E-ISSN: 2618-0618
P-ISSN: 2618-060X

NAAS Rating (2025): 5.20
www.agronomyjournals.com
2025; 8(12): 749-753
Received: 11-09-2025
Accepted: 17-10-2025

VS Mynavathi
Associate Professor, Livestock Farm Complex, Veterinary College and Research Institute, Theni, Tamil Nadu, India

S Gunasekaran
Associate Professor, Livestock Farm Complex, Veterinary College and Research Institute, Chinnasalem, Tamil Nadu, India

R Murugeswari
Associate Professor, Department of Animal Nutrition, Veterinary College and Research Institute, Chinnasalem, Tamil Nadu, India

M Suganthi
Assistant Professor, Institute of Animal Nutrition, Kattupakkam, Tamil Nadu, India

C Valli
Retired Dean, Faculty of Basic Sciences, Madras Veterinary College, Tamil Nadu Veterinary and Animal Sciences University, Chennai, Tamil Nadu, India

Corresponding Author:
VS Mynavathi
Associate Professor, Livestock Farm Complex, Veterinary College and Research Institute, Theni, Tamil Nadu, India

Seed production performance of fodder sorghum in a *Gliricidia sepium* based Silvopastoral system

VS Mynavathi, S Gunasekaran, R Murugeswari, M Suganthi and C Valli

DOI: https://www.doi.org/10.33545/2618060X.2025.v8.i12k.4473

Abstract
Sorghum (Jowar) is an important fodder crop and it is fed to livestock as both green and dry fodder. The acute shortage of quality green fodder and forage seed remains a major constraint to livestock productivity in India. This study evaluated the seed production performance of fodder sorghum [*Sorghum bicolor* (L.)] variety Co(FS)29 grown under a *Gliricidia sepium* based silvopastoral system in degraded wasteland conditions at Institute of Animal Nutrition Kattupakkam, Tamil Nadu. The experiment was conducted in a randomized block design with two sowing methods *viz.,* Line sowing (60 × 15 cm) and Broadcasting replicated four times and assessed over three successive harvests. Results indicated that line sowing consistently produced higher seed yield across all harvests with total seed yield of 129.4 kg ha^{-1} compared to 83.2 kg ha^{-1} under broadcasting. Growth parameters such as plant height, tiller number and dry fodder yield were higher under line sowing. Seed yield declined with successive harvests, with the first cutting recording the highest yield and superior growth attributes. Economic analysis revealed that line sowing generated higher net returns (Rs. 38,566 ha^{-1}) compared to broadcasting (Rs. 11,984 ha^{-1}). The study demonstrates that line sowing of fodder sorghum under a *Gliricidia sepium* silvopastoral system is a viable and economically sustainable approach for improving forage seed production.

Keywords: Fodder sorghum, seed production, silvopastoral system

Introduction
The livestock sector plays a pivotal role in the Indian economy, contributing approximately 5.5% to the nation's Gross Value Addition (GVA) (GOI, 2022). One of the major constraints affecting livestock productivity is the acute shortage of green fodder, which is currently estimated at a deficit of about 36% (Singh, 2019) [13]. One of the reasons for deficit of green fodder production is due to non availability of quality seeds. The major problems in forage seed production are that forage crops are shy seed producers and harvested before seed setting to feed the animals, thereby restricting seed production (Kumar *et al*., 2015). Besides, farmers and other agencies do not take much interest to produce seed for their requirement and prefer to purchase from other sources. Consequently, a substantial gap persists between the demand and supply of quality forage seed across the country. (Chandra, 2020) [1].

Sorghum, besides being fifth most important cereal crop of the world, is also valued for its fodder and stover. Forage sorghum plant grows 6 to 12 feet tall and produces more dry matter tonnage than grain sorghum (Pandey and Roy, 2011) [8]. Globally sorghum is the major millet contributing 65% of total millet production (FAO, 2020). Fodder sorghum (*Sorghum bicolor*) is a major forage crop in tropical and subtropical regions due to its high biomass production, adaptability to varied agroclimatic conditions, and tolerance to drought and heat stress (Patel, 2018) [9]. In addition to green fodder production, availability of quality seed is critical for sustaining fodder-based production systems. Seed yield in fodder sorghum is strongly influenced by growing environment and management practices and therefore evaluating its performance under alternative and sustainable cropping systems i essential to ensure consistent seed supply (Singh and Kumar, 2017) [5, 12].

