

Effect of Conservation Trenches on Plantation Crop in Degraded Watershed in Kandhamal District of Odisha

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Abstract

Kandhamal district situated in central part of Orissa receives an annual rainfall of 1396 mm, and this region is highly prone to soil and runoff loss due to heavy rainfall during kharif. A trial was conducted during 2001-2004 to study the effect of conservation trenches on plantation crop. This trial was conducted on farmers' field of Sudreju village of Kandhamal district under National Agricultural Technology Project (NATP, RRPS-7), with the following objectives.

1. To conserve moisture for establishment of plantation crop
2. To reduce erosion from upstream area.
3. To increase production of timber, fruit species, fuel wood and fodder .The following treatments were tried.

a. No treatment (Control) b. Continuous V-ditches at 10 m horizontal interval. c. Continuous V-ditches at 20 m horizontal interval. d. V-ditches staggered at 5 m horizontal interval. e. V-ditches staggered at 10 m horizontal interval. Mango varieties Pusa Amrapalli was tried during kharif and during, rabi Black gram (PU-30) was tried in between mango rows. It is observed that in, cont. contour V-ditch at 10 m interval rate of growth was 2.06 cm/month in case of Amrapalli, which is 46% higher compared to control. The grain yield of niger, black gram and mustard are 33.4%, 23.5% and 26.6% higher than control, respectively. Though the cost of construction is little high, it is recommended to practice contour V-ditch at 10 m intervals, to conserve soil and moisture, and to get more grain yield in degraded watershed of Kandhamal district.

Keywords: Conservation trenches; Plantation crop

Introduction

Kandhamal, though receives rainfall around 1396 mm, due to its uneven distribution, heavy downpour of rain at times results in sudden high runoff, which ultimately causes substantial soil loss. The uneven distribution of rainwater and movement of soil within the watershed, results heavy loss to farmers. So conservation trenches for plantation crops helps to conserve the soil and moisture, and ultimately improves grain yield of the farmers. The objectives of the experiment are to conserve moisture for establishment of plantation crop, to reduce soil erosion from upstream area, and to increase production of timber, fruit species, fuel wood and fodder.

Samra JS [1] reported that renovation of terrace and plantation of fruit plants, timber plants improved biomass production, net returns, growth of crop, productivity, reduction of runoff in the range of 1.5-10.8 times, peak flow rate by 20 times and soil loss in the range of 1.2 to 5.2 times, as well as water table rise. Subudhi et al. [2] have reported that effect of vegetative barrier like Vetiver has increased the rice yield, decreased the soil loss and decreased the runoff compared to farmers practice. Arora and Gupta [3] reported that there is a growing need for rain water management, since 96 m ha out of 142 m ha of net cultivated land of the country is rain fed. Scientific use of these resources will definitely increase the productivity and conservation of resources like soil and water. Kumar [4] reported that impact of different soil and water conservation techniques *viz.* contour bunding, terracing, land leveling, smoothening and gully plugging, sowing across the slope, vegetative barrier, increase the Kharif crops by 25-30%. Establishment of vegetative barrier with mechanical measures were more effective in controlling soil erosion (3.8 t ha^{-1}) over conventional method (9.64 t ha^{-1}), and runoff thereby making more moisture available for crop growth. Anonymous [5] reported that V-ditch at 10 m CCVD increased the crop yield significantly compared to no treatment.

Materials and Methods

The study area lies in the Pila-Salki Watershed of Mahanadi Catchment. It falls under Sudreju revenue village of Khajuripada block in Phulbani district. As per Soil Conservation Department Govt. of Orissa, it is a part of watershed ORM 3-9-6-5. As per watershed map classification reported by the Orissa Remote Sensing Application Center (Department of Science and Technology, Govt. Of Orissa), the selected Micro-Watershed falls under Sub-Watershed No 17-07-31-01-01. This sub-watershed consists of parts of Survey of India Topographical Sheet Nos. 73D/2, 73D/6, 73D/3 and 73D/7. However, the Micro-Watershed under study falls only under Topo Sheet No. 73D/6. These Micro-Watersheds are located at a distance of about 10 km from Phulbani district headquarters on Phulbani-Sudrukumpa State Highway. An on farm trial was conducted in the year 2001-2004, at Sudreju under Dry land Agril Research Project, Orissa University of Agriculture and Technology, Phulbani, financed through National Agricultural Technology Project, Rain fed Rice Production System-7. Five following treatments were tested with 4 replication in randomized block design.

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Treatments

T1-No treatment; T2-Continuous V-ditches at 10 m horizontal intervals; T3-Continuous V-ditches at 20 m horizontal intervals; T4-V-ditches staggered at 5 m horizontal interval; T5-V- ditches staggered at 10 m horizontal intervals.

The name of farmer is Kisore Pradhan. Mango variety Amrapalli was tried during Kharif in 5 meter spacing and Niger, Black gram and Mustard were tried during Rabi with 30 cm spacing. Weather was favorable for all crops (Table 1).

