RESEARCH PAPER Asian Sciences (June & December, 2009) Vol. 4 Issue 1 & 2 : 47-49

Effect of tillage and organic amendments on moisture conservation, moisture use efficiency and economics of sorghum under rainfed conditions

A.L. DHAMAK*, P.N. KARANJIKAR[1], S.B. JADHAV[2], P.R. AMBEGAONKAR AND R.B. DESHMUKH[3]
Department of Soil Science and Agricultural Chemistry, College of Agriculture, Ambajogai, BEED (M.S.) INDIA

ABSTRACT

A field experiment was conducted for two consecutive years to see the effect of various tillage practices and organic amendments on moisture status, moisture use efficiency, yield and gross monetary returns of sorghum under rainfed conditions on vertisols. Three tillage systems (low weight wooden plough, high weight mould board plough and tractor plough), three organic amendments level (No FYM/PMC, PMC @ 5 Mgha^{-1} and FYM 5 Mgha^{-1}) and two pulverization treatments (two harrowings and one rotavation). Data showed a significant effect of deep tillage, press mud compost and rotavation on moisture status, moisture use efficiency, yield and economics of sorghum. The highest moisture conservation, moisture use efficiency, plant height, yield and net return were noted with tractor plough, press mud compost and pulverization by rotavation and lowest in case of low weight wooden plough, No FYM/PMC and pulverization by harrowings.

Key words : Tillage, Organic amendments, Pulverization, Economics, Moisture content

INTRODUCTION

Sorghum is the most widely grown cereal crop in arid and semiarid area of India. Sorghum successfully grown where rainfall during growing season exceeds 500mm.In Maharashtra, it is well adopted to annual rainfall of 500-1150 mm and best suited to medium black soil.

The farmer manages soil through tillage for loosening compacted soil for improving water infiltration, breaking hard pans to a depth of 30-50 cm, for facilitating root growth for good crop establishment and water use efficiency (Anonymous, 1997), destroying weeds, incorporating residues and amendments into soil (Prihar, 1990). Successful tillage systems and practices of amending the soil by organics have been developed specially for moisture conservation in the rainfed areas (Gill and Akhtar, 2002).

The present investigation was planned to determine the effect of different tillage systems in combination with organic amendments on soil moisture status, moisture use efficiency and economics of sorghum under rainfed conditions.

MATERIALS AND METHODS

A field experiment was conducted to evaluate the effect of different tillage systems and organic amendments on moisture conservation and economics of sorghum under rainfed conditions, at Agronomy farm, Marathwada Agricultural University, Parbhani (M.S.). Three tillage systems (T_1- tillage with low weight wooden plough, T_2- tillage with heavy weight mould board plough and T_3- tillage with tractor plough), three levels of organic amendments (A_1- No FYM/PMC, A_2-PMC @ 5 Mgha^{-1} and FYM 5 Mgha^{-1}) and two pulverization treatments (P_1-two harrowing and P_2-one rotavation) were used. The experiment was laid out in a factorial randomized design with four replications. The recommended doses of N,P and K were applied to soil in different plots. The soil of experimental field was clayey in texture with bulk density of 1.32 Mg M^{-3}, alkaline in reaction (pH-7.97) with normal EC of 0.38 dsm^{-1}, calcareous in nature, medium in organic carbon (4.2 gkg^{-1}), low in available nitrogen (196 kgha^{-1}), medium in available phosphorus (12.78 kgha^{-1}) and high in available potassium (356.68 kgha^{-1}). The soil moisture content in soil profile (15 cm depth interval) was recorded at sowing, flowering and harvest of crop as per method described by Singh (1980). The data regarding plant height, moisture use efficiency and yield was recorded and analyzed statistically. Economics was also calculated of each year.

RESULTS AND DISCUSSION

The results obtained from the present investigation are summarized below :

Moisture content:

The moisture content of soil was significantly

*** Author for correspondence.**
[1]Department of Agronomy, College of Agriculture, Ambajogai, BEED (M.S.)
[2]Department of Agricultural Engineering, College of Agriculture, Ambajogai, BEED (M.S.)
[3]College of Agriculture, Ambajogai, BEED (M.S.)

influenced by different tillage system and organic amendments (Table 1). The data showed that the moisture content was significantly higher for plots under tillage with tractor plough (T_3). The moisture content of soil profile was increased with depth of soil in all the treatments and at all the stages of sampling under both the years of study. The pulverization by rotavation (P_2) proved its superiority over the treatment two harrowing (P_1) to conserve more moisture in soil profile. Deep tillage loosed the soil thereby absorbed maximum soil moisture compared to mould board wooden plough. Similar results were described by Sharma *et al*. (1988).