Silvopastoral systems integrating multipurpose trees with forage crops have gained importance for improving resource-use efficiency, soil fertility and system sustainability (Nair, 2012) [7]. *Gliricidia sepium*, a fast growing nitrogen fixing tree, is widely grown in such systems due to its

ability to improve soil nutrient status through biomass addition and pruning residues (Santiago, 2016) [11]. However, information on the seed production performance of fodder sorghum grown under *Gliricidia sepium* based silvopastoral systems is limited. The present study was therefore undertaken to evaluate the seed production performance of fodder sorghum in a *Gliricidia sepium* based silvopastoral system and to assess its suitability for sustainable seed production.

Materials and Methods

Location: The experiment was conducted on a *Gliricidia sepium* based silvopasture maintained in degraded wasteland established under All India Co-ordinated Research Project on Agroforestry scheme at the Institute of Animal Nutrition, Tamil Nadu Veterinary and Animal Sciences University, Kattupakkam, Tamil Nadu, India during the year 2020 to study the seed production performance of fodder sorghum grown under *Gliricidia sepium* based silvopastoral system. The farm is situated at 12.8198^0N latitude and 80.0352^0E longitude with an altitude of 52 m above mean sea level. The soil of the experimental site was red soil and having a pH of 6.2. The soil available nitrogen, phosphorus and potassium were 548.0, 4.6 and 190 kg ha^{-1}, respectively and the organic carbon content was 0.62%. Annual rainfall of the region during the experimental period was 1480 mm and more than 80 per cent was received between August to December. Mean annual maximum and minimum temperature were 32.15 ^{0}C and 25.02 ^{0}C, respectively.

Experimental details: Fodder sorghum variety Co(FS)29 was selected for this experiment. The experiment was laid out in a Randomized Block Design (RBD) replicated four times. The treatments are; Fodder sorghum was established with two methods *viz.*, Line sowing with a spacing of 60 x 15 cm (T_1) and Broadcasting (T_2). The plot size adopted was 5mx3m. Seed rate of 5kg/ha was used for line sowing and for broadcasting 10 kg/ha was used. Ploughing was done three times to get good tilth, ridges and furrows of 6m long and 60 cm apart were formed and line sowing was done with a spacing of 60 x 15 cm. First weeding on 25-30 days after sowing and depending on the weed flora weeding was done periodically. Irrigation was carried out once in 7days depending upon the soil moisture condition. Seeds were harvested 125 days after sowing and harvested three times in a year. All recommended agronomic practices such as land preparation, fertilizer application, irrigation, weed management and plant protection measures were uniformly followed for all the treatments, except the method of sowing.

Statistical analysis: The data recorded were subjected to analysis of variance (ANOVA) appropriate for a Randomized Block Design to test the significance of treatment effects. The treatment means were compared using the critical difference (CD) at 5% level of significance.

Pictures 1 to 8 depicts the establishment of Fodder sorghum Co(FS)29 to evaluate the seed production performance of fodder sorghum understorey *Gliricidia sepium* based silvopastoral system.

Plate 1: Field preparation

Plate 2: Broacasting of seeds

Plate 3: Levelling the field after broadcating

Plate 4: Field view - Broadcasted crop

Plate 5: Field view - Line sown crop

Plate 6: Field view before harvesting

Plate 7: Manual harvesting in broadcasted crop

Plate 8: Machine harvesting in line sown crop

Results and Discussion

The growth and yield of fodder sorghum Co(FS) 29 grown under a *Gliricidia sepium* based silvopastoral system were influenced by the type of sowing at different cutting intervals is presented in Table 1 and figure 1. Across all three harvests, line sowing (T_1) consistently recorded higher plant height, number of tillers, leaf length, leaf breadth and dry fodder yield compared to broadcasting (T_2); however, these differences were statistically non-significant. A progressive reduction in growth parameters was observed with successive harvests, irrespective of sowing method, indicating the effect of repeated cutting and understorey growing conditions. The present findings are in agreement with the findings of Iyanar *et al.* (2015) [4]. The number of leaves per tiller differed significantly at the first harvest with line sowing producing more leaves than broadcasting, while no significant differences were observed at subsequent harvests.

