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RESEARCH PAPER

Effect of tillage practices on soil moisture in vertisol

■ **SACHIN S. BHAGADE,** KAPIL K. SAMAR **AND** AMOL D. SHURPATNE

ABSTRACT

Effect of tillage practices on soil moisture conservation practices in vertisol was carried out during *Kharif*-2012 at All India Co-ordinated Research Project (AICRP) for dryland agriculture farm, Marathwada Agricultural University, Parbhani, to know the effect of tillage practices on soil moisture content in the soil regime. Four treatments from 10 cm to 40 cm; were adopted. It was found that ploughing across the slope up to 30cm depth is beneficial.

KEY WORDS : Tillage practices, Soil moisture, Vertisol

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INTRODUCTION

India has largest area under cultivation but ranks fourth in production. In India, deep rooted and shallow rooted crops are grown which requires optimum tillage for germination. Tillage normally is used to modify the structural organization of the soil by mechanically loosening the soil surface. This loosening results in a reduction of bulk density and an associated increase in the porosity and hydraulic conductivity. Water retention is enhanced and root proliferation is encouraged to exploit available soil water and nutrients. Harrowing, ploughing and chiselling are the main tillage operations.

Tillage operation is essential for both shallow and deep rooted crops (Cavalaris and Gemtos, 2002; Gurumurthy and Rao, 2006 and Manian *et al.*, 1984). Many deep rooted crops are grown in India. Among all, Cotton is one of the important. In India, cotton is grown on around 9 million hectare. Maharashtra grows above 30 per cent cotton of this country but only 18 per cent production is obtained (Ahmadi amd Mollazade, 2009 and Ahuja, 2002).

Moisture content of the soil is the main feature contributing the growth of the cotton. At the sowing time, moisture content greater and then periodically it goes down which is known as moisture depletion. The rate of moisture depletion can be decreased by using conservation practices. Vertisol (referred as black soil) covers an area of 72.90 m/ha which contribute almost 22.2 per cent of total geographical area of country. This soil has high water storage capacity and high production potential. The soil becomes very hard when dry and it is extremely difficult to plough. Due to improper knowledge of tillage practices, farmers are not taking interest for cultivating these soils in rainy season. The main intent of this study is to evaluate the effect and cost economics of tillage practices on soil moisture at different depth.

Many researchers show their keen interest towards moisture conservation technique. Manyatsi *et al.* (2011) carried out a research on the effect of different *in-situ* water conservation tillage methods on growth and development of Taro. It was found that growth and yield of taro were highest under irrigation of flat land in decreasing order by tied-ridged, ridges, half moon and under rainfed flat condition (Bharambe *et al.*, 1999; Chavan, 1999; Devkant and Tiwari, 2000 and Gupta and Bhan, 1993).

Malligawad (2010) studied the effect of *in-situ* soil moisture conservation and nutrient management practices on the productivity of sesame and sorghum in sequence cropping system and indicated that *in-situ* soil moisture conservation through 2:1 or 3:1 skip row method of planting along with application of either organic manures or organic manures + inorganic

fertilizers to preceding sesame crop and no organic manures and no inorganic fertilizers to succeeding sorghum produced higher yields of both the sesame and sorghum crops in this system.

Allolli *et al.* (2008) reported that ridge and furrow along with mulch enhanced the vigour of the crop as manifested in higher plant height, leaf area and dry matter production. Awodun (2007) found that ridge is the most suitable tillage operation for production of fluted pumpkin vegetable in Nigeria region. Bhanavase *et al.* (2007) also recommended the ridge practices for Pigeonpea.

EXPERIMENTAL PROCEDURE

In the present study, an experiment was carried out at All India Co-ordinated Research Project for dry land agricultural farm, Marathwada Agricultural University, Parbhani (M.S.). The study area falls under semi arid tropic climatic condition. The area is bounded by longitude 76°47'E and latitude 11°36'N. The average rainfall is 892mm per annum. The mean daily maximum temperature at Parbhani ranging from 44°C during month of May and lowest 11°C during December.

Mechanical and chemical compositions of the soil of experimented plot were determined by mechanical and chemical test. The soil sample were collected from field up to a depth of 30cm. Half kg of well mixed soil sample was taken for tests. Soil properties determined during the test are given in Table A. Experimental details are mentioned in Table B. Schematic view of experimental field is shown in Fig. A. Four treatments were adopted in the experimental field wherein the ploughing practice was done by tractor drawn mould board plough across the slope at a depth of 10 cm to 40 cm with an interval of 10 cm.

