrients as compared to the solid manure.
2. Research works can be done to standardize the filtration techniques for other organic manures also.
3. Research works can be done to standardize the filtration techniques for organic pesticides and insecticides.
4. As per the requests from some of the manufacturers, the standard for Ball valves used in drip irrigation system may be designed.

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ANNEXURE

P-Draft

Indian Standard

Prevention of Clogging in Drip Irrigation Systems in Organic Fertigation

Filtration techniques for Jeevamrut - Code of Practice

1 SCOPE

This standard specifies guidelines for preparation and filtration of organic manure - jeevamrut in order to prevent clogging of drip irrigation system laterals in organic fertigation.

This standard does not cover filtration of other organic manures like panchagauvya, beejamrut, amrutpani, etc.,

2. DEFINITIONS

For the purpose of this standard, the following definitions shall apply.

2.1 Jeevamrut : cow dung based organic liquid prepared following certain procedure and used as fertilizer in organic farms.

2.2 Bio-Digester : Concrete tank built above the ground in which jeevamrut constituents are collected, mixed, stored and fermented.

2.3 Filter pipe : It is a prefabricated PVC with 1 mm mesh which is fixed end to end inside the bio-digester.

3. JEEVAMRUT COMPOSITION

3.1 Jeevamrut is prepared by adding 1000 liters of water with 50 Kg Indian /desi cow dung and 50 L cow urine /gomutra, to this liquid formulation add 10-12 Kg of jaggery and 10-12 Kg of gram flour /besan and banana peels. Two handfuls of soil taken from the roots of banyan tree (or any other old tree found close to the farm).

3.2 The above ingredients should be stored in a cool place and away from sunlight.

3.3 The mixture needs to be stirred couple of time (every 12 hours) for 4 days.

3.4 The ingredients are fermented and Jeevamrutham is prepared for the use. This jeevamrutham can now be used within 2- 3 days of preparation. Beyond the 8th day of preparation, the bacterial colonies in the liquid start reducing.

3.5 It is beneficial to do a live mulching (mulching with help of grass, hay, sugarcane straw remains etc.) along with the Jeevamrut application. Mulching will help the earthworms (Gandul / Kenchua) to work in the soil till upper most layer bringing more porosity and minerals till the surface.

3.6 The ingredients can be proportionally increased/decreased according to the requirement and size of the organic farm.

Table 1 The composition of jeevamrut.

Ingredients	**Proportion**
Water	1000 L
Local fresh cow dung	50 Kg
Urine	50 L
Gram flour	10 - 12 Kg
Jaggery	10 - 12 Kg
Banana peels	10 Kg or As much as possible
Soil as bioinoculant	200gm

4 FILTRATION TECHNIQUES

Following two methods can be used for filtration of jeevamrut as per necessity and feasibility.

4.1 METHOD 1 :

4.1.1 Jeevamrut is filled in a prefabricated PVC with mesh - 500 micron mesh Anti Insect porous container (called strainer).

4.1.2 The bottom sealed strainer with manure is dropped vertically inside a tank and the tank is filled with water.

4.1.3 Water from the tank percolates the strainer through the net and dissolves the organic manure. It is allowed without disturbance for 6-24 hours (sedimentation time). Eventually undissolved sludge particles will remain inside the strainer while the water in the tank has dissolved fertilizer in it.

4.1.4 This organic diluted solution is Pumped from the upper level of the tank (Minimum 1 foot from bottom) so that clear strained solution is extracted.

4.1.5 Cloth may be used to filter the solution. Then it is passed through Screen filters into the mainline, and again filter the total fertigation water (irrigation water + Organic liquid after passing the Screen filter) through a Disc or Gravel filter. This is used for fertigation.

4.1.6 After Organic Liquid injection, clean water is used to wash the system for 30 minutes. Drip lines flushing should take place (according the application frequency) after every Organic liquid injection.

Fig 1 : Strainer inside tank

4.2 METHOD 2:

This method involves construction of a concrete structure called Bio-Digester and filtering the jeevamrut with less manual interruption.

4.2.1 Bio - Digester - construction

4.2.1 The bio-digester is a concrete tank built above the ground with about 20ft diameter for 4.5 ft height.

4.2.2 Two filter pipes - prefabricated PVC with 1mm SS mesh cover - are fitted inside the digester, end to end in both directions, at the height of 2.5 ft from the bottom. This filter pipe serves as the only outlet for the slurry from the biodigester..

4.2.3 Initially 20,000 L of water is filled in the digester. Cow dung and urine are mixed and collected in the digester on a daily basis.

4.2.4 Jaggery, Gram flour, banana peel, soil for bio-inoculation and waste decomposer are added on weekly basis. Fermentation is allowed for 30 days.

4.2.5 After 30 days, first batch of liquid slurry is taken out from the digester through one end of the 1 mm filter pipe.

4.2.6 It reaches another slurry filter (130 micron filter) for further filtration process.

4.2.7 The filtered organic liquid from slurry filter then is stored in another concrete storage tank that can be built underground or over the ground. The volume of the storage tank may be planned according to the need and size of the farm.

4.2.8 The collection of jeevamrut in storage tank continues till required amount of organic liquid fertilizer is collected in the storage tank.

4.2.9 Once the required amount of filtered fertilizer is collected, it is pumped through 5/8” hose to reach the mainline of water supply. There it is mixed with the flowing water and reaches every crop on regular basis.

4.2.10 After the injection of fertilizer is completed, backwash is done to clean the filter pipe in the bio-digester.

भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS

Doc. No. : PRTD/AR/**PF:04**	Issue No. : 1	Issue Date 28 Apr 2020	**DECLARATION OF ORIGINAL WORK**

DECLARATION OF ORIGINAL WORK

I, **A ARIVAZHAGAN, Sc-C, EMP No. 062022** hereby declare that the Action Research Project titled"**A Study on Drip Irrigation System for Organic Agriculture** " is the original research work done by me. I have not copied from any other Action Research Project or any other work of similar nature and topic done by any person/institution/body either published or yet to be published. Data and information from other sources, used if any, have been with prior permission, wherever required and is duly acknowledged appropriately in the project report submitted by me.

This declaration is made on **30 MARCH 2021.**

Arivazhagan 30/03/21
Sign. of Officer with Date