



Effect of Continuous Contour Trenches on Nutrient Status of the Micro-Catchment

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Abstract

The adoption of *in-situ* soil and water conservation techniques are the need of the day all over the country. Taking into consideration this logic, the experiment on practical implementation of the conservation measures along with impact assessment was undertaken at AICRP for Dryland Agriculture Dr. PDKV, Akola. In which impact assessment of continuous contour trenches (CCTs) on hydrological, agronomic, soil nutrient status has been made. In this paper the results related to soil nutrient losses are presented. The small catchment was divided into two parts one is treated with CCTs and other is without CCTs. From the recorded data and nutrient status analysis, it was observed that in CCT treated (T_1) micro-catchment Nitrogen, Phosphorous and Potassium was more by 25 %, 15.31% and 9.96% respectively over untreated (T_2) micro-catchment. The micro-nutrients *viz.* Zinc, Ferrous, Magnesium and Copper in CCT treated micro-catchment was observed more by 15.56 %, 7.70%, 23.07% and 37.54% respectively over untreated (T_2) micro-catchment. The pH and EC was also observed to be more in CCT treated (T_1) micro-catchment as compared to untreated (T_2) micro-catchment. These results conclude that in CCT treated micro-catchment the losses of nutrients had been reduced which ultimately useful for plant growth. Thus continuous contour trenches are useful for conservation of soil nutrients.



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Introduction

Agricultural drought is common in Dryland agriculture. Soils of shallow depth, low fertility, and poor water holding capacity and the resultant soil moisture stress during crop growth are some of the major

constraints. Integrated Watershed management is being recommended for improving the productivity of drylands. Activities aimed at conserving the natural resources, particularly soil nutrients and water, and their judicious development and utilization form the

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backbone of the watershed programmes. As a part of better land management, several land treatments such as contour farming tied ridging, broad bed furrows are being suggested for erosion control and rain water conservation. The utility of such measures in terms of soil water availability to crops will depend on a number of factors. Additional retention of water in the soil profile will depend on the antecedent soil moisture condition, amount of rainfall infiltration and seepage / percolation losses besides the water holding capacity of the soil⁷. The utility of such practices will also depend on the frequency of runoff events as well as the quantum of runoff, which we are trying to control through such practices¹⁷.

Plant nutrition is the study of the chemical element and compound necessary for plant growth, plant metabolism and their external supply. In its absence the plant is unable to complete a normal life cycle or that the element is part of some essential plant constituent or metabolite. The soil supplies nitrogen, phosphorus, potassium, calcium, magnesium, and sulphur are called macronutrients and iron, manganese, boron, molybdenum, copper, zinc, chlorine, and cobalt, are called micronutrients¹⁸.

Prevention of losses of these nutrients is possible by continuous contour trenches. In order to know the actual benefits and quantification of soil moisture regimes, soil nutrient losses, groundwater recharge and water balance of the treated catchment over the untreated catchment, the present study have been undertaken with the objective of estimation of nutrient losses through treated and untreated micro- catchment.

Study Area

The field experiment was conducted at All India Co-ordinated Research Project for Dryland Agriculture, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola during 2014-15^{17,19}. The site is situated at the latitude of 20° 43' North and Longitude of 77° 02' East. The altitude of this place is 307.41m above MSL. The climate of the place is semi-arid and characterized by hot dry summer and cool winter¹². Area of experimental plot was 1 hectare and it is divided into two parts (50x100 m²) each. The micro catchments A and C are treated (T₁) with continuous contour trenches (CCTs) and B and D are untreated (T₂). The micro-catchment A and B are having Custard apple

(*Annona squamosa*) plantation and micro-catchment C and D are having Atemoya (*Annona cherimola*) plantation. There are four observation wells viz., well A, well B, well C and well D prepared in each micro-catchment A, B, C and D respectively. Eight moisture tubes viz., M₁, M₂, M₃, M₄, M₅, M₆, M₇ and M₈²⁰ are also installed in these micro-catchments; Two moisture tubes in each micro-catchment i.e. M₁ and M₂ in A, M₃ and M₄ in C, M₅ and M₆ in B and M₇ and M₈ in D. Green gram has been taken as an inter crop in the perennial plantation in both the micro-catchment. The details of treatments in the micro-catchments are given below.