Seed yield was significantly influenced by the type of sowing at all harvests. Line sowing produced significantly higher seed yield than broadcasting at the first harvest (53.30 vs. 35.30 kg ha^{-1}), second harvest (40.10 vs. 27.10 kg ha^{-1}) and third harvests (35.96 vs. 20.83 kg ha^{-1}). The superior performance under line sowing may be attributed to better plant spacing and reduced competition under tree shade. Shattering of seeds to the extent of twenty five per cent in Co(FS)29 was attributed as reason for poor seed yield. The similar results were earlier reported by Manjunath Patil *et al.*, 2024 [6].

Dry fodder yield was numerically higher under line sowing at all harvests, but the differences were non-significant. Overall line sowing (60 × 15 cm) proved more efficient than broadcasting for improving seed yield and maintaining better growth of fodder sorghum under *Gliricidia sepium* based silvopastoral systems.

Table 1: Growth and yield parameters of fodder sorghum Co(FS)29 understorey *Gliricidia sepium* influenced by type of sowing at different cutting intervals

Parameters	Harvest					
	I		II		III	
	T_1	T_2	T_1	T_2	T_1	T_2
Plant height (cm) NS	223.40±17.77	198.50±11.81	119.00±0.57	11.00±1.73	98.33±2.02	96.66±4.05
No. of tillers NS	10.00±0.58	7.00±1.53	5.60 ±0.33	4.33±0.33	4.33±0.33	5.33±0.33
No. of leaves/ tiller	81.00^{b}±1.15	70.33^{a}±1.78	36.33±2.72	36.33±1.85	35.66±2.18	35.33±0.33
Leaf length (cm) NS	72.00±0.58	67.67±1.45	38.66 ±0.66	38.00±2.51	36.33±0.88	35.33±0.33
Leaf breath (cm) NS	3.83±0.19	3.97±0.03	2.06 ±0.24	2.26 ±0.14	2.00±0.11	1.96±0.03
L:S ratio NS	0.17±0.00	0.16±0.00	0.10 ±0.00	0.10 ±0.00	0.10±0.00	0.10±0.00
Seed yield (Kg/ha)	53.30^{b}±4.42	35.30^{a}±4.69	40.10^{b} ± 3.80	27.10^{a} ±3.70	35.96^{b}±4.27	20.83^{a}±2.73
Dry fodder yield (t/ha) NS	9.60±0.49	8.75±0.45	5.56 ±0.20	4.83 ±0.12	4.86±0.20	4.60±0.12

T_1 - Line sowing (60 x 15 cm), T_2 - Broadcasting

***** Mean of three replications Means bearing alphabetical superscripts within row for specific harvest between treatments differ significantly (P<0.05)

NS - Statistically Non significant (p>0.05)

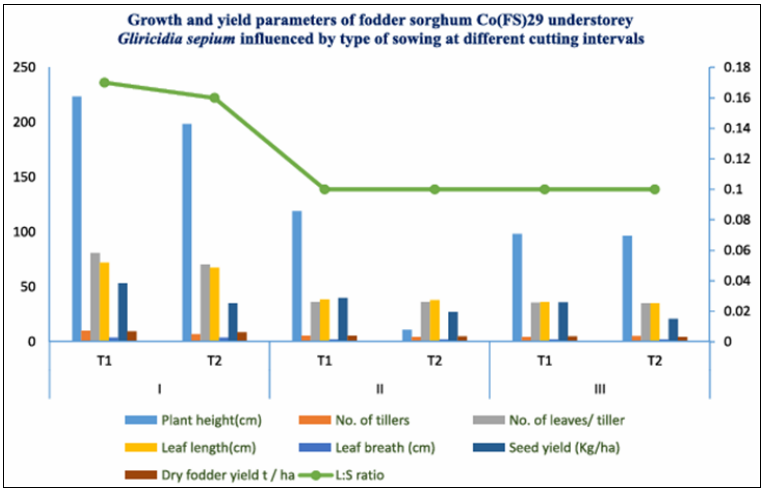

Fig 1: Growth and yield parameters of fodder sorghum Co(FS)9 understorey *Gliricidia sepium* influenced by type of sowing at different cutting intervals

Irrespective of the harvest the seed yield was significantly (P<0.05) highest in line sowing. There was no significant (P>0.05) variation in all other parameters for all harvests irrespective of treatments adopted. However in the first harvest the number of leaves per tiller was significantly (p<0.05) highest in line sowing.

