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# SORGHUM GROWTH, PRODUCTIVITY, QUALITY AND ECONOMICS INFLUENCED BY TILLAGE METHODS AND INTEGRATED NUTRIENT MANAGEMENT

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## SUMMARY

A field experiment was conducted during **kharif** seasons of 2009 and 2010 at main Forage Research Area, CCSHAU, Hisar. The experiment was laid out in split plot design with three replications. Treatments comprised three tillage methods (Conventional tillage, reduced tillage and minimum tillage) in main plot and four nutrient management treatments [control, 100% recommended dose of fertilizer (80 kg N+30 kg $P_2O_5$/ha) through inorganic fertilizers, 75% recommended dose of fertilizer (RDF)+5 t FYM/ha and 50% RDF+2.5 t FYM/ha+Azotobactor+PSB] in sub-plot. The results revealed tht the maximum plant height (243.2 in 2009 and 263.6 in 2010), number of tillers per meter row length (18.0 in 2009 and 14.0 in 2010), green fodder yield (362.4 q/ha in 2009 and 382.7 q/ha in 2010) and dry matter yield (104.4 q/ha in 2009 and 110.0 q/ha in 2010) were recorded in conventional tillage during both the years. Crude protein content and IVDMD percent were not influenced significantly by tillage and nutrient management methods. The maximum gross income and net income were obtained in conventional tillage with 100 per cent recommended dose of fertilizer applied as compared to other treatments.

**Key words :** Sorghum growth, INM, productivity, quality, economics

Conventionally sorghum is sown on a fine seedbed but now-a-days mindset of farmers and scientists has changed to reduce the number of tillage operation to minimize the cost of production. Moreover, to overcome the energy crisis and pollution hazards, minimum tillage practice can be a tool for reducing fuel consumption during land preparation operation. Excessive tillage and excess use of inorganic fertilizers are considered important factors limiting the productivity of crops in intensive cropping system. Fertilizer use has been key input in intensive cropping. Use of recommended levels of fertilisers to individual crops produced higher yields. However, alone application of inorganic fertilizers resulted in soil degradation, there was need to substitute the part of it through organic manures like FYM and also to incorporate the benefits from biofertilizers. The adoption of resource conservation technology such as minimum tillage sowing with integrated nutrient management is being suggested for sustaining the crop productivity. The zero tillage is a very popular resource conservation technology in rice-wheat cropping system but much information is not available for forage sorghum under minimum tillage and integrated nutrient management. Hence, the present investigation was undertaken.

## MATERIALS AND METHODS

A field experiment was conducted during **kharif** seasons of 2009 and 2010 at main Forage Research Area, CCSHAU, Hisar. The experiment was laid out in split plot design with three replications. Treatments comprised three tillage methods (Conventional tillage, reduced tillage and minimum tillage) in main plot and four nutrient management treatments [control, 100% recommended dose of fertilizer (80 kg N+30 kg $P_2O_5$/ha) through inorganic fertilizers, 75% recommended dose of fertilizer (RDF)+5 t FYM/ha and 50% RDF+2.5 t FYM/ha+Azotobactor+PSB] in sub-plot. The soil of experimental field was low in organic matter and available

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TABLE 1
Effect of different fertility levels on growth, yield and economics of fodder sorghum genotypes

