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Effect of soybean crop residue, tillage and nutrient management on growth and yield of *rabi* sorghum (*Sorghum bicolor* L.)

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Abstract

Aim: To study the effect of soybean crop residue, tillage and fertility levels on growth and yield of *rabi* sorghum (*Sorghum bicolor* L.)

Study Design: The study consisted of residue management and tillage practice as one factor which required a bigger plot size and second factor was fertility levels which is to be analyzed precisely. Thus, as one factor (residue management and tillage practices) needs a bigger plot size and the other (fertility levels) required a more precise results with small plot size, suitable design for the study was chosen as split-plot design.

Place and Duration of Study: Agricultural Research Station (ARS), Adilabad during consecutive *rabi* seasons (2024-25 and 2025-26).

Methodology: The study comprised three tillage and residue management practices viz., zero tillage (*Khari*f soybean crop stubbles spreading and sprayed with PJTAU decomposer) (M_1), conventional tillage (2 ploughings, 1 levelling and removing stubbles) (M_2) and reduced tillage (1 plough, 1 rotavator for residue incorporation) (M_3) as main plots, and three fertility levels (50%, 75% and 100% recommended dose of fertilizers) in sub plots. The treatments were replicated thrice. The data were statistically analyzed using analysis of variance for split plot design.

Results: The results indicated that residue management, tillage and fertility levels significantly influenced dry matter accumulation. Conventional tillage (M_2) and reduced tillage with residue incorporation (M_3) recorded higher dry matter production at all the crop growth stages compared to zero tillage (M_1), likely due to better soil physical conditions and nutrient availability. Among fertility levels, application of 100% RDF (S_3) significantly improved dry matter production at all crop growth stages over 75% and 50% RDF. Grain yield and stalk yield were significantly higher under conventional and reduced tillage, while zero tillage recorded lower yields. Similarly, 100% RDF resulted in maximum yields due to enhanced nutrient supply. However, harvest index was not significantly influenced by the treatments.

Conclusion: Conventional tillage and reduced tillage with soybean residue incorporation improved the dry matter production at all crop growth stages and yield of *rabi* sorghum compared to zero tillage. Application of 100% recommended dose of fertilizers resulted in higher grain and stalk yields over lower fertility levels. However, harvest index was not significantly influenced by the treatments.

Keywords: Tillage, residues, nutrient management, *rabi* sorghum, growth and yield

1. Introduction

Agriculture remains the backbone of global food security and livelihood generation, supporting the nutritional requirements of an ever-increasing human population. The world population is projected to exceed 9 billion by 2050 (Mottaleba *et al.*, 2021) ^[24], thereby exerting tremendous pressure on agricultural systems to produce more food from limited natural resources. Ensuring sustainable food production under changing climatic conditions, declining soil fertility and shrinking cultivable land has become one of the major challenges confronting modern agriculture. The conventional intensive agricultural practices that largely depend on excessive tillage, monocropping and indiscriminate use of chemical fertilizers have contributed significantly towards increased crop productivity during the past decades (Apoorva and Kundlas, 2024) ^[2]. However, these practices are now associated with several adverse

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consequences such as deterioration of soil physical properties, decline in soil organic matter, nutrient imbalance, increased production costs, soil erosion and environmental degradation. Hence, the development and adoption of sustainable crop production practices are essential to maintain productivity while conserving natural resources.

Continuous monocropping or cultivation of crops with similar rooting patterns and nutrient requirements often leads to depletion of soil nutrients and moisture from the same soil depth, resulting in reduced soil fertility and decline in crop productivity over time. Monocropping systems also increase the incidence of weeds, pests and diseases, thereby affecting sustainability of agricultural production systems. In this context, crop diversification has emerged as an effective strategy for improving soil health, enhancing nutrient cycling, reducing production risks and ensuring sustainable productivity. Inclusion of legumes in cropping systems plays an important role in improving soil fertility through biological nitrogen fixation, addition of organic matter and better utilization of available resources (Kebede, 2021) ^[7]. Soybean-based cropping systems are gaining importance in many parts of India due to their ability to improve soil fertility and provide economic returns.

