Research Paper

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CONTINUOUS CONTOUR TRENCHES - A USEFUL CONSERVATION MEASURE FOR GROUNDWATER RECHARGE

Agriculture

KEYWORDS : Catchment, groundwater, recharge

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ABSTRACT

The study was undertaken on the field of All India Coordinated Research Project for Dryland Agriculture, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola. The area under study was divided into four micro-catchments. Catchments A and C are treated with continuous contour trenches (CCT) and B and D are non-treated. The catchment A and B are having custard apple plantation and catchment C and D are having Hanuman phal plantation. The water levels were observed during 2012 to 2014. On an average during all recorded months the ground water recharge in the CCT treated catchment was more compared to the non treated catchment. It was also observed that during below average rainfall years the groundwater recharge in CCT treated catchment was more by 38.64% and 33.97% over non treated catchment and this will clearly indicate the usefulness of continuous contour trenches for conservation of rainfall and thereby increasing the groundwater recharge.

INTRODUCTION

In dry land agriculture, the amount of water that can be retained in soil profile is most critical, especially between dry spells. However, the amount of water retained in a particular soil depends upon type of soil, soil texture, nature of minerals and other soil properties. Therefore understanding the soil water regime of dry land regions is important for efficient rainwater conservation and for its optimum uses. The proportion of pores filled with air or water varies, and changes as the soil wets and dries. When all pores are filled with water, the soil is saturated and water within macro-pores will drain freely from the soil via gravity. Continuous contour trench system (CCT) system, developed for plantation in non arable lands in low rainfall areas, has been found to be very effective in soil and water conservation, leading to considerably high groundwater recharge (Nagdeve *et al*., 2009). Whenever rainfall-runoff event occurs, runoff begins and flows down from the slopes causing erosion giving not much chance for water to infiltrate down the soil. In such situations CCTs are adopted for reducing runoff and enabling the water to infiltrate down to the ground.

Contour trenches

Contour trenches are used both on hill slopes as well as on degraded and barren waste lands for soil and moisture conservation and afforestation purposes (Pendke, 2009). The trenches break the slope and reduce the velocity of surface runoff. It can be used in all slopes irrespective of rainfall conditions (i.e., in both high and low rainfall conditions), varying soil types and depths. Trenches can be continuous or interrupted. The interrupted one can be in series or staggered, continuous one is used for moisture conservation in low rainfall areas and require careful layout (Thomas *et al*., 2010). Intermittent trenches are adopted in high rainfall areas. The size of the trench depends upon the soil's depth. The trench may be of 30 cm base and 30 cm top width and square in cross section or it can be trapezoidal with side slopes 1:1. Based on the quantum of rainfall to be retained, it is possible to calculate the size and number of trenches. In Vidarbha region of Maharashtra the trench size of 60 cm top, and 30 cm deep is commonly adopted. The CCTs are helpful for conservation of soil and water and thereby increases groundwater recharge (Sadgir *et al*.,2006).

Study area

The study was undertaken on the experimental field of AICRP for Dryland Agriculture, Dr. PDKV, Akola in the Vidarbha region of Maharashtra. The site is situated at the latitude of 20^0 42' North and Longitude of 77^0 02' East. The altitude of this place is 305 m above sea level. Soil survey of the catchment was carried out by traversing and sites for soil profiling were selected based on variations in soil types. In the present study three types of soils were identified viz. Inceptisol, Entisol and Vertisol. Taxonomically these soils are classified into the family of Vertic Haplustepts, Typic Ustorthents, Typic Haplusterts (Soil survey staff, 1994).

METHODOLOGY

The study area (1.0 ha) was divided into two micro-catchments. One catchment was treated by constructing continuous contour trenches (CCTs) and other was without continuous contour trenches. Both catchments are having plantations of custard apple and atemoya (Hanuman phal). The small catchments were again divided into two parts, thus in entire area there are four parts. In each part the observation well was prepared for measuring the ground water levels.

RESULTS AND DISCUSSION

The water levels in all the four observation wells located into A, B, C and D micro-catchments were monitored on weekly basis with the help of water level indicator for different months during 2012 to 2014. Monthly averages of the observed levels were calculated. Similarly the month wise averages of the observed ground water levels were calculated for the year 2012, 2013 and 2014.

The observations during the year 2012 are given in the Table 1. From the table, it is observed that initially there was no recharge in any of the four observation wells. However, in the month of August the groundwater recharge was started in observation well number, 3 and 4. The groundwater recharge was more in OW-3 than OW-4. The percentage increase was more in the month of August (84.26%) and stabilizes over the period. It was also observed from the table that the groundwater recharge was more in CCT treated catchment compared to non treated catchment in all the months. On an average during the four months the ground water recharge in the CCT treated catchment was more by 38.64 % compared to the non treated catchment.

Table 1. Average monthly ground water levels (m) in the observation wells during 2012

S. N.	Month	Average ground water levels, m						Increase in ground water recharge of CCT treated catchment (%)
		CCT treated catchment(T_2)		Non-treated catchment (T_1)		Average of CCT treated catch- ment	Average of non- treated catch- ment	
		OW-1	OW-3	OW-2	OW-4			
1	August	-	1.64	-	0.89	1.64	0.89	84.26
2	September	3.28	4.34	2.84	3.71	3.81	3.27	16.51
3	October	3.03	3.85	2.21	3.29	3.44	2.75	25.09
4	November	2.73	3.54	1.93	3.01	3.13	2.47	26.72

The observations during the year 2013 are given in the Table 2. From the table, it is observed that initially there was no recharge in any of the four observation wells. However, in the month of July the groundwater recharge was started in the observation wells. The percentage increase in groundwater recharge of CCT treated catchment over non treated catchment was more in the month of December (24.28%). It was also observed that the groundwater recharge was more in CCT treated catchment compared to non treated catchment in all the months. On an average during the six months the ground water recharge in the CCT treated catchment was more by 17.41 % compared to the non treated catchment.

