

JAIN-CLIMATE SMART AGRICULTURAL SOLUTIONS

To Negate Terminal Heat Stress Impact in Wheat Adopt Jain Crop Cooling Technology

Background:

Global climate models predict an increase in mean ambient temperatures between 2.5 to 4.0°C by the end of this century (IPCC, AR6). Climate is already affected by greater variability in temperature and increased frequency of hot days. There are different types of manifestations of this elevated heat on crops.

The terminal heat stress that is found to occur in wheat in northern states of India during the grain filling stage (in March) results in poor grain filling. Lost of yield is one such serious impact of heat stress on crop production.

Challenges:

Wheat is very sensitive to high temperature. Wheat experiences heat stress to varying degrees at different phenological stages. 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. End-of-season or ‘terminal’ heat stress is also likely to increase for wheat in the near future.

The optimum temperature for wheat anthesis and grain filling ranges from 12 to 22°C. Any increase in temperature above this range during the grain filling results in yield loss due to low grain filling and small grains. On a macro scale it is reported that yield losses up to 12-16 million ton during a wheat season in India.

Temperatures above the optimum for growth can be deleterious, causing injury or irreversible damage, which is generally called “heat stress”.

Heat stress is a function of the magnitude and rate of temperature increase, as well as the duration of exposure to the raised temperature.

Solution: Resilience through Climate Smart technologies

Jain Irrigation offers not only irrigation and crop production technologies to the farmers, it has over a period of time studied the damaging effects of different weather variables like heat (high temperature) or frost (low temperature) on different crops. The experts of the company then offer field applicable low- input technologies to continue crop production in such deleterious effects on the crop due to climate change. One such technological intervention is the field methodology developed to reduce the heat stress damage that occurs in wheat crop during the grain filling period.

While plant breeders are taking this aspect of heat stress into consideration for breeding to produce heat tolerant wheat varieties; one of the agronomic option we have tried and found working at micro level (field level) is cooling of the wheat panicles by micro/mini sprinkler. Besides, these sprinklers also provided soil moisture for wheat growth.

The principle of cooling as a result of evaporation is utilised in this innovative technology.

The following results (from Yamuna Nagar, Haryana) clearly demonstrate the impact of this innovation. On an average the Rainport/mini sprinkler plots had up to 6°C lower temperature just above the canopy compared to the controlled field of wheat crop.

Sr. No.	Particulars	Wheat crop canopy cooling by Jain Rainport system	Flood irrigated conventional crop
1	No. of tillers per plant	9-16	4-9
2	No. of Spikelets per tiller	48-65	35-44
3	No. of Grain per spike lets	55-62	25-38
4	Weight of 100 grain (g)	4.71	3.02
5	Yield (t/acre)	1.8	1.46



Fig. Rainport/ micro sprinkler installed at panicle level to help reduce ambient temperature around the panicle.

During the grain filling period in March as ambient temperature increases, these special mini/micro sprinkler system is used to apply several short pulses (1-2 minutes duration) of sprinkling water into the atmosphere close to the panicles. The operation of these pulse sprinkling is restricted to the peak ambient heat period-12.30 pm to 4.30 pm. The ambient atmosphere cools around the panicle upto 6°C enough to reduce the heat stress during grain filling stage. However this depends on other climatic conditions like humidity & wind velocity etc...

Considering the enormity of grain loss and negative impact of heat stress and the time it may take for plant breeders to come up with heat tolerant wheat varieties this simple innovation would be of great impact if adopted at a large scale. The current loss due to terminal heat stress (12-16 million ton) could be partially recovered by cooling the near canopy during grain filling stage.

Crop yields depend on climate, soil, and management and therefore can't be guaranteed by the company.

