TELANGANA STATE MICROIRRIGATION PROJECT

A Special Purpose Vehicle to avert water scarcity and enhance yield, incomes and environmental sustainability

V. Praveen Rao & V. Ramulu

Professor Jayashankar Telangana State Agricultural University, Rajendranagar
Hyderabad, Telangana State, India - 500030

Background

Water in appropriate quality and quantity is essential for agricultural production, food and nutritional security. Water is also important for energy, industry and other economic sectors. Overall, water supports economic growth and income generation and, therefore, economic access to food. As India's population heads for more than 1.8 billion people by 2050, demand for food is expected to surge by more than 22 per cent. Majority of this increase would need to come from irrigated agriculture with higher crop productivity, crop diversification and cropping intensity as limited opportunity exists for increasing agricultural land further. Expanding of efficient agricultural water management technologies such as microirrigation viz., surface & subsurface drip irrigation is a key part of the solution to increasing yields and resource use efficiency in agriculture in a sustainable manner, considering that currently only 3.5 per cent of net irrigated land in the country is under drip irrigation.

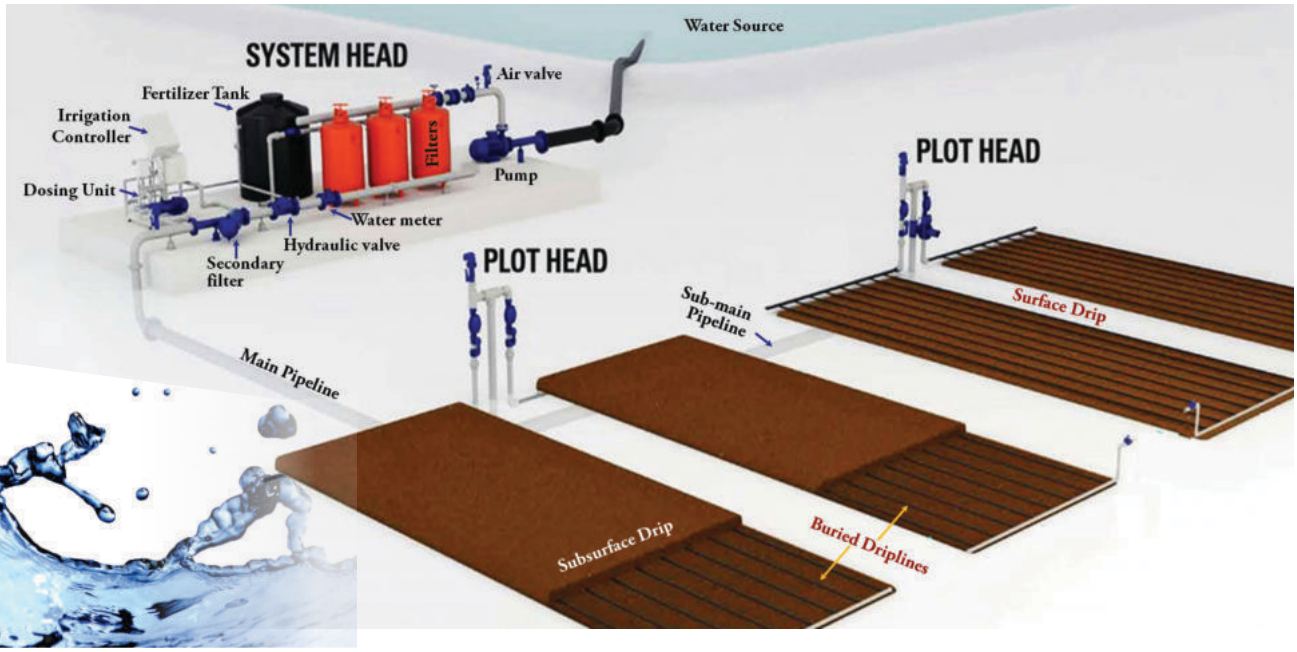
Addressing water scarcity through efficient irrigation solution in the agriculture sector directly contributes to the achievement of the 2030 Agenda for Sustainable Development, its SDGs, and the Paris Agreement of the United Nations Framework Convention on Climate Change (UNFCCC). The Paris Agreement recognizes the fundamental goal of ensuring food security and ending hunger, as well as the vulnerability of food production systems to climate change. Therefore, investments in efficient drip irrigation technologies can lead to major improvements in the standard of living of small and marginal farmers who produce the majority of food required in developing countries besides promoting environmental security.

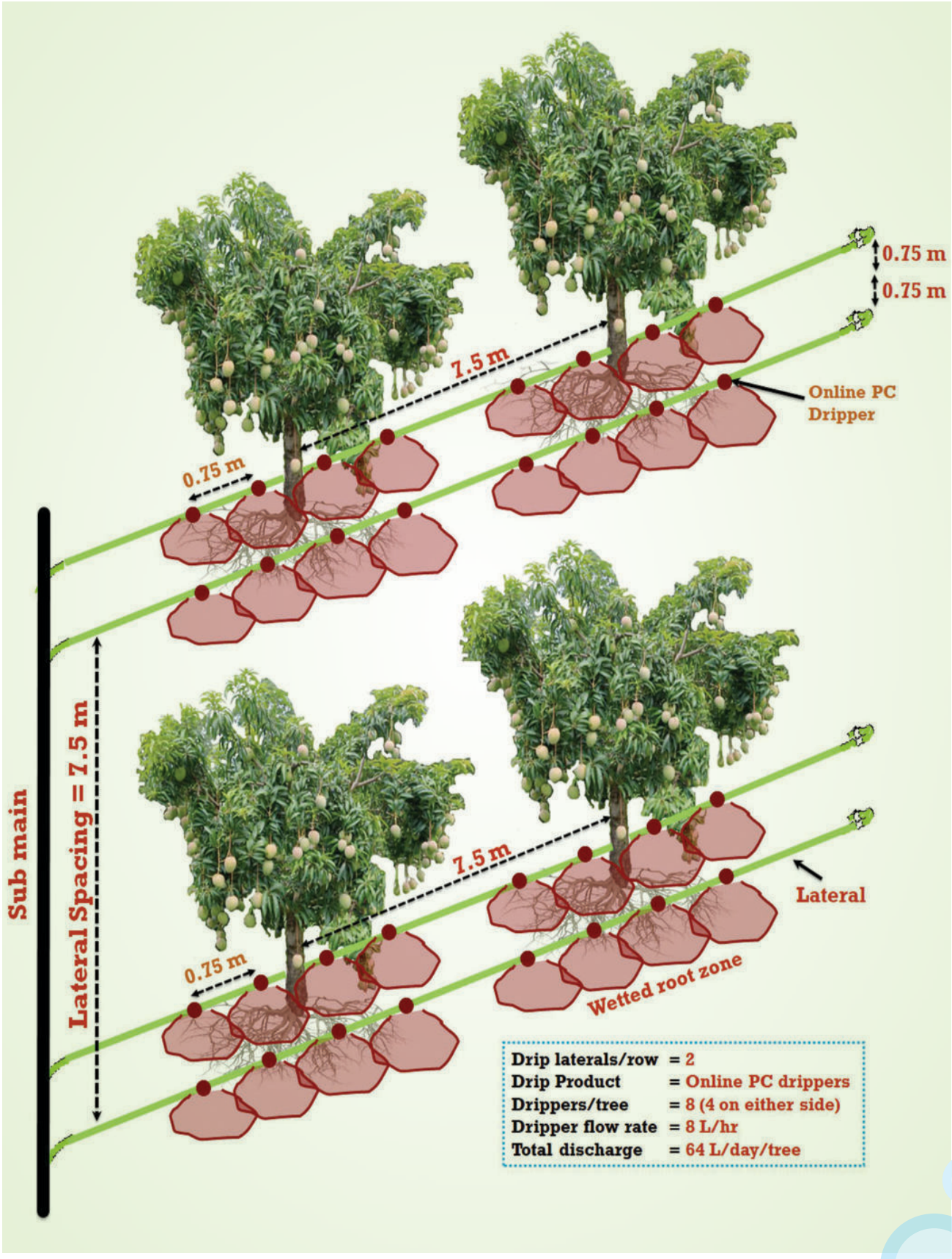
Irrigation Technology in Action
- The Case of TSMIP

Project Details

The Telangana State Micro Irrigation Project (TSMIP) (termed as Andhra Pradesh Microirrigation Project i.e., APMIP prior to bifurcation of Andhra Pradesh State in 2014) was launched on 3rd November 2003. The major objective of this project was "to provide the farmers with a tool, in the form of a new drip irrigation system, that is more efficient and easier to manage than what he currently has, and to provide him with professional training that will result in more efficient use of water and fertilizer, reduced labour, power & production costs, increase in cultural practice flexibility, potential increase in quality & yield of crops contributing to higher farm profitability". The new drip irrigation systems were designed with higher water application efficiency and distribution uniformity of at least 90% on crops. The scope of this project was to provide drip irrigation equipment viz., filters, above ground materials (laterals, integral driplines and online emitters), control valves, and below ground PVC pipelines etc., for installation, water & fertilizer scheduling, and monitoring. The specific material and installation requirements varied from field to field depending on the field size, land topography, location of water source, water yield & quality, crops & cropping system, agro-ecological conditions, etc.

