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Review on Technical Reform of Agriculture and Drip Irrigation Water Conservation Measure

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Abstract:- Agriculture is widely used in India almost largest livelihood depends on it and their contribution has a significant figure in GDP. Agriculture practice in India is unknown strength of Indians, here millions of people are involved in agriculture that is largest private enterprise and India is the world largest producer of tea, spices, pulses, milk, and jute. And the second-largest producer of wheat, sugarcane, rice, vegetables, fruits, oilseeds, and cotton. Currently, India is the world, fourth-largest producer of agrochemicals. Green Revolution reforms have been taken to increase for expansion of farming areas, double-cropping system, using seeds with improved genetics. Green Revolutions make a substantial change in Agriculture practice by using high yielding variety (HYV) seeds, tractors, irrigation facilities, pesticides, and fertilizers. Conventionally, surface irrigation is most popular and widely used in India but nowadays drip irrigation is very popular to save water and nutrient by supplying it more effectively to the root of crops. Design modification of dripper reduces half of the expenses of conventional drip irrigations which make drip irrigation more affordable and efficient for farmers in the world.

Keywords:- *Drip Irrigation, Drip Emitter, Irrigation Water Productivity, Evapotranspiration, Pressure – Compensating.*

I. INTRODUCTION

Agriculture, with its allied sector, is the provider largest livelihood in India which provide a significant contribution to the Gross Domestic Product (GDP). Environment sustainable agriculture is essential to conserve the soil, natural resource management and biodiversity protection required for holistic rural development. Indian agriculture development by its allied programs like a green revolution, a yellow revolution, a white revolution and a blue revolution make supportive role [Ministry of Agriculture & Farmers Welfare]. In India, Green Revolution was mainly led by **M.S. Swaminathan** to increase in production of food grains (especially wheat and rice). India has one of the largest irrigation areas in the world but its per hectare availability of water for irrigation is less in the world. The water demand has been increasing day by day and the future availability has been decreasing at a faster rate. Water is essential for agricultural produce. The drip irrigation system is the most popular and globally accepted method to save water and supply required nutrients to roots of the crop with minimum wastage and which is the cost-effective method [1]. Drip irrigation is the most efficient and water-saving method used in agriculture, which supplied water slowly on the crop root zone instead of the entire field surface irrigation. In his system water is supplied under pressure through small emitters one drop at a time or sprayed the water as the fine mist form over a portion. Emitters control the water quantity supply rate in the trickle or drip irrigation system which can be categories into four parts 1) Point-source emitters or drip bubbler 2) Basin bubblers 3) In-line emitter 4) Micro spray sprinkler [3]

