Environment & Ecology 35 (2D) : 1526—1528, April—June 2017
Website : environmentandecology.com ISSN 0970-0420

Performance Evaluation for Up-Scaling Water Productivity of Wheat in Ranbir Canal Command of Jammu

A. K. Raina, Vijay Bharti, P. K. Nanda

Received 28 August 2016; Accepted 27 September 2016; Published online 14 October 2016

Abstract The present study was conducted within gravity flow Ranbir canal system of Jammu. The spatial and non-spatial data inputs were used for determining water productivity of wheat crop during *rabi* season. The study indicated that minimum water requirement during three stages of wheat crop growth i.e. CRI, maximum-tillering and booting stage at system level are not met by canal water, as it remains closed during the period. Comparison of normalized vegtative index (NDVI) for wheat crop (Raj-3077) within problematic reach of identified canal system i.e. from middle to tail reach during *rabi* of 2012-13 was in the range of 0.2 to 0.5 as rainfall was 48.4% higher than the proceding year *rabi* of 2011-12 during which NDVI was in the range of 0.0 to 0.1 only. The average yield of wheat in the farmer's fields was found in the range of 25 q/ha having yield potential of 35-40 q/ha. Under these circumstances, Scalability of proven water management techniques like laser leveling, furrow irrigated raised bed (FIRBS) and boarder strip irrigation for wheat crop is essential including installation of shallow tube-wells within farmer fields . These interventions shall improve water productivity of wheat from 0.83 to 1.16 kg/m in near future within middle to tail reach of farmer's fields of the study area.

Keywords Rainfall pattern, Normalized difference vegetative index, Water productivity of wheat.

A. K. Raina*, Vijay Bharti, P. K. Nanda
Water Management Research Center
Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu, Chatha 180009, India
e-mail : dr.ashokraina@gmail. com
*Correspondence

Introduction

Jammu region has 96% area under wheat cultivation with 28.3% under irrigation [1]. In view of crop intensification and increase in acreage under rice-wheat sequence the irrigation authorities adopted rotational distribution of water on 7 days basis instead of daily supply of irrigation [2]. The objective of the study was to develop performance indicators for up scaling of water productivity of wheat crop in the study area with use of spatial and non- spatial inputs without any adverse impact on environment and ecology at system level.

Table 1. Pattern of rainfall distribution in study area.

Seasons	Months	Monthly average	Average rainfall	Percentage of total rainfall
Pre-monsoon	May	35.3	132.3	11.0
	Jun	97.0		
Monsoon	Jul	346.3	779.5	64.9
	Aug	321.9		
	sep	111.3		
Post-monsoon	Oct	21.2	61.5	5.1
	Nov	13.2		
	Dec	27.1		
Winter	Jan	53.3	228.0	18.9
	Feb	66.4		
	Mar	70.8		
	Apr	37.5		
			1201.3	

Materials and Methods

Study area

Benchmarking of irrigation infrastructure (BII) of entire gravity based canal system is developed under the study indicating culturable command area (CCA) of 38,623 ha. The capacity of main canal is 28.3 cumec having network of 17 distributaries.

Climate

The annual rainfall in the area is 1,150 mm out of which 876.5 mm rainfall occurs during the rainy season (July to September). Rice is the major crop during *kharif* season and wheat is the major crop during *rabi* season.

Table 3. Major rainfall events (*rabi* of 2011-12 and *rabi* 0f 2012-13).

Sl. No.	Date/ year	Rainfall (mm)	Date/year	Rainfall (mm)
1	31/12/2010	46.2	7/1/2012	28.4
2	8/2/2011	18.2	16/1/2012	42.8
3	14/2/2011	15.0	13/2/2012	13.0
4	18/4/2011	11.6	5/3/2012	25.8
5	....	.....	11/4/2012	24.2
	Total rainfall (mm)	90.4	Total rainfall (mm)	134.2

Tabel 2. Effect of rainfall on wheat yield.