TSMIP operates as part of the Telangana State Horticulture Department, and it acts as nodal implementing agency for all microirrigation subsidy programs in the state. The organizational structure is decentralized with TSMIP Project Directors or the District Water Management Authority carrying out the key functions at the field level. The decentralized organizational structure enables easier handling of large volume of applications and smoothens monitoring & field inspection. TSMIP receives funding from both Government of Telangana (including NABARD assistance) and Government of India. Funds are allocated according to district quotas and company-wise targets set centrally by Project Officer, TSMIP. Meanwhile, the State government has also secured a loan of Rs. 887 crore from the National Bank for Agriculture and Rural Development (NABARD) to expand the microirrigation schemes in the state including Geo-tagging and Geo-fencing works.




0.75 m
0.75 m
7.5 m
Online PC
Dripper
0.75 m
Sub main
Lateral Spacing = 7.5 m
7.5 m
Lateral
0.75 m
Wetted root zone
Drip laterals/row = 2
Drip Product = Online PC drippers
Drippers/tree = 8 (4 on either side)
Dripper flow rate = 8 L/hr
Total discharge = 64 L/day/tree

SUBSIDY MODEL

All farmers irrespective of the social category and economic status are eligible for drip irrigation system installation subsidy up to 5 ha land holding possessed by the farmers as per the title deed or Rs. 6.5 lakhs whichever is less in the following proportions:

- **All SC & ST farmers under small & marginal holding category are eligible for 100% subsidy per family.**
- **All BC & other category farmers under small, marginal & medium holding category are eligible for 90% subsidy per family.**
- **All other category farmers are eligible for 80% subsidy per family.**

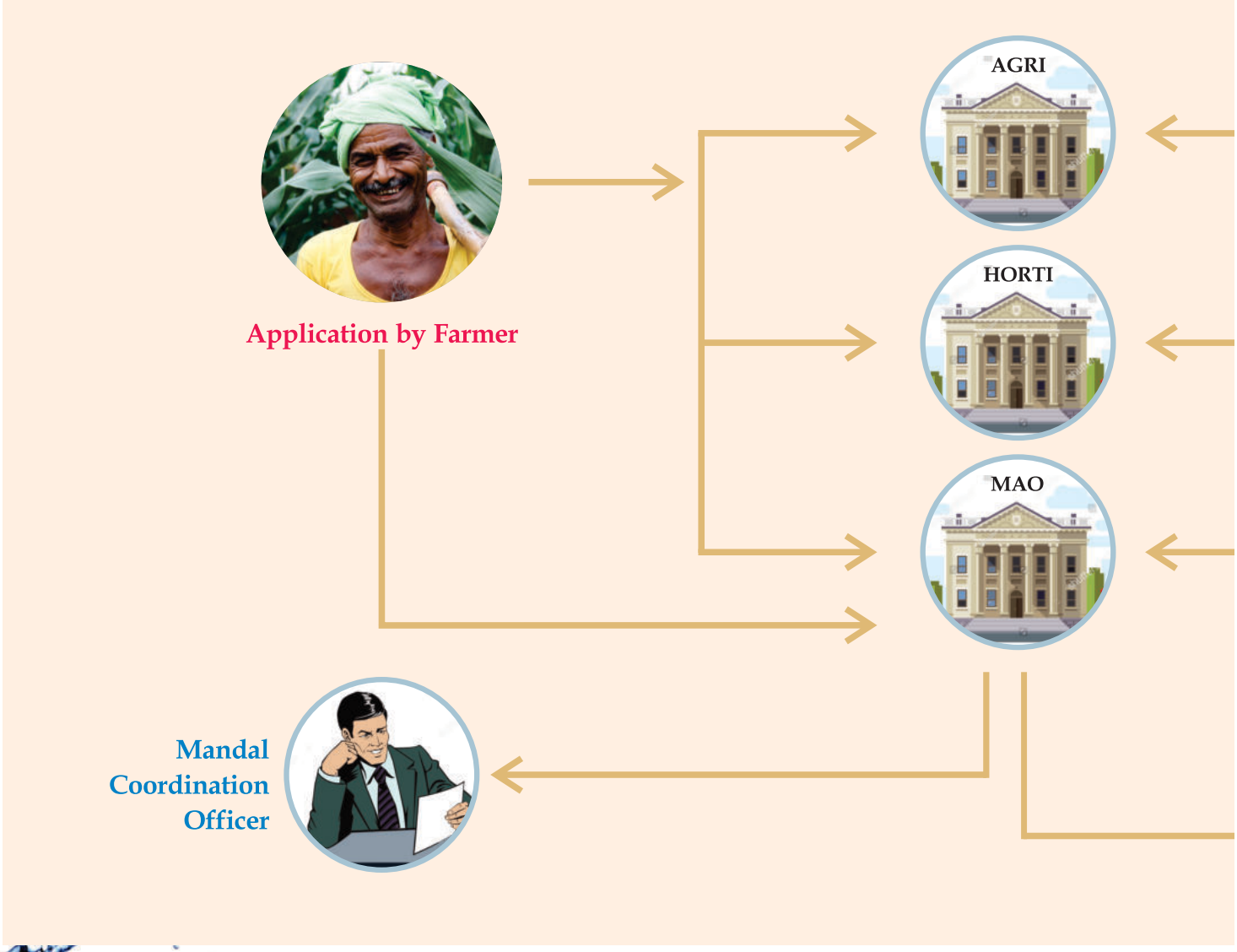
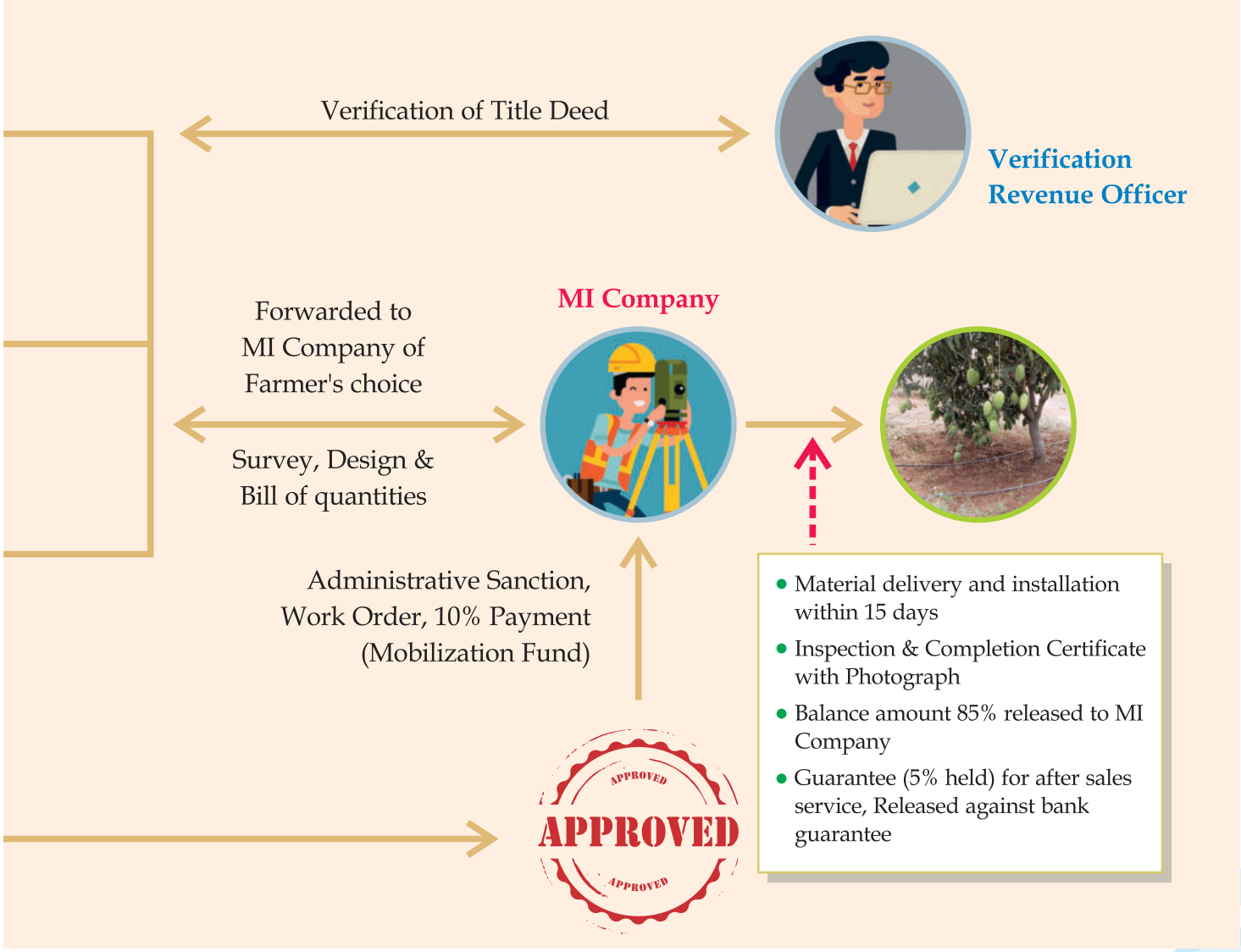