Point-source emitters

In-line drip emitters

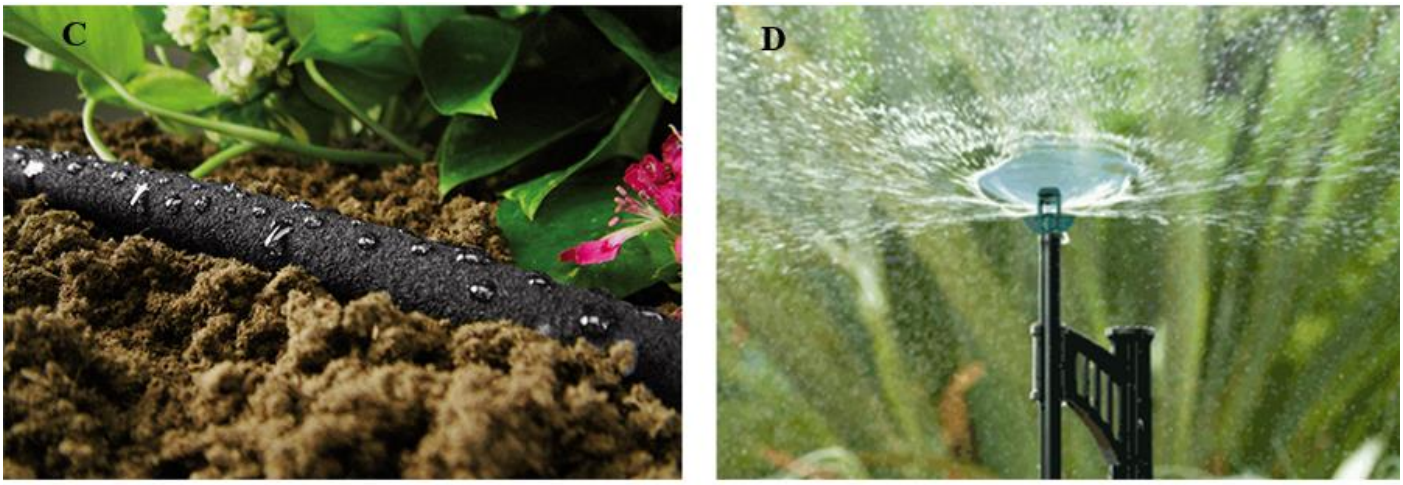

Fig 1. Showing the A, B, C and D, different types of trickle or drip irrigation systems [3]

II. MATERIAL AND METHODS

A. Drip Irrigation Incorporating Water Conservation Measure

A large amount of water is used in the agriculture sector, so it is very important to use the water efficiently and conserve the water. Optimization of water supply with a different mode of irrigation, drip irrigation makes the optimum utilization of water and also monitored supply quantity simultaneously it is also essential to get the best irrigation mode with crop response. Gimeno et al. [6] studied water-saving, quality, IWP and yielding of the citrus orchard is affected by different parameters such as drip-line position and number of emitters per plant. Comparisons between the 7 and 14 emitters with an additional drip line, it was found that the higher number of emitters has a good plant-water situation. Systematic irrigation gets through SSI systems without damage of crop yielding and saves approximately 23% water thus improving IWP. This study concluded that further research on the financial feasibility can make a sustainable system and can save an enormous amount of water in citrus production.

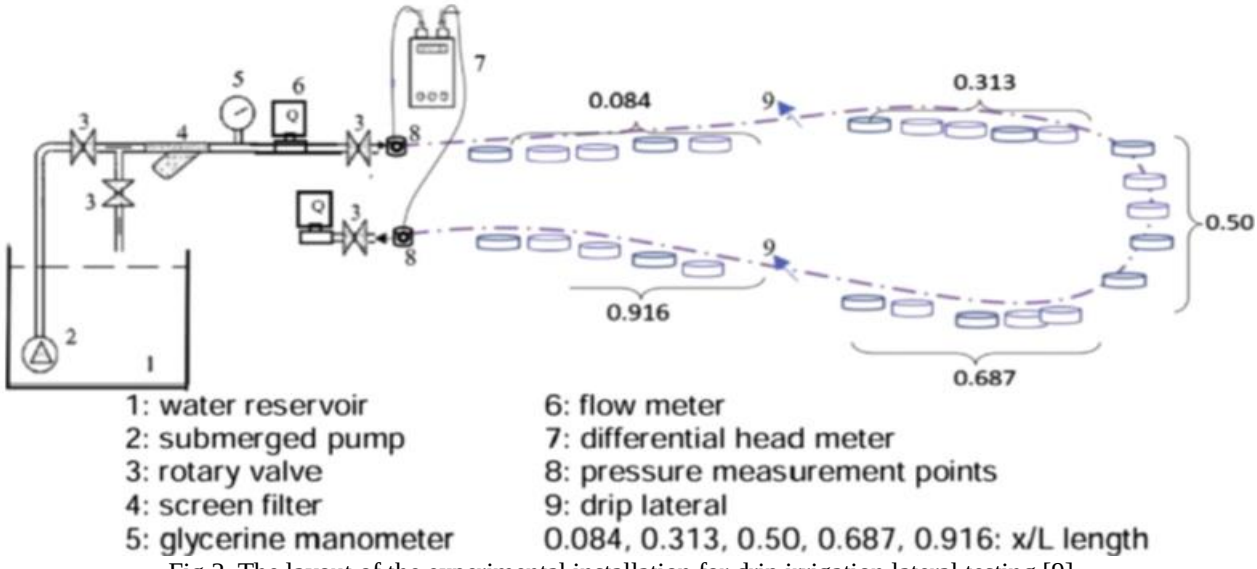

Fig 2. The layout of the experimental installation for drip irrigation lateral testing [9].