Among the various resource conservation technologies, tillage plays a crucial role in influencing soil physical environment, nutrient dynamics and crop productivity. Conventional tillage, which involves repeated ploughing and soil manipulation, creates a favourable seedbed and facilitates weed control; however, continuous soil disturbance accelerates oxidation of soil organic matter, increases soil erosion and leads to moisture loss. In contrast, reduced tillage and zero tillage systems minimize soil disturbance, conserve soil moisture, reduce fuel and labour requirements and improve soil structure over time. Conservation tillage practices also enhance microbial activity and promote accumulation of soil organic carbon, thereby improving overall soil health. Adoption of reduced and zero tillage practices have therefore gained considerable attention as a sustainable approach for enhancing resource use efficiency and maintaining productivity under rainfed and dryland conditions (Li *et al.*, 2024) ^[12].

Crop residue management is another important component of conservation agriculture. In many farming systems, crop residues are either removed from the field or burnt, leading to substantial loss of valuable nutrients and organic matter. Incorporation or retention of crop residues on the soil surface helps in improving soil physical, chemical and biological properties. Soybean crop residues are particularly valuable due to their relatively lower carbon to nitrogen ratio and higher nutrient content compared to cereal residues. Retention or incorporation of soybean residues contributes to increased soil organic carbon, improved aggregation, enhanced water infiltration and greater nutrient availability (Gezahegn *et al.*, 2016) ^[4]. Decomposition of soybean residues also stimulates microbial activity and improves nutrient cycling, thereby creating a favourable environment for subsequent crops. Residue retention further helps in reducing soil temperature fluctuations, minimizing evaporation losses and suppressing weed growth. Therefore, integration of soybean residue management with appropriate tillage practices can play a significant role in sustaining soil productivity and crop performance.

Nutrient management is another critical factor governing crop growth and yield. Balanced and integrated nutrient management practices are essential for maintaining soil fertility and achieving sustainable crop production. Sole dependence on chemical fertilizers may not sustain productivity in the long run due to

declining nutrient use efficiency and deterioration of soil health. Integration of inorganic fertilizers with organic sources and biological inputs helps in improving nutrient availability, enhancing nutrient uptake efficiency and maintaining favourable soil conditions (Krasilnikov *et al.*, 2022) ^[8]. Efficient nutrient management practices become even more important under conservation tillage systems, where nutrient dynamics and residue decomposition patterns differ from conventional systems.

Sorghum (*Sorghum bicolor* L.) is one of the most important cereal crops cultivated in semi-arid and arid regions of the world. It is known for its drought tolerance, adaptability to marginal soils and ability to withstand adverse climatic conditions (Mwamahonje *et al.*, 2024) ^[16]. In India, *rabi* sorghum occupies a prominent place in dryland agriculture, particularly in regions characterized by limited rainfall and moisture stress conditions. Sorghum grain serves as an important source of food, feed and fodder, while its stover is widely utilized as nutritious livestock fodder. The crop is rich in carbohydrates, proteins, minerals and dietary fibre, making it an important component in ensuring nutritional security. However, productivity of *rabi* sorghum is often constrained by poor soil fertility, inadequate moisture availability and improper crop management practices.

Under these circumstances, integration of soybean crop residue management, suitable tillage practices and efficient nutrient management may provide a sustainable solution for improving growth and productivity of *rabi* sorghum. Residue retention along with reduced soil disturbance can improve soil moisture conservation, nutrient availability and soil biological activity, thereby enhancing crop performance under dryland conditions. Although several studies have evaluated the individual effects of tillage, residue management and nutrient management, limited information is available regarding their combined influence on growth and yield of *rabi* sorghum in soybean-based cropping systems. Therefore, the present investigation was undertaken to evaluate the interactive effects of these management practices on crop growth, yield attributes and productivity of *rabi* sorghum under sustainable agricultural systems.