Fig. 1 : The TSMIP model of c

Figure 1 illustrates the process of subsidy delivery under TSMIP. The process of applications and approvals is delegated to TSMIP Project Directors or the District Water Management Authority in each district.

Farmers submit their application to the local Micro Irrigation Area Officer (MIAO) or the local Agriculture/Horticulture Officer. The application is sent to the village revenue officer and returns to MIAO after land title verification. Then the application is forwarded to the company of farmers' choice for survey and design preparation. After the survey, the application is sent to the Mandal Coordination Office (MCO) and the MIAO informs the farmer about how much she/he has to pay towards 30% of share as a demand draft. Upon submission of DD, the application is forwarded for scrutiny and sanction at the district office. After sanction, 10% of the total cost is released to the company as 'mobilization fund' and the company is expected to complete material delivery and installation within 15 days. After successful installation, MCO conducts an inspection and issues a



drip irrigation subsidy delivery

completion certificate along with photograph after which 85% of the total payment is released to the company. There is an emphasis on service to farmers with 5% of the total cost being retained as guarantee for providing after-sales agronomic and technical service; this amount is released if the company provides bank guarantee. However, field level inspection has revealed that the quality of service is variable despite the threat of de-registration due to poor-farmer awareness. Detailed work-flow charts stipulate maximum time for each step for application processing. But instances of variable performance and delays in payments, forcing companies to discontinue installation have been reported. Sluggishness in subsidy release also supresses demand. The subsidy is regulated by fixed yearly quotas and allotment of geographical domains to each microirrigation company. However, quota system cripple's competition, distorts market share with companies fighting for quota-share rather than market share. A toll-free number is provided for enquiries about application status. Unit costs of MI systems for crops and spacings are standardized and price differentiation is not possible in any district. Dealer networks exist with perceived quality of service.

Drip Area Spread

Of the roughly 1524 million ha of arable land in the world, 324 million ha of area is irrigated, and only a little over 13.08 million ha is drip irrigated. Much of this lies in 7 countries: India, USA, Spain, China, Korea, Brazil & South Africa. Together, these countries represent nearly 74.6% of the world's drip irrigated area. These countries, especially USA, also have significant sprinkler irrigated areas and are among the top five countries with respect to the adoption of planned irrigation technologies. Drip irrigation technologies were initially developed to irrigate high value greenhouse crops and became commercially viable for field crops after the invention of inexpensive, weather resistant polyethylene plastics post World War II. According to ICID till 1991, drip irrigated area in India was only about 71,000 ha but in the last two decades, the area under drip has grown to nearly 2 million ha, making India the largest drip irrigator in the world. More recent data from March 2016 suggests that drip irrigated area in India has further expanded to over 3.372 million ha with Rajasthan, Maharashtra, Gujarat, Karnataka, Andhra Pradesh, and Telangana being the leading states. As per the records of Horticulture Department statistics, a cumulative area of 0.73 lakh ha has been brought under drip irrigation in Telangana State by the end of 2003-04. Whereas, the drip irrigated area coverage after the launch of TSMIP (then APMIP) in the state i.e., from 2003-04 to 2016-17 was significant with a cumulative of 5.93 lakh ha (Fig. 2).

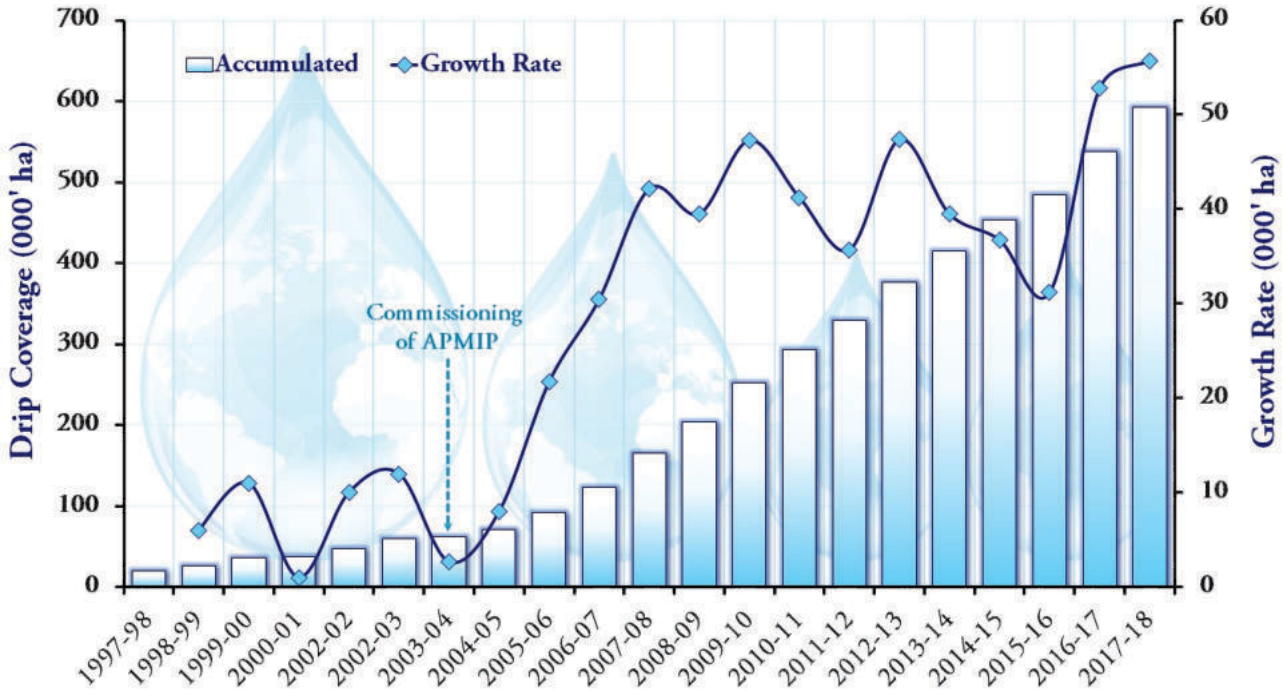


Fig. 2 : Drip irrigation area in Telangana State

IMPACT ASSESSMENT

A quantitative assessment of the impact of efficient drip irrigation technology access in the Indian state of Telangana helps to illustrate its benefits (Fig. 3).

WATER

Drip irrigation delivers water directly to the most efficient part of the root zone, reduces irrigation runoff from the field, and causes minimal deep percolation losses below the crop root zone contributing to substantial savings in irrigation water requirements. Additional water savings also accrue from drastic reduction in surface soil evaporation and water uptake by weeds. These benefits enable farmers to (i) use less irrigation water during crop growing season i.e., reduced irrigation requirements to bring same acreage under crops; (ii) growing diverse crops more productively over a large acreage using same quantity of water, and (iii) use the same quantity of water to raise higher value, more water-intensive crops like vegetables.

