Journal of Agrometeorology 6 (2) : 238 - 241 (Dec 2004)

Effect of different land management practices on moisture conservation and yield of wheat in the mid Himalayan region of Uttaranchal*

N.S.MURTY, R.K.SINGH and M.P.S.ARYA[1]
GBPUAT, Hill Campus, Ranichauri-249 199, Tehri Garhwal, Uttaranchal
[1]National Centre for Women in Agriculture, Bhubaneswar, Orissa

ABSTRACT

An experiment was conducted using different land management practices to optimise the conservation of moisture at Ranichauri. The treatment no tillage conserved lowest moisture during all the three years of experimentation. While ridges & furrows conserved highest moisture of 8.4% higher than no tillage followed by deep tillage. A linear regression was fitted between the moisture consumed and total dry matter per plant during the last 50 days of crop growth. Among the treatments, on an average, deep tillage gave the highest wheat yield of 13.6 qha^{-1} followed by tied ridges.

Key words: Moisture conservation, land treatments, wheat

Himalayan ecosystem constitute an important part of the world's climate and characterised by a harsh and fragile system which affects the productivity greatly. In this region 90 % of the cultivated area is rainfed. Moderate to severe soil erosion on the slopes is one of the main problems. Cultivation is practised even on lands having slopes 60% or more without proper terracing which causes severe soil erosion and water losses. Thereby, moisture retained in the soil is low. Because of this, crops suffer from moisture stress during the long dry spells and breaks in the monsoon during *kharif* season which are not uncommon. The rainfall during *rabi* is not only low but also erratic in its distribution. The thermal regime is also low during early part of the *rabi* season and the crops remain dormant for a period of two to three months after germination. In some cases the crop may germinate in the month of February. Once the crop starts growing from month of February, the distribution of rainfall is low and erratic in quantity. The only alternate way of augmenting the soil moisture is to develop technologies to conserve moisture. In order to achieve this an experiment was laid out to study the *in situ* moisture conservation by different land management practices and their effect on yield of wheat in the mid Himalayan region.

*Paper presented in the National Seminar on "Agrometeorological Research for Sustainable Agricultural Production", held at G.A.U., Anand during 27-28 September 2001.

MATERIALS AND METHODS

An experiment was conducted at G.B.Pant University of Agriculture and Technology, Hill Campus, Ranichauri situated at an altitude of 1900 m, latitude of 30° 15' and longitude of 78° 30' to study the effect of different land management practices on moisture conservation. The experiment was conducted with wheat (cv. HS 240) as a test crop with seven treatments and three replications in a randomised block design during 1996-99. The treatments were no tillage, conventional tillage, deep tillage, ridges and furrows, compartmental bunding, tied ridges and deep sowing. The dates of sowing were 12.12.96, 10.12.97 and 10.12.98 and crop was harvested on 20.6.97, 25.5.98 and 17.5.99 respectively. The plot size was 4 x 3 m. Fertilizer applied was 60 Kg N and 40 Kg P_2O_5 per hectare as basal application. Package of practices recommended for the region were followed. Soil moisture was measured at regular intervals during crop growth seasons and the same was converted to depth of water (mm) available for the crop. The total dry matter per plant was also calculated and linear regression was fitted between the moisture consumed during the last 50 days of crop growth and total dry matter per plant.

RESULTS & DISCUSSION

The weekly rainfall during *rabi* 1997-98 was above normal, while during 1998-99 it was only 38% of the average *rabi* season rainfall. A total of 398.8 mm, 671.7 mm and 173.1 mm was recorded during

Table 1 : Influence of different land treatments on soil moisture (mm)

Treatments	1996-97				1997-98				1998-99				
	0-15	15-30	total	%increase over control	0-15	15-30	30-45	total	%increase over control	0-15	15-30	30-45	total	%increase over control
No tillage	37.8	40.2	78.0	-	47.2	51.5	54.7	153.4	-	34.9	39.9	46.4	121.2	-
Conventional tillage	34.2	41.8	81.0	3.8	49.7	53.2	56.1	159.0	3.6	35.5	43.2	47.2	125.9	3.9
Deep tillage	41.2	43.9	85.1	9.1	53.1	56.8	59.6	169.5	10.6	35.8	41.2	47.7	124.7	2.9
Ridges & furrows	41.3	43.6	84.9	8.8	49.6	53.1	58.7	161.4	5.3	39.2	44.4	50.9	134.5	11.0
Compartmental bunding	41.8	43.9	85.7	9.9	50.0	52.3	56.1	158.3	3.2	37.4	43.1	47.0	127.6	5.2
Tied ridges	40.4	42.9	83.3	6.8	48.2	52.2	55.6	156.0	1.9	38.8	33.8	50.3	122.9	1.4
Deep sowing	39.6	42.2	81.8	4.9	48.2	51.3	54.8	158.3	0.6	35.2	40.8	46.7	122.6	1.2