2. Materials and Methods

A field experiment was carried out at plot no-23, Agricultural Research Station (ARS), Adilabad, during consecutive *rabi* seasons (2024-25 and 2025-26). The experimental site was geographically located at 19° 39' N latitude, 78° 32' E longitude and an altitude of 268.9 m above mean sea level (MSL). The experimental site lies in the Northern Telangana Agro-Climatic Zone and it is part of tenth agro-climatic zone of India i.e., Southern plateau and hills and categorised as sub-humid with hot summer and cold winter. Experimental soil was clayey in texture, slightly alkaline in reaction with pH of 7.98 and EC of 0.18 dSm⁻¹. The soil was medium in organic carbon (0.45%) and available N (194 kg ha⁻¹), medium in available P₂O₅ (48.6 kg ha⁻¹) and available K₂O (285 kg ha⁻¹). The experiment was laid out in split plot design with three residue management and tillage practices imposed in main plots viz., M₁- Zero tillage (*Kharif* soybean crop stubbles spreading (3 t ha⁻¹) and sprayed with PJTAU decomposer @ 2%), M₂- Conventional tillage (2 ploughings, 1 levelling and removing stubbles) and M₃- Reduced tillage (1 plough, 1 rotavator for residue incorporation @ 3 t ha⁻¹) and three nutrient levels in sub plots viz., S₁: 50% RDF, S₂: 75% RDF and S₃: 100% RDF respectively. The seed was treated with carbendazim 50% WP @ 3 g kg⁻¹ seed. The variety selected was SVT-55 (Sorghum Varietal Trial - 55 also

known as Tandur Jonna-55) suitable for *rabi* season. Sowing was done on 15th November, 2024 and 22nd November, 2025 after the harvest of *kharif* soybean by adopting a seed rate of 10 kg ha⁻¹. Half dose of nitrogen was applied as basal at the time of sowing. Nitrogen, phosphorus and potassium were supplied in the form of urea, diammonium phosphate and muriate of potash respectively. The crop was harvested at maturity and seed yield was recorded.

Data was subjected to analysis of variance procedures as outlined for split plot design. Statistically significance was tested by F-value at $p=0.05$ (5%) level of probability and critical difference was worked out where ever the effect was significant. Treatment differences that were non-significant were denoted as NS.

2.1 Harvest index (%)

Harvest index (HI) was calculated by using the formula (Yoshida, 1972) [23] as given below.

$$HI = \frac{\text{Economic yield (grain yield)}}{\text{biological yield (grain + stalk yield)}} \times 100$$

3. Results and Discussion

3.1 Dry matter production (kg ha⁻¹)

Dry matter production increased progressively from vegetative stage to harvest during both the years of experimentation (Table 1). The rate of increase in dry matter production was comparatively higher from vegetative stage to flowering stage and thereafter increased steadily up to harvest. The data recorded at vegetative, flowering, grain filling and harvest stages during 2024–25 and 2025–26 revealed significant differences in dry matter production due to residue management, tillage and fertility levels. However, the interaction effect between residue management, tillage and fertility levels was found to be non-significant at all the stages of crop growth during both the years of experimentation.

During 2024–25, at vegetative stage, conventional tillage (M₂) recorded significantly higher dry matter production (878 kg ha⁻¹) and remained on par with reduced tillage (M₃) (830 kg ha⁻¹), whereas significantly lower dry matter production was recorded under zero tillage (M₁) (590 kg ha⁻¹). During 2025–26 also, conventional tillage (M₂) recorded significantly higher dry matter production (928 kg ha⁻¹) and remained on par with reduced tillage (M₃) (880 kg ha⁻¹), while significantly lower dry matter production was recorded under zero tillage (M₁) (640 kg ha⁻¹).

At flowering stage during 2024–25, significantly higher dry matter production was recorded under conventional tillage (M₂) (6304 kg ha⁻¹), which remained on par with reduced tillage (M₃) (6129 kg ha⁻¹), whereas zero tillage (M₁) recorded significantly lower dry matter production (4913 kg ha⁻¹). Similar trend was observed during 2025–26, wherein conventional tillage (M₂) recorded significantly higher dry matter production (6756 kg ha⁻¹) and remained on par with reduced tillage (M₃) (6298 kg ha⁻¹), while significantly lower dry matter production was recorded under zero tillage (M₁) that recorded dry matter production of 5251 kg ha⁻¹.