FERTILIZER

Fertigation allows precise delivery of nutrients daily according to crop demand eliminating wastage i.e., leaching out of the wetted soil root volume. This enhances fertilizer use efficiency enabling farmers to reduce the amount of fertilizer needed per crop or tree, lower labour input and pollution of water bodies.

ENERGY

Higher on-farm irrigation efficiency under drip irrigation reduces water use because less water is needed for a comparable area of irrigation, which in turn requires less energy for pumping this water. Further, automation of drip system offers considerable flexibility in timing irrigation and safely irrigate crops during times of fewer power disruptions.

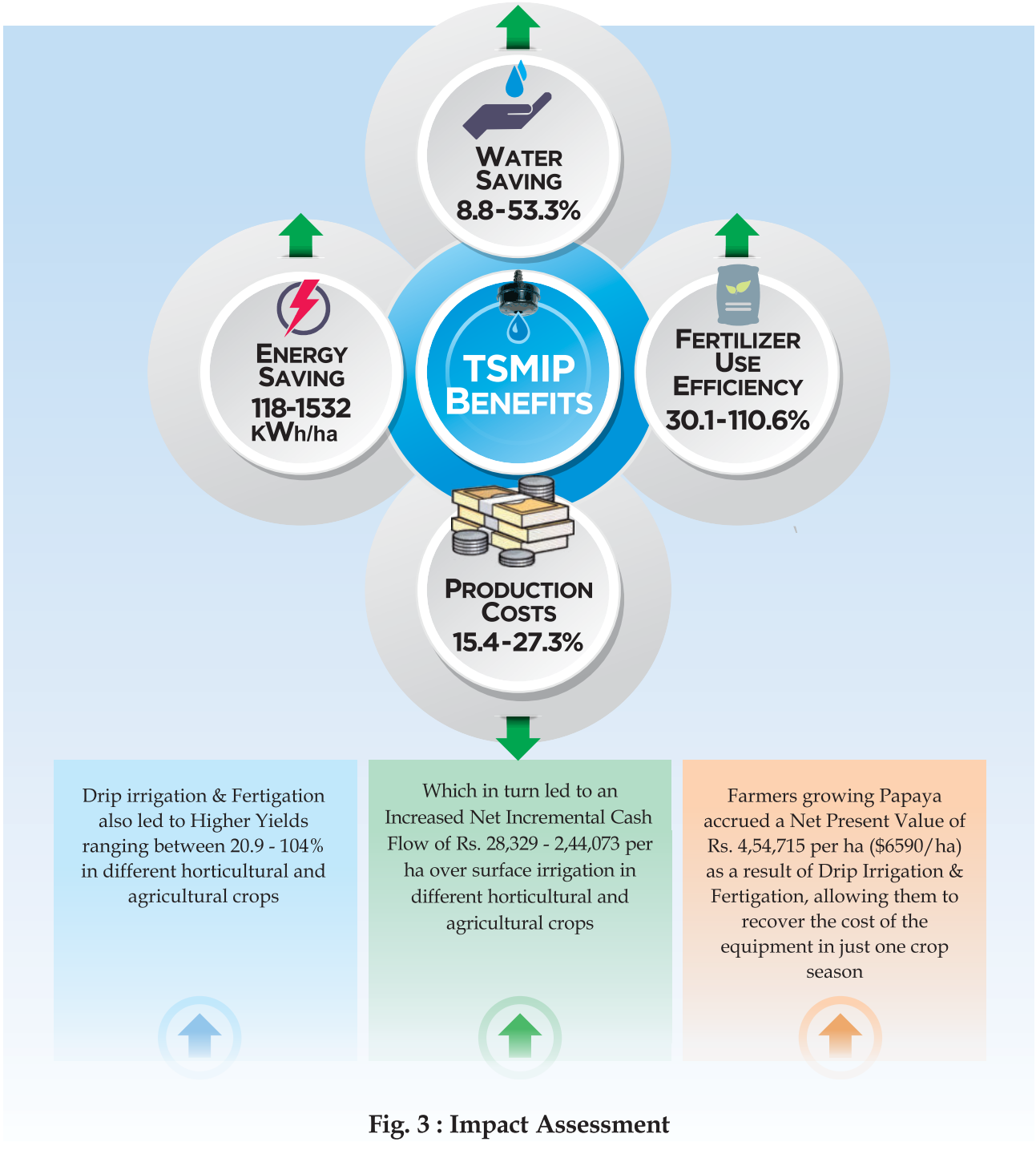
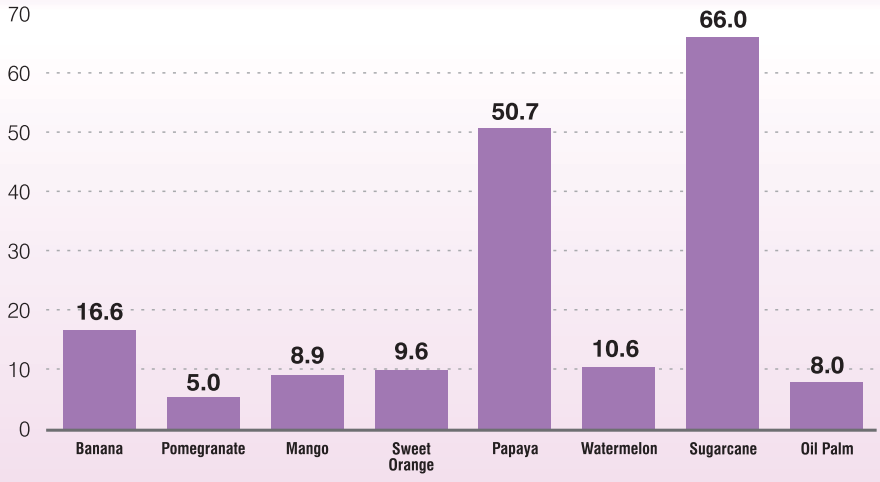
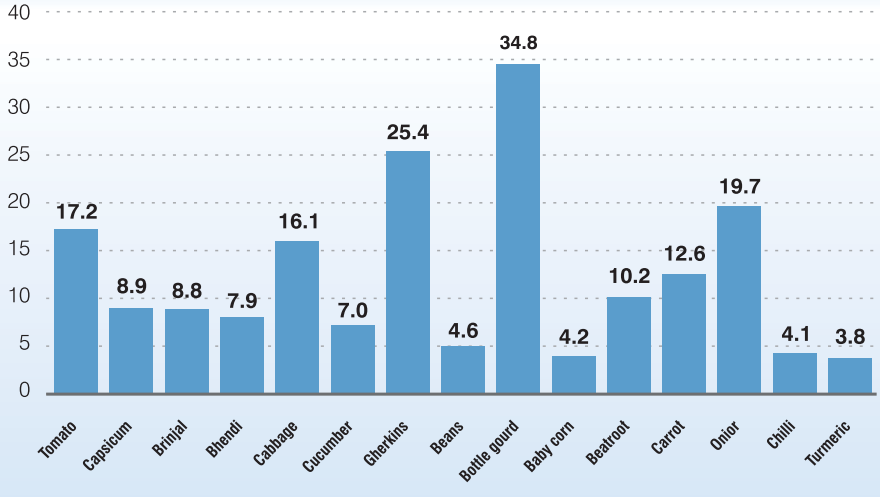


Fig. 3 : Impact Assessment

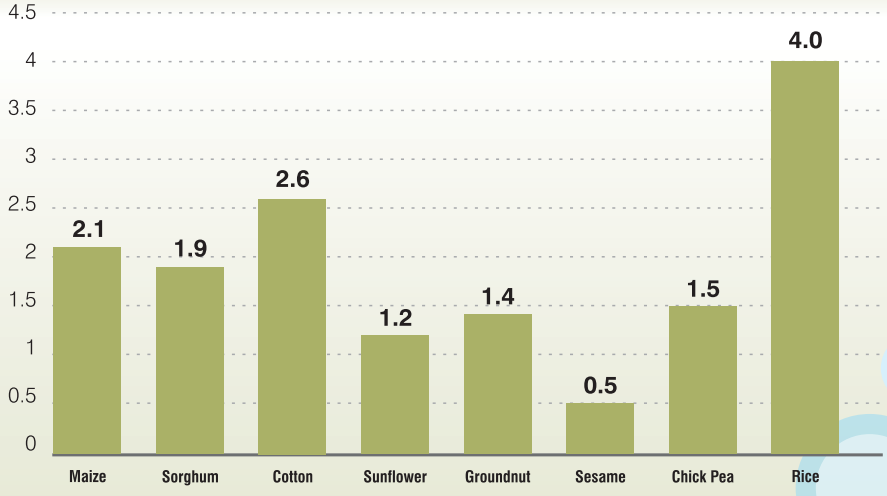
Fruit's Yield Increase (Tonnes per ha)