Materials and Methodology

Available Nitrogen, Phosphorus, Potassium

Available Nitrogen is calculated by alkaline potassium permanganate method¹³. Available Phosphorus¹⁴ is calculated by NaHCO₃-(0.5) pH 8.5 Colorimetric¹⁶. Available Potassium is calculated by Neutral normal ammonium acetate using Flame photometer¹⁵.

Micro Nutrients

DTPA extractable micronutrients (Zn, Fe, Mn and Cu) are calculated⁶. The Atomic Absorption Spectrophotometer used for this purpose was shown in Fig.1



Fig. 1: Atomic Absorption Spectrophotometer

pH of Soil

pH of soil is calculated by using glass electrode pH meter (Fig. 2)³.

EC of Soil

EC of soil is calculated by using electric conductivity meter (Fig.3)³.

Nutrient analysis was done in the laboratory of AICRP for Dryland Agriculture, Dr. PDKV, Akola.

Nitrogen, Phosphorus, Potassium and Micro nutrient were calculated in treated (T_1) and untreated (T_2) micro-catchment. For nutrient analysis soil samples were collected from the field. Four samples from treated (T_1) micro-catchment with CCTs and four samples from untreated (T_2) micro-catchment.

CCT-C-H-1= First sample of soil in C section of micro-catchment which is treated (T_1) by continuous



Fig. 2: Glass electrode pH meter



Fig. 3: Electric conductivity meter

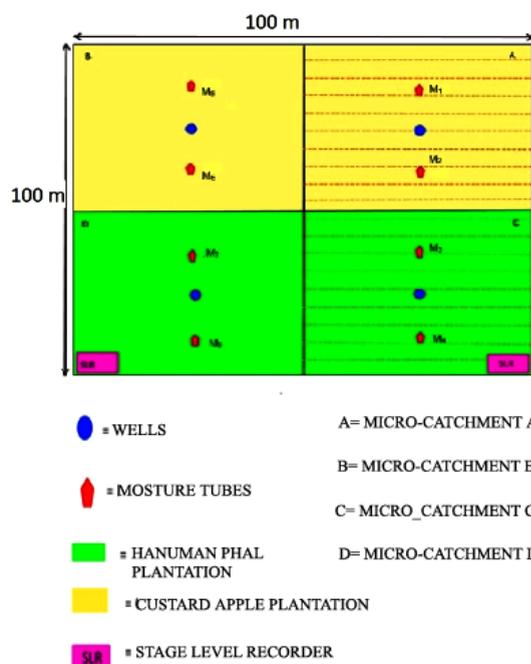


Fig. 4: Layout of Experimental Area

Table 1: Nutrient Status in Custard Apple Plantation for Cct Treated and Untreated Micro-Catchment.

Micro-Catchment	Nutrient Status in Custard Apple Plantation								
	MICRONUTRIENT							pH	EC
	N (kg ha^{-1})	P (kg ha^{-1})	K (kg ha^{-1})	Zn (mgkg $^{-1}$)	Fe (mgkg $^{-1}$)	Mn (mgkg $^{-1}$)	Cu (mgkg $^{-1}$)		
Treated (T_1)	175.6	17.03	308	0.77	8.08	0.91	7.32	8.25	0.01
Untreated (T_2)	131.7	14.42	277.3	0.65	7.45	0.7	4.57	7.94	0.13

Table 2: Nutrient status in atemoya plantation for CCT treated and untreated micro-catchment.

