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CONTOUR BUNDING HELPS IN SOIL AND WATER CONSERVATION

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Systematic studies on evaluation of contour bunding in drought prone area in respect of runoff, soil losses, crop yields and moisture distribution in the inter bunded area were carried out at the Dry Farming Research Station, Solapur. The runoff and soil losses were found to be 3 to 4 times more from the unbunded area, indicating thereby usefulness of contour bunding from soil and water conservation point of view in drought prone area. The yields of pearl millet and red gram were increased by 26.76 per cent and 25.81 per cent respectively in contour bunded area. The increase in yield in contour bunded area was mainly due to more water conserved in the soil. The moisture content and eventually the yields were found to be more near the bund and decreased towards the centre of the field in contour bunded area. However, there was less variation in the crop yield and moisture content in the unbunded area.

The dry tract of the Maharashtra State suffers from a very scanty and illdistributed rainfall of which a large percentage is of erosive nature. Partial or total famine due to failure of rainfall is quite common in this area. Large quantities of surface soils have been lost due to soil erosion in the past and are being lost every year. Soil and moisture conservation have, therefore been the basic needs of the drought prone area for successfull crop production.

The construction of bunds for controlling runoff and soil losses is an age old practice though it was not based on the proper engineering principles. A programme of construction of contour bunding in shallow and medium soils of low rainfall areas was started on catchment basins since 1943 in Maharashtra. The primary aim of the programme was to prevent further erosion and to conserve consequent rainfall which ultimately leads to more crop production. The primary studies on the effect of contour bunding on crop yields showed about 7-8% increase in yields of crops due to contour bunding. It was further observed that this increase in yield was as high as 20% in an year with low rainfall (Kanitkar *et al.* 1960). To evaluate the contour bunding from crop production point of view, the State Govt had undertaken 193 statistically laid out crop cutting trials during 1961 to 1963 (Pharande,

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1970). It was pointed out that the average increase in yield of pearl millet was 44.4% in the bunded area as compared with unbunded area. Similarly, the average increase in yield of *rabi* sorghum was 35.7% in the bunded fields. Khan (1961) also found a beneficial effect of bunding from crop production point of view as well as for moisture conservation. A detailed interpretation was done by Kulkarni and Raheja (1970) of the data collected for evaluation of contour bunding in Maharashtra. It wss reported that 1% increase in bunded area in Pune division gave an increase of 0.5% in production of of sorghum, 0.3% for pearl millet and cotton, and 0.4% in groundnut.

Crop production, however, is not the only criteria for evaluating the contour bunding. The runoff, soil losses, moisture distribution in the inter bunded area, crack developments and other related aspects are also required to be taken into consideration while evaluating the effects of contour bunding. Systematic studies in this respect were therefore started at the Dry Farming Research Station, Solapur since 1975-76 and the results are discussed here.

MATERIAL AND METHODS

The investigation was coducted at the Dry Farming Research Station, Solapur in shallow soils having 15 to 35 cm soil depth with clay content 41.99%, silt 38.01%, sand 17.40%. Hydraulic conductivity (cm/hr) 9.01, Bulk density, (g/cm)^3) - 1.25, Infiltration rate (cm/hr) - 0.78, pH 8.0 EC (mmhos/cm) - 0.14, Organic carbon - 0.59%, Av. P. 4.8 kg/ha and Av.K. 205 kg/ha. A piece of 4.60 ha area was divided into two separate compartments along the slope (3%). In one compartment, contour bunds having cross section 0.95 m^2 were constructed with necessary surplusing arrangement, and the other compartment was kept as such without any soil conservation measure. An intercropping system of pearl millet+red gram (2:1) was adopted in both the compartments with same seed rate 2.5/g + 12.5/g/ha respectively, with 30 cm spacing, 50 kg N+25 kg P_2O_5 / ha and three hoeings were given as per the recommends. The runoff losses were recorded with the help of automatic water level recorders and 90°V knotches. The soil losses were determined by collecting the adequate runoff samples for every five minutes during the storm. The moisture content in the soil was determined gravimatrically with 15 days interval. The consumptive use of moisture (CUM) is calculated by using periodical moisture and CUM is utilised in estimation of MUE in the field as

$$\text{MUE Kg/mm} = \frac{\text{Grain production in kg}}{\text{CUM in mm.}}$$

The moisture use efficiency MUE is defined as grain production

in kg per millimeter of moisture utilised.

The yield of the crops of pearl millet and Red gram were recorded at every 10 m interval along the slope for both the compartments.

RESULTS AND DISCUSSION

Runoff and Soil Losses :

The runoff and soil losses recorded from both the compartments during five years are presented in Table 1. The runoff occurred for very few occasions. The average runoff losses were only 3.41 mm in case of contour bunded area as against 10.39 mm in case of unbunded area, which is four times more than the contour bunded area. It would be clear from the data that the contour bunding was helpful in reducing the runoff losses. During the period of heavy rains, water stagnated against the contour bund, and thus prolonged the time for penetration of water in the soil. This ultimately resulted into increase in the moisture storage in the soil. However, in the unbunded area, most of the rain water was lost as runoff with ease as there was no provision of any obstacle for controlling the rain water.