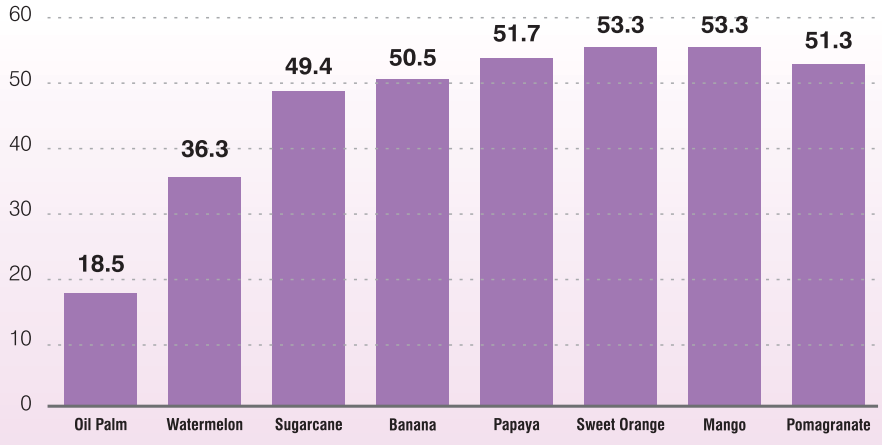
Vegetable's Yield Increase (Tonnes per ha)



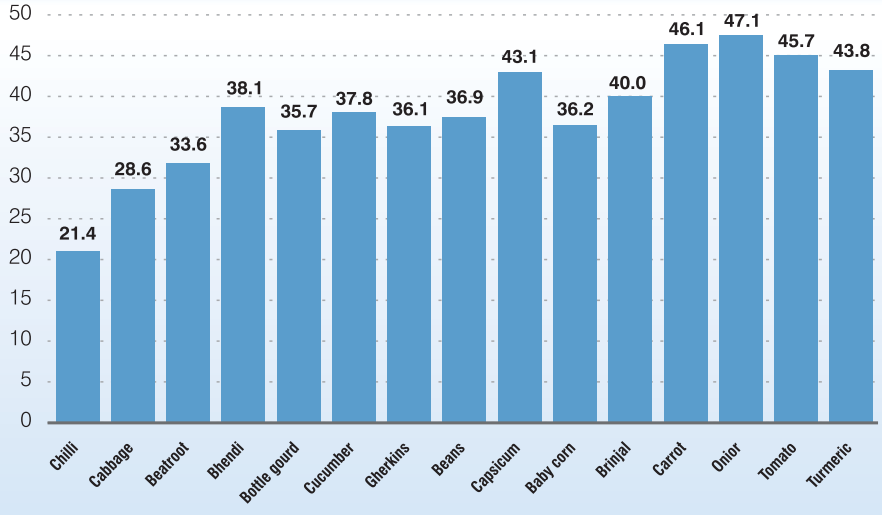
Field Crop's Yield Increase (Tonnes per ha)



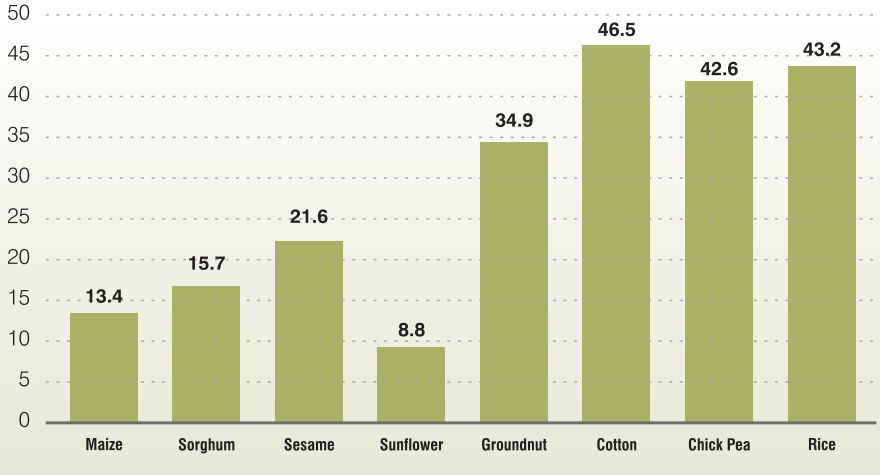
Water Savings in Fruits (%)



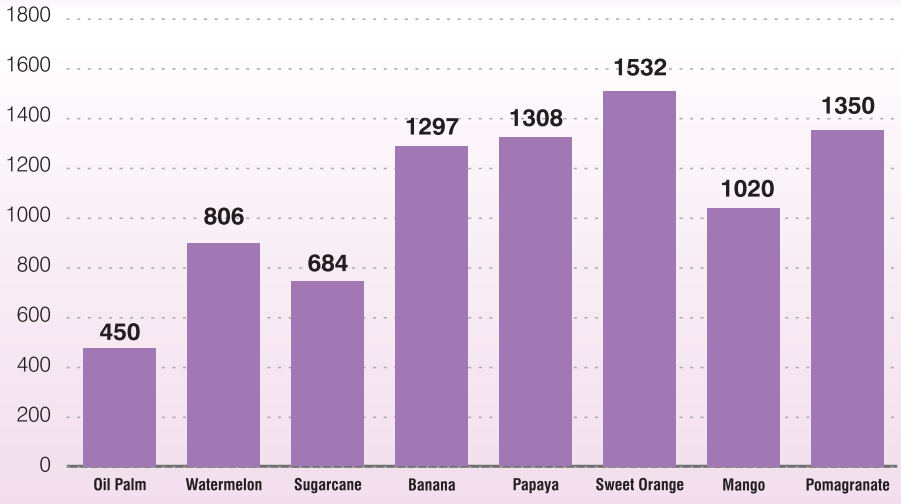
Water Savings in Vegetables (%)



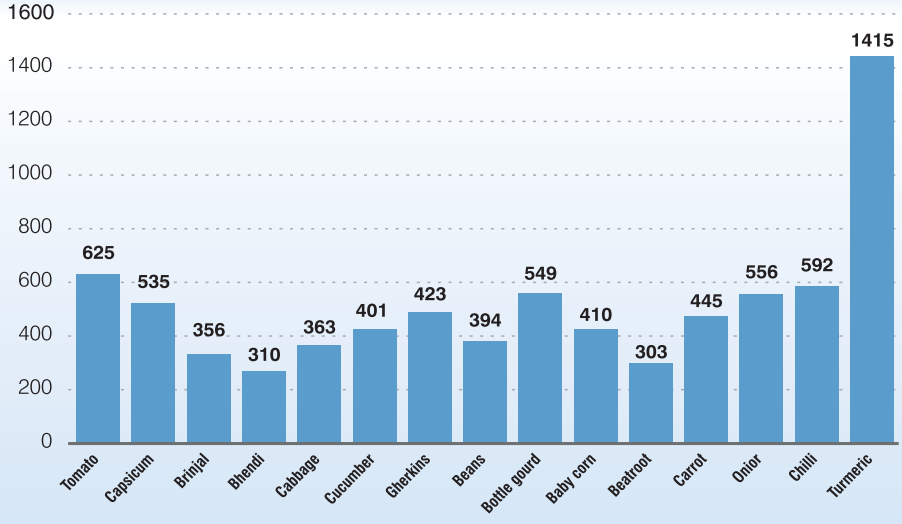
Water Savings in Field Crops (%)



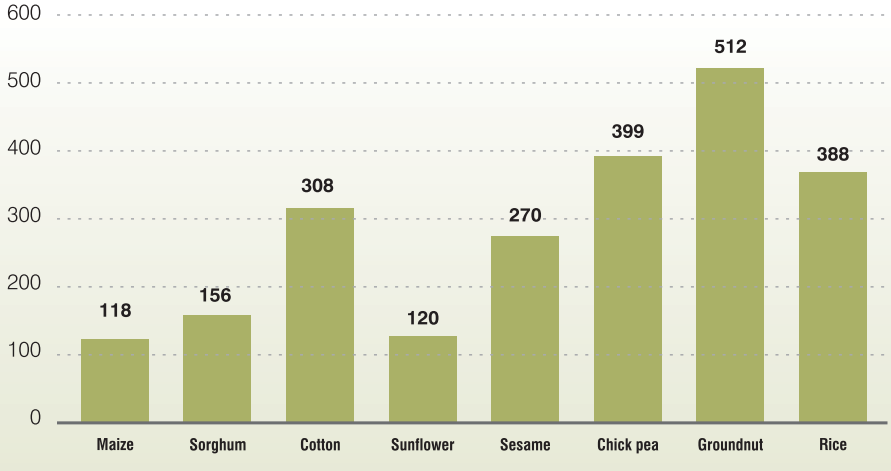
Energy Savings in Fruits (kWh/ha)