Table 2 : Effect of land treatments on total dry matter (TDM g plant^{-1}) and moisture consumption (mm) during 1996-97

Treatments	Initial stage		Grand growth		Grain fillling	
	TDM	Moisture consumed	TDM	Moisture consumed	TDM	Moisture consumed
No tillage	1.36	69.5	6.33	100.3	10.98	152.5
Conventional tillage	1.89	77.5	6.40	108.3	13.99	154.7
Deep tillage	1.47	67.4	3.66	108.3	15.82	155.9
Ridges & furrows	1.46	73.9	4.86	112.5	14.71	162.8
Compartmental bunding	1.72	75.7	4.88	113.8	11.75	158.4
Tied ridges	1.31	80.7	5.49	110.4	14.21	160.9
Deep sowing	1.42	68.3	4.88	106.5	10.25	147.4
Average	1.52	73.3	5.21	108.6	13.10	156.1

Table 3 : Effect of wheat yield (q ha^{-1}) as influenced by different land treatments.

Treatments	1996-97	1998-99
No tillage	8.75	7.49
Conventional tillage	13.75	6.83
Deep tillage	11.46	15.9
Ridges & furrows	13.13	3.06
Compartmental bunding	10.38	9.49
Tied ridges	10.00	11.11
Deep sowing	10.00	9.65
Average	11.10	9.08

1996-97, 97-98 and 98-99 respectively as against average rainfall of 452 mm. During 1996-97 *rabi* season was near normal, however, during 1998-99 though rainfall of 173.1 mm was recorded only 97.3 mm was received from 44 to 18 standard meteorological week. During 1996 November and December months were dry and similar pattern was observed during 1998 also. However, during 1997 the rainfall was quite good in these two months, which along with adequate rains during early part of 1998 helped the crop to perform better.

During all the three years of experimentation the treatment 'no tillage' conserved lowest moisture. The treatment, ridges and furrows conserved higher moisture of 8.4% (Table 1) more than no tillage followed by deep tillage. The deep sowing treatment could conserve only 2.2

percent above no tillage. Over the three year period, the treatment ridges and furrows followed by deep tillage could conserve relatively higher moisture. During normal rainfall season i.e., 1996-97, the moisture conservation practice (compartmental bunding) could conserve the moisture upto 9.9% over control, whereas during excess rainfall year only the treatment, deep tillage could conserve 10.6% moisture over control. However, other treatments were at par, while during dry year 1998-99, similar results were observed.

The total dry matter per plant collected during 1996-97 are presented in Table 2. Highest dry matter per plant was observed with the treatment deep tillage (15.8 g plant^{-1}) followed by ridges and furrows. Similar pattern was observed during 1998-99. The moisture consumption was calculated from the available soil moisture and rainfall received during the period. The soil moisture available when the total dry matter was around 1.3 g plant^{-1} was taken as initial soil moisture and later moisture consumption was calculated. The consumption of moisture was calculated when the growth pattern was high. A linear regression was fitted between the moisture consumed (X) and total dry matter per plant (Y) during last 50 days of the growth and the linear regression equation thus found is as follows

$Y = -10.143 + 0.152\ X$ $(R^2 = 0.89^{**})$

The wheat yield as influenced by different treatments is presented in Table 3. On an average deep tillage gave highest yield of 13.6 q ha^{-1} followed by tied ridges and conventional tillage while no tillage produced 8.12 q ha^{-1}. During both the years similar pattern was observed. During 1997-98 though the germination was good, the crop growth was poor up to the month of March and therefore, experiment was abandoned.

The apparent yield decline in the minimum tillage system needs to be evaluated in terms of tillage cost and improved technologies for wheat, residue and nutrient management. Though not significant, effect of treatment deep tillage was found to be superior over other treatments. However, the treatment deep tillage produced 55.1% higher than the treatment no tillage.

REFERENCES

Anonymous, 1996-99. Final Report of ICAR Ad-hoc project on *In situ* moisture conservation under hill conditions, G.B.Pant University of Agriculture & Technology, Hill Campus, Ranichauri.

Anonymous, 1996-99. Annual Progress Reports of All India Coordinated Research Project on Agrometeorology, G.B.Pant University of Agriculture & Technology, Hill Campus, Ranichauri.

Murty, N.S. and Singh, R.K. 1998. Studies on Climatic factors in the mid Himalayan region of U.P. with special reference to Agriculture. *J. Appl. Hydrol.*,11(2-3): 57-63.