Teble 1 Runoff and soil losses from contour bunded and unbunded area

Year	Total rainfall (mm)	Rainfall causing runoff (mm)	No. of incidences of runoff	Bunded			Unbunded		
				Total runoff (mm)	Runoff %	Soil losses (kg/ha)	Total runoff (mm)	Runoff %	Soil losses [kg/ha]
1977-78	524.00	69.47	One	2.80	4.03	310.00	4.87	7.00	474.00
1978-79	879.00	187.59	Two	2.40	1.28	158.36	11.86	6.09	698.19
1979-80	764.00	201.25	Five	3.22	1.60	240.10	12.39	6.15	989.82
1980-81	643.00	42.94	Two	0.67	1.56	4.03	11.11	4.95	32.91
1981-82	731.50	377.00	Twelve	7.99	2.12	261.06	11.70	3.10	828.72
Average	708.00	175.06	—	3.41	2.12	194.71	10.39	5.46	604.73

Apart from prevention of runoff, contour bunding activity in the drought prone area has another distrnct role to play, namely that of soil erosion control. The contour bunding was found to prevent the soil erosion with only 194.71 kg per year soil losses as against 604.73 kg per year though unbunded area. In contour bunding, the runoff stagnated against the bund which helped to deposit the silt at upstream side of the contour bund. The excess runoff was disposed off through the specially constructed waste weirs without erosion. However, in unbunded area the runoff took place along the slope of the field, which resulted into sheet and rill erosion and

sometimes a gully erosion. Thus, it clearly indicates that for soil and water conservation, contour bunding is essential in drought prone area.

CROP YIELDS :

The crop yields recorded from contour bunded and unbunded area are given in Table 2. The average yield of pearl millet from contour bunded area was 7.28 q/ha as against 5.74 q/ha from unbunded area, with 26.76% increase in the yield. The yield of Red gram was also found to increase by 25.81% due to contour bunding. The increase in the yield may be attributed to the increased moisture conservation in the soil due to contour bunding.

Table 2 Yields of crops from contour bunded snd unbunded area

Year	Pearl millet [q/ha]		Per cent increase	Red gram (q/ha)		Per cent increases
	Contour bunded	Unbunded		Contour bunded	Unbunded	
1976-77	3.55	2.53	40.31	0.58	0.40	45.00
1977-78	1.53	1.38	10.86	1.30	0.92	41.30
1978-79	10.62	9.24	14.93	1.78	1.60	11.25
1979-80	7.04	5.33	32.08	0.87	0.78	11.53
1980-81	9.48	7.28	30.21	0.41	0.35	17.14
1981-82	11.50	8.70	32.18	2.02	1.57	28.66
Average	7.28	5.74	26.76	1.15	0.93	25.81

Though there was an increase in the yield due to contour bunding, the crop yields were not found to be uniform throughout the interbunded space as presented in Tabie 3. The yields of both the crops were higher near the bund and were in decreasing order towards the centre.

In contour bunded area, the yield of pearl millet near the bund was 13.10 q/ha, whereas it was as low as 7,94 q/ha at the centre of the field. Similarly, the yield of Red gram near the bund was 2.17 q/ha, and the same decreased as low as 1.15 q/ha at the centre. However, in case of unbunded area, though the crop yields were low as compared to contour bunded area, the yields of both the crops were almost uniform throughout the field. The moisture conserved in the soil and the consmptive use of moisture also showed similar trend.

Table 3 Variation in the yield and M. U. E. in the contour bunded and unbunded area (1976-77 to 1981-82)

Distance from the bund (m)	Contour bunded			Unbunded		
	Pearl millet (q/ha)	Red gram (q/ha)	M. U. E. (kg/mm)	Pearl millet (q/ha)	Red gram (q/ha)	M. U. E. (kg/mm)
10 (1st bund)	13.10	2.17	4.19	11.19	1.64	3.81
20	10.96	2.07	3.79	9.96	1.36	3.11
30	9.39	1.82	3.09	9.34	1.22	2.88
40	8.09	1.57	2.61	9.12	1.15	2.74
50	7.96	1.21	2.54	8.89	1.10	2.49
60	7.94	1.21	2.50	8.24	1.04	2.49
70	9.49	1.15	2.99	8.12	1.01	2.48
80	11.72	2.67	3.92	7.90	0.94	2.39
90 (2nd bund)	13.50	2.32	4.68	7.85	0.93	2.35
10	9.09	1.64	3.27	7.70	0.91	2.31
20	7.48	1.28	2.45	7.44	0.92	2.25
30	7.59	1.05	2.36	7.01	0.90	2.10
40	8.70	1.22	2.53	6.76	0.96	2.01
50 (3rd bund)	10.00	1.57	3.41	6.81	0.88	1.98

Whether the present spacing is able to provide adequate moisture over the whole bunded compartment for proper growth of the intended crops is a point that requires further investigation. However, with about 1 to 2 per cent slope, the approximate distance between the two bunds is usually 80 to 90 m and with 0.3 m water head at the waste weir. The ponded water against the bund would spread up to 15 to 20 m above the bund within the compartment. It will also be seen that the area below the contour bund also gets advantage of percolation water from the ponded area and the benefit of conserved moisture was extended over a strip of 30 to 40 m in width.

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