Albaji et al. [7] focused on the comparative study of various irrigation systems. Suitability maps for drip and sprinkler irrigation systems have been made by using Geographic Information system (GIS). The final results found that sprinkler and drip irrigation systems were more effective, efficient and suitable than surface irrigation systems and it was also showing that good irrigation management policy makes the irrigation system resolve the water shortage problems and make economically sustainable and feasible for the farmers. Sinha et al. [8] designed and developed a method to increase the profit margins and conserve the water by irrigation scheduling and scheming out fertigation. One joined three irrigation strategies (with different Crop Evapotranspiration) were joined with three fertigation schedules with control operations like furrow irrigation and RDF manual application. Finally result found that 80% RDF with 80% Crop Evapotranspiration drip irrigation give higher energy and water productivity which is also economically feasible.

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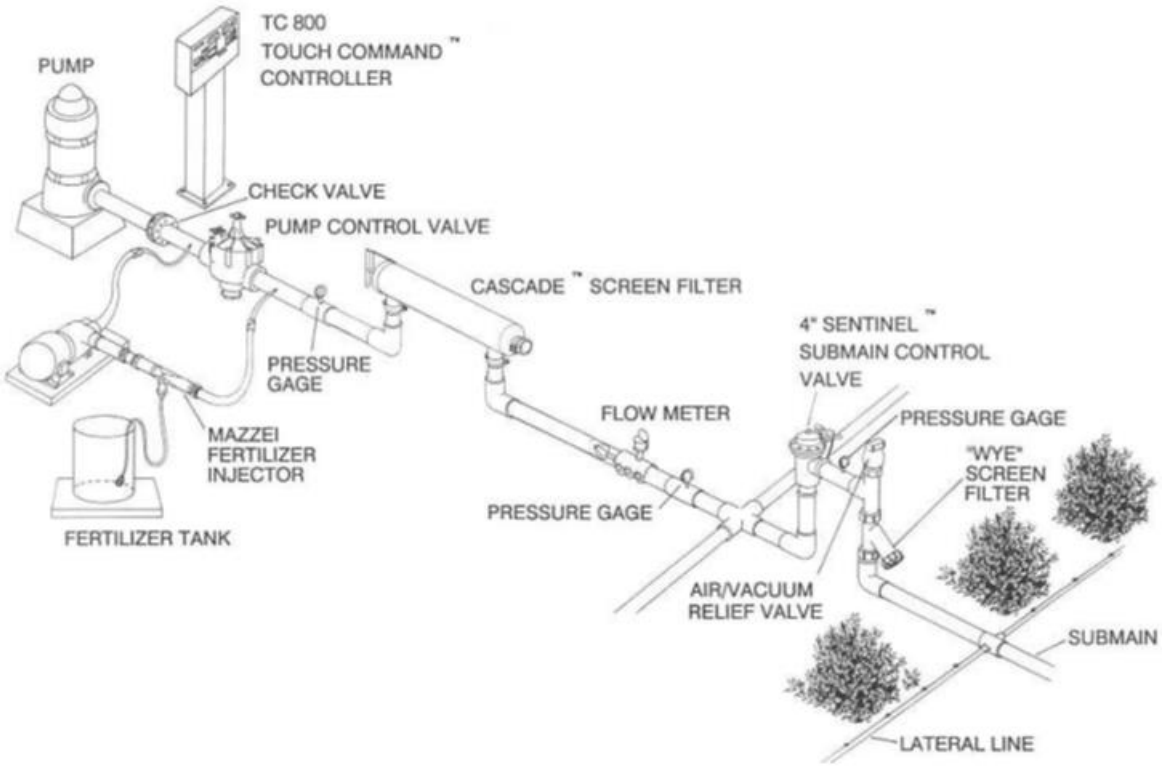

Fig 3. Commercial Drip Irrigation System Layout [4]