Table 2. Average monthly ground water levels (m) in the observation wells during 2013

S. N.	Month	Average ground water levels, m						Increase in GW recharge of CCT treated over non-treated catchment (%)
		CCT treated catchment (T_2)		Non-treated catchment (T_1)		Average of CCT treated catch-ment	Average of non-treated catch-ment	
		OW-1	OW-3	OW-2	OW-4			
1	July	1.28	1.59	1.01	1.55	1.43	1.28	11.72
2	August	5.46	6.45	4.41	5.54	5.95	4.97	19.72
3	September	5.26	6.21	4.32	5.47	5.73	4.89	17.18
4	October	6.03	6.94	5.06	6.15	6.48	5.60	15.71
5	November	5.07	5.90	4.20	5.26	5.48	4.73	15.86
6	December	4.35	5.18	3.54	4.12	4.76	3.83	24.28

The observations during the year 2014 are given in the Table 3. It is observed that the percentage increase in groundwater recharge of CCT treated catchment over non treated catchment was more in the month of June (71.05%) followed by July (62.50%). It was also observed that the groundwater recharge was more in CCT treated catchment compared to non treated catchment in all the months and this effect was depicted in figure 1 and 2. On an average during the twelve months the ground water recharge in the CCT treated catchment was more by 33.97 % compared to the non treated catchment.

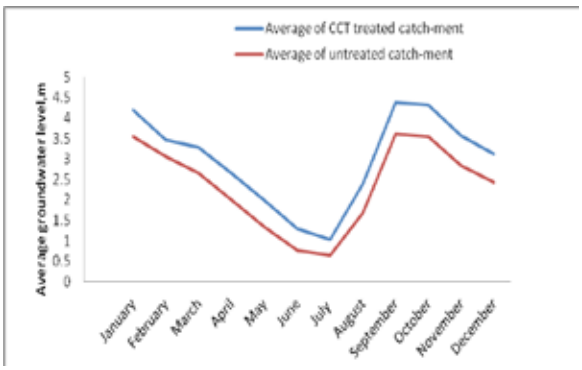

Fig. 1: Ground water levels in different months in the catchment

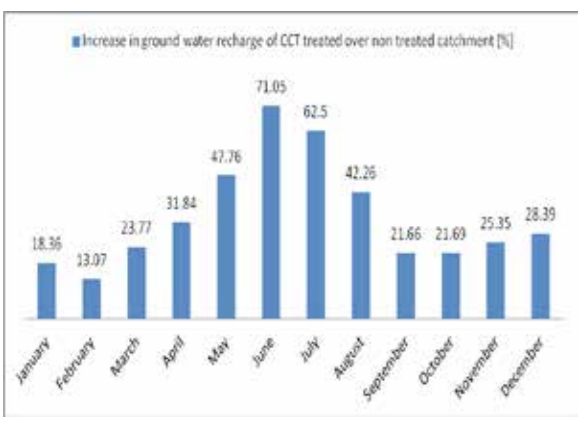

Fig. 2: Increase in groundwater recharge in

Table 3. Average monthly ground water levels (m) in the observation wells during 2014

S. N.	Month	Average ground water levels, m						Increase in GW recharge of CCT treated catchment (%)
		CCT treated catchment (T_2)		Non-treated catchment (T_1)		Average of CCT treated catch- ment	Average of non-treated catch-ment	
		OW-1	OW-3	OW-2	OW-4			
1	January	3.78	4.61	2.99	4.09	4.19	3.54	18.36
2	February	3.31	3.61	2.52	3.61	3.46	3.06	13.07
3	March	2.88	3.69	2.11	3.19	3.28	2.65	23.77
4	April	2.26	3.05	1.47	2.56	2.65	2.01	31.84
5	May	1.58	2.38	0.81	1.88	1.98	1.34	47.76
6	June	0.91	1.70	0.33	1.19	1.30	0.76	71.05
7	July	0.65	1.44	0.37	0.92	1.04	0.64	62.50

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8	August	1.99	2.79	1.17	2.20	2.39	1.68	42.26
9	September	4.01	4.76	3.21	4.00	4.38	3.60	21.66
10	October	3.91	4.74	3.05	4.05	4.32	3.55	21.69
11	November	3.16	3.97	2.34	3.35	3.56	2.84	25.35
12	December	2.73	3.52	1.92	2.94	3.12	2.43	28.39

CONCLUSION

On the basis of the results during 2012 to 2014 it can be concluded that on an average during all recorded months the ground water recharge in the CCT treated catchment was more compared to the non treated catchment. It was also observed that during below average rainfall years the groundwater recharge in CCT treated catchment was more by 38.64% and 33.97% over non treated catchment and this will clearly indicate the usefulness of continuous contour trenches for conservation of rainfall and thereby increasing the groundwater recharge.

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