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Water Table Management System

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Abstract

Water logging adversely affected agricultural lands creating doubts about the sustainability of irrigated agriculture. Many irrigation project command areas of Tamil Nadu lack adequate supply of water to agriculture in three to four months every year due to inadequate water resources. At the same time water logging problems due to excess water release from reservoirs during heavy rainfall periods from inter-state rivers is the common problem in some low lying areas. Hence a dual system to tackle water logging in monsoon season and scarcity during summer is the need of the hour. Water table management system (i.e. Controlled Drainage cum Sub irrigation system) is the next level of improving water management in irrigated agriculture. The water table management system was designed to work effectively both in monsoon season as controlled drainage system and as sub irrigation system during summer.

Introduction

The effective agricultural water management requires control of how much water is added to the soil (irrigation) and how much water is removed (drainage). Agricultural water management interventions have, understandably, focused on perfecting the control of irrigation water. The result, in general terms has been to ignore the importance of drainage. Drainage removes excess water from the soil profile and provides a tool to control soil salinity. Some soils drain naturally but in many excessive irrigated lands, drainage systems have to be installed and operated to maintain water tables at an acceptable level. The report from Knowledge and Research (KaR) - Integrated Irrigation and Drainage to save water – carried out by International Development Group of water Research Institute, reveals that there is a tune of potential of more than 25 million hectare area in the world needs Water Table Management Systems (WTMS). The major countries requiring this system, they reported are Egypt, India, Iraq, Israel, Pakisthan, Syria, Uzbekisthan, Tajikistha, and Turkmenistan.

The system is preferred to fulfill the following advantages are-

- to provide a system that satisfies both drainage and supplemental irrigation needs,
- for operational cost savings, mainly in reduced energy consumption compared to conventional irrigation systems,
- to conserve water, the system takes advantages of rainfall events,
- to offer flexibility in managing in drainage water.

The dual purpose system would normally fluctuate between the drainage, controlled drainage and sub irrigation modes several times during one cropping season (Doty *et al.*, 1975). Water table management system is a method used

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for the integration of irrigation management with drainage management (Halbac, 2014). Essentially drainage technology is vital to alleviate the water logging problem, but the same system technically, if used for irrigation with some modified design values through conjugative strategy of ground water in the above areas, the crop productivity and production could be increased all round the year (Ravi *et al.,* 2007). To meet the food needs of growing population of Tamil Nadu, depleting water resources and to safe guard the interest of the rice growing farmers of the state where such water logging is encountered, the Control Drainage and Sub irrigation (CD & SI) system.

Working Principle of Water Table Management System

The working principle of water table management system is that it should function efficiently both under sub irrigation and drainage modes and fulfilling both the needs (Figure 1 & 2). Water table management system synonymously known as controlled drainage sub irrigation system. Controlled drainage operates as a traditional drainage system during wet periods; excess water is removed from the field through a system of underground drain tubes under controlled mechanism of opening and closing of drain tubes at a specific period which conveys outlet to a main drain pipe. It should remove the excess water logging and keep the crop in congenial condition. The same system can furnish water to plants through sub irrigation, under sub irrigation mode, the upward flux and the discharge rate must satisfy the plant's life saving irrigation needs during summer. Inevitably, if the system is efficient in sub irrigation mode, it will satisfy the needs of the controlled drainage also since the spacing requirement is less for sub irrigation mode. A single system will functions as both drainage and irrigation.