At grain filling stage during 2024–25, conventional tillage (M₂) recorded significantly higher dry matter production (9612 kg ha⁻¹) and remained on par with reduced tillage (M₃) (8948 kg ha⁻¹), whereas significantly lower dry matter production was recorded under zero tillage (M₁) (7371 kg ha⁻¹). During 2025–26 also, significantly higher dry matter production was recorded under conventional tillage (M₂) (10639 kg ha⁻¹), which remained

on par with

reduced tillage (M₃) (9717 kg ha⁻¹), while zero tillage (M₁) recorded significantly lower dry matter production (8488 kg ha⁻¹).

At harvest during 2024–25, conventional tillage (M₂) recorded significantly higher dry matter production (12255 kg ha⁻¹) and remained on par with reduced tillage (M₃) (11656 kg ha⁻¹), whereas significantly lower dry matter production was observed under zero tillage (M₁) (9723.6 kg ha⁻¹). Similar trend was observed during 2025–26 also, wherein conventional tillage (M₂) recorded significantly higher dry matter production (12435 kg ha⁻¹) and remained on par with reduced tillage (M₃) (12183 kg ha⁻¹), while significantly lower dry matter production was recorded under zero tillage (M₁) (9852 kg ha⁻¹).

With respect to fertility levels, during 2024–25, at vegetative stage, application of 100% RDF (S₃) recorded significantly higher dry matter production (825 kg ha⁻¹), whereas 75% RDF (S₂) (759 kg ha⁻¹) remained on par with 50% RDF (S₁) (713 kg ha⁻¹). During 2025–26 also, significantly higher dry matter production was recorded with 100% RDF (S₃) (876 kg ha⁻¹), while 75% RDF (S₂) (809 kg ha⁻¹) remained on par with 50% RDF (S₁) (763 kg ha⁻¹).

At flowering stage during 2024–25, application of 100% RDF (S₃) recorded significantly higher dry matter production (6217 kg ha⁻¹), whereas 75% RDF (S₂) (5638 kg ha⁻¹) remained on par with 50% RDF (S₁) (5491 kg ha⁻¹). Similar trend was observed during 2025–26, wherein significantly higher dry matter production was recorded with 100% RDF (S₃) (6651 kg ha⁻¹), while 75% RDF (S₂) (6013 kg ha⁻¹) and 50% RDF (S₁) (5641 kg ha⁻¹) remained on par with each other.

At grain filling stage during 2024–25, significantly higher dry matter production was recorded with 100% RDF (S₃) (9490 kg ha⁻¹), whereas 75% RDF (S₂) (8577 kg ha⁻¹) remained on par with 50% RDF (S₁) (7864 kg ha⁻¹). During 2025–26 also, application of 100% RDF (S₃) recorded significantly higher dry matter production (10294 kg ha⁻¹), while 75% RDF (S₂) (9440 kg ha⁻¹) and 50% RDF (S₁) (9109 kg ha⁻¹) remained on par with each other.

At harvest during 2024–25, significantly higher dry matter production was recorded with 100% RDF (S₃) (12196 kg ha⁻¹), whereas 75% RDF (S₂) (10797 kg ha⁻¹) remained on par with 50% RDF (S₁) (10642 kg ha⁻¹). Similar trend was observed during 2025–26 also, wherein application of 100% RDF (S₃) recorded significantly higher dry matter production (12360 kg ha⁻¹), while 75% RDF (S₂) (11234 kg ha⁻¹) and 50% RDF (S₁) (10877 kg ha⁻¹) remained on par with each other.

