

# Effect of Tillage Options on Productivity, Profitability and Quality of Forage Crops under Food-Fodder Based Cropping System in Mollisols

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## Abstract

Field experiment was conducted during 2009-10 at Instructional Dairy Farm, G. B. Pant University of Agriculture & Technology, Pantnagar to study the effect of tillage options on growth, forage yield and forage quality of berseem. The experimental site was silty loam in texture with 0.84% organic carbon and neutral in soil reaction (soil pH 7.1). The available N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O was 365, 36, 145 and kg/ha, respectively. The experiment consisted of 8 tillage options i.e. T<sub>1</sub>, Conventional tillage with 3 cultivation (one disc harrow+2 cultivator), T<sub>2</sub>, 2 Cultivation (1 disc harrow+1 cultivator), T<sub>3</sub>, 2 cultivation with Rotavator, T<sub>4</sub>, 1 cultivation with disc harrow, T<sub>5</sub>, 1 cultivation with Rotavator, T<sub>6</sub>, Broadcast seed before T<sub>3</sub>, T<sub>7</sub>, Broadcast Seed before T<sub>3</sub>, and T<sub>8</sub>, Zero tillage. The existing cropping system of the region i.e. '*Sorghum-Wheat-Maize+Cowpea*' was grown with all recommended agro-techniques of all crops of the system. The conventional tillage gave highest green fodder yield equivalents, dry fodder yield, crude protein, net profit as well as B:C ratio followed by reduced tillage with broadcasting of seed before 2 cultivation with rotavator with respect of net profit and B:C ratio. Therefore conventional tillage or two pass of rotavator may be recommended for higher productivity, profitability and quality fodder production in Mollisols.

## Keywords

Crude Protein; Net Return; Productivity; Profitability; Tillage Options.

## Introduction

India ranks first in livestock population, hence there is tremendous pressure on the limited feed and fodder resources. At present, only 5.4 per cent (around 7.8

million hectares) of total cultivable land is engaged in fodder production in the country that has one of the world's largest livestock population. If the current situation continues then India's green fodder shortage will reach 66 per cent and dry fodder will reach 25 per cent by 2030. Even the feed industry will not fulfil this deficit, so fixing the problems is imperative. Again the drastic outcomes of climate change may worsen the fodder scenario of the country in years to come. Therefore the option to increase the fodder production is to grow fodder crops in different existing cropping systems as well to improve the natural grasslands. Presently the tillage options like zero and reduced tillage have proved its utility to reduce the cost of cultivation with equal or more crop productivity. The reduced or zero tillage also help to minimize the gas emission. The existing potential food-fodder based cropping systems like rice-berseem-maize+cowpea, sorghum-wheat-maize+cowpea, baby corn-wheat-baby corn, Maize-berseem+oat-maize+cowpea etc. are prevalent in the Tarai region of Uttarakhand. Therefore sorghum (F)-wheat-maize+cowpea (F) was grown under different tillage options to find out the best tillage with higher productivity and profitability in the region.

## Materials and Methods

Field experiment was conducted during 2009-10 at Instructional Dairy Farm, G.B. Pant University of Agriculture & Technology, Pantnagar to study the effect of tillage options on growth, forage yield and forage quality of Berseem. The experimental site was

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silty loam in texture with 0.84% organic carbon and neutral in soil reaction (soil pH 7.1). The available N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O was 365, 36, 145 and kg/ha, respectively. The experiment consisted of 8 tillage options i.e. T<sub>1</sub>, Conventional tillage with 3 cultivation (one disc harrow+2 cultivator), T<sub>2</sub>, 2 Cultivation (1 disc harrow+1 cultivator), T<sub>3</sub>, 2 cultivation with Rotavator, T<sub>4</sub>, 1 cultivation with disc harrow, T<sub>5</sub>, 1 cultivation with Rotavator, T<sub>6</sub>, Broadcast seed before T<sub>3</sub>, T<sub>7</sub>, Broadcast Seed before T<sub>5</sub>, and T<sub>8</sub>, Zero tillage. The existing cropping system of the region i.e. 'Sorghum-Wheat-Maize+Cowpea' was grown with all recommended agro-techniques of all crops of the system. The tillage options were practiced only in the beginning of experiment in *Kharif* season 2009 and later in other seasons like Rabi and Summer, the crops were grown under conventional tillage in all treatments. The green and dry fodder yield of all crops were recorded and later green fodder yield equivalents of the system was calculated based on green fodder yield of all crops of the cropping system. Similarly the crude protein, net profit as well as B:C ratio of all the treatments were estimated.