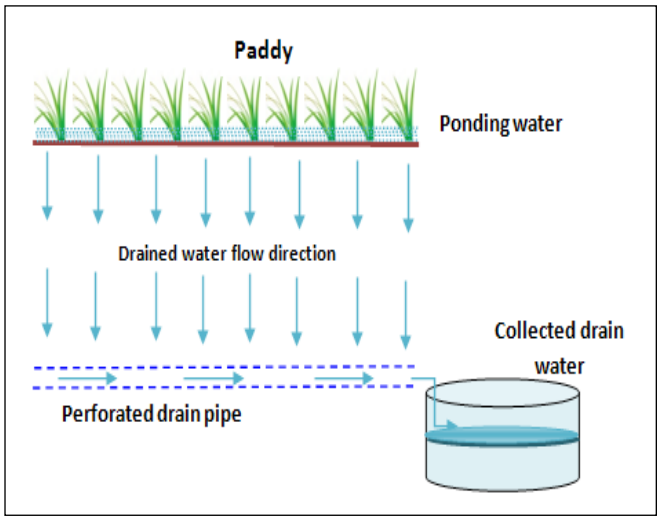

Figure 1: Principle of control mode

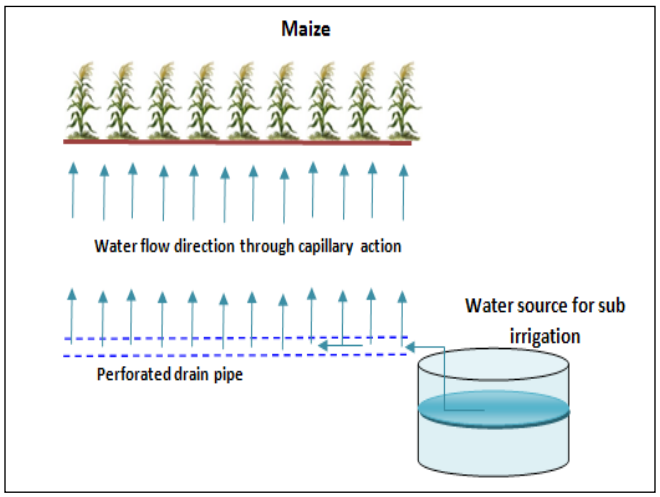

Figure 2: Principle of sub irrigation mode

Installation of Water Table Management System

Trenches were made with the help of poclain machine having a bucket width of 40 cm. With the help of level staff and dumpy level, the depth of cut was monitored throughout the digging operation to ensure proper gradient in the laterals and collector lines. Cleaning and smoothening was done manually along the bottom of lateral and collector lines to attain proper surface conditions for laying the pipes (Figure 3). Trench beds are layered with gravels to act as filter media with a thickness of 2.5 cm. Lateral pipes were

Figure 3: Installation of controlled drainage

wrapped firmly with two layers of coconut coir fibre envelope materials. Lateral pipes were laid and back filling were done manually. One end of the lateral was closed with an end plug and other end was fixed with rigid PVC pipe and connected to the inspection chamber. Every lateral pipes were connected with gate valve for controlling the depth of water table. The pipes were lowered smoothly and were placed in the trenches. Above the laterals also, 2.5 cm thick zero sized metal chips were placed. Adequate care was taken to see that no damage

was caused to the pipes while backfilling was done with minimum soil disturbance compared to before trenching. Rigid PVC pipes of 110 mm diameter and 6 m length were used to construct the collector (Figure 4). Installation of collector pipe was started from the outlet and moved towards upstream end. After one crop season, the laterals and collector pipes were interconnected and at the end of the collector pipe one PVC ball valve were fitted. This was very much essential for conducting the sub irrigation trials. Paddy and maize crop were raised in controlled drainage and sub irrigation mode (Figure 5 & 6).

Figure 4: Installation of sub irrigation system

Figure 5: Paddy crop in controlled drainage mode

Figure 6: Maize crop in sub irrigation mode

Conclusion

Water table management system operates as a traditional drainage system during wet periods excess water is removed from the field through a system of underground drain tubes which conveys outlet to a main drain tube or open ditch. During times of water shortage, a structure is used in the outlet ditch to regulate the drainage rate. The dual purpose system would normally fluctuate between the drainage, controlled drainage and sub irrigation modes several times during one cropping season.

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