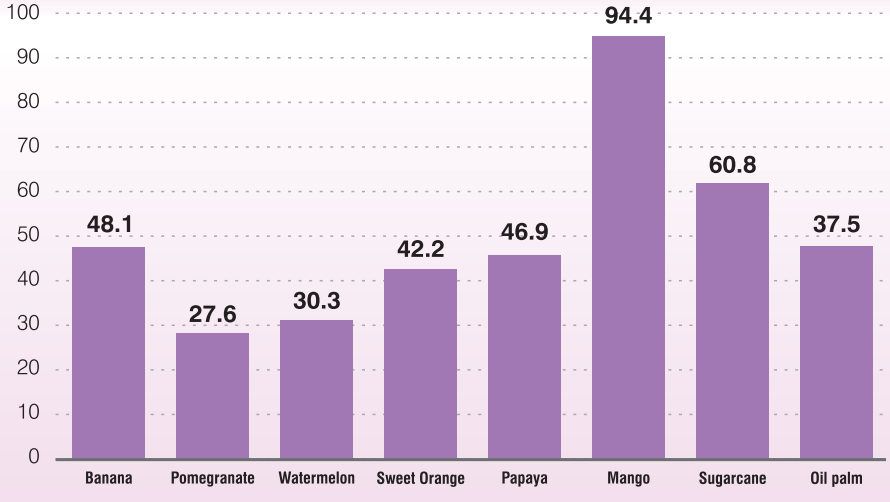
Energy Savings in Vegetables (kWh/ha)



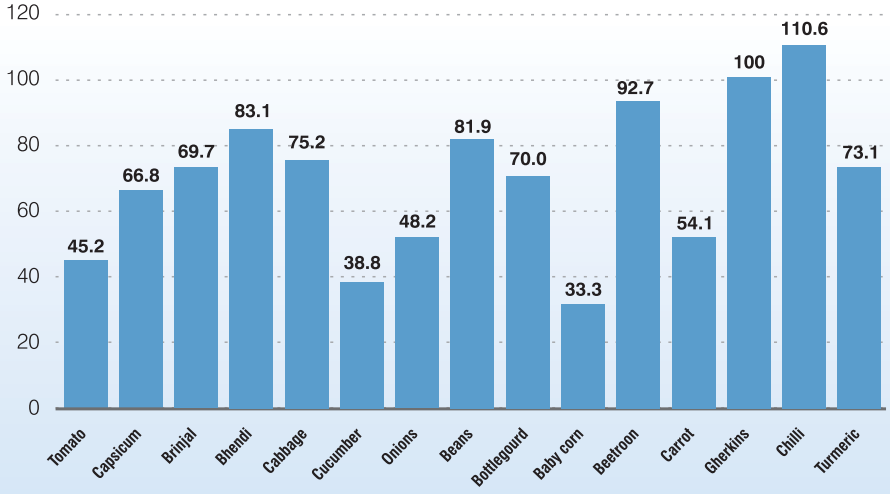
Energy Savings in Field Crops (kWh/ha)



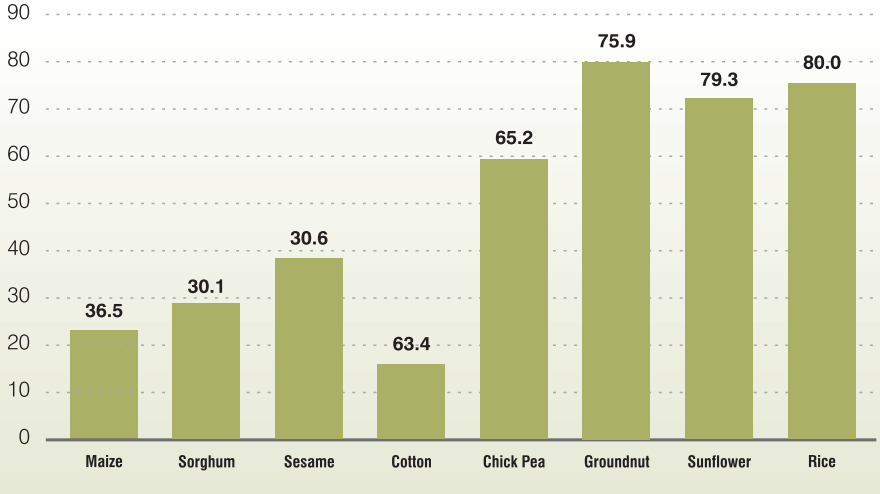
Fertilizer Use Efficiency in Fruits Increase (%)



Fertilizer Use Efficiency in Vegetables Increase (%)

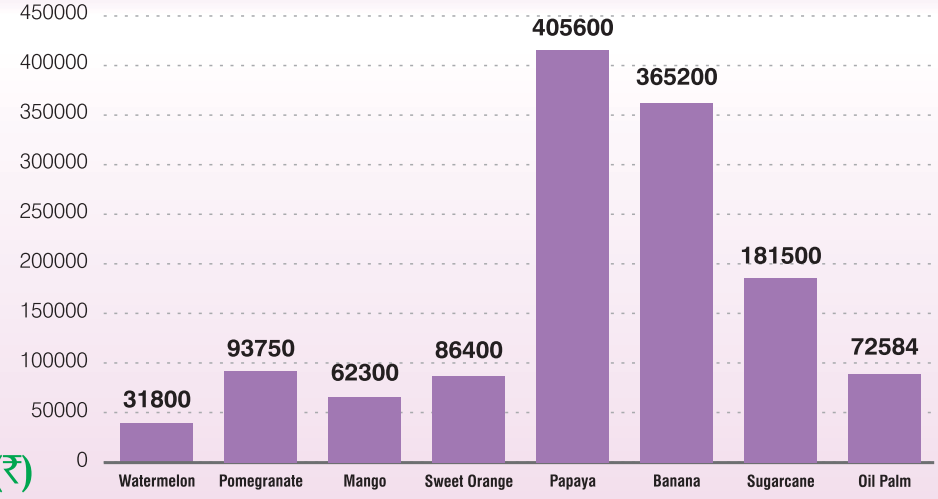


Fertilizer Use Efficiency in Field Crops Increase (%)



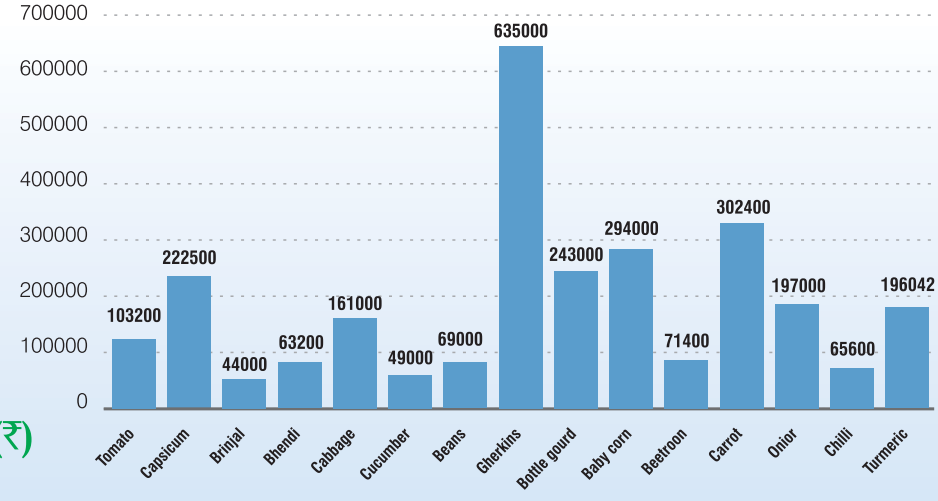
Returns in Fruits

Increase Over Surface (₹)



