Effect of mulching and land configuration on moisture use, moisture use efficiency and yield of soybean (*Glycine max* L.)

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ABSTRACT

An experiment was conducted to know the effect of mulching and land configuration on moisture use, moisture use efficiency and yield of soybean (*Glycine max* L) at Department of Agronomy, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola during *Kharif* season 2006.It revealed that application of straw mulch recorded lowest moisture use (292.75 mm) as compared to no mulch (299.93 mm) and moisture use efficiency was found highest in mulch plot (6.35 kg/ha-mm) over no mulch plot (5.06 kg/ha-mm). The maximum grain yield (1855.06 kg/ha) was recorded under mulch plot which was 18.12% more over no mulch plot. Among land configuration treatments, lowest moisture use was recorded in ridges and furrows (290.89 mm) followed by opening of furrows after every two rows (294.22 mm) and highest in flat bed (303.91 mm). Moisture use efficiency was found highest in treatment plot of ridges and furrow (6.23 kg/ha-mm) followed by opening of furrows after every two rows (5.99 kg/ha-mm) and lowest in flat bed (4.90 kg/ha-mm). Treatment plot of ridges and furrow recorded significantly higher yield of soybean as compared to other treatments.

Key words : Mulching, Land configuration, Moisture use, Moisture use efficiency

INTRODUCTION

Soybean (*Glycine max* L.) is one of the important oilseeds as well as leguminous crop. Due to its high nutritive value soybean cultivation has taken great strides during the recent years. It is cheapest and richest source of high quality protein. Among all legumes, soybean is most sensitive to soil moisture. After few showers, in month of July-August the monsoon rains are usually heavy and frequent. High evaporation under rainfed conditions especially after rainy season results high consumptive use and water loss from the soil which reduces water availability and moisture use efficiency of crop. Due to reduced soil moisture availability crops suffers from water stress and yield of crop gets reduced drastically. The loss in yield can be minimized if good amount of water is stored in soil. By adopting soil moisture conservation technique water availability and water utilization by crop increased to greater extent. So adoption of the agronomic practices like mulching is helping in reducing water loss from soil. Singh *et al.* (2006); Tomer *et al.* (2005) reported that use of mulching reduces water loss from soil, and increases yield, individually. So, the present study was conducted to evaluate the effect of mulching and land configuration on moisture use, moisture use efficiency and yield of soybean.

MATERIALS AND METHODS

An experiment was conducted during *Kharif* season of 2006 at Agronomy farm of Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola. The soil of the experimental plot was clayey in texture with 0.42 % organic carbon, and 197.40 kg/ha, 17.64 kg/ha, 356.85 kg/ha available N, P and K, respectively. Soil was slightly alkaline in reaction (pH–7.78). The field capacity and permanent wilting point in 0-30 cm depth were 33.50 and 15.60 per cent, respectively. The bulk density was 1.30 Mg m^{-3} for 0-30 cm soil depth. The rainfall received during crop season was 726.5 mm. The mean evaporation rate noted during crop season was 5.38 mm/day. Soybean crop variety TAMS-38 was sown on 21st July maintaining 45 cm x 5 cm spacing. The experiment was laid out in factorial Randomized Block Design with six treatments replicated four times. Mulching with wheat straw @ 5 t/ha was applied 24 DAS in between crop rows. Furrows were opened 24 DAS. Land configuration treatments consisted of flat bed, ridges and furrows and opening of furrows after every two rows. Crop was harvested on 30th October.

RESULTS AND DISCUSSION

The results of the present experiment as well as relevant discussions have been presented under following heads :

Effect of mulching :

The moisture content in soil from 0-30 cm depth was

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Table 1: Soil moisture content (%) at 0-30 cm depth as influenced by various treatment at different growth stages of crop