| Treatment | Plant height (cm) | | No. of tillers/meter row length | | Green fodder yield (q/ha) | | Dry matter yield (q/ha) | | Gross income (Rs./ha) | | Net income (Rs./ha) | | B : C ratio | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 |
| **Tillage** | | | | | | | | | | | | | | |
| Conventional tillage | 243.2 | 263.6 | 18.0 | 14.0 | 362.4 | 382.7 | 104.4 | 110.0 | 25368 | 28702 | 13583 | 16102 | 1.86 | 1.78 |
| Reduced tillage | 235.7 | 248.1 | 17.2 | 13.7 | 347.2 | 365.1 | 99.6 | 108.6 | 24094 | 27427 | 12559 | 15452 | 1.91 | 1.77 |
| Minimum tillage | 207.3 | 239.7 | 16.5 | 13.0 | 313.3 | 339.6 | 91.0 | 94.4 | 21931 | 25470 | 10646 | 14120 | 2.06 | 1.80 |
| S. Em± | 1.4 | 8.9 | 0.19 | 0.10 | 5.7 | 27.5 | 1.6 | 3.3 | | | | | | |
| C. D. (P=0.05) | 4.3 | NS | 0.57 | 0.39 | 22.5 | NS | 4.8 | NS | | | | | | |
| **Nutrient management** | | | | | | | | | | | | | | |
| Control | 176.1 | 227.6 | 13.1 | 11.3 | 274.8 | 296.8 | 82.0 | 82.5 | 19236 | 22260 | 8076 | 11306 | 2.38 | 1.96 |
| 100% RDF | 256.1 | 275.0 | 20.6 | 16.3 | 381.8 | 425.3 | 113.4 | 128.3 | 26726 | 31897 | 14941 | 19297 | 1.78 | 1.65 |
| 75% RDF+5 t FYM/ha | 249.6 | 254.5 | 19.1 | 14.3 | 373.5 | 394.1 | 108.8 | 116.1 | 26145 | 29557 | 13755 | 16377 | 1.90 | 1.80 |
| 50% RDF+2.5 t FYM/ha+Azotobactor+PSB | 233.2 | 244.8 | 16.1 | 12.3 | 333.8 | 334.8 | 94.0 | 90.4 | 23366 | 25110 | 11806 | 12773 | 1.97 | 1.96 |
| S. Em± | 1.6 | 3.3 | 0.22 | 0.20 | 3.2 | 4.9 | 1.7 | 2.3 | | | | | | |
| C. D. (P=0.05) | 4.9 | 9.8 | 0.66 | 0.60 | 9.5 | 14.5 | 4.9 | 7.0 | | | | | | |

nitrogen and medium in available phosphorus and available potassium. The nutrients were applied as per treatments. The full dose of phosphorus and FYM and half dose of nitrogen was applied as basal at the time of sowing and remaining half dose of nitrogen was top dressed at crop knee high stage. The crop was harvested at 50 per cent flowering stage. The plant samples were collected at crop harvest and analyzed for quality parameters by standard procedure.

## RESULTS AND DISCUSSION

Plant height, number of tillers, green fodder yield and dry matter yield of sorghum were significantly influenced by tillage methods during 2009 but in 2010 tillage methods did not affect the growth and yield of sorghum significantly (Table 1). The maximum plant height (243.2 in 2009 and 263.6 in 2010) and number of tillers per meter row length (18.0 in 2009 and 14.0 in 2010) were recorded in conventional tillage during both the years. Conventional tillage recorded significantly higher plant height and number of tillers as compared to reduced and minimum tillage during 2009.

The maximum green fodder yield (362.4 q/ha in 2009 and 382.7 q/ha in 2010) and dry matter yield (104.4 q/ha in 2009 and 110.0 q/ha in 2010) were recorded in conventional tillage during both the years. Though the difference between conventional tillage and reduced tillage was not significant. Conventional tillage produced 14.12 and 15.64 per cent higher green fodder and dry matter yield over minimum tillage, respectively, on mean basis.

Crude protein content and IVDMD per cent were not influenced significantly by tillage methods. The maximum crude protein yield (9.64 and 8.72 q/ha in 2009 and 2010, respectively) and DDM (46.51 and 55.14 q/ha in 2009 and 2010, respectively) were obtained from conventional tillage. The maximum gross income and net income were obtained from conventional tillage during both the years (Table 2).