Disease and pest

Mango hopper in all Mango varieties. Crop stand: Good. Slope: Field was contour surveyed, and the slope was 4.15%. Soil loss was measured after the rainy season in the V-ditches; the soil was completely filled in 10 m CCVD. So soil conserved was calculated as we know the size of the V-ditch before and after the rainy season.

Results and Discussion

Monthly rainfall is presented in Table 2. It is observed from above table that the year 2002 is a drought years, it received only 74% of rainfall, a deficit of 36% from mean rainfall. But 2001 and 2003 are

Sl.No.	Name of the farmer	Depth (cm)	Crop	pH (1:2.5)	EC (dsm ⁻¹ q)	OC (g/kg)	OM (g/kg)
1	Kishore Pradhan	0-30	Mango	5.42	0.0174	5.62	9.67
2	Kishore Pradhan	30-60	Mango	5.98	0.042	3.26	5.61

Table 1: Soil analysis report.

Month	Monthly normal	Actual in 2001	Deviation from normal, %	Actual in 2002	Deviation from normal, %	Actual in 2003	Deviation from normal, %
January	9.18	-	-100	13.0	+41.6	0.0	-100
February	14.07	-	-100	-	-100	23.5	+67.0
March	21.70	56.0	+158.1	20.0	-7.8	12.5	-57.6
April	30.40	-	-100	32.0	+5.2	89.0	+192.7
May	57.48	48.0	-16.5	70.0	+21.8	7.0	-87.8
June	191.62	504.9	+163.5	149.0	-22.2	117.0	-38.9
July	353.62	797.6	+125.6	129.0	-63.5	237.0	-33.0
August	378.65	300.1	-20.7	329.0	-13.1	358.1	-5.4
September	218.57	124.7	-42.9	134.9	-38.3	350.1	+60.2
October	88.93	111.5	+25.4	11.0	-87.6	216.0	+142.9
November	27.48	6.9	-74.9	-	-100	0.0	-100
December	4.45	-	-100	-	-100	42.0	-843.8
Annual	1396.15	1949.7	+39.6	887.9	-36.4	1452.2	+4.0

Soil: The soil data has been presented in Table 2 it reveals that pH is low in top soil (5.42), compared to bottom soil (5.98)

Table 2: Monthly rainfall (mm) during 2001, 2002 and 2003 and their deviation from mean.

Treatments	Niger (q/ha) (2001-02)	Black gram (q/ha) (2002-03)	Mustard(q/ha) (2003-04)	Mean moisture Content (%) At 0-30 cm on weight basis during 2001-03	Mean rate of growth of mango (cm/month) during 2001-2003	Mean Soil conserved in ton/ha
T1-No treatment	2.33	6.12	4.17	3.67	1.22	0
T2-Continuous V-ditches at 10 m horizontal interval.	3.11	8.00	5.28	10.25	3.02	6.2
T3-Continuous V-ditches at 20 m horizontal interval.	2.44	7.12	4.85	5.59	2.47	3.2
T4-V-ditches staggered at 5 m horizontal interval.	2.51	7.37	5.15	8.47	2.42	5.5
T5-V- ditches staggered at 10 m horizontal intervals.	2.49	7.25	5.00	7.02	2.50	3.1
SE (m) +	0.13	0.57	0.05			
CD (0.05)	0.39	NS	0.17			

Table 3: Yield, plant height and moisture content and soil conserved in different treatments.

good years receiving 39.6% and 4% more than the mean annual rainfall, respectively. The mean annual rainfall is 1396.14 mm. The fluctuation shows the rainfall is very erratic in all the three years.

Table 3 shows rate of growth of mango. The rate of growth is highest (3.02 cm/month) in T2-CCVD at 10 meter interval, and lowest (1.22 cm/month) in control from 2001-2003. The grain yield of Niger, black gram and mustard are 33.4%, 23.5% and 26.6% higher than control, respectively (Table 3). This may be due to more soil and water conserved at root zone of the crop as the moisture content in T2 is more compared to all other treatments and lowest in control, as there was no V-ditch (Table 3). The soil conserved in T2 is 6.2 ton/ha, followed by T5 where soil conserved was 5.5 t/ha. Patil et al. [6] has obtained similar result, they got lowest soil loss (1.51 t/ha) and highest survival percentage of cashew nut plantation in Continuous contour trench compared to staggered trench (3.95 t/ha) and control (16.55 t/ha). So it can be concluded that 10 m CCVD should be recommended for uplands of degraded watershed at Kandhamal district of Orissa.

Summary and Conclusion

The present study reveals that grain yield of niger, black gram and mustard are 33.4%, 23.5% and 26.6% higher than control, respectively. Though the cost of construction is little high, it is recommended to practice contour V-ditch at 10 m intervals, to conserve soil and moisture, and to get more grain yield in degraded watershed of Kandhamal district. It is observed that in cont. contour V-ditch at 10 m interval rate of growth was 3.02 cm/month in case of Amrapalli, which is 46% higher, compared to control. Also, we can conserve 6.2 t/ha of soil by 10 sm CCVD, which is highest among all the treatments.

It can be concluded that 10 m CCVD should be recommended for upland of degraded watershed of Kandhamal district of Orissa.

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