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Success or Failure?

Innovations, the Jain Irrigation way

Jain Irrigation has come up with solutions to overcome farming woes



The biggest demand the agriculture sector faces right now is how to maximize productivity, ensure nutrition security, reduce carbon footprint and be more climate-resilient. All these are embedded in the Water-Food-Energy Security nexus. And, climate change is hitting this hard. Untimely rains, heat waves, temperature variations, cold waves, drought and methane (GHG) emissions from farms are affecting Farmers' incomes resulting in agriculture becoming unsustainable.

Jain Irrigation has developed "Innovative Technologies, Products and Solutions For Crops" to overcome the impact of climate change and nature's vagaries.

No more terminal heat stresses in wheat: Global climate models predict an increase in mean ambient temperatures of 1.8-5.8oC by the end of this century (IPCC, 2007). This heat load is already in place and greater variability in temperature and increased frequency of hot days are occurring now.

Wheat is sensitive to high temperatures. Wheat experiences heat stress to varying degrees at different phenological stages, but heat stress during the reproductive phase is more harmful than during the vegetative phase due to the direct effect on grain number

and dry weight. The optimum temperature for wheat anthesis and grain filling is 12-22oC. Any increase in temperature above this during the grain-fill duration results in yield loss, due to low grain fill and higher unfilled grain (chaff).

The solutions developed and validated by Jain Irrigation are creating a required micro-climate – at field level, by cooling the near atmosphere of the wheat by a specially designed RainPort sprinkler system. Besides, these systems also provided soil moisture for wheat growth.

This simple innovation would be of great impact, if adopted on a large scale. This intervention developed by Jain Irrigation helps in achieving food security of the country Let us say: 'heat stress; no more stealing the bread'.

Rice with drops of water!: As most fresh water is utilised for irrigation (69 per cent globally and 82 per cent in India); progressive water scarcity will affect agriculture production; eventually affecting food security. Rice is the giant crop in terms of field water consumption. Also, it is the growing of this crop in standing water that results in a major global warming factor; the methane emission, one of the GHG. Of the total 17.6 percent GHG emission by agriculture,

20.9 percent is from rice cultivation. But both these negative issues would not stop the preference of rice as a primary food. Hence, the Jain Irrigation team has come up with technological solutions to solve these issues.

Irrigating rice crops with drip-fertigation technology could result in reducing water consumption, as well as nullifying methane emission. It also increases rice productivity and maintains soil health.

Over the last decade, Jain Irrigation has standardized the technology package for growing rice with 'drip irrigation-assisted precision farming' method. The technological might of the company proved that:

- Rice can be grown without it standing in water in the field, by just satisfying the crop evapotranspiration, as is the case with all other crops.



- The water consumption of rice can be brought down by 50-58 per cent still producing very high grain yields.
- This technology is successful in all rice growing ecologies.

The innovative crop growing package includes germination irrigation, ETP based drip irrigation and soil test-based fertigation and an effective weed management method.

This indeed is sustainable rice production! On an average, 25-35 per cent more rice is produced in drip method, with just 48-52 per cent of water and 48 per cent of power of the conventional flood method. The water productivity of rice improved from 0.13 kg/ m3 to

0.62 kg/ m3.

This innovation achieves food security without harming the environment and exhausting the resources; and climate-neutral crop production ensures food security.

JISL has developed a system of climate-neutral cultivation of black pepper -- for mass cultivation in areas where black pepper could not be grown traditionally. The areas suitable to grow pepper in India are reducing due to climate change. JISL's climate-neutral black pepper cultivation system enables farmers to take up cultivation in any region. The innovative technology commenced with the objective of enhancing productivity where farmers can reap harvests of 2.5-3 tonnes/acre. It helps in improving quality of the produce, reducing pest and disease incidence and ultimately to develop and standardize the package of practices that can suit even off-season cultivation.

What it means to farmers:

Farmers can grow most of the crops irrespective of climate vagaries. Their yield per unit area has been increased by 4-6 times over conventional methods. They get better quality products, free from chemicals and pesticide residue. And the growing system is amenable to automation to reduce human dependence. Last but not the least, he gets tools and solutions to fight issues he is facing due to climate change.

Precision Farming:

Irrigation decision tools boil down to two key questions: "when and how much?". An irrigator wants to know when to water and how much water to apply to the crop. "Jain Logic" is an application developed to precisely answer





Rice with drip

these questions. Jain Logic is an amalgam of Digital - Tech Solutions created to fulfill precision agriculture and irrigation management requirements. It includes monitoring and control devices, software applications and real time analytical intelligence and prediction analysis for decision support systems.

A soil moisture probe is deployed to give the grower insight into the application of water and nutrients throughout the profile. The interpretation and presentation of that data determine the level of success in answering those two questions. With the increasing availability of machine learning and predictive analytics, we are able to use existing data to offer better answers.