Plant height, number of tillers, green fodder yield, dry matter yield, crude protein yield and DDM of sorghum were influenced significantly by nutrient management treatments (Table 1). The maximum plant height and number of tillers per meter row length were recorded at 100 per cent RDF, which were significantly higher than other nutrient management treatments during both the years. The green fodder and dry matter yields were also maximum at application of 100 per cent recommended dose of fertilizer, which were significantly higher than other nutrient management treatments during 2010 but at par with 75 per cent RDF+5 t FYM/ha during 2009. Higher yield in 100 per cent RDF compared to those recorded in rest of the treatments was mainly due to higher values of yield attributing characters viz., plant height and number of tillers. The reduction in green fodder yield was 29.18, 17.16 and 4.89 per cent and 31.94, 23.71 and 6.95 per cent in dry matter yield in control, 50 per cent RDF+2.5 t FYM/ha+Azotobactor +PSB and 75 per cent RDF+5 t FYM/ha as compared to 100 per cent RDF, respectively, on mean basis. The results are in close conformity with the findings of Angadi and Raut (2010). Meena *et al*. (2010) also

TABLE 2
Effect of different fertility levels on quality of fodder sorghum genotypes

| Treatment | Crude protein content (%) | | Crude protein yield (q/ha) | | IVDMD (%) | | DDM (q/ha) | |
|---|---|---|---|---|---|---|---|---|
| | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 |
| **Tillage** | | | | | | | | |
| Conventional tillage | 8.97 | 8.10 | 9.64 | 8.72 | 43.40 | 51.05 | 46.51 | 55.14 |
| Reduced tillage | 8.97 | 8.04 | 8.82 | 8.54 | 41.60 | 52.20 | 41.06 | 55.38 |
| Minimum tillage | 8.92 | 8.42 | 8.14 | 7.79 | 42.80 | 52.28 | 39.07 | 48.26 |
| S. Em± | 0.16 | 0.14 | 0.26 | 0.35 | 0.68 | 0.41 | 1.17 | 1.80 |
| C. D. (P=0.05) | NS | NS | 0.82 | NS | NS | NS | 3.66 | NS |
| **Nutrient management** | | | | | | | | |
| Control | 8.75 | 8.02 | 6.77 | 6.32 | 42.07 | 51.30 | 32.65 | 40.43 |
| 100% RDF | 8.90 | 8.02 | 10.24 | 10.13 | 43.73 | 52.20 | 50.27 | 66.02 |
| 75% RDF+5 t FYM/ha | 8.97 | 8.61 | 9.69 | 9.59 | 42.20 | 52.97 | 45.71 | 59.09 |
| 50% RDF+2.5 t FYM/ha+Azotobactor+PSB | 9.19 | 8.10 | 8.77 | 7.36 | 42.40 | 50.90 | 40.22 | 46.17 |
| S. Em± | 0.19 | 0.16 | 0.31 | 0.41 | 0.78 | 0.47 | 1.36 | 2.08 |
| C. D. (P=0.05) | NS | NS | 0.95 | 1.26 | NS | NS | 4.22 | 6.46 |

reported that application of recommended dose of fertilizer through inorganic fertilizers recorded higher plant height, green fodder and dry matter yield as compared to 75 per cent RDF+25 per cent N through FYM and 50 per cent RDF+25 per cent N through FYM+biofertilizer.

The maximum crude protein yield (10.24 and 10.13 q/ha in 2009 and 2010, respectively) and DDM (50.27 and 66.02 q/ha in 2009 and 2010, respectively) were recorded in 100 per cent RDF which were significantly higher than other nutrient management treatments during both the years (Table 2). The maximum gross and net incomes were obtained when 100 per cent recommended dose of fertilizer was applied as compared to other treatments.

The maximum growth, yield and economics of sorghum fodder were recorded in conventional tillage with the application of 100 per cent dose of recommended fertilizer. The results are in close conformity with the findings of Meena *et al*. (2010). Angadi and Raut (2010) also reported that maximum gross and net returns were obtained with the application of recommended dose of fertilizer. This indicated that organic management practices needed long term evaluation to achieve at par growth and yield that of inorganic nutrient management practices.

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