As regard organic amendments, press mud compost proved its superiority over FYM and control to preserve greater moisture in soil at all the stages of sampling in both the years of study. The press mud compost contains calcium and phosphorus, having higher binding capacity of soil particles to influence structural indices; which inturn helped to conserve more moisture in soil profile for a prolonged period. The results are also in line with those of Bellaki and Badanur (1997).

Grain and fodder yield:

There was a positive effect of tillage and organic amendments on grain and fodder yield of sorghum (Table 2). Tillage with tractor plough resulted in significant increased the grain (1341.30 and 2085.50 kg ha^{-1}) and fodder (3307.70 and 5006.60 kg ha^{-1}) yield, respectively in both the years of study over other treatments of tillage. Incase of organic amendments, the results of PMC was positive to increase the grain (1293.00 and 1984.10 kg ha^{-1}) and fodder (3173.70 and 4851.50 kg ha^{-1}) yield than control and FYM for the two years, respectively. As regards, pulverization rotavation (P_2) proved its superiority over the treatments of two harrowing (P_1). Deep ploughing and incorporation of organic amendments might be resulted in better conservation of soil moisture, which ultimately used more efficiently by the crop for longer periods. During second year, the over all yield was high as compared to first year, which might be due to the well-distributed rainfall throughout the season.

Economic analysis:

Economic analysis (Table 2) showed that maximum net returned was obtained when soil was tilled with tractor plough (6562.70 and 10834.00 Rs. ha^{-1}), amending the soil with PMC (6314.40 and 10331.00 Rs. ha^{-1}) and pulverization by rotavation (6157.76 and 9573.93 Rs. ha^{-1}), respectively, in both the years of study over other treatments of tillage, organic amendments and pulverization.

Moisture use efficiency

Data pertaining to moisture use efficiency of sorghum are listed in Table 2, which showed that the influence of tillage and organic amendments on moisture use efficiency of sorghum. As regards, tillage treatments, T_3 treatment (2.47 and 3.48 kg $mm^{-1}ha^{-1}$) proved better over other treatments. The effect of T_1 and T_2 was more or less similar to influence moisture use efficiency. The organic

Table 1 : Moisture content of soil profile at 15 cm depth interval as influenced by tillage and organics at sowing and harvest of sorghum

Treatments	Sowing of sorghum						Harvest of sorghum					
	1998-99			1999-2000			1998-99			1999-2000		
	0-15 cm	15 -30 cm	30 - 45 cm	0-15 cm	15 -30 cm	30 - 45 cm	0-15 cm	15 -30 cm	30 - 45 cm	0-15 cm	15 –30 cm	30 - 45 cm
T_1	5.26	5.42	5.59	5.15	5.28	5.46	5.27	5.45	5.61	5.04	5.23	5.46
T_2	5.69	5.82	6.02	5.51	5.64	5.83	5.72	5.89	6.04	5.41	5.58	5.82
T_3	6.24	6.45	6.64	6.03	6.20	6.40	6.03	6.23	6.43	5.88	6.10	6.61
S.E.±	0.012	0.026	0.020	0.014	0.012	0.008	0.033	0.032	0.034	0.008	0.019	0.012
C.D. (P=0.05)	0.042	0.091	0.070	0.049	0.041	0.028	0.114	0.112	0.119	0.028	0.066	0.043
P_1	5.69	5.84	6.02	5.51	5.65	5.85	5.61	5.79	5.96	5.40	5.60	5.83
P_2	5.77	5.94	6.14	5.61	5.76	5.95	5.73	5.91	6.09	5.49	5.68	5.90
S.E.±	0.007	0.008	0.008	0.007	0.008	0.008	0.010	0.016	0.011	0.008	0.015	0.007
C.D. (P=0.05)	0.021	0.024	0.024	0.019	0.023	0.023	0.028	0.451	0.032	0.028	0.042	0.022
A_1	5.68	5.83	6.01	5.49	5.61	5.89	5.59	5.78	5.93	5.33	5.54	5.74
A_2	5.78	5.95	6.14	5.64	5.81	6.01	5.76	5.94	6.13	5.55	5.72	5.97
A_3	5.74	5.90	6.09	5.95	5.69	5.89	5.67	5.85	6.03	5.46	5.64	5.88
S.E.±	0.009	0.010	0.010	0.008	0.010	0.010	0.012	0.019	0.014	0.009	0.018	0.009
C.D. (P=0.05)	0.026	0.029	0.029	0.023	0.029	0.029	0.035	0.055	0.039	0.027	0.051	0.027