Over application of fertilizers is one of the major pain points Agriculture is facing. It impacts the crop economy in multiple ways, due to over application of fertilizers, soil health is degrading, leached fertilizers further contaminates the ground water sources, costly fertilizer goes waste, fertilizer resources are depleting very fast. Jain Irrigation has developed an advanced fertigation machine "Jain Nutricare" that helps to apply fertilizers precisely and in the right proportions. It monitors the EC and pH of the fertilizer laden solution to maintain the right pH value so that plant roots can easily absorb the fertilizers and at the same time it controls the EC levels so that the osmotic pressure difference is not decreased beyond limit.

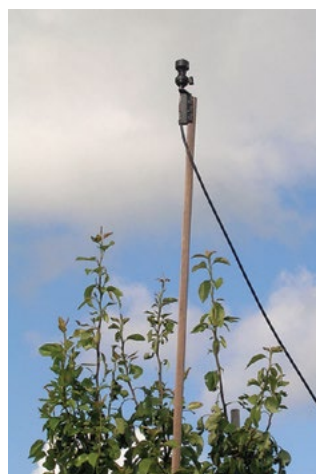
Future Farming: Aeroponics as a tool to mitigate climate change
The Aeroponic system is one of the modern techniques of

the soilless culture, where the plant grows in the air with the assistance of artificial support instead of soil or substrate culture. It is an air-water plant growing technique where lower portions such as the roots of the plant are hung inside the growth chamber under complete darkness in controlled conditions. In the system, plant roots are openly exposed in the air and directly irrigated with a small droplet size of the water nutrient at interval basis. It could be set up in any place, a building that has lifted the global climate without considering the current climate such as the rainy season and winter.

Standard cultivation



Potato grown with aeroponic system



Crop Cooling

methods increase greenhouse gasses, contribute to land degradation, and decrease biodiversity. According to CGIAR, 20% of global land is being lost and cultivation is responsible for 30% of greenhouse gas emissions worldwide. Change is the need of the hour and Aeroponics is one of the emerging tools to tackle climate change.

With Aeroponics, a grower can take the exact same seed from the field and grow it in half the time than a traditional field farmer, leading to 390 times more productivity per square foot when compared to



Ultra Low energy drip at Punjab

a commercial field farm. Moreover, water usage is cut by 95 per cent from traditional field farming. Further, without the sun, precise LEDs are used to display the perfect light for photosynthesis for each species of plant. Frequency, light intensity, and wave spectrum are all carefully calculated and provided for optimum growth of the tubers.

Jain Irrigation Systems Limited, Jalgaon (JISL) has developed a unique seven tier production method that ensures disease-free, genetically pure, true to type, high yielding, uniform sized potato seed tubers.

Climate factor	Issues	Jain Irrigations Solutions
Heat waves	Terminal heat stress during the grain filling period affects grain formation & yields drop up to 30%	<ul style="list-style-type: none"> Especially designed sprinklers to be operated to control heat stress at the hottest part of the day during grain maturity.
Cold Waves (Frost)	Sudden cold waves or black frost freezes the sap flow and crop burning occurs.	<ul style="list-style-type: none"> Innovative Micro/mini Sprinkler with fully automated system equipped with frost sensor to be operated to warm up the crop area at the coldest pre-morning hours
High Temperature stress	<ul style="list-style-type: none"> Cracking of fruits Crop yield decreases, Discoloration of fruits 	<ul style="list-style-type: none"> Mini Sprinkler System to be used for evaporative cooling during fruit development stages
Global Warming (Especially through crop irrigated with flood irrigation or requires standing water)	Methane emission(GHG)	<ul style="list-style-type: none"> Adoption of drip irrigation even for the crops presumed to require standing water e.g. rice
Sudden climatic fluctuations	Crop yield decreases	<ul style="list-style-type: none"> Developed Climate Neutral cultivation practices using which farmer can grow most of the crops commercially anywhere in the tropics and subtropics by climate proofing methods
Prolonged dry spells (rain breaks) during monsoon	Decrease in crop yield or entire crop loss due to non-availability of soil moisture at critical periods of growth.	<ul style="list-style-type: none"> Developed package and practices for survival irrigation which uses portable irrigation sets. Use of drip irrigation also helps to ameliorate intermittent dry spells.
Droughts	Crop loss, decrease in yield	<ul style="list-style-type: none"> Developed drought tolerant varieties. Developed package and practices for crop survival during drought periods.
Higher energy consumption in agriculture is an indirect factor responsible for climate change	High energy cost to the user and governments and impacts the environment	<ul style="list-style-type: none"> Developed drip irrigation system which can perform at very low pressure, as low as 0.1 kg/cm², that reduces energy consumption. Developed Solar powered drip irrigation system. Developed Agro-photovoltaic system.
Soil Degradation	Overuse of water and fertilizers degrades the soil	<ul style="list-style-type: none"> Digi-tech solution "Jain Logic" which helps to optimize irrigation according to soil moisture. Advance fertigation machines which ensures maximum efficiency by monitoring EC and pH during fertigation