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ASSESSING RUNOFF POTENTIAL FOR HARVESTING IN AKOLA DISTRICT

A. M. MAHULIKAR, V. P. PANDAGALE

College of Agricultural Engineering & Technology, Dr. Panjabrao Deshmukh Agricultural University, Krishi Nagar, Akola (MS), India-444 104

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Abstract: *Rain is one of the major source of water for crops. The water harvesting measures includes inducement of runoff from certain selected areas, collection and storage runoff into suitable reservoir and utilization of stored water. The Average annual, seasonal rainfall and rainfall causing runoff were 817.1 mm, 694.5mm, 409.44 mm respectively of Akola district. Now the runoff water harvested through various irrigation projects in Akola district (247.33 Mm^3) in which by major (86.35 Mm^3) medium (81.99 Mm^3) and minor (78.99 Mm^3) projects respectively. The daily rainfall data of Akola district from 1998 to 2008 were analyzed and estimated runoff by Curve Number Technique were 119.35 mm. considering the estimated runoff and geographical area 543000 ha the total runoff potential estimated as 648.02 Mm^3 of Akola district. Up to March 2010 the runoff potential harvested through different soil conservation structure constructed such as continuous contour trenches, graded bund, farm pond, earthen bund, cement nala bund and loose boulder structure are estimated as 103.24 Mm^3 of Akola district. Thus the balance runoff potential need to be harvested for Akola district were 308.92 Mm^3through different irrigation projects and soil conservation measures for sustainable conservation measures for sustainable Agriculture.*

Keywords: *Water harvesting, Runoff Potential, SCS curve number*

Corresponding Author: MR. A. M. MAHULIKAR

Co Author: MR. V. P. PANDAGALE

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INTRODUCTION

The water shortage problem becomes critical day by day and impact of general water shortage is going to hit our cities. To assess the safe water to be a basic human right and toensure adequate availability of water adoption of various measures like watershed management through rehabilitation of existing system like tanks, construction of check dams and rain water harvesting structures. Our aim is to increase agricultural production per unit volume of water, per unit area of cropped land, per unit time.

In many areas of the world the amount and timing of rainfall are not adequate to meet the moisture requirement of crops and irrigation to raise crops necessary to meet the needs food and fibre. The irrigation potential can be sustainability augmented by adopting water harvesting technology. The water harvesting technique include water stored in the major, medium and minor storage structures and the soil conservation structures such as cct, graded bund, farm pond, earthen bund, cement nala bund, loose boulder structure etc.

Soil conservation measures are tailored to store and conserve as much rainfall as possible by reducing runoff and increasing the storage capacity of the profile. More water will become available for retention as soil moisture, which is resulted more permanent vegetation in the form of crops trees and grasses and makes rain fed agriculture more productive.

2. MATERIALS AND METHOD

This section deals with the material and methods to achieve the objectives.

Methodology

Area selected for the study is Akoladistrict situated in Maharashtra state. Geographical area of Akola district are 5,430 sq. Km.To assess the runoff potential for harvesting in Akola district, runoff was estimated by curve number technique from daily rainfall data. Runoff harvested by irrigation project and soil and water conservation measures carried out in the districts were collected from irrigation and agriculture department of state government and balance to be harvested is asses.

Location

Vidharba region is located on the East side of Maharashtra state. It extends latitude from $18^0$43'N to $21^0$46'N and longitude from $75^0$57' to $80^0$53'E. Akola district is lies between 20.097^0 N to 21.098^0N latitude and 76.775^0E longitude.

Collection of rainfall and evaporation data

The daily rainfall data during 1998 to 2008 of different tahasil of Akola district were collected from the metrological department of Dr. P.D.K.V., Akola. The weekly evaporation data of Akola district were taken from Lanjewar V.S. et. al. Unpublish thesis.

Rainfall analysis

The daily rainfall data was used for analysis of rainfall on weekly basis, monthly basis for estimation of weekly/fortnightly tahasil wise runoff of Akola district. From tahasilwise weekly rainfall average, rainfall of the district was calculated.

Runoff

i. Estimation of runoff by CNT

The runoff is estimated from the daily rainfall data using the curve number technique method. In order to calculate the runoff, following steps are involved.