At an interval of 10 days, replication wise soil sample were collected from a depth of 15 cm, 30 cm and 45 cm. Moisture content from the collected samples were calculated by the gravimetric method as shown in eq.1.

$$\text{Moisture content (db)} = \frac{W_1 - W_2}{W_2} \times 100$$

where,

Table A : Physical and chemical properties of sample soil

Sr. No.	Soil characteristics	Unit	Value
Mechanical composition			
1.	Coarse sand	Per cent	6.58
2.	Fine sand	Per cent	10.30
3.	Clay	Per cent	54.40
4.	Silt	Per cent	21.44
Chemical composition			
1.	Ph		8.02
2.	EC	Ds/m	0.16
3.	Organic carbon	Per cent	0.62
4.	$CaCO_3$	g/kg	5.7
5.	Available N	Kg/ha	135.6
6.	Available P	Kg/ha	4
7.	Available K	Kg/ha	829.4

Table B : Experimental details

Sr. No.	Parameters	Specification
1.	Field size	64×49.2 m
2.	No. of treatments	4
3.	No. of plots	12
4.	Replication	3
5.	Design	Split plot
6.	Land slope	1.45 per cent
7.	Soil type	Medium black

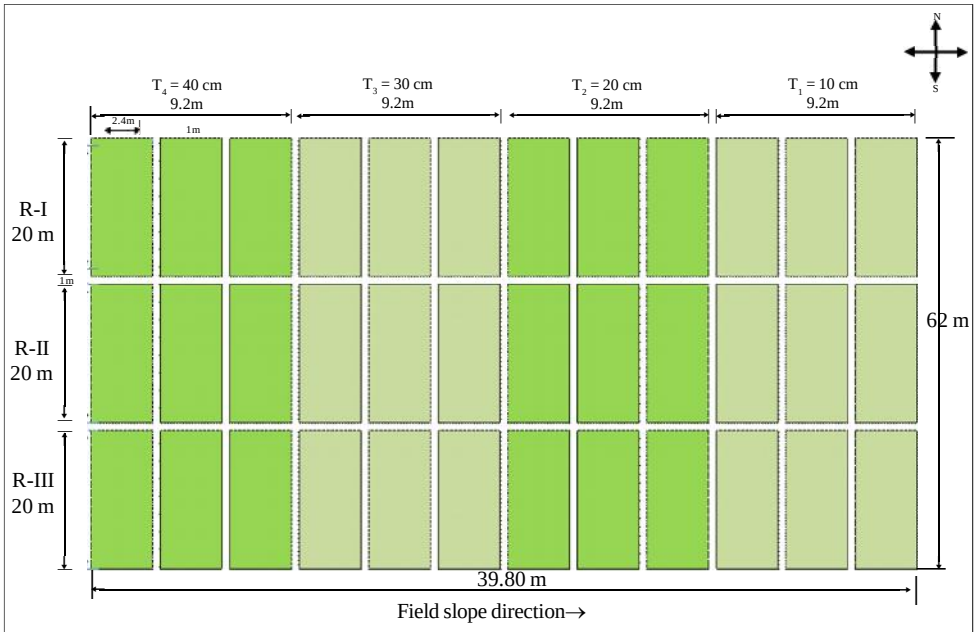

Plate No. 3.1 Layout of plot

Fig. A : Schematic view of experimental field

W_1 = weight of wet sample, g.
W_2 = weight of dry sample, g.

In each treatment, time required for ploughing was noted by stop watch and time required for ploughing per hectare was worked out which shows the economics of tillage practices.

EXPERIMENTAL FINDINGS AND ANALYSIS

Tillage treatment and depth wise soil moisture content (%) as influenced by tillage practices were recorded. Five sets of such experiments were done at an interval of 10 days. First experiment was done on 2nd September 2012, where in it was found that ploughing across the slope tillage up to 40cm depth recorded higher soil moisture content *i.e.* 16.08 per cent and it was 26.61 per cent more than the control treatment (T_4). Also, ploughing across the slope up to 30cm depth (T_2) and up to 20 cm depth (T_3) recorded 23.85 per cent and 20.70 per cent more than control treatment, respectively as shown in Fig. 1.