## Results and Discussion

### Fodder Yield

The conventional tillage produced significantly highest green fodder followed by 2 Cultivation (1 disc harrow+1 cultivator, 1 cultivation with disc harrow and 2 cultivation with rotavator from the Sorghum-Wheat-Maize+Cowpea cropping system. The T<sub>8</sub>, zero tillage and T<sub>7</sub>, broadcasting of seed before one cultivation with rotavator produced the lowest green fodder yield equivalents of the system with 14.7 % lower green fodder than conventional tillage. Similarly the dry fodder yield did not influenced by tillage options but the highest dry fodder yield was recorded under conventional tillage followed by 1

cultivation with rotavator and two cultivation with rotavator. The zero tillage had the lowest dry fodder yield. The results indicated that zero and minimum tillage are not suitable for fodder crops, however cultivation with rotavator twice may be sufficient for fodder crops. Deva et al. (2014) observed that conventional tillage produced higher green and dry fodder of oat. Kumar and Karmakar (2015) also reported that conventional tillage recorded higher green (354.6 q/ha) and dry fodder (78.7 q/ha) yield of oat over zero and minimal tillage. But Munsif *et al.* (2011) also reported at Peshawar (Pakistan) that reduced tillage produced taller plants (211 cm), more leaves per plant (9.3) and higher fresh and dry fodder yield of maize (130.5 & 48 t per ha). Similarly, reduced tillage resulted in higher gross income (Rs.65250) and net income (Rs. 63250). Higher value cost ratio (31.6) was recorded for reduced tillage followed by no-tillage (24.8).

### Quality of Fodder

The crude protein production was significantly affected by tillage options and the highest value was achieved under conventional tillage followed by 2 cultivation with rotavator. The lowest crude protein production was found under zero tillage. All other treatments had lower and almost equaled crude protein production.

### Economics

The net profit was also affected significantly by tillage options and significantly maximum net profit was recorded under conventional tillage followed by one cultivation with rotavator, seed broadcast before 2 cultivation with rotavator. The lowest net profit was recorded under seed broadcasting before only one cultivation with rotavator and followed by zero tillage. The B:C ratio was also found significantly highest

**Table 1:** Effect of tillage options on fodder and crude protein yield, net return and B:C ratio of *whole sequence* (Sorghum-Wheat-Maize+Cowpea) in Mollisols

Treatments	Green forage yield Equivalent (q/ha/year)	Dry matter yield (q/ha/year)	Crude protein yield (q/ha/year)	Net return (Rs./ha/year)	B:C ratio
T <sub>1</sub> , Conventional tillage with 3 cultivation (one disc harrow+2 cultivator)	2545	390	33.7	105810	2.52
T <sub>2</sub> , 2 Cultivation (1 disc harrow+1 cultivator),	2325	368	30.9	93132	2.24
T <sub>3</sub> , 2 cultivation with Rotavator,	2304	377	31.7	91880	2.21
T <sub>4</sub> , 1 cultivation with disc harrow	2324	371	31.4	94395	2.31
T <sub>5</sub> , 1 cultivation with Rotavator,	2299	378	31.3	92837	2.32
T <sub>6</sub> , Broadcast seed before T <sub>3</sub>	2311	366	30.5	93687	2.34
T <sub>7</sub> , Broadcast Seed before T <sub>5</sub> ,	2217	372	30.3	88062	2.20
T <sub>8</sub> , Zero tillage	2219	344	29.0	89240	2.29
CD (0.05)	143	ns	1.5	8613	ns

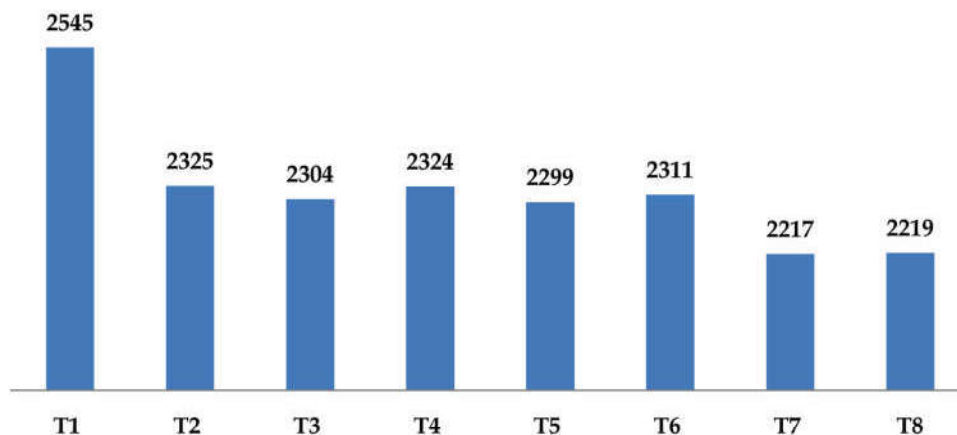


Fig. 1: Effect of tillage options on green fodder yield (q/ha)

under conventional tillage followed by seed broadcasting before 2 cultivation with rotavator (Table 1). The higher net profit and B:C ratio was the result of high green fodder yield equivalents under conventional tillage. Deva et al. (2011) stated that highest net returns and B:C ratio was under plots treated with conventional tillage. Kumar and Karmakar (2015) found that reduced tillage gave higher gross returns (Rs. 79,689/ha), energy output (142985 MJ/ha) net energy returns (129471 MJ/ha) and energy use efficiency (11.7) over zero and minimal tillage. However, Munsif *et al.* (2011) concluded that reduced tillage resulted in higher gross income (Rs.65250) and net income (Rs. 63250). Higher value cost ratio (31.6) was recorded for reduced tillage followed by no-tillage (24.8).

### Conclusion

The experimental results indicated that conventional tillage was found better for higher fodder productivity and profitability; hence the food-fodder based rotation should be grown under conventional tillage.

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