The higher dry matter production recorded under conventional tillage and reduced tillage treatments might be attributed to improved soil physical environment, better aeration, enhanced root proliferation and increased uptake of water and nutrients, which promoted vigorous vegetative growth and biomass accumulation throughout the crop growth period. In contrast, lower dry matter production under zero tillage might be due to comparatively compact soil conditions and reduced nutrient availability during the early growth stages. The present findings are in conformity with the results of Kumari *et al.* (2022) [9] who observed significantly higher dry matter accumulation and grain yield in sorghum with incorporation of crop residues along with decomposer application. Naveen *et al.* (2023) [17] reported significantly higher dry matter production under soybean residue incorporation treatments in maize.

The superior performance of conventional tillage and reduced tillage treatments in the present study is also supported by the findings of Menon and Singh (2025) [14], who reported higher

dry weight under conventional tillage in rainfed sorghum. Kumari *et al.* (2020) ^[11] also observed higher dry matter accumulation under improved tillage practices in maize.

Significantly higher dry matter production recorded with application of 100% RDF might be attributed to adequate and balanced nutrient supply, which enhanced photosynthetic activity, leaf area development, chlorophyll synthesis and translocation of assimilates, resulting in greater biomass accumulation. Lower fertility levels might have restricted nutrient availability and thereby reduced dry matter production. Thirupathi *et al.* (2016) also observed higher dry matter accumulation with increased nitrogen application in maize. Similarly, Naveen *et al.* (2023) ^[17], reported significantly higher dry matter production with application of 100% RDF in maize. Kumari *et al.* (2025) ^[10] reported significantly higher dry matter accumulation in sorghum with higher nitrogen levels.

3.2 Grain yield (kg ha⁻¹)

Grain yield of *rabi* sorghum differed significantly due to residue management, tillage and fertility levels during both the years of experimentation (Table 2). However, the interaction effect between residue management, tillage and fertility levels was found to be non-significant during both the years of experimentation.

During 2024-25, conventional tillage recorded significantly higher grain yield (3193 kg ha⁻¹) and remained on par with reduced tillage (3025 kg ha⁻¹), whereas significantly lower grain yield was recorded under zero tillage (2521 kg ha⁻¹). During 2025-26 also, significantly higher grain yield was recorded under conventional tillage (3334 kg ha⁻¹) and remained on par with reduced tillage (3270 kg ha⁻¹), while significantly lower grain yield was recorded under zero tillage (2578 kg ha⁻¹).

With respect to fertility levels, during 2024-25, application of 100% RDF recorded significantly higher grain yield (3206 kg ha⁻¹), whereas 75% RDF (2803 kg ha⁻¹) remained on par with 50% RDF (2730 kg ha⁻¹). During 2025-26 also, significantly higher grain yield was recorded with 100% RDF (3334 kg ha⁻¹), while 75% RDF (2996 kg ha⁻¹) remained on par with 50% RDF (2852 kg ha⁻¹).

Higher grain yield recorded under conventional tillage and reduced tillage might be attributed to improved soil tilth, better root proliferation, enhanced soil aeration and moisture conservation which facilitated efficient nutrient uptake and better translocation of photosynthates towards reproductive structures. Increased yield attributes under these treatments also contributed to enhanced grain yield. Lower grain yield under zero tillage might be due to greater soil compaction and reduced mineralization of nutrients during the initial years of experimentation. The present findings are in conformity with the results of Mishra *et al.* (2019) ^[15], who reported 14% higher grain yield under conventional tillage compared to reduced tillage and substantially higher yield over no tillage in sorghum. Similar findings were also reported by Sharma *et al.* (2016) ^[19], who observed superior sorghum productivity under conventional tillage practices. Kumari *et al.* (2025) ^[10] also reported higher grain yield of sorghum with residue incorporation using rotovator along with ANGRAU decomposer application.