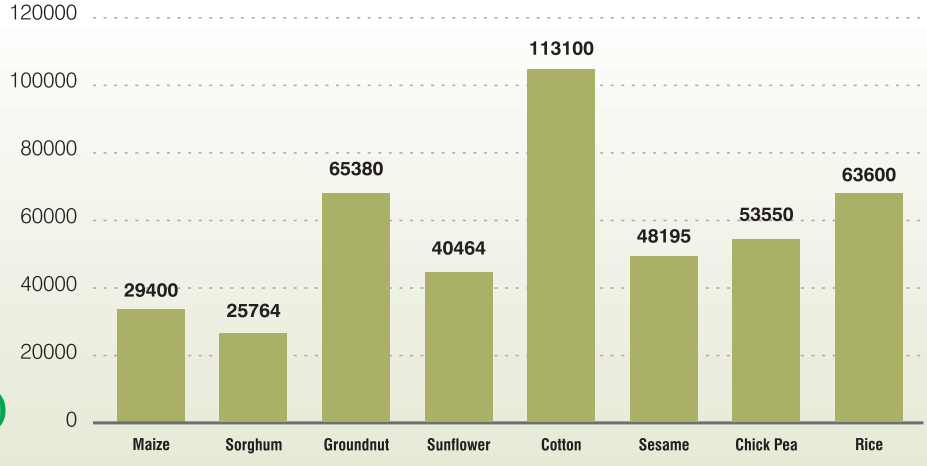
Returns in Vegetables

Increase Over Surface (₹)



Returns in Field Crops

Increase Over Surface (₹)



Labour

Simultaneous application of water, fertilizer, agro-chemicals; reduced weed infestation due to partial wetting between crop rows or trees, flexibility in cultural operation owing to dry soil surface, fewer cycles of harvesting, system automation – soil moisture sensors, computer interfacing, remote controllers etc., enable farmers to save labour in drip irrigated crops.

Crop Yield & Quality

Efficient drip irrigation and fertigation technology characterized by frequent and precise delivery of water to the most active root zone maintaining optimal soil water regime without large time fluctuations in the soil moisture, no problems of soil aeration, improved fertilization timing enhancing nutrient availability, reduced salinity hazard to plants, limited weed growth, fewer attacks from pests & diseases etc., favour better crop growth and enhanced crop yield with improved quality of produce.

Farm Profitability & Environmental Sustainability

Adoption of efficient drip irrigation technology coupled with diverse crops, higher cropping intensity, input savings, system automation, management flexibility, enhanced crop yield, improved quality of produce – grade, size, shape & colour etc., in the presence of functioning markets and a favourable business environment, in turn help farmers generate greater farm profits and livelihood security. Further, through its effects on resource use efficiency (water and energy) and soil quality, efficient drip irrigation technology also promotes environmental sustainability. Agriculture accounts for about 96 per cent of states freshwater use, greatly contributing to increasing scarcity of freshwater. The use of efficient drip irrigation technology therefore helps farmers in vulnerable districts to adapt and strengthen their resilience to climate change.

Key Enabling Factors to Technology Adoption

While the benefits of efficient irrigation technology are clear, a number of factors are necessary to unleash these positive impacts (Fig. 4)

Awareness and Skills

The adoption decision, performance and sustainability of efficient drip irrigation technology depends on farmers' initial awareness of its technical feasibility, economic viability, knowledge of system components and their proper use. The technical feasibility parameters include suitability of farmers' land viz., holding size, topography, agro-ecological conditions, soil hydraulic properties, choice of crops & cropping systems, water source, its yield & quality, pump suitability etc. Whereas the decision criteria for economic viability are yield increase, system cost, subsidy pattern (amount), profitability, IRR and payback period. Likewise, the knowledge of system components, their operation and maintenance are important for proper use and top performance. Therefore, the equipment manufacturers & dealers willingness and their ability to provide agronomic & technical support and after sales services to the farmers play an important role in the performance, success and sustainability of drip irrigation technology.

Infrastructure

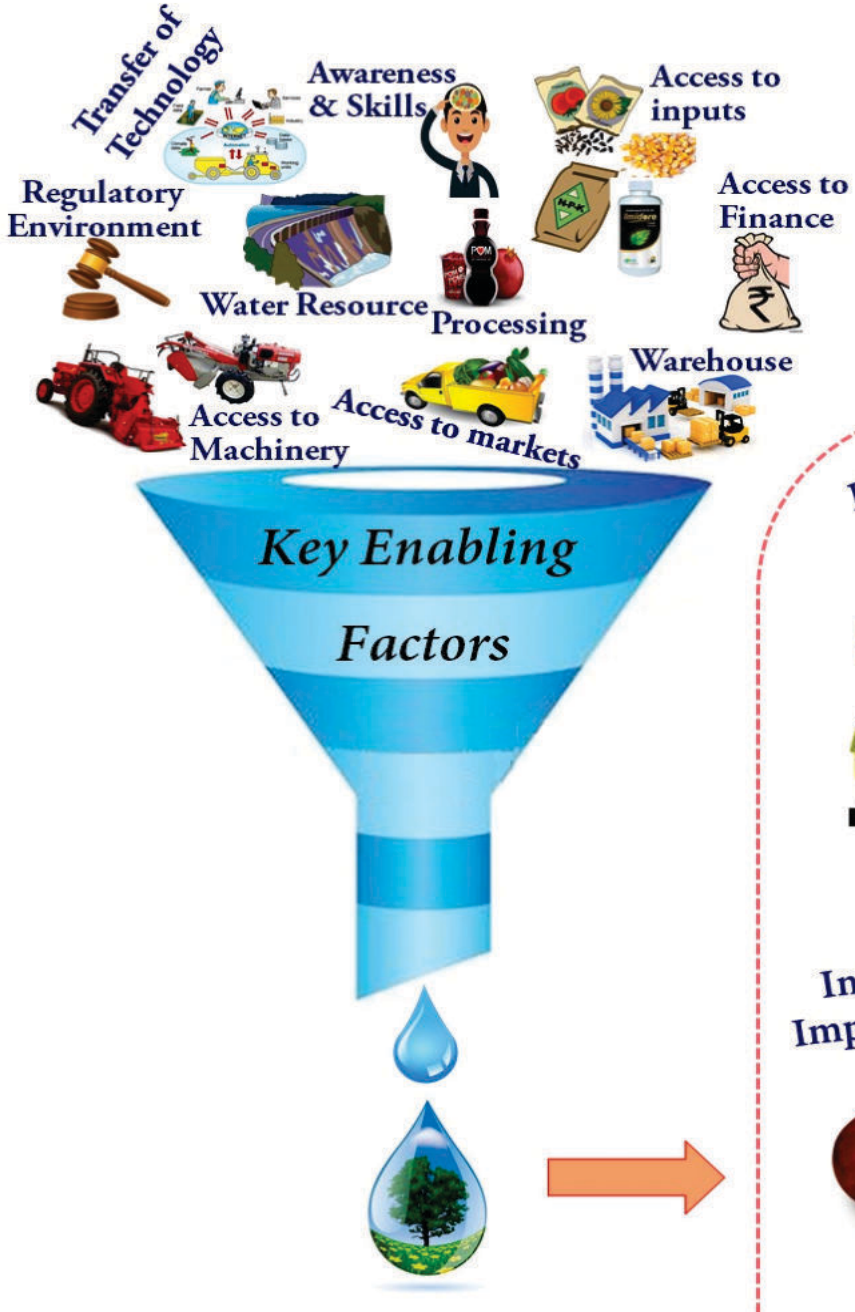
Agriculture infrastructure viz., Input based – Seed, fertilizer, agrochemicals, farm machinery & equipment etc; Resource based – access to water/irrigation, electrification etc; Physical - reliable roads & bridges for timely transport of agricultural commodities to market, access to warehouses, preservation, processing, cold chain storage etc; Institutional – Agricultural research, extension & education technology, krishi vignan kendras, soil testing labs, information & communication services, credit & financial institutions, marketing, rural literacy etc., is a sine qua non for accelerating the process of adoption of efficient drip irrigation technology and ensuring farmers to realize its full benefits. Both private and public sectors have important roles to play in creating these infrastructural facilities for raising farm productivity, lowering production costs, accelerate economic growth, rural development and poverty alleviation.

Regulatory Environment

On the regulatory side, the government has a role to play in ensuring that appropriate regulations are in place such as efficient & transparent subsidy fund flow models, better process management including online tracking & monitoring, ensuring smoother & long-term technical & financial implementation guidelines, crop focussed solutions, infrastructure status to microirrigation industry, priority sector lending status to microirrigation etc., which support small & marginal holding agriculture and ensure farmers' access to modern and efficient drip irrigation technology. Investment climate is also an important factor in the efficient irrigation companies' decisions to launch operations in a particular market.