Treatments	30 DAS	45 DAS	60 DAS	75 DAS	At harvest
Mulching					
Mo	34.15	26.09	31.80	26.01	17.16
M_1	34.80	27.28	32.61	27.43	19.09
Land configuration					
F_1	33.66	25.11	31.32	25.92	16.77
F_2	35.22	28.05	33.13	27.44	19.32
F_3	34.54	26.90	32.17	26.80	18.28
Interaction (M x F)					
GM	34.47	26.68	32.20	26.72	18.12

found higher in mulched plots as compared to no mulch plots at all growth stages of crop up to the harvest of crop (Table 1). Highest moisture content was observed at 30 DAS (34.80 mm) followed by 60 DAS (32.61 mm) and 75 DAS (27. 43 mm). This might be due to reduced soil temperature due to mulching, which prevents the evaporation of water from soil. Dubey *et al.* (1993) stated that in soybean wheat straw mulching retained significantly more soil moisture (29.8 mm) over no mulch (23.6 mm). Treatment of mulching (M_1) recorded lowest moisture use (292.75 mm) as compared to no mulch (M_0) treatment (299.93 mm) (Table 2). Gajera *et al.* (1998) found that in pigeon pea the consumptive use of water decreased with application of sugarcane trash mulch (193.5 mm) as compared to mulch (227.5 mm). Similarly treatment of mulching (M_1) recorded highest moisture use efficiency (6.35 kg/ha-mm) over (M_0) treatment which showed lowest (5.06 kg/ha-mm). This result was supported by Gupta and Rao (1989); Sharma *et al.* (1985). They individually reported that higher water use efficiency was observed under mulching (3.3 kg/ha-mm) as compared to control (2.5 kg/ha-mm) in green gram and (3.3 kg/ha-mm) and (1.3 kg/ha-mm) in cowpea, respectively. There was significant improvement in number of pods/plant (38.96), weight of pods/plant (13.52 g^{-1}), number of grains/plant (80.08), grain yield/plant (9.67 g) and 100 seed weight (13.43 g) in mulched plot of wheat straw as compared to no mulch plot (Table 3). Treatment of mulching (M_1) significantly increased grain yield of soybean (1855.06 kg/ha) which was 18.12% more over no mulch (M_0) which was found (1570.53 kg/ha). Jayapaul *et al.* (1996) found that application of sugarcane trash mulch significantly increased seed yield of soybean (1127 kg/ha) over control (1035 kg/ha).

Table 2 : Moisture use (mm) and moisture use efficiency (Kg/ha-mm) as influenced by various treatments

Treatments	Grain yield (kg/ha)	Moisture Use (mm)	Moisture use efficiency (kg/ha-mm)
Mulching			
Mo	1570.53	299.93	5.06
M_1	1855.06	292.75	6.35
Land			
configuration	1480.71	303.91	4.90
F_1	1902.35	290.89	6.23
F_2	1755.33	294.22	5.99
F_3			
Interaction (M x F)			
GM	1712.89	296.34	5.70

Effect of land configuration:

In treatment plot ridges and furrows (F_2) highest soil moisture content from 0-30 cm depth was recorded at 30 DAS (35.22 mm) followed by opening of furrows after every two rows (F_3) (34.54 mm) and lowest soil moisture was observed in flat bed (F_1) (33.66 mm) at all growth stages of crops (Table 1). Lowest moisture use was found in treatment plot of ridges and furrows (F_2) (290.89 mm) followed by opening of furrows after every two rows (F_3) (294.22 mm) and highest in flat bed (F_1) treatment (303.91 mm). Moisture use efficiency was found highest in ridges and furrow (F_1) plot (6.23 kg/ha-mm) followed by opening of furrows after every two rows (F_3) (5.99 kg/ha-mm) and lowest in flat bed (F_1) treatment (4.90 kg/ha-mm). Jat *et al.* (2000) found ridges and furrows planting recorded higher water use efficiency in pigeon pea.