Micro-catchment	Nutrient status in Atemoya plantation								
	MICRONUTRIENT								
	N (kg ha^{-1})	P (kg ha^{-1})	K (kg ha^{-1})	Zn (mg kg^{-1})	Fe (mg kg^{-1})	Mn (mg kg^{-1})	Cu (mg kg^{-1})	pH	EC
Treated (T ₁)	181.88	16.47	297.58	0.79	7.67	0.91	6.6	8.2	0.12
Untreated (T ₂)	144.25	14.62	288.56	0.62	7.64	0.64	5.85	8.02	0.25

contour trenches and have Atemoya plantation. CCT-C-H-2=second sample of soil in C section of micro-catchment which is treated (T₁) by continuous contour trenches and have Atemoya plantation. CCT-A-S-3=Third sample of soil in A section of micro-catchment which is treated (T₁) by continuous contour trenches and have Custard apple plantation. CCT-A-S-4=Fourth sample of soil in A section of micro-catchment which is treated (T₁) by continuous contour trenches and have Custard apple plantation. NCCT-B-S-5=Sixth sample of soil in B section of micro-catchment which is not treated (T₁) by continuous contour trenches and have Custard apple plantation. NCCT-B-S-6=Sixth sample of soil in B section of micro-catchment which is not treated (T₁) by continuous contour trenches and have Custard apple plantation. NCCT-D-H-7=Seventh sample of soil in D section of micro-catchment which is not

treated (T₁) by continuous contour trenches and have Atemoya plantation.

Results and Discussion

The soil analysis was done to know the nutrient status of the soils in CCT treated as well as untreated catchment in custard apple and atemoya plantation. The results are presented in Table 1 and 2 for

Nutrient status in custard apple plantation

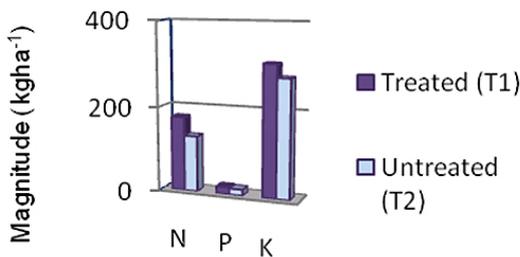


Fig. 5: Nutrient status in custard apple plantation

Micro-Nutrient status in custard apple plantation

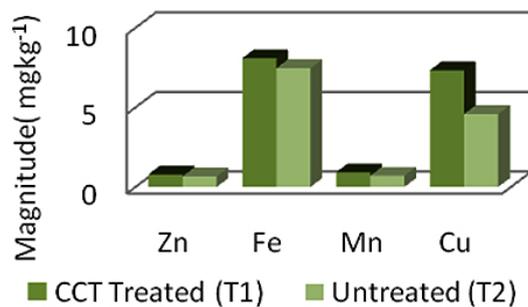


Fig. 6: Micro-Nutrient status in custard apple plantation

the soils in custard apple and atemoya plantation respectively. From these tables it is observed that the nutrient/ micronutrient status of CCT treated soils is more as compared to untreated soils for both the plantations.

Nutrient Losses Through Custard Apple Plantation

The nutrient and micronutrient status of the soils in custard apple plantation are depicted in Fig. 5 and Fig. 6 respectively. The pH and EC comparison is depicted in Figures 7 and 8 respectively.

From Fig.5, it was observed that the nutrient status of treated (T₁) micro-catchment in respect of Nitrogen, Phosphorous and Potassium was more compared to untreated (T₂) micro-catchment. In treated (T₁) micro-catchment Nitrogen, Phosphorous and Potassium was more by 25 %, 15.31% and 9.96% respectively over untreated (T₂) micro-catchment.

