Effect of Mulching Practices on Soil Moisture and Yield of Forage Crops

Champak Kumar Kundu
Bidhan Chandra Krishi Viswavidyalaya, India

Himangshu Das
Bidhan Chandra Krishi Viswavidyalaya, India

Pintoo Bandopadhyay
Bidhan Chandra Krishi Viswavidyalaya, India

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Champak Kumar Kundu*, Himangshu Das, Pintoo Bandopadhyay
Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, India
*Corresponding author e-mail : champakbckv@gmail.com

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Introduction

One of the main impediments in the way of improvement of livestock production is insufficiency of fodder. The gap between supply and demand would further aggravate due to increase in livestock population. In eastern India and Bengal delta land is usually devoted to fodder crops beyond monsoon when soil moisture becomes a limiting factor for crop production. Appropriate soil moisture conservation practices may reduce the evaporation loss and increase the yield. Among the different soil water conservation measures, mulching has gained popularity because it reduces the direct evaporation loss of soil water by restricting the transport of water vapour from soil surface to the adjoining microclimate. Although a number of researchers have evaluated the positive effect of mulching in different crops, information is lacking in fodder crops from lower gangetic plains. The present study was undertaken to assess the effect of mulching on soil moisture and yield of different forage crops.

Materials and Methods

A field experiment was carried out at the central research farm (latitude 22^0 $58^/$N, longitude 88^0 $31^/$E and 9.75 m above mean sea level) during the winter and summer seasons of 2010-11. The experimental site is located in the tropical sub-humid climatic zone of eastern India. Average annual rainfall is 1608 mm and most of its received during June to September. The soil was sandy loam in texture with bulk density 1.46 g/cc, having pH of 6.9 and organic carbon 0.38%. The available N, P_2O_5 and K_2O were 192.30, 17.25 and 145.65 kg/ha, respectively (0-15 cm depth of soil). Three perennial grasses (*Panicum maximum* cv. Hamil, *Setaria anceps* cv. Nandi and *Brachiaria brizantha* cv. Selection 665) and three different mulching (no mulching, soil dust mulching and live mulching with legumes) were replicated thrice and laid out in a factorial Randomized Complete Block Design. A spacing of 50 x 50 cm between rows and plants were maintained for perennial grass. Berseem and cowpea seeds were sown in between two lines of perennial grass in live mulch plots during winter and summer seasons respectively. At the same time, soil dust mulching was introduced by loosening of surface layer. Observations were recorded on green forage yield (q/ha) and dry matter yield (q/ha). Crude protein yield (q/ha) was calculated by multiplying crude protein concentration with dry matter yield. Crude protein concentration was work out by multiplying the Kjeldhal's N value (Jackson, 1973) with 6.25. Soil moisture content was determined at harvest in 0-15 and 15-30 cm depths by gravimetric method. The data were statistically analyzed using analysis of variance for factorial Randomized Complete Block Design as outlined by Gomez and Gomez (1984).

Results and Discussion

Data on green forage yield during both the seasons indicated that the performance of *Setaria anceps* was significantly superior over *Panicum maximum* and *Brachiaria brizantha* (Table 1). On an average of two seasons green forage yield increase up to the tune of 29.27% and 65.10% by *Setaria anceps* as compared to *Panicum maximum* and *Brachiaria brizantha*respectively. Variations in yield of different forages are due to the variation in growth habit and morphology (Ullah *et al*., 2006). Variation in dry matter yield was differed from green forage yield. In both seasons highest dry matter yield was obtained with *Panicum maximum* followed by *Setaria anceps* and *Brachiaria brizantha*. This might be due to the variation in leaf water content among different forage crops. Mulching had a significant effect on green forage and dry matter yield (Table 1). Use of legumes as live mulching gave highest green forage yield as well as dry matter yield followed by soil dust mulching and no mulching conditions in both seasons. Mulched condition reduced evaporation loss of soil moisture, shortened competition for nutrient and water (Shrivastava *et al*., 1994) and resulted in highest yield under mulched treatments. Crude protein yield followed the same trends of dry matter yield. In live mulching crude protein yield increased by 17.95% as compared to soil dust mulch, but increase in dry matter production was only 5.64%. Due to nodulation effect of legume mulching increase nitrogen content as well as crude protein content (data not shown), resulted in the relative increase in crude protein yield was more as compared to dry matter yield between these two treatments. All treatments had more yield in summer season as compared to winter season. The reason might be that amount of rainfall was varied in two seasons along with other weather related phenomenon in summer season suitable for vigorous growth.