The growth and yield parameters of fodder sorghum Co(FS) 29 understorey *Gliricidia sepium* as influenced by cutting intervals irrespective of type of sowing is presented in Table 2 and figure 2.

Table 2. Growth and yield parameters of fodder sorghum Co(FS) 29 understorey *Gliricidia sepium* as influenced by cutting intervals irrespective of type of sowing

Parameters	Cuttings		
	I	II	III
Plant height(cm)	210.95^{b}± 11.05	115.00^{a}± 1.97	97.50^{a}± 2.06
No. of tillers	8.50^{b}± 0.99	5.00^{a}± 0.37	4.83^{a}± 0.31
No. of leaves/ tiller	75.67^{b}± 2.56	36.33^{a}± 1.48	35.50^{a}± 0.99
Leaf length(cm)	69.83^{b}± 1.19	38.33^{a}±1.17	35.83^{a}±0.91
Leaf breath (cm)	3.90^{b}±0.09	2.17^{a}± 0.13	1.98^{a}± 0.05
L:S ratio	0.17^{b}± 0.00	0.10^{a}± 0.00	0.10^{a}± 0.00
Seed yield (Kg/ha)	44.30^{b}± 4.95	33.60^{ab}± 3.77	28.40^{a}± 4.07
Dry fodder yield(t/ha)	9.17^{b}± 0.35	5.20^{a}± 0.19	4.75^{a}± 0.12

*****Mean of six replications

Means bearing alphabetical superscripts within rows differ significantly (p<0.05) NS - Statistically Non significant (p>0.05)

The growth and yield parameters of fodder sorghum Co(FS) 29 grown understorey in *Gliricidia sepium*, as influenced by cutting intervals irrespective of the type of sowing, showed significant variation (Table 2). The first cutting recorded significantly higher plant height (210.95 cm), number of tillers (8.50), number of leaves per tiller (75.67), leaf length (69.83 cm), leaf breadth (3.90 cm), and leaf-to-stem ratio (0.17) compared to the second and third cuttings, indicating better vegetative growth and forage quality during the initial harvest. This superiority may be attributed to greater availability of assimilates, better nutrient uptake, and less physiological stress during early growth stages, whereas successive cuttings likely reduced carbohydrate reserves and regenerative capacity of the plants. Yield parameters followed a similar trend, with the highest seed yield (44.30 kg ha^{-1}) and dry fodder yield (9.17 t ha^{-1}) recorded at the first cutting, which were significantly higher than the third cutting and comparable to the second cutting. The progressive decline in growth and yield with later cuttings could be due to reduced photosynthetic area, shading effects of *Gliricidia sepium*, and depletion of soil moisture and nutrients over time. Overall, the results demonstrate that the first cutting interval is more favorable for maximizing growth, fodder yield and forage quality of fodder sorghum Co(FS) 29 under *Gliricidia sepium* irrespective of sowing method.

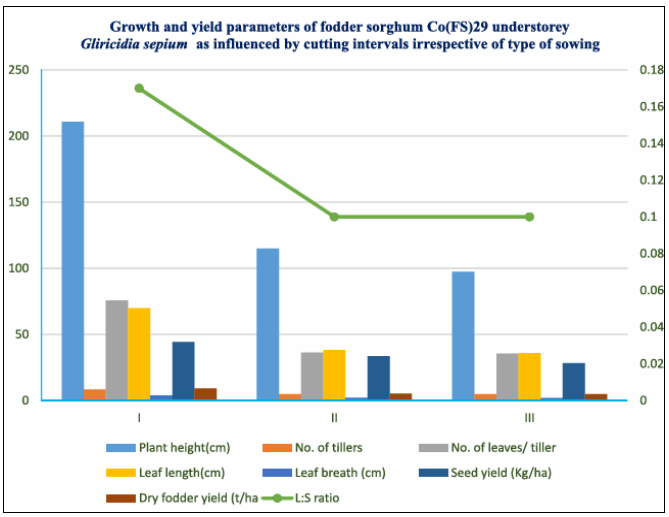

Fig 2: Growth and yield parameters of fodder sorghum Co(FS)9 understorey *Gliricidia sepium* as influenced by cutting intervals irrespective of type of sowing

The seed yield and fodder yield of fodder sorghum Co(FS)9 as influenced by treatments and harvest intervals is presented in Table 3. Line sowing at 60 × 15 cm (T_1) recorded higher seed and fodder yields at all harvests compared to broadcasting (T_2), resulting in greater total seed yield (129.4 kg ha^{-1}) and dry fodder yield (19.9 t ha^{-1}). In both treatments, yields were highest at the first harvest and declined in subsequent harvests.