JAIN CROP COOLING TECHNOLOGY



ACURAIN - 5022 SD-U

Specifications

Discharges	: 310-800 lph
Diameter	: 18 m to 23 m
Recommended Pressure	: 1.5 kg/cm ² to 4 kg/cm ²
Inlet Connection	: 1/2" male threaded.
Operating Pressure	: 3 kg/cm ² to 5 kg/cm ² (For flow Regulator option)

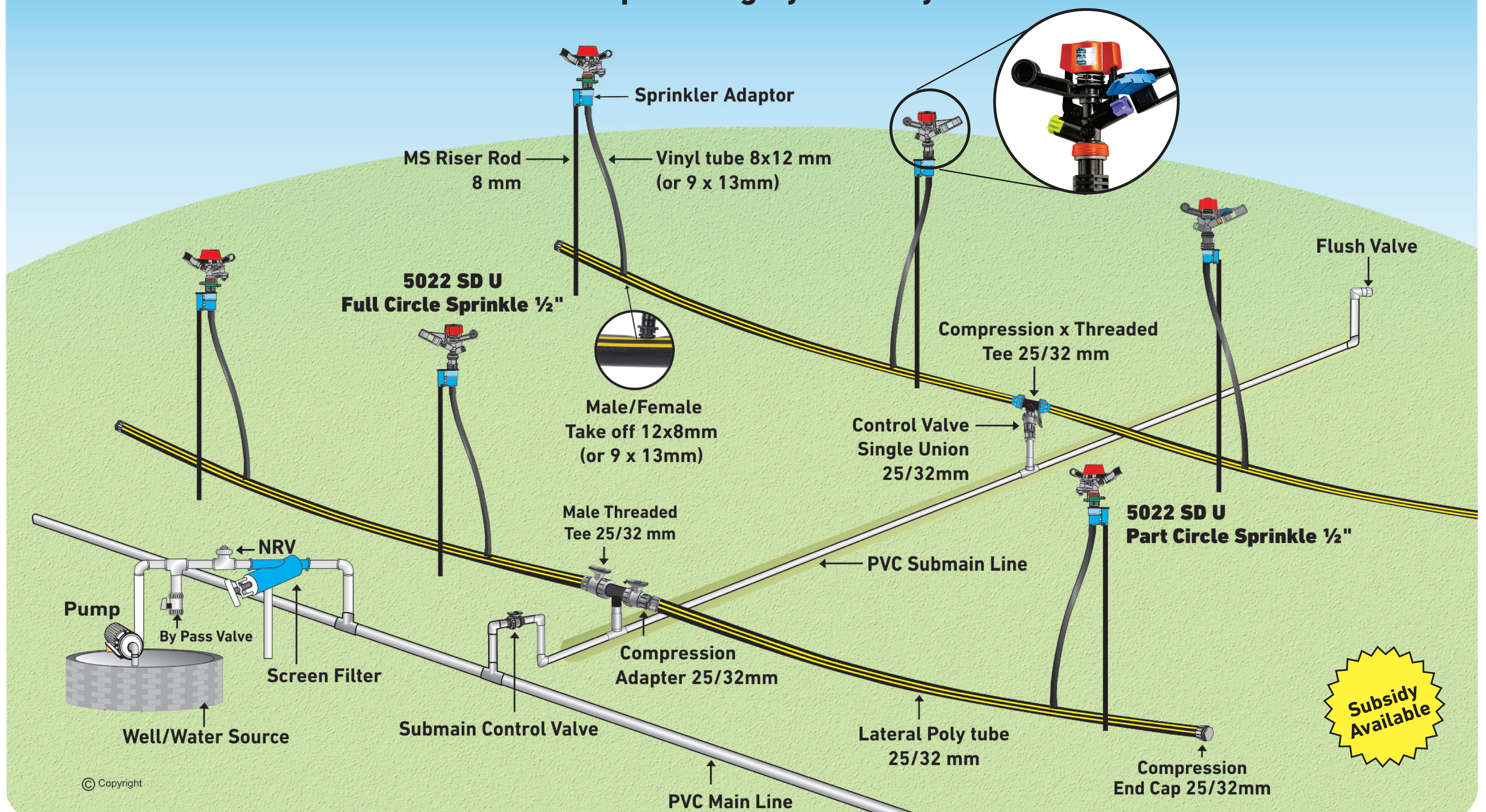
Jain Crop Cooling Technology - Benefits

- The innovative concept & technology developed by Jain Irrigation efficiently negates the impacts & heat stress in Wheat.
- Apart from crop cooling the mini sprinkler system can be used to do irrigation.
- The technology not only saves crops but also increases the productivity.
- To negate the impact of terminal heat stress in wheat, farmers in South Haryana / Punjab are using Jain Crop Cooling Technology.