Access to Inputs

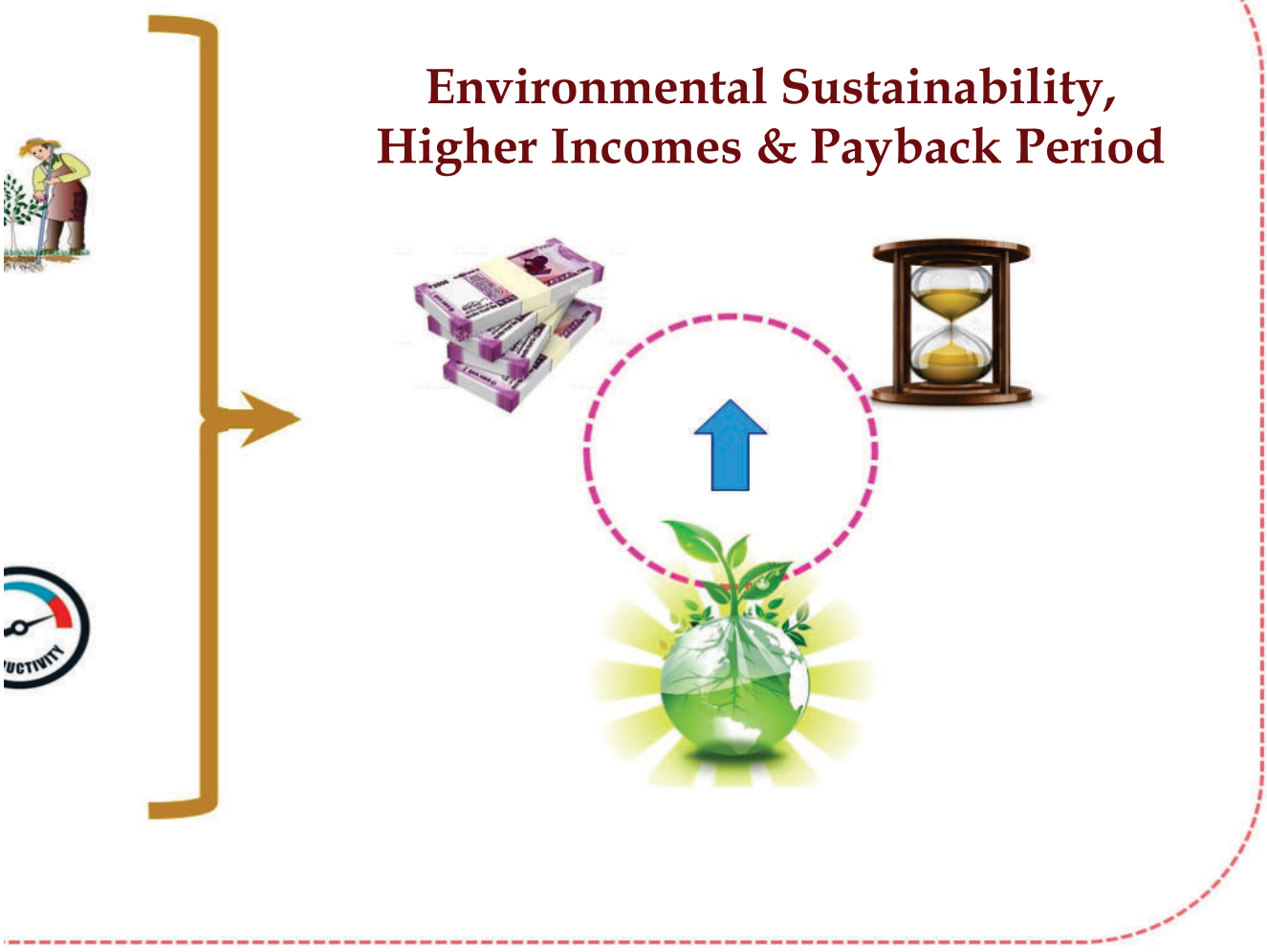
Quality agricultural inputs play a fundamental role in adoption of efficient drip irrigation & fertigation technology and enhancing crop productivity as they constitute the basal segment of the agricultural value chain. Therefore, access and quality of farm inputs, timely availability of



Drip Ferti-Irrigation: An Efficient Irrigation Tool

Fig. 4 : Key enabling factors to efficient drip irrigation technology adoption

PRINCIPAL BENEFITS & IMPACTS



inputs such as seeds of high yielding varieties & hybrids, water soluble fertilizers, agro-chemicals, and value chain mechanization, combined with high frequency application of water & fertilizers in tune with crop developmental stages through drip system synergistically impact the input use efficiency, yield and farm incomes particularly in small & marginal farmers fields.

Access to Markets

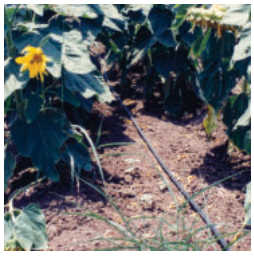
In agriculture, efficient agri-logistics and enhanced market linkage is the key factor that determines the economic viability of farming. Therefore, the impact on farmers' incomes from adopting efficient drip irrigation & fertigation technology depends on whether improved crop quality and higher yield translate into higher prices and farm incomes. The participation of small & marginal farmers in agriculture markets is limited to only local mandis due to the small scale of their production, the high transaction costs involved in reaching more distant markets, and their inability to comply with the stringent requirements relating to volume, quality, and timely delivery demanded by modern agricultural value chains. The farmer's share in consumer's price is very low (varies from 15–40%) leading to low farm income and profitability for the farmer. The agriculture market advisory services for target marketing & positioning, the availability and reliability of offtake agreements, direct selling by farmers through rythu bazars, participation & involvement in FPOs, e-markets (eNAM), traders, processors, exporters and others who purchase farmers' crops help to reduce price fluctuations, wastage and realize higher farm incomes.

Access to Finance

Many small & marginal farmers in Telangana operate with no drip irrigation equipment and can only water their crops when it rains. This means that fields stay dry and uncultivated most of the year, severely limiting output and earnings potential. Drip irrigation is critically important as an innovative climate smart irrigation practice in smallholder agriculture in semiarid groundwater irrigation commands of Telangana state. This is because it improves farm productivity, farming systems adaptation to climate variability and change, higher incomes and achievement of household food & nutritional security and national developmental goals. However, the lack of access to finance to purchase efficient drip irrigation equipment is considered to be the main constraint to technology adoption. These challenges are exacerbated for small & marginal farmers by their lack of credit history, collateral, and financial skills, as well as limited or no prior experience with efficient drip irrigation equipment. Government subsidies (80 to 100% depending on the social category) in Telangana have facilitated the adoption of efficient drip irrigation technology by small & marginal farmers in 5.4 lakh ha helping to generate the physical & financial benefits shown in TSMIP example, which in turn benefited smallholders' livelihoods. Other sources of finance for farmers could include partnerships between sugar & oilseeds cooperatives, FPOs, contract farming units and financial institutions.

CONCLUSION

Irrigation of crops using inefficient gravity irrigation is a major impediment to optimizing productivity to majority of small & marginal farmers world over including Telangana State of India. Therefore, Government of Telangana's investment in TSMIP – A Special Purpose Vehicle to strengthen the farmers hands with efficient drip irrigation & fertigation tools through 80 – 100% subsidies is aimed at promoting highly productive yet climate-smart agriculture. Providing means to small & marginal farmers to use innovative and efficient drip irrigation & fertigation technologies in crop production, is a key to averting water scarcity, increasing agri-horticultural productivity, incomes and household food security. Efficient drip irrigation also broadens farmers' crop choices and enables them to grow higher-value vegetables and fruits for the market place. It generates employment for people both with and without land, since more people are needed to harvest, process, and market the crops and to supply farm inputs. The additional farm income ripples through the local economy, generating employment and higher incomes for off-farm workers as well, all of which reduce rural poverty as the poor typically spend 60–70 percent of their income on food.



Drip Fertigation Philosophy

Irrigating
&
Fertigating the Plant not the Soil

Drip Fertigation For More Crop Per Drop

Reduced Costs

Reduced Risk

Increased Production

Increased Profits

Professor Jayashankar Telangana State Agricultural University

Rajendranagar Hyderabad, Telangana State, India - 500030