Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2320-7051.6335

ISSN: 2320 – 7051

Int. J. Pure App. Biosci. **6 (1):** 1234-1237 (2018)

International Journal of Pure & Applied Bioscience

Short Communication

OPEN ACCESS

Optimal Sizing of OFR for Various Land Holdings

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Received: 5.01.2018 | Revised: 13.02.2018 | Accepted: 18.02.2018

ABSTRACT

The software was tested for rice cropping under different irrigation management strategies under various field sizes. This software provides flexibility in determining the OFR size in rain-fed farming system at various combinations of cropped area, cropping sequence, and soil type and soil moisture conditions. With the increase in soil moisture depletion level and total field area, the OFR area (%) follows a decreasing trend under same cropping pattern. The optimal OFR size for rice system was found to decrease from 6.6 to 5% of cropped field area during entire growing season. In the field area 1900 m^2 and 2000 m^2 the optimal size of OFR during entire season and during critical growth stages at 10% depletion the OFR area (%) are same but volume of water present in the OFR was more during the critical growth stages. Larger OFR sizes are required to provide supplemental irrigation during entire growing period of the crop. This software provides optimum size of OFR for that particular year.

Key words: *Irrigation management strategies, On-farm reservoir, Rain-fed farming, Soil moisture depletion, Critical growth stages, Supplemental irrigation.*

INTRODUCTION

Rainfall distribution varies with space and time. About two–third of total annual rainfall occurs in monsoon season (June to September) whereas almost drought situation persist for rest of the period. Moreover, occurrence of dry and wet spells within monsoon season also creates stress to crop growth. Proper planning, management practices and optimal utilization of rainwater are necessary for enhancing productivity in rain-fed agriculture. Rice is a major crop grown in all types of topographic conditions. Productivity of rain-fed rice in uplands can be increased with the provision of supplemental irrigation during its critical growth stage by harvesting rainwater in an on-farm reservoir (OFR). Adaptation of the OFR technology in the farmer's field is one of the options to increase water and land productivity in rain-fed agriculture. Runoff coming from the diked rice field is stored in the OFR and its reuse is an important aspect of conservation of soil, water and nutrients.

Cite this article: Kumar, M., Kerketta, A.K., Mamta and Dameshwar, Optimal Sizing of OFR for Various Land Holdings, *Int. J. Pure App. Biosci.* **6(1):** 1234-1237 (2018). doi: http://dx.doi.org/10.18782/2320-7051.6335

With the help of the OFR technique, farmers are encouraged to take winter crops in rain-fed regions. The main objective of this paper is to develop software for determining the optimum sizing of the OFR for various land holdings under various irrigation management practices, under both unlined and lined OFR systems and for different types of soil.

MATERIAL AND METHODS

Description of the software

Various input parameters required for initial running of the software are to be fed by the user through specific boxes provided in the window illustrated through Fig. 1. The user has to specify the field area in which he wants to grow the crop, irrigation management practices, and depth of OFR and percent area of OFR. In that case the software will simulate only for the specified depth and will calculate optimum OFR area. The combo boxes are provided in the window to select the soil type, crop type, OFR type and irrigation practices. On selection of the soil type, the software will automatically read the FC, WP and SAT of that soil. The software is flexible for various crops and cropping systems. User can select the preferred crops from the combo boxes. Once the crop is selected, the software will automatically read necessary information about the crop from a data file. If the user cannot find the desired crop in the combo boxes, he can enter a new crop type and related inputs regarding that crop type in the excel file provided in the software. Next time when he runs the software, the crop type will appear in the combo box. In the existing software he, tw, bw, s_1 and s_2 are kept constant because increasing of any above parameter, the software shows more percent of OFR area and we don't want to waste more cultivable land for OFR construction. User can only increase the value of depth of the OFR (D) as per requirement.