Table 1: Effect of mulching practices on yield of different forage crops

Treatments	Green forage yield (q/ha)		Dry matter yield (q/ha)		Crude protein yield (q/ha)	
	Winter	Summer	Winter	Summer	Winter	Summer
Forage crops						
Panicum maximum	162.00	341.22	44.61	96.44	3.49	9.32
Setaria anceps	222.50	428.00	35.07	81.44	2.39	7.23
Brachiaria brizantha	126.56	267.44	26.23	70.68	2.21	5.91
SEm (±)	2.96	2.66	0.83	0.90	0.06	0.08
CD (p=0.05)	8.89	7.97	2.49	2.70	0.18	0.25
Mulching practices						
No mulching	156.22	306.78	31.21	69.69	2.22	5.75
Soil dust mulching	176.83	352.67	36.93	86.38	2.83	7.53
Live mulching	178.00	377.22	37.78	92.49	3.04	9.18
SEm (±)	2.96	2.66	0.83	0.90	0.06	0.08
CD (p=0.05)	8.89	7.97	2.49	2.70	0.18	0.25

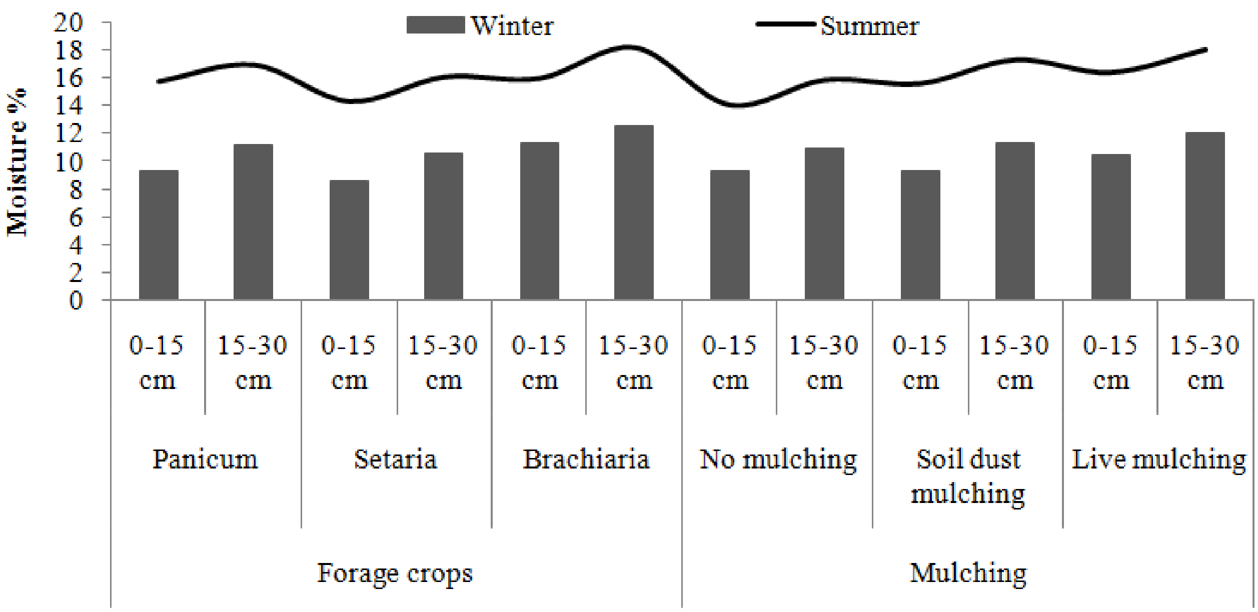

Fig. 1: Effect of mulching on mean value of soil moisture content (depth of 0-15 cm and 15-30 cm) at harvest of different forage crops in two seasons

Soil moisture content at harvest varied in different seasons (Fig. 1) due to variable in rainfall (data not shown). The soil moisture content was lower at surface layer (0-15 cm) as compared to sub-surface layer (15-30 cm). Different forage crops did make a variation in soil moisture content at harvest in both seasons and depths (Fig. 1). With the increase in biomass production, there was lower soil moisture content, which might be due to more vigorous growth leading to greater exploitation of soil moisture. The increase in soil moisture content with live mulching over no mulched plots in 0-15 and 15-30 cm depths ranged from 12.07% and 10.62% respectively in winter season and 16.55% and 13.66% respectively in summer season. The variation was more in surface layer. Mulching reduced evaporation from soil surface and allowed redistribution of moisture within the soil profile, leading to retention of greater moisture in the soil profile (Sharma *et al.*, 1998) at harvest.

Conclusion

It was concluded that live mulching with legume is a beneficial practice for enhanced moisture conservation, leading to increase productivity. Among the different forage crops *Setaria anceps* gave highest green forage yield. The treatment legume mulching can be easily adopted in *Setaria anceps* to reap maximum production for livestock.

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