Through drip irrigation, farmers can control the timing and water discharge rate and supply only as much water as a crop requires. Drip irrigation can decrease the water requirement by as much as 60 per cent and increase crop yielding by 90 per cent, compared to the conventional (surface) irrigation method but the main problem for this system is the high initial cost of the setup. Recently engineers at the **Massachusetts Institute of Technology** (MIT), led by Amos Winter, an assistant professor of mechanical engineering, optimized the drippers (reduce the pressure requirement), reduce the price of the solar-powered drip system by half which decrease the pumping power requirement (main cost) by half for irrigation that lower the energy bill for farmers with the same amount of water delivery. Through the modification of system upstream, filters, solar power system, pumps and tubing to finally develop drip irrigation system affordable for farmers in the world. The number of farmers in a developing country like India generates only a few hundred dollars per year, so this modification research in the drip irrigation system makes it affordable and also increase the yield and income of the farmers. Farmer in developing countries in the world like as India, for agriculture mainly use flood irrigation to grow the crop, due to this method is inexpensive but this method has little control of water supply over when and how much water needs to their crops, this is inefficient method as large amount of water evaporates or drains away from fields [5].

B. Design Modification of Dripper Reduce Half of the Expenses of Conventional Drip Irrigation

The most conventional drip irrigation system requires at least 1 bar pressure for operation, to maintain this pressure continuously require energy, which plays a major role in the expense in off-grid drip irrigation systems and the on-grid primary recurring expense in the systems. Shamshery and Winter targeted to develop pressure-compensating drippers which operated at 0.1 bar pressure that is one-tenth pressure of the commercial systems. This decrement in the pressure requirement decreases the power requirement for the water pump in the drippers and the capital expense of an off-grid drip system. They develop the model for conventional pressure-compensating dripper in MATLAB and generate the numerical computing program that find the dimension change behaviour of the model and Shamshery did a study of the dynamic behaviour of the water flow through the dripper model. And got the mathematical explanation of the dripper interior features affects during fluid flow and also the effect of water pressure. After simulation with different parameters of drippers with a continuous feedback system, they discarded those dimensions which produce an undesirable effect on water pressure. They develop new drippers design (new geometry) that generate the optimal flow rate with a low-pressure initial pressure requirement (0.15bar). Simulation results were validated by prototype testing which matched their simulation results [5].

III. RESULTS AND DISCUSSION

Agriculture is widely used in India almost largest livelihood depends on it and their contribution has a significant figure in GDP. Agriculture practice in India is unknown strength of Indians, here millions of people are involved in agriculture that is the largest private enterprise in India. Many revolutions came in India to increase their yielding like Green Revolution reforms have been taken to increase for expansion of farming areas, double-cropping system, using seeds with improved genetics**.** Green Revolutions make a substantial change in Agriculture

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practice by using high yielding variety (HYV) seeds, tractors, irrigation facilities, pesticides, and fertilizers. Conventionally, surface irrigation is most popular and widely used in India but nowadays drip irrigation is very popular to save water and nutrient by suppling it more effectively to the root of crops. But the problems are that the initial cost and service charge (irrigation power requirement) is high so their Design modification of dripper reduces half of the expenses of conventional drip irrigations which make drip irrigation more affordable and efficient for developing countries farmers in the world.

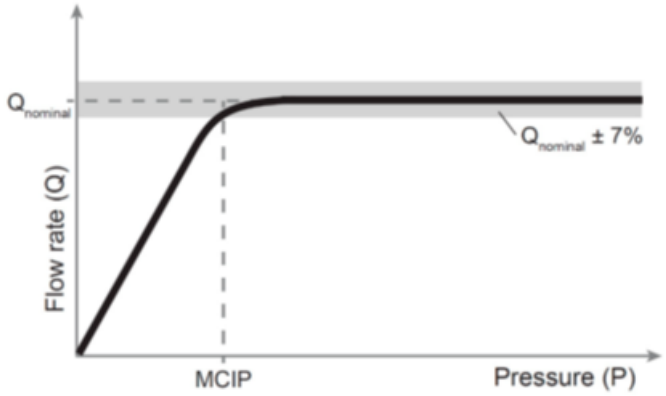

Fig 4. Graphical representation for flow rate Vs water pressure at the emitter inlet for pressure-compensating (PC) emitters [10]

