



Research Article

INNOVATIVE AND MODIFIED RIDGE-FURROW IRRIGATION SYSTEM IN MALWA REGION

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Abstract: In a study conducted during 2017-18, a comparative evaluation between traditional ridge-furrow irrigation system and modified irrigation practices was made. It was observed that innovative practices like PVC pipe with taps & valves and flexible rubber pipe with holes not only match with the costly micro irrigation system (drip, trickle irrigation) but also helpful in controlling water movement in the furrow, increasing time of concentration, providing uniform soil moisture profile throughout the furrow and in avoiding the over irrigation with lesser time and labour requirement in comparison to traditional ridge-furrow irrigation system. At the same time, these practices are having higher distribution efficiency as water in the furrow covering higher number of furrows simultaneously.

Keywords: Ridge-furrow system, Innovative approach, Irrigation water management

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Introduction

As we are celebrating 'world water day' 2019 with the theme '*Leaving No One Behind*'. It motivates us to rethink about irrigation practices which are more water consuming. Now a days about 80% the farmers irrigate their soil by using flood irrigation system [1]. Water use efficiency indicates that India uses 2-3 times more water than major agricultural countries like China, Brazil and the US to produce one unit of food crop [2]. NITI Aayog's report (2018) on 'composite water management index' also underlined the depressing state of water stress, hence efficient and innovative irrigation system is needed. In Malwa region of Madhya Pradesh, ridge-furrow irrigation system is the traditional irrigation system for vegetable crops. Ridge Furrow is the best planting method; however, this practice is time and labour consuming as physical presence in the field required throughout the irrigation process [3]. Irrigation variables (inflow discharge, furrow length and time of irrigation cutoff) affect the performance of furrow irrigation systems [4-6]. Holzapfel Eduardo, *et al.*, (2010) [4] Suggested the design criteria for furrow irrigation management, but practically movement of water in furrow are found to be non-uniform, resulting over irrigation of the furrow. In the study area, it is observed that water availability is increased due to Narmada-Kshipra Link Project [7]. Since there is hypothesis that the farmers over irrigate their field if sufficient water is available. Therefore, it is essential to introduce efficient, effective cheaper and labour-time saving techniques for irrigation. Similarly use of drip irrigation system have been advocated by different research workers from time to time [8,9]. However, this micro irrigation system is relatively costlier [10] and not user friendly and farmers opt for the traditional irrigation practices instead for irrigating different crops. Thus, a suitable and alternative irrigation practice is required to enhance the efficiency in comparison to traditional irrigation practices, to match the costly micro irrigation system. With this idea and objectives in view, the present study was carried out to compare the traditional ridge-furrow irrigation system with few innovative and cheaper ridge-furrow irrigation techniques adopted by few farmers in consultation with the team of All India Coordinated Research Project for Dry land Agriculture, College of Agriculture Indore.

Material and Methods:

The study was carried out in different villages of Malwa region namely Jalod keu and Jani of Indore district (N-22° 47.717', E-76° 03 .680'). In these villages it has been observed that due to an ambitious and important project of linking Narmada-Kshipra river (Feb 2014) water availability has been increased appreciably. Similarly, due to construction of stop dam near these villages in Kshipra river almost throughout the year water is stored in the nearby river portion. This not only increased the surface water but also ground water recharge insured the irrigation water throughout the year. Thus, many traditional irrigation systems have been widely practiced by the farmers (Prajapati, J.R. and Suryanarayana, T.M.V., 2014) However, few innovative and cost-effective irrigation systems by modifying existing traditional system have been adopted in consultation with the project team. A comparative study has been made on these practices and documented here.

Result and Discussion:

Efficient water management

There is a hypothesis that due to enhanced water availability the farmers do not use the irrigation water judiciously but over irrigate their fields and waste the precious water. On the other hand, however, in these two villages, it has been observed that the farmers not only converted their fields into terraced field but also made provision to save their fields from the losses due to runoff during monsoon season. The already eroded fields are now converted into levelled field after spreading excavated soil from other areas. Similarly, underground pipelines are laid from water source to cultivated fields to reduce the water conveyance losses. This has to reduce appreciable amount of water losses and enhance the water availability in the field.

Innovative irrigation practices

Normally with the enhanced water availability, the farmers are advised to adopt micro irrigation system for irrigation for efficient and judicious use of the precious water.

Table-1 Comparison between traditional and innovative irrigation practice

Particular	Traditional Ridge-Furrow system	PVC pipe with tap and valves	Flexible rubber pipe with holes
Delivery of water	Channel on upper portion	PVC pipe with tap and valves	Flexible rubber pipe with holes
Distribution efficiency	Less	Higher	Higher
Labour required	Continuous monitoring and opening-closing	Not required	Not required
Number of furrows irrigated simultaneously	04-May	20	20
Erosion losses	Possible due to uncontrolled movement	NIL	NIL
Over irrigation	Always possible	Not possible	Not possible
Water movement in the furrow	Moves like flood irrigation	Trickle down the slope	Trickle down the slope
Tools required	Spade, pickaxe	Not required	Not required
Time of concentration	Less	More	More
Soil moisture profile	Non uniform	uniform	uniform
Regulating irrigation	Manually using Spade, pickaxe	Through tap and valves	Through cotton strip
Irrigation system	Flood/wild	Micro irrigation	Micro irrigation

However, in practice most of the farmers do not adopt the micro irrigation system, as these are not only costly but also tedious and difficult in handling. Instead, most of the farmers adopt traditional system of irrigation viz. border and ridge-furrow with flood irrigation system. However, few of the farmers are adopting innovative and cheaper irrigation practices as an alternative to micro irrigation system.