Section of Command	Reference points	Grain yield (q/ha) *rabi* of 2011-12	Grain yield (q/ha) *rabi* of 2012-13	Straw yield (q/ha) *rabi* of 2011-12	Straw yield (q/ha) *rabi* of 2012-13	Rainfall (mm) *rabi* of 2011-12	Rainfall (mm) *rabi* of 2012-13
Head reach	N 32°41.323′ E 74°47.968′	29.0	30.5	48.4	51.8	90.4	134.2
Middle reach	N 32°41.269′ E 74°47.593′	20.2	23.3	36.7	40.5		
Tail-end	N 32°40.845′ E 74°47.246′	15.5	19.5	27.6	40.3		

Data and software used

LANDSAT-V digital satellite data for two years of study were used along with field data inputs i.e. 38 years rainfall, soil type , crop area, yield of wheat in the farmers fields during study period were used for developing images. The images were developed and converted to digital number (DN) values based into series of columns. The number of gray level classes were identified on color range.

Results and Discussion

Rainfall pattern

Long term distribution of rainfall of 39 years (1975-2013) in command area is presented in Table 1. The effect of rainfall and its events on wheat productivity during study period is given in Tables 2 and 3.

Rainfall pattern and wheat yield

As crown root initiation (CRI) stage of wheat crop and application of irrigation water (60 mm) coincides with canal closure in the study area which results in decrease of wheat yield [3]. Timely rainfall during this period has strong co-relation with yield. Referring Table 2, it was estimated that average grain yield was 13% more during *rabi* of 2012-13 as compared to *rabi* of 2011-12. This was mainly due to 48% more rainfall received during *rabi* season of 2012-13 refer Table 3. The (NDVI) value ranging

Table 4. Normalized difference vegetative index for rabi crop (Wheat) for the years 2011-12 and 2012-13.

rabi of 2011-12 (4/2011)			*rabi* of 2012-13 (4/2012)		Percentage (%)
NDVI values	Particulars	Area covered (ha)	Particulars	Area covered (ha)	
0.0—0.1	No vegetation	9558.1	No vegetation	1069.0	794% (decrease during 2011-12)
0.1—0.2	Settlement/bare land	4884.4	Settlement/bare land	4884.4	At par
0.2—0.3	Grass lands	13,731.9	Grass lands	13,995.0	—
0.3—0.5	Cropped agric fields	6705.2	Cropped agric fields	15,727.3	134 (Increase during 2012-13)
0.5—0.7	Good cropped agric fields	3171.8	Good cropped agric fields	2369.5	—
Total		38051.7		38045.3	—

from 0.1-0.7 was used for defining the levels of performance indicators of wheat crop [4] refer Table 4.

The normalized difference vegetative index (NDVI) for head reach of canal from distributary D-1 to D-9 is in the range 0.2 to 0.5 indicating good wheat crop condition irrespective of rainfall pattern during both years of the study. Comparison of NDVI from middle to tail reaches from distributary i.e. D-10 to D-17 during 2012-13 is in the range of 0.2 to 0.5 as rainfall was 48.4% higher than the year 2011-12 having NDVI in the range of 0.0 to 0.1indicating bad wheat crop condition within 60% area of canal command from middle to tail reaches. This , delinates problematic reach of canal command area in terms of deficit moisture during *rabi* period. scalability of proven water management techniques is essential along with installation of shallow tube-wells at farmer fields. These interventions will up-scale water productivity of wheat crop from 0.83 to 1.16 kg/m^3.

References

1. Anonymous (2014) Economic survey J and K, 2013-14. Direct Econ and Stat, Govt of Jammu and Kashmir, pp 194.
2. Raina AK, Bharti V, Samanta A, Purshotam S (2012) Adequacy and equity of rotational distribution of irrigation water of gravity flow Ranbir canal system of Jammu province-A case study. J Soil and Water Conserv 11 : 27—32.
3. Gupta NK, Gupta LM, Bijral G (2008) Climate change and its impact on crops in canal commands in Jammu district of J and state (India). A paper presented in Int Groundwater Conf 19—22 Mar 2008, Jaipur, India.
4. Koshal AK (2012) Spatio-temporal SPOT VGT image analysis for crop mapping in India. Int J Scien and Res Publ 2 : 1—10.