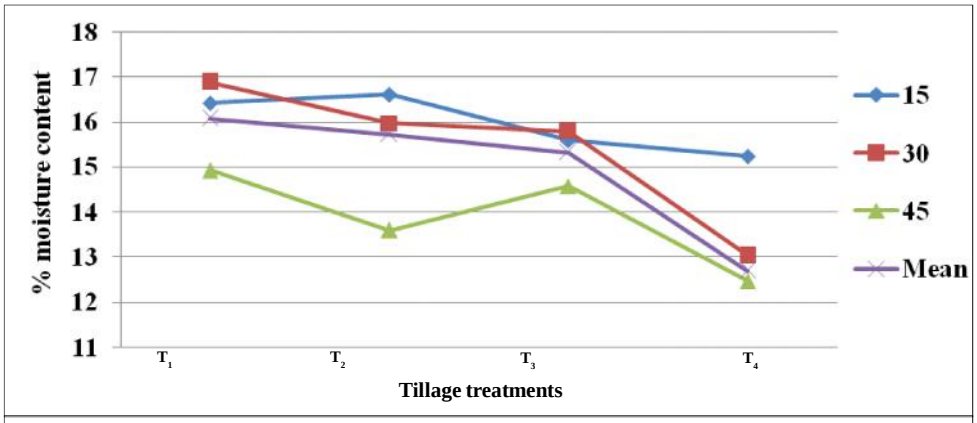

Fig. 1 : Variation in moisture content against tillage treatment

In every set of experiment a similar trend of results were observed. It was found that treatment T_1, T_2 and T_3 recorded significantly superior soil moisture content than control treatment (T_4). The interaction of tillage practices and depth shows that tillage practice (T_1) at 30cm depth recorded higher soil moisture content than rest of the tillage practices. Tillage treatment and depth wise soil moisture content (%) as influenced by tillage practices during crop growth period, *Kharif*-2012 is shown in Fig. 2. Ingle *et al.* (1998) and Jat *et al.* (2010) also worked on the similar topic.

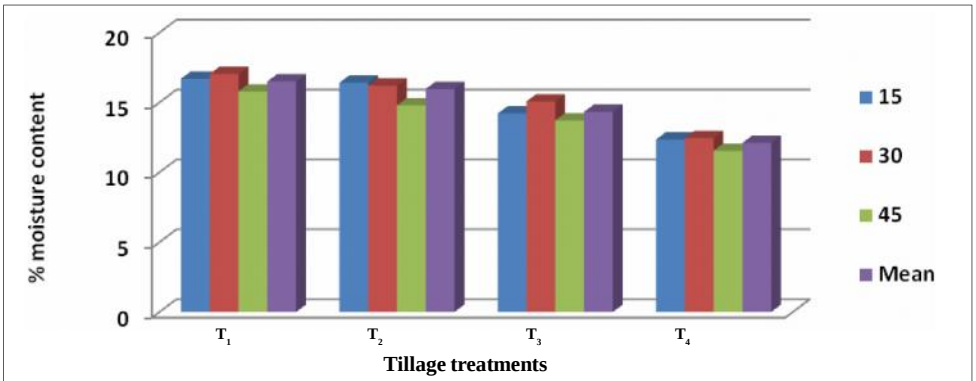

Fig. 2 : Variation in soil moisture during *Kharif*-2012

Conclusion :

In this experiment , ploughing was done across the slope up to 40cm depth (T_1), up to depth 30cm (T_2), up to 20cm depth (T_3) and up to 10cm depth (T_4) *i.e.* control treatment. Design was split plot with three replications. Replication wise soil samples were collected by 10 days interval at 15cm, 30cm and 45cm depth and their moisture content was recorded. Among tillage practices ploughing up to 30cm depth across the slope give significantly higher soil moisture content *i.e.* 16.51 per cent over the rest of the treatments and it was 36.33 per cent more than the control treatment. It is concluded that ploughing across the slope up to 30cm depth is more beneficial for conserving maximum rainwater.

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MEMBERS OF RESEARCH FORUM

AUTHOR FOR CORRESPONDENCE :

Sachin S. Bhagade
College of Agricultural Engineering and Technology,
Marathwada Agriculture University,
PARBHANI (M.S.) INDIA
Email: bhagadesachin2008@gmail.com

CO-OPTED AUTHORS :

Amol D. Shurpatne, College of Agricultural Engineering and Technology, Marathwada Agriculture University, PARBHANI (M.S.) INDIA
Email: bhagadesachin2008@gmail.com

Kapil K. Samar, College of Technology and Engineering, Maharana Pratap University of Agriculture and Technology, UDAIPUR (RAJASTHAN) INDIA