Traditional Ridge-Furrow system- In this region village Jalod keu and Jani the farmers are growing wheat and chick pea after soybean and even potato, onion, garlic etc after *rabi* season farmers also growing vegetables during summer season due to enhanced water availability of surface and ground water for irrigation because of Narmada-Kshipra link project. Normally for growing vegetables during *rabi* and summer season ridge furrow system is adopted for growing and irrigating the crops. In ridge furrow system, 15cm high ridges are formed alternately with 15cm wide furrow in between in the entire cultivated field. Planting is done on the ridges manually and irrigation is provided through these furrows by diverting irrigation water through a channel form on the upper portion of the field. For diverting and irrigating 5-10 furrow lines simultaneously the water is diverted manually by closing main opening by using spad manually. Thus, irrigating ridge furrow requires continuous monitoring and labour and its laborious and time-consuming job. If proper attention is not given over irrigation is possible and even excess water moves out of the field without any use.

Innovative ridge-furrow irrigation using PVC pipe

Shri Surendra Rathore of village Jalod Keu are adopting effective, efficient and cheaper irrigation system for irrigating vegetable crops in ridge furrow system. In ridge furrow system planting is done traditionally. However, for irrigating the crops instead of providing a channel on the upper portion for water flow, a PVC pipe of 10 cm diameter and 6-meter-long pipe is used. In this pipe at a regular interval of 30cm, 20 plastic taps of 12mm diameter and 50mm long are provided with provision of valves for opening and closing the taps. The end of the pipe is closed providing a end plug and to build up the pressure for delivery from these taps. After laying, the pipe on the upper portion of ridge furrow system irrigation, water is provided in the pipe by connecting it from the water source. After flowing the water in the pipe, the all-20 taps are opened to deliver the water in each furrow with uniform discharge. The water slowly moves down through the furrow and irrigate entire length very effectively and efficiently. Thus, the entire 6-meter width is covered simultaneously. The advantage of the system is that continuous monitoring, attention and physical presence is not required in the field instead the farmer can regulate the flow in the furrow system using tap valves. This way he can estimate the required to complete the irrigation by judging and monitoring the movement of water in the furrows. Thus, he can use this time for carrying out other essential work. Practically in this ridge furrow system, more time is required for irrigating first time as the soil is dried. In the subsequent irrigation gradually, lesser time is required because due to moist soil layers the rate of water advancement is increase. This way farmer can calculate the time required to complete the irrigation process every time and therefore he need not to be in the field all the time for managing irrigation due to this arrangement even mechanical tool like spade and pickaxe are not required for closing and opening the movement of water in the furrow.

Use of flexible rubber pipe for ridge furrow irrigation system

Shri Omprakash Patel of village Jani of Indore district is also using a safe, efficient, effective and low-cost innovative irrigation practice for cultivating vegetable crops. In this system at the upper side of the ridge furrow system a flexible rubber pipe of 10cm diameter is laid. At a distance of 30cm, the holes of 5mm are provided by using scissor continuously in the 6m pipe. The end of this pipe is closed by using a rope and water is provided from the water source through the other end of the flexible pipe using PVC pipe. From these holes in flexible pipe, the irrigation water moves down the slow after irrigating the entire furrow simultaneously and uniformly. To control and regulate the flow from each hole a cotton strip is tied so that the all the holes deliver same amount of water in each furrow. This way 20 furrows are irrigated simultaneously. So, it can be suggested that instead of using costly micro irrigation system. The available pipe (PVC and flexible rubber) can be provided with tap and valves or holes at regular interval to allow the irrigation in 6m wide ridge and furrow system uniformly. These systems not required continuous monitoring and physical presence in the field. While adopting these innovative irrigation practices and even for restricting wastage of water and over irrigation.

Conclusion

From the above study, it is concluded that despite increased water availability the farmers are using innovative and cheaper irrigation system for efficient utilization of precious water. Thus, the hypothesis that the farmers waste the water if enhanced irrigation water is available, prove to be wrong. These innovative practices match with other micro irrigation viz. drip/sprinkler. The maintenance of these adopted practices is also easier.

Application of research: It is useful in the field of irrigation water management and for increasing irrigation efficiency.

Research Category: Ridge-furrow system, Irrigation water management.

Abbreviations: RVSKVV: Rajmata Vijayaraje Scindia Krishi Vishwa Vidhyalay

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Study area / Sample Collection: Malwa region

Cultivar / Variety / Breed name: *Kharif, Rabi* crops

Conflict of Interest: None declared

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.

Ethical Committee Approval Number: Nil

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