Table 3: Seed yield and fodder yield of fodder sorghum Co(FS) 29 as influenced by treatments and harvest intervals.

Treatments	Seed yield (Kg/ha)				Dry fodder yield (t/ha)			
	Harvest			Total	Harvest			Total
	I	II	III		I	II	III	
T_1 -Line sowing (60 x 15 cm)	53.3	40.1	36.0	129.4	9.6	5.5	4.8	19.9
T_2 - Broadcasting	35.3	27.1	20.8	83.2	8.7	4.8	4.6	18.1

The superior performance of line sowing may be attributed to better plant spacing, efficient resource utilization, and reduced competition, while the reduction in yield with successive harvests could be due to depletion of plant reserves and reduced regenerative capacity after repeated cutting. These results corroborate the findings of Patil *et al.*, 2024 [10], who reported that management practices *viz*., optimizing sowing and nutrient practices influences the seed yield in perennial fodder sorghum.

The net economics of fodder seed production as influenced by sowing methods are presented in Table 4. Line sowing at 60 × 15 cm (T_1) recorded lower seed and weeding costs compared to broadcasting (T_2), resulting in a lower total cost of cultivation (Rs. 51,053 ha^{-1}). Owing to higher seed and fodder yields, T_1 realized greater total returns (Rs. 89,619 ha^{-1}) and net income (Rs. 38,566 ha^{-1}), whereas broadcasting recorded lower total returns (Rs. 68,232 ha^{-1}) and net income (Rs. 11,984 ha^{-1}).

Table 4: Net economics of fodder seed production

Treatments	Seed cost/ha (Rs.)	Weeding cost (Rs.)	Total cost of cultivation (Rs./ha)	Seed cost (Rs.)	Fodder cost (Rs.)	Total returns (Rs.)	Net income (Rs.)
T_1	1925	3270	51053	49,819	39800	89619	38,566
T_2	3850	6540	56248	32032	36200	68232	11,984

Thus, the results clearly indicate that line sowing is economically superior to broadcasting for fodder seed production.

Conclusion

The present investigation clearly demonstrates that fodder sorghum Co(FS)29 can be successfully grown for seed production under a *Gliricidia sepium* based silvopastoral system in degraded wastelands. Among the sowing methods evaluated, line sowing at 60 × 15 cm proved superior to broadcasting by significantly enhancing seed yield across all harvests and providing better economic returns, while maintaining comparable growth and fodder yield. Irrespective of sowing method, the first cutting was most favorable for achieving higher growth, forage quality, seed yield and dry fodder yield, with a progressive decline observed in subsequent cuttings. The integration of fodder sorghum with *Gliricidia sepium* thus offers a sustainable option for augmenting forage seed availability while improving land productivity. Adoption of line sowing under silvopastoral systems can therefore be recommended for enhancing fodder seed production and farm profitability in similar agroclimatic conditions.

References

1. Chandra A. Forage seed production and management in India. J Livest Sci. 2020;11(3):45-55.
2. Food and Agriculture Organization of the United Nations. Global millet production statistics. Rome: FAO; 2020.
3. Government of India. Economic Survey of India 2021-22. New Delhi: Ministry of Finance, Government of India; 2022.
4. Iyanar K, Babu C, Kumaravadivel N. A high-yielding multicut fodder sorghum CO 31. Electron J Plant Breed. 2015;6(1):54-57.
5. Kumar R, Singh P, Sharma V. Constraints in forage seed production in India. Indian J Agron. 2015;60(2):210-218.
6. Patil M, Ramesh BK, Pralhad, Mahesh C, Mahantesh MT, Sreedhara JN. Assessment of suitability of perennial fodder sorghum varieties CoFS-29 and CoFS-31 for fodder and seed production in Kalyana Karnataka region. Int J