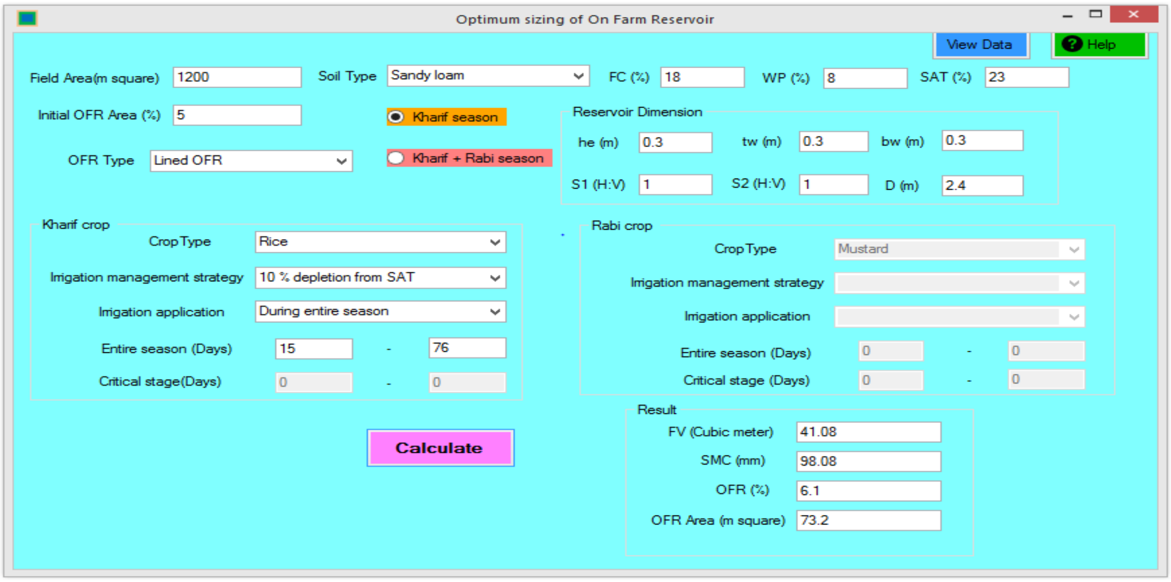

Fig. 1: Optimum sizing of On-farm reservoir

RESULTS AND DISCUSSION

OFR size under rice cropping system

In case of rice cropping, two types of soil moisture conditions were maintained, i.e. 10 and 20% depletion from saturation. Table 1 represents the variation of OFR area (%) due to different field size under various soil moisture conditions for single rice crop during the year 2014. Under 10% depletion condition, OFR area increases rapidly as irrigation requirement is very high. Supplemental irrigation plays an important role in designing of OFR sizes. The optimal OFR sizes (%) were found to decreases as the field area increase for rice cropping systems. It was further noticed that the sizes of OFRs were dependent on the irrigation management practices of the crops. The reason for obtaining the higher OFR sizes for 10% depletion than 20% depletion irrigation demand in *kharif* rice may be due to higher amount of irrigation requirements at 10% MAD level and consequently demanding higher size structures. When the field areas increase from 1000 to 10,000 m^2, the optimal OFR sizes for rice system was found to decrease from 6.6 to 5% of cropped field area. From Table 1, it is illustrated that for field area 2000 m^2 the optimal size of OFR during entire season and during critical growth stages at 10% depletion the OFR area (%) are same but volume of water present in the OFR was more during the critical growth stages.

Table 1: Optimum OFR size for rice crop under different moisture depletion levels from SAT (Saturation) during 2014

Field area (m^2)	During entire growing period				During critical growth stages			
	10%depletion		20%depletion		10%depletion		20%depletion	
	OFR (%)	OFR (m^2)	OFR (%)	OFR (m^2)	OFR (%)	OFR (m^2)	OFR (%)	OFR (m^2)
1000	6.6	66	5.7	57	6.5	65	5.6	56
1100	6.3	69.3	5.4	59.4	6.2	68.2	5.3	58.3
1200	6.0	72	5.4	64.8	5.9	70.8	5.1	61.2
1300	5.8	75.4	5.2	67.6	5.7	74.1	5.0	65
1400	5.6	78.4	5.0	70	5.5	77	5.0	70
1500	5.4	81	5.0	75	5.3	79.5	5.0	75
1600	5.3	84.8	5.0	80	5.2	83.2	5.0	80
1700	5.2	88.4	5.0	85	5.1	86.7	5.0	85
1800	5.1	91.8	5.0	90	5.0	90	5.0	90
1900	5.0	95	5.0	95	5.0	95	5.0	95
2000	5.0	100	5.0	100	5.0	100	5.0	100
10000	5.0	500	5.0	500	5.0	500	5.0	500

CONCLUSIONS

The developed software provides flexibility in determining the OFR size in rain-fed farming system at various combinations of cropped area, cropping sequence, and soil type and soil moisture conditions. With the increase in soil moisture depletion level and total field area, the OFR area (as a percentage of field area) follows a decreasing trend under same cropping pattern. The optimal OFR size for rice system was found to decrease from 6.6 to 5% of cropped field area. In the field area 1900 m^2 and 2000 m^2 the optimal size of OFR during entire season and during critical growth stages at 10% depletion the OFR area (%) are same but volume of water present in the OFR was more during the critical growth stages. Comparison between sizes of OFR for SI requirement during entire growing period of crop and during critical stages of crops indicated that larger OFR sizes are required to provide supplemental irrigation during entire growing period of the crop.

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