1. First hydrological soil group of the catchment determine according to infiltration rate of the soil.
2. CN for AMC II is determined according to land used treatment given hydrological condition and hydrological soil group.
3. CN for AMC I and AMC III have been obtained from the convergent table.
4. Potential maximum retention (S) is determined by using following equation

$$CN = \frac{25400}{254 + S} \quad \text{..... Eq. (1)}$$

5. The runoff (Q) is determined using formula,

$$Q = \frac{(P - 0.2S)^2}{P + 0.8S} \quad \text{.....Eq. (2)}$$

Where,

Q= runoff in mm

P= rainfall in mm

S= potential maximum retention in mm

Evaporation data

The weekly evaporation data of Akola district is taken from Lanjewar V.S. et. Al. unpublished thesis (2008).

Runoff harvesting

After the estimation of runoff, the total runoff potential of the district is estimate. To estimate present water harvesting potential for Akola district, the information of water harvesting measures constructed by state agriculture, irrigation departments/offices up toMarch 2010 etc. The same will be used to estimate present runoff potential harvested and balance amount of runoff which need to be harvest for Akola district. Runoff harvested by different soil and water conservation measures are CCT, Graded Bund, Loose boulder structure, Farm Pond, Earthen Bund, Cement Nala Bund.

Runoff harvested in different irrigation projects

Irrigation project are categorized on the basis of capacity and expenditure as major, medium and minor projects.

Major Irrigation Projects: If the catchment area is above 10000 ha the project is classified as major irrigation project. The runoff harvested by major irrigation project in Akola districts is 86.35 Mm^3.

Medium Irrigation Projects: Runoff harvested by medium irrigation project is 81.99 Mm^3, of Akola districts respectively.

Minor Irrigation Projects: Runoff harvested by minor irrigation project is 78.99 $Mm^3$of Akola districts respectively.

3. RESULT AND DISCUSSION

After analysis of daily rainfall data of Akola district and the runoff was estimated. Information regarding soil and water conservation works carried out by state department up to march 2010 was collected and runoff potential harvested by irrigation department was also collected and asses the runoff to be harvested.

Analysis of rainfall

The daily rainfall data which is obtained from the metrological department of Dr. PDKV Akola of Akola district.Analysed the daily tahasil wise rainfall data into weekly, monthly and annually.

In Akola district the average rainfall is 817.99 mm which is estimated from daily rainfall data from 1998 to 2008. In which maximum average annual rainfall of Paturtahasil is 950.35 mm and minimum in Murtizapurtahasil is 663.95 mm. The details of average weekly tahasil wise rainfall of Akola district were obtained during 1998 to 2008.

Monthly rainfall of different tahasil of Akola district are presented in Table No. 3.1

Table 3.1. Average monthly tahasil wise rainfall of Akola district during 1998 to 2008 mm

Month	**Tahasil**							
	Akot	Telhara	Balapur	Patur	Akola	Barshitakli	Murtijapur	Average
Jan	0.38	1.45	4.27	0.90	5.77	4.36	3	2.87
Feb	0.46	1.63	2.54	2.63	0.67	0	4.44	1.77
March	8.92	5.91	3.18	12.13	4.90	17.54	7.55	8.59
April	2.39	2.09	1.2	1	0.45	0	0.62	1.108
May	3.99	6.53	2.4	7.5	3.27	2.49	9.01	5.02
June	158.85	153.73	168.91	158.78	170.06	153.5	135.61	157.06
July	231.11	225.45	193.07	283.49	212.34	230.44	158.5	219.2
Aug	223.38	196.92	214.14	293.5	185.94	229.21	198.61	220.24
Sep	158.64	151.07	133.92	113.94	125.86	134.75	136.96	136.44
Oct	49.41	54.4	63.38	70.9	55.98	63.22	65.22	60.38
Nov	2.02	2.64	5.63	4.45	4.31	6.03	0	3.58
Dec	0	0	0	0	0	0	0	0
Average	**829.43**	**801.3**	**792.33**	**948.56**	**769.24**	**841.34**	**663.72**	**816.56**

The average annual rainfall is estimated by Arithmetic mean method and Theissen polygon method. The average annual rainfall by Arithmetic mean method is 817.19 mm and by Theissen polygon method is 803.78 mm of Akola district. The details are given in table no. 3.3.

Table 3.3 Average Rainfall of Akola District during 1998 to 2008 mm by Theissen Polygon method

Sr. No.	Tahasil	Average Rainfall (P), mm	Area of tahasil, Sq.Km	PA	Mean Arial Rainfall (P), mm
1	Akot	829.43	795.83	660085.27	$P=\frac{\Sigma PA}{A}$
2	Telhara	805.66	583.31	469949.53	$=\frac{4343709.71}{5404.13}$
3	Balapur	792	668.46	529420.32	
4	Patur	950.34	696.22	661645.71	= 803.78
5	Akola	770.81	1099.39	847420.81	
6	Barshitakli	841.35	781.75	657725.36	
7	Murtizapur	663.95	779.37	517462.71	
			$\Sigma A = 5404.13$	$\Sigma PA = 4343709.71$	

Estimation of runoff by CNT method

For Akola district hydrological soil group to be 'C' as infiltration rate of soil is low. The estimated runoff by curve number technique during kharif season for Akola districtduring 1998 to 2008.