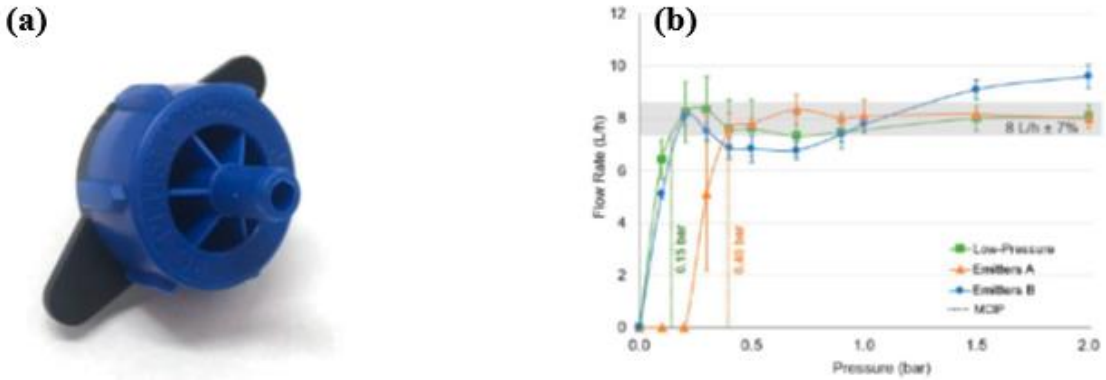

Fig 5. (a) Photograph of the low-pressure emitter. (b) Characteristic curves for low-pressure and conventional emitters used in field trials [10].

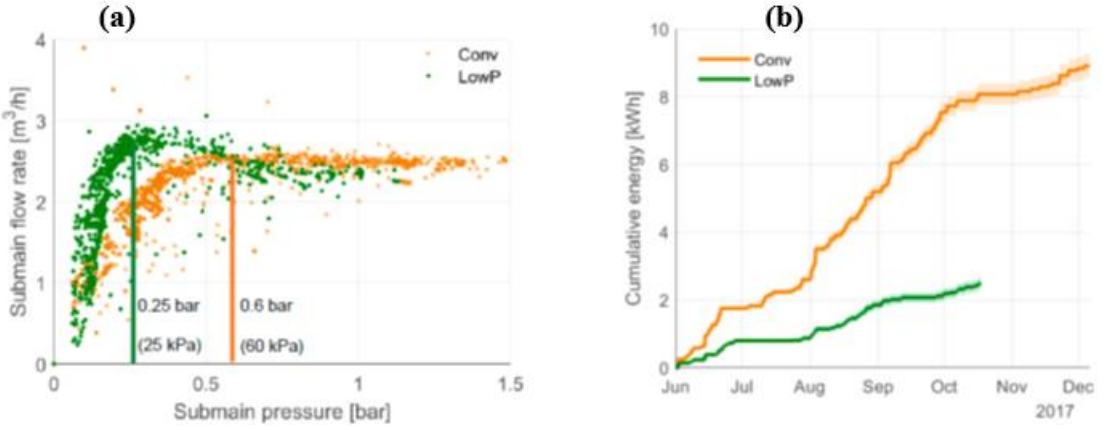

Fig 6. (a) Plot of Submain flow rate over submain pressure for both Conv. (conventional) and LowP (low-pressure) emitters. for pipes supplying both low-pressure (LowP) and conventional (Conv) emitter plots. All recorded data points are plotted (b) Cumulative hydraulic energy Vs during irrigation period for Conv. And LowP [10].

A low-pressure water delivery emitter reduces both the capital and operational charge of drip systems. A large amount of pressure losses occurs mainly in the PC (Pressure - Compensating) emitters [10] which makes the constant discharge rate even in the changing of the water pressure or pressure is more than the MCIP (Minimum Compensating Inlet Pressure). Significant reducing the MCIP of PC emitters reduce the pump capacity so power requirement also decreases that leading to a decrease in the initial cost of the

pump and also decreasing the cost for power supply of recurring electricity or off-grid systems [10].

IV. CONCLUSION

Green Revolutions make a substantial change in Agriculture practice by using high yielding variety (HYV) seeds, tractors, irrigation facilities, pesticides, and fertilizers. Conventionally, surface irrigation is most popular and widely used in India but nowadays drip irrigation is very popular to save water and nutrient by suppling it more effectively to the root of crops. To overcome the problem of the capital cost of the pump and power supply requirement by Design modification of dripper reduce half of the expenses of conventional drip irrigations which make the drip irrigation more affordable and efficient for developing countries farmers in the world. A low-pressure water delivery emitter reduces both the capital and operational charge of drip systems.

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