Improved grain yield with application of 100% RDF might be due to adequate and balanced nutrient supply throughout crop growth period, resulting in improved vegetative growth, enhanced photosynthetic activity and better partitioning of assimilates towards sink development. Higher nutrient availability under 100% RDF improved yield attributes that reflected in higher grain yield. These results are in agreement

with the findings of Kumari *et al.* (2025) ^[10], who reported significantly higher grain yield with application of higher nitrogen levels in sorghum. Similar findings were also reported by Naveen *et al.* (2023) ^[17], Tudu *et al.* (2023) ^[20], Majrashi *et al.* (2022) ^[13], who observed significant improvement in grain yield with application of recommended or higher fertilizer doses

3.3 Stalk yield (kg ha⁻¹)

Stalk yield differed significantly due to residue management, tillage and fertility levels during both the years of experiment (Table 2). However, the interaction effect between residue management, tillage and fertility levels was found to be non-significant during both the years of experimentation.

During 2024-25, conventional tillage recorded significantly higher stalk yield (9061 kg ha⁻¹) and remained on par with reduced tillage (8631 kg ha⁻¹), whereas significantly lower stalk yield was recorded under zero tillage (7203 kg ha⁻¹). During 2025-26 also, significantly higher stalk yield was recorded under conventional tillage (9100 kg ha⁻¹) and remained on par with reduced tillage (8913 kg ha⁻¹), while significantly lower stalk yield was recorded under zero tillage (7274 kg ha⁻¹).

Among fertility levels, during 2024-25, application of 100% RDF recorded significantly higher stalk yield (8989 kg ha⁻¹), whereas 75% RDF (7994 kg ha⁻¹) remained on par with 50% RDF (7912 kg ha⁻¹). During 2025-26 also, significantly higher stalk yield was recorded with 100% RDF (9025 kg ha⁻¹), while 75% RDF (8238 kg ha⁻¹) remained on par with 50% RDF (8025 kg ha⁻¹).

Higher stalk yield under conventional tillage and reduced tillage could be attributed to improved crop growth, higher dry matter accumulation and enhanced nutrient uptake resulting from favourable soil physical conditions. Better root growth and increased availability of soil moisture and nutrients under these treatments might have promoted vigorous vegetative growth leading to higher biomass production. These findings corroborate with the reports of Ambadi *et al.* (2018) ^[1], who observed significantly higher stover yield with FYM and RDF application in *rabi* sorghum. Similar findings were also reported by Kumari *et al.* (2025) ^[10], who documented higher fodder and stover yields under improved tillage and residue management practices.

Significantly higher stalk yield with application of 100% RDF might be due to increased nutrient availability and uptake which enhanced cell division, cell elongation and photosynthetic efficiency, thereby producing greater vegetative biomass. Adequate nitrogen supply particularly promotes vegetative growth and dry matter production. The present findings are in close agreement with those of Kumari *et al.* (2025) ^[10], Yadav and Singh (2016) ^[22] and Jat *et al.* (2013) ^[6], who reported significantly higher stover or biological yield with higher fertilizer application levels.

3.4 Harvest index (%)

Harvest index was not markedly influenced by residue management, tillage and fertility levels during both the years of experimentation (Table 2). The interaction effect between residue management, tillage and fertility levels was also found to be non-significant.

During 2024-25, harvest index ranged from 35.1 to 35.2% under tillage treatments and from 34.5 to 35.7% under fertility levels. During 2025-26, harvest index ranged from 35.4 to 36.7% under tillage treatments and from 35.5 to 36.9% under fertility levels.

The non-significant variation in harvest index among residue management, tillage and fertility levels might be due to

proportional increase in both grain and stalk yield under the respective treatments, resulting in relatively stable partitioning efficiency of assimilates between economic and biological yield. Similar findings were reported by Yadav and Singh (2016) ^[22], who observed only marginal variations in harvest index under

different fertility levels in sorghum. The results find support from Dadarwal *et al.* (2015) ^[3] and Verma *et al.* (2017) ^[21], who reported non-significant results on harvest index with different fertiliser levels.