From Fig. 6 it is observed that the Micro-nutrient status of CCT treated (T₁) micro-catchment in respect of Micro-nutrients viz. Zinc, Ferrous, Magnecium and Copper was more as compared to untreated (T₂) micro-catchment. In treated (T₁) micro-catchment Zinc, Ferrous, Magnecium and Copper was more by 15.56 %, 7.70%, 23.07% and 37.54% respectively over untreated (T₂) Micro-catchment. From Fig. 7 and 8 it is observed that the pH and EC observed more in treated (T₁) micro-catchment as compared to untreated (T₂) micro-catchment.

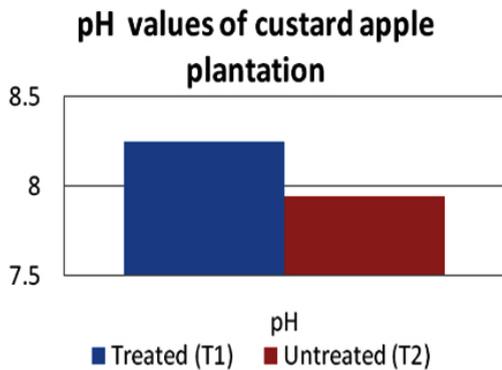


Fig. 7: pH values of custard apple plantation

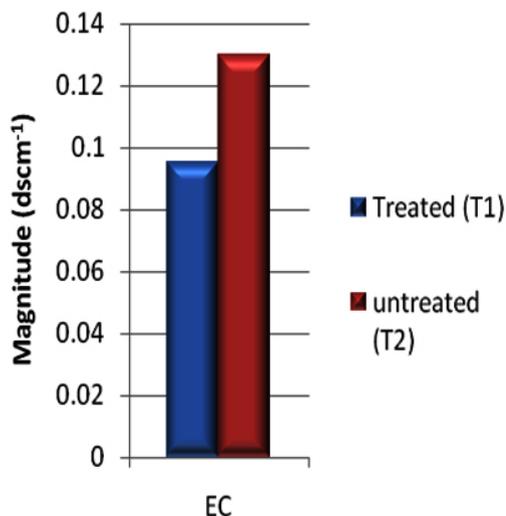


Fig. 8: EC values of custard apple plantation

Nutrient status in Atemoya plantation

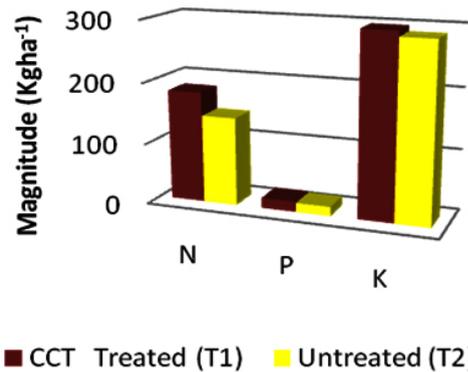


Fig. 9: Nutrient status in Atemoya plantation

Micro-Nutrient status in Atemoya plantation

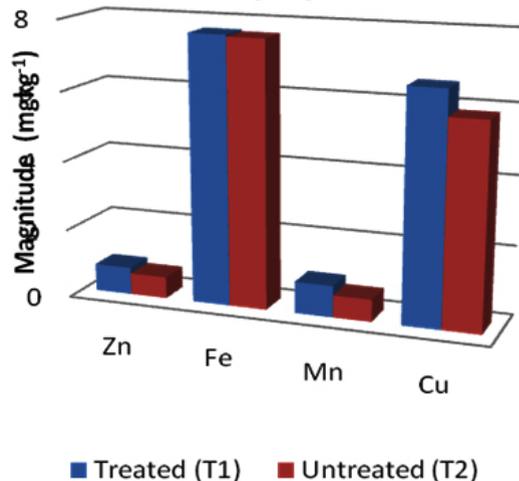


Fig. 10: Micro-nutrient status in Atemoya plantation

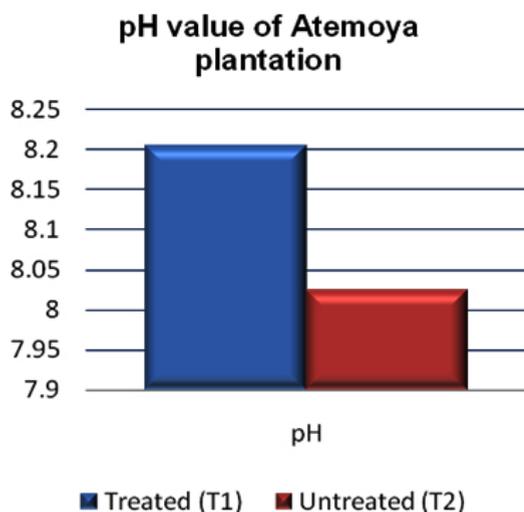


Fig. 11: pH values of Atemoya plantation

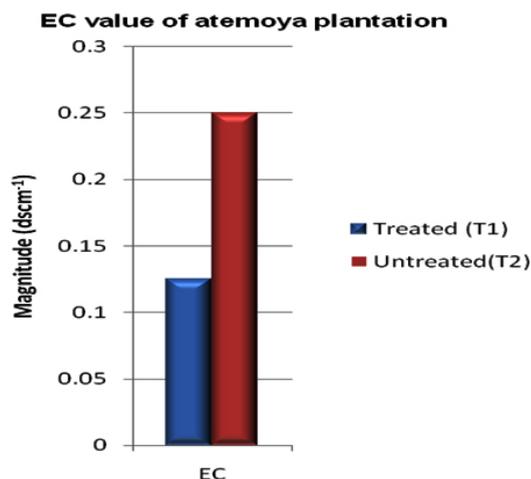


Fig. 12: EC values of Atemoya plantation

Nutrient Losses Through Atemoya Plantation

The nutrient and micronutrient status of the soils in atemoya plantation are depicted in Fig. 9 and Fig. 10 respectively. The pH and EC comparison is depicted in Figures 11 and 12 respectively.

From Fig. 9 it is observed that the nutrient status of treated (T₁) micro-catchment in respect of Nitrogen, Phosphorous and Potassium was more compared to untreated micro-catchment. In treated (T₁) catchment Nitrogen, Phosphorous and Potassium was more by 20.68 %, 11.24% and 3.02% respectively over untreated (T₂) micro-catchment

