Journal of Pharmacognosy and Phytochemistry 2019; 8(5): 1947-1948

Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2019; 8(5): 1947-1948
Received: 23-07-2019
Accepted: 27-08-2019

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*Short communication*

# Need for Irrigation system design in Direct seeded rice technology

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## Introduction

In pursuit of saving of water, new technology of rice crop establishment i.e. Direct Seeded Rice (DSR) has been introduced in the states like Haryana and Punjab. The change in crop sowing/planting/establishment technique must be coupled with proper irrigation system design in this case to harness the full potential of the technology.

It has generally been experienced especially in North West India that the farmers irrigate the DSR crop in a full one acre block at a single time. Some farmers (very few) who divide the one acre in two blocks have been found irrigating the second block while passing the water through the first block even after the irrigation in first block has been completed. This leads to deep percolation from the first block continuously till the irrigation is continued in the second block. The practice would have been suitable in case of puddled rice because the percolation is checked due to puddling. In puddled fields, the water application at the head end and the tail end would be same due to the impervious layer which blocks the higher infiltration amount at the head end. But in DSR, the field should be irrigated like any close growing upland crop for example wheat through border irrigation system while conventionally grown transplanted rice is irrigated through check basin irrigation system. To apply the suitably designed irrigation system, the bunds have to be made at specified distance in the field. The old practice of irrigation (in puddled rice) is one of the reasons not to provide bunds in the field of rice (DSR). To minimize the deep percolation losses and/or increase the water application efficiency it is necessary to suitably design the new irrigation system. The designing involves the determination of proper length, breadth/stream size according to the soil type, slope conditions and the machinery width. Mostly the research works done on water saving in DSR have been carried out in small experimental plots in which the irrigation efficiency in DSR crop is higher than that can be achieved at a commercial field. This is due to the lower water application efficiency in comparatively bigger plots. Yadav *et al*. (2010) [5] also studied the water balance in plots of 9 X 7 m size which is comparatively smaller. Numerous scientists have worked on surface irrigation design and they have proved that a suitably designed irrigation system has the potential to save irrigation water.

Sometimes when there is power failure while irrigation is continuing in DSR fields and if the irrigation system is not properly designed (there are no bunds within the field) then there is huge water loss in terms of deep percolation from the portion of the land which has already been irrigated and the water has to move through that same portion next time when the power is on again. This situation is very common in our country. The power failure does not affect the puddled fields after the transplanting due to the presence of hard pan in the soil. The water moves on the surface of standing water and it is distributed uniformly in the field in the puddled soils. However, if there is power failure during irrigating the fields for puddling then there are huge water losses because puddling requires a lot of water and at that time there is no impermeable layer in soil to restrict the penetration of water into deeper soils. It has been observed that the puddling requires 6 to 8 hours irrigation on an average considering the pump sizes of the farmers. There are a lot of chances of power failure in between the irrigation. There are many farmers (areas) who face this problem regularly. The switching to DSR can avoid this problem. Now, if couple three things together 1) there are chances of more percolation losses from a DSR field due to absence of hard pan in the soil 2) suitably designed irrigation system has the potential to uitilize water efficiently by reducing the percolation losses 3) power failure while irrigating the fields is a common phenomenon, we find that the irrigation system should be designed properly in DSR crop to make it water efficient.

There are defined guidelines available about how to design the surface irrigation system. Walker (1989) [4] proposed the surface irrigation design, a trial and error procedure by which a selection of lengths, slopes, field inflow rates and cutoff times can be made that will maximize application efficiency. Considerations such as erosion and water supply limitations will act as constraints on the design procedures. Many fields will require a subdivision to utilize optimally the total flow available. This remains a judgement that the designer is left to make after weighing all other factors that he feels are relevant to the successful operation of the system. Maximum application efficiencies, the implicit goal of design, will occur when the least watered areas of the field are just refilled. Deep percolation will be minimized by minimizing differences in intake opportunity time, and then terminating the inflow on time also the surface runoff is controlled or reused. Khanjani and Barani (1999) [2] concluded that it is possible to select a suitable combination of the border system's parameters (border's length, inflow rate, and cutoff time) to obtain maximum application efficiency. Michael (1983) [3] suggested different border lengths ranging from 60 m (sandy soils) to 300 m (clay soils) according to soil types and slope. He also suggested suitable width of the borders according to soil types and irrigation stream available. He suggested 10-15 LPS per meter of border width and 2-4 LPS per meter of border width stream size for sandy and clay soils respectively. Aggarwal *et al*. (2007) [1] concluded that accurate design and high quality optimization of the border irrigation system is necessary for efficient and judicious use of water resources.

The irrigation system can be designed with simple infiltration experiments and drawing opportunity- time curves for different soils and other factors combinations. The practice of not doing partition in DSR fields is attributed to the old practice of irrigation in rice, cost involved in making bunds, land wastage due to formation of channels and bunds and the extra care/ labour requirement in diverting the water to different blocks while irrigating the fields. Bunding may also increase the time required in sowing operation due to hindrance posed by bunds in the machinery movement. Therefore, the other factors (cost, land wastage, labour requirement, machinery hindrance etc.) associated with bunding may be the constraints in this. The bunding requires additional research regarding the size (height) of bund. The height of bunding is a compromise between the aspect of trapping rainfall and machinery movement. Therefore, detailed studies are necessary to analyze the economic performance of DSR relating to these issues.

Coming to the most important issue about irrigation system design, the system design must be compatible to the other crops also in the cropping pattern. So that there is no need to dismantle and form the bunds again and again which would save machinery, time, fuel, energy, money and environment. This type of system design is a cumbersome process but will help saving in resources. For example, in North West India the conventional rice-wheat cropping system is grown in two contrasting irrigation methods where wheat is grown through border irrigation method and rice is grown through check basin irrigation method. The bunds are formed in wheat (border irrigation) but then dismantled in rice (check basin irrigation) and then again formed in wheat. But with the advent of DSR technology, the bunds once formed may be used throughout the cropping pattern (wheat as well as rice).

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