Table 1: Dry matter production (kg ha⁻¹) of *rabi* sorghum as influenced by residue management, tillage and fertility levels

Treatments	Dry matter production (kg ha ⁻¹)											
	Vegetative			Flowering			Grain filling			At Harvest		
	2024-25	202-26	Mean	2024-25	202-26	Mean	2024-25	202-26	Mean	2024-25	202-26	Mean
Main Plot-Residue management & tillage (M)												
M1- Zero tillage	590	640	615	4913	5251	5082	7371	8488	7930	9724	9852	9788
M2- Conventional tillage	878	928	903	6304	6756	6530	9612	10639	10125	12255	12435	12345
M3- Reduced tillage	830	880	855	6129	6298	6214	8948	9717	9332	11656	12183	11920
S.Em±	20	21	-	247	176	-	257	301	-	471	380	-
CD (p=0.05)	80	84	-	995	710	-	1037	1214	-	1900	1534	-
Sub plot-Fertility levels(S)												
S1-50% RDF	713	767	738	5491	5641	5566	7864.1	9109	8487	10642	10877	10760
S2-75% RDF	760	810	784	5638	6013	5826	8577.0	9440	9009	10797	11234	11015
S3-100% RDF	826	876	851	6217	6651	6434	9489.6	10294	9892	12196	12360	12278
S.Em±	18	19	-	152	176	-	272.3	266	-	364	272	-
CD (p=0.05)	55	59	-	473	548	-	848.1	829	-	1134	847	-
Interaction (M x S)												
S.Em±	34	36	-	428	305	-	445.7	521	-	816	659	-
CD (p=0.05)	NS	NS	-	NS	NS	-	NS	NS	-	NS	NS	-
Interaction (S x M)												
S.Em±	32	34	-	428	305	-	463.1	482	-	698	541	-
CD (p=0.05)	NS	NS	-	NS	NS	-	NS	NS	-	NS	NS	-

Table 2: Yield (kg ha⁻¹) and harvest index (%) of *rabi* sorghum as influenced by residue management, tillage and fertility levels

Treatments	Grain yield (kg ha ⁻¹)			Stalk yield (kg ha ⁻¹)			Harvest index (%)		
	2024-25	2025-26	Mean	2024-25	2025-26	Mean	2024-25	2025-26	Mean
Main Plot-Residue management & tillage (M)									
M1- Zero tillage	2521	2578	2550	7203	7274	7239	35.1	35.4	-
M2- Conventional tillage	3193	3334	3264	9061	9100	9081	35.2	36.6	-
M3- Reduced tillage	3025	3270	3148	8631	8913	8772	35.1	36.7	-
S.Em±	123	108	-	351	289	-	-	-	-
CD (p=0.05)	497	435	-	1415	1165	-	-	-	-
Sub plot-Fertility levels (S)									
S1-50% RDF	2730	2852	2791	7912	8025	7969	34.5	35.5	
S2-75% RDF	2803	2996	2900	7994	8238	8116	35.0	36.3	
S3-100% RDF	3206	3334	3270	8989	9025	9007	35.7	36.9	
S.Em±	99	98	-	273	194	-			
CD (p=0.05)	308	305	-	849	603	-			
Interaction (M x S)									
S.Em±	213	187	-	608	500	-	-	-	-
CD (p=0.05)	NS	NS	-	NS	NS	-	-	-	-
Interaction (S x M)									
S.Em±	186	175	-	521	398	-	-	-	-
CD (p=0.05)	NS	NS	-	NS	NS	-	-	-	-

4. Conclusion

The results of the present investigation clearly indicate that residue management, tillage and fertility levels had exerted a pronounced effect on biomass accumulation at all the crop growth stages as well as the grain and stalk yields of *rabi* sorghum. Conventional tillage and reduced tillage consistently recorded superior dry matter production, grain yield and stalk yield protein yield compared to zero tillage, which may be attributed to improved soil physical conditions, better root growth and enhanced nutrient and moisture availability.

Among fertility levels, application of 100% RDF significantly improved growth parameters and yield attributes due to adequate and balanced nutrient supply, in conclusion, the study demonstrates that adoption of conventional or reduced tillage

along with 100% recommended dose of fertilizers is beneficial for achieving higher dry matter production and yields in *rabi* sorghum.

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