The daily rainfall of Akola district from 1998 to 2008 were analysed and estimated average runoff by CNT were 119.35 mm.

Runoff harvesting

The runoff harvested by different irrigation projects such as major, medium and minor and the storage capacity of the project is given table no.3.5. and the runoff harvested through different soil and water conservation measures like cct, graded bund, farm pond, earthen bund, cement

nala bund and loose boulder structures etc. and the storage capacity of the structures is also given in table no. 3.5

Table 3.5 Estimated runoff potential, runoff harvested and to be harvested from Akola District

Sr. No.	PARTICULARS	AKOLA
1	Area (ha)	543000
2	Runoff (mm)	119.35
3	**Estimated Runoff potential (Mm^3)**	**648.02**
4	**a. Irrigation project capacity (Mm^3)**	
	i. Major	86.35
	ii. Medium	81.99
	iii. Minor	78.99
	Total (Mm^3)	**247.33**
5	**b. Runoff harvested through different soil and water conservation measures (Mm^3)**	
	i. CCT	3.49
	ii. Graded Bund	71.27
	iii. Farm Pond	12.73
	iv. Earthen Bund	1.1
	v. Cement Nala Bund	13.5
	vi. Loose boulder structure	1.15
	Total	**103.23**
	Runoff to be harvested =	**297.46**

[3(4a+4b)] (Mm^3)

CONCULSION

From the study of water harvesting measures in Akola district based on the result study for the following conclusion were found.

1. The estimated average weekly, monthly and annual rainfall of Akola district were 817.99 mm, 816.56 mm and 817.1 mm.
2. The runoff which estimated by CNT is 119.35 mm Akola district.
3. Estimated total runoff potential of Akola district are calculated as 648.02Mm^3.
4. The capacity of different irrigation projects (major, medium and minor) to harvest runoff water of 247.33 Mm^3, 523.66 $Mm^3$of Akola.
5. Runoff potential harvested through different soil conservation measures such as cct, graded bund, farm pond, earthen bund, cement nala bund, and loose boulder structure are 103.24 Mm^3 of Akola district.
6. To harvest balance runoff potential of 297.46 Mm^3 different soil conservation measures and irrigation projects are to be undertaken in Akola district.

REFERENCE

1. Agresco (1985) Effect of bunding on moisture distribution and erosion.

2. Anonymous (1988) Soil moisture variation under different types of soils of different slopes in relation in rainfall characteristics, Agrisco Report, C.R.S., Akola.

3. Anonymous (1988) Evaluation of soil conservation structure research highlight, Annual report on central soil and water conservation research and training institute, Deharadun 7-11.

4. Babu ram, R.C.Bansal (1978) Effect of bunding on runoff and peak discharge in agril watershed in doom valley, Indian Journal of soil conservation 6(2):89-90.

5. Chittaranjan, S., et.al (1981) Runoff harvesting and recycling on black soils for increasing crop production extension bulletin No. 3. Central soil and water conservation research and training institute, Research centre, Bellary.

6. Gajri, P.R., Verma H.N and Prohar S.S. (1982) Rain water harvesting and its reducing for maximization of crop production. Indian Journal of soil conservation 9(2-3) 69-75.,

7. Howard Matson (1943) More farm ponds needed. Journal of AgrilEngg. 24 (380-384).

8. Jajoo, S.B. and Kadam, R.G. (2006) Design of Farm Pond for Nagpur region.Journal of Maharashtra Agricultural University. 31(1): 104-107.

9. Nema, J.P. and Kananvar, H.K. (1976) Water harvesting and storage efficiency. Annual report.CSWCRTI, research centre, Vasad, Gujarat.

10. Phadnvis, A.N., et. al (1998) Impact of water harvesting structure on ground water recharge in semiarid Maharashtra. Indian Journal of Soil conservation 26(1): 44-47.

11. Sahu, R.K., et.al (2001) A study of small farm reservoirs for developing sustainable agriculture in rainfed areas. Journal soil and water conservation Indian 45 (1-2): 32-40.

12. Sastry, G. (1983) has studied an farm ponds and their influenced on flood retardance and effect of land treatment on runoff.