Table 2 : Yield, monetary return and MUE of sorghum as influenced by tillage and organics

Treatments	Grain yield (kg ha^{-1})		Fodder yield (kg ha^{-1})		Total monetary return (Rs. ha^{-1})		MUE (kg $mm^{-1}ha^{-1}$)	
	1998-99	1999-2000	1998-99	1999-2000	1998-99	1999-2000	1998-99	1999-2000
T_1	1072.20	1473.40	2650.00	3621.40	5251.10	7449.50	2.00	2.47
T_2	1258.00	1850.90	3083.00	4500.90	6139.50	9348.70	2.35	3.11
T_3	1341.30	2085.50	3307.70	5006.60	6562.70	10834.00	2.47	3.48
S.E.±	46.53	10.10	73.61	18.91	145.23	149.99	0.087	0.016
C.D. (P= 005)	160.77	34.92	254.37	65.35	501.80	518.22	0.303	0.056
P_1	1188.36	1735.10	2926.33	4223.56	5811.10	8847.46	2.21	2.91
P_2	1259.26	1868.00	3100.90	4529.00	6157.76	9573.93	2.35	3.13
S.E.±	30.88	5.61	46.17	10.90	108.89	183.09	0.057	0.009
C.D. (P= 005)	85.46	15.55	127.78	30.17	301.34	506.71	0.159	0.026
A_1	1142.30	1591.30	2833.30	3850.50	5602.40	7984.60	2.12	2.66
A_2	1293.00	1984.10	3173.70	4851.50	6314.40	10331.00	2.41	3.33
A_3	1236.20	1829.30	3033.70	4451.90	6036.50	9316.30	2.30	3.06
S.E.±	37.82	6.88	56.54	13.35	133.36	224.24	0.070	0.118
C.D. (P= 005)	104.68	19.04	156.49	36.95	369.07	620.59	0.195	0.032

amendment showed their differential response to improve moisture use efficiency of sorghum over control and PMC (A_2) recorded greater values (2.41 and 3.33 kg $mm^{-1}ha^{-1}$) of MUE in two years of study. The effect of pulverization was inconsistent in moisture use efficiency. The results are in line with Ratansingh *et al*. (2000).

REFERENCES

Anonymous (1997). On farm water management field manual.vol. VI. Irrigation Agronomy. Federal water management cell. Ministry of Food, Agriculture and livestock, Islamabad. **13** : 299-302.

Bellaki, M.A. and Badanur, V.P. (1997). Long-term effect of integrated nutrient management on properties of vertisol under dry land agriculture. *J. Indian Soc. Soil Sci.*, **45** (3): 438-442.

Gill, M.S. and Akhtar, M.S. (2002). Soil water use and bulk density as affected by tillage and fertilizer in rainfed wheat production system. In: Abs. Soil management under stress environment. pp. .39. 9th Int. natl. cong. Soil Sci. March 18-20,2002 at NIAB, Faislabad.

Prihar, S.S. (1990). Impact of tillage on soil physical environment. In: Abs: Applied soil physics in stress environment. pp.252-266. Jan.22-26, 1989 at PARC, Islamabad.

Ratansingh, Prasad, S.N. and Chauvan, V. (2000). Effect of tillage and crop residue on moisture conservation, grain yield, water use and water use efficiency of sorghum in kota clay loam soil. In : Abs: National seminar on development in soil science. 65th Annual Convention Indian Society of Soil Science. Dec.27-30, 2000.

Sharma, P.K., De Datt, S.K. and Redulla, C.A. (1988). Tillage effects on soil physical properties and wetland rice. *Agron. J.*, **80** : 34-40.

Singh, R.A. (1980). *Soil Physical Analysis.* Kalyani Publishers. New Delhi.

Accepted : October, 2009