From Fig.10 it was observed that the micro-nutrient status of treated (T₁) and untreated (T₂) micro-catchment in respect of Zinc, Ferrous, Magnesium and Copper was more in treated (T₁) micro-catchment as compared to untreated (T₂) micro-catchment. In treated (T₁) micro-catchment Zinc, Ferrous, Magnesium and Copper was more by 21.23 %, 0.64%, 29.67% and 11.35% respectively over untreated (T₂) micro-catchment.

From Fig.11 and 12 it is observed that the pH and EC observed more in treated (T₁) micro-catchment as compared to untreated (T₂) micro-catchment.

Conclusion

1. For custard apple plantation, in treated (T₁) micro-catchment Nitrogen, Phosphorous

and Potassium content is observed more by 25 %, 15.31% and 9.96% respectively over untreated (T₂) micro-catchment. For atemoya plantation in treated (T₁) micro-catchment Nitrogen, Phosphorous and Potassium content is observed more by 20.68 %, 11.24% and 3.02% respectively over untreated (T₂) micro-catchment.

2. For custard apple plantation, in treated (T₁) micro-catchment Zinc, Ferrous, Magnesium and Copper is observed more by 15.56 %, 7.70%, 23.07% and 37.54% respectively over untreated (T₂) micro-catchment. For Atemoya plantation in treated (T₁) micro-catchment Zinc, Ferrous, Magnesium and Copper is observed more by 21.23, 0.64%, 29.67% and 11.35% respectively over untreated (T₂) micro-catchment. From these results it is concluded that the CCTs are found effective in preventing nutrient and micro-nutrient losses.

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