- Jain Crop Cooling Technology; Acurain - Mini Sprinklers are saviors for Wheat.

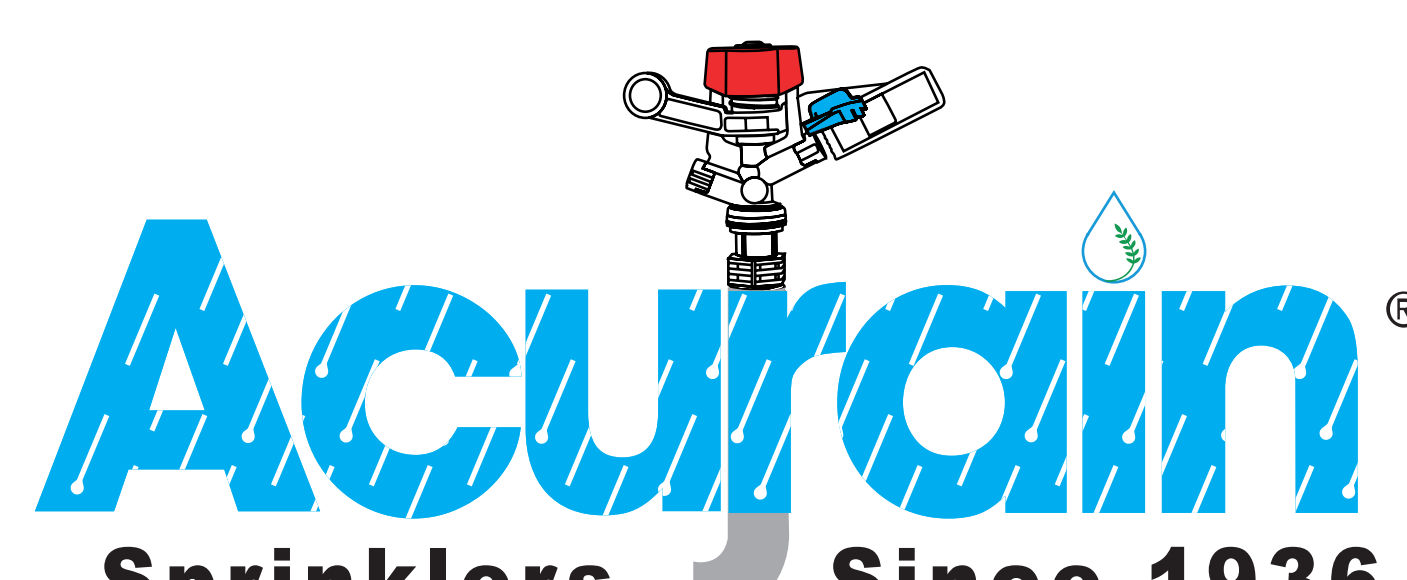
Jain Mini Sprinkler for Crop Cooling - Application

- The height of the sprinkler riser should be such that the sprinklers will deliver the spray of water just above the panicles of wheat so that the desired cooling effect is obtained.
- Mini Sprinkler crop cooling system should be used in pulsating pattern - Sprinklers should be operated after every 15 minutes for 2 minutes to get optimum results.
- Note : During the anthesis stage in wheat, the sprinkler irrigation should be suspended for a period of 3 - 7 days to allow pollination to occur.

Jain Crop Cooling System Layout



Subsidy Available



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