Significantly higher number of pods/plant (39.38), weight of pods/plant (13.20 g), number of grains/plant (80.01), grain yield/plant (9.56 g) and 100 seed weight (13.68 g) were recorded in the treatment plot of ridges and furrows (F_2) as compared to opening of furrows after every two rows (F_3) which also proved its superiority in recording significantly higher values for all these yield contributing characters over flat bed (F_1) treatment (Table

Table 3: Yield contributing characters and yield of soybean as influenced by various treatments

Treatments	No. of pods/ plant	Wt of pods plant (g)	No of grains/plant	Grain yield/plant (g)	100 seed weight (g)	Grain yield (kg/ha)
Mulching						
M_0	37.96	11.42	77.88	8.28	12.93	1570.53
M_1	38.96	13.52	80.08	9.67	13.43	1855.06
S.E. $\pm$	0.17	0.14	0.09	0.06	0.12	34.90
C.D. (P=0.05)	0.51	0.43	0.30	0.19	0.38	105.19
Land configuration						
F_1	37.41	11.69	78.08	8.36	12.66	1480.71
F_2	39.38	13.20	80.01	9.56	13.68	1902.35
F_3	38.61	12.52	78.85	8.99	13.20	1755.33
S.E. $\pm$	0.21	0.17	0.12	0.07	0.15	42.74
C.D. (P=0.05)	0.63	0.52	0.36	0.23	0.47	128.83
Interaction (MxF)						
S.E. $\pm$	0.29	0.24	0.17	0.11	0.22	60.45
C.D. (P=0.05)	N.S.	N.S.	0.52	0.33	N.S.	182.19
GM	38.46	12.47	78.98	8.97	13.17	1712.80

3). Significantly higher grain yield of soybean was recorded in ridges and furrows (F_2) (1902.35 kg/ha) as compared to opening of furrows after every two rows (F_3) (1755.33 Kg/ha) and flat bed (F_1) treatment (1480.71 Kg/ha). Ingale *et al.* (1999) concluded that significantly higher number of pods/plant, test weight, grain yield and straw yield/plant were recorded in soybean crop grown on ridges and furrows over flat bed. Significantly higher grain yield (18.41 q ha^{-1}) was recorded under ridges and furrows as compared to 15.83 qha^{-1} in flat bed. The increase in grain yield (Kg/ha) in ridges and furrows treatment plot might be due to ridge method of planting as it provides well drained and well aerated rooting medium on wet soils which helps to maintain proper air and water balance in these plots.

Effect of interaction (M x F):

Interaction effect of mulching and land configuration on number of grain yield (kg/ha) of soybean was found to be at par. Table 4 showed that grain yield (kg/ha) in treatment combination of mulching and ridges and furrows (M_1F_2) (1939.36 kg/ha) was being at par with treatment combinations of no mulch and ridges and furrows (M_0F_2) (1865.34 kg/ha). Mulching and opening of furrows after two rows (M_1F_3) (1816.86 kg/ha) and mulching and ridges and furrows (M_1F_1) (1808.95 kg/ha) recorded significantly higher grain yield ha^{-1} than the treatment combinations of no mulch and opening of furrows after every two rows (M_0F_3) (1693.80 kg/ha) and no mulch and flat bed (M_0F_1) (1152.46 kg/ha).

Table 4 : Effect of interaction between mulching and land configuration on grain yield of soybean (kg/ha)

Treatments	M_0	M_1	Mean
F_1	1152.46	1808.95	1480.71
F_2	1865.34	1939.36	1902.35
F_3	1693.80	1816.86	1755.33
Mean	1570.53	1855.06	
S.E. $\pm$	60.45		
C.D. (P=0.05)	182.19		

There was significant increase in grain yield due to mulching, as there is development of all yield contributing characters, as optimum moisture availability, probably utilized for reproductive growth of soybean crop. The higher grain yield in ridges and furrows was observed might be due to ridge planting as it avoids excess water or temporary water logging condition and provides relatively well drained and well aerated rooting medium on wet soils to which pulse crops are very sensitive. Also well aerated environment near to roots might increase higher N, P, and Zn uptake attributes to higher yield. Jat *et al.* (2000) found that nutrient uptake increase in biomass production and there by increase in higher yield of pigeon pea. Also, Chaudhary and Bhatia (1972) reported that yield of *Kharif* pulses increased when they are grown on ridges as compared with flat bed sowing in the event of continuous rains because *Kharif* pulses sown on flat bed were damaged by water logging. Low yield in flat bed system may observe because of water stagnation due to high intensity and frequency of rainfall which affects growth and development of crop which ultimately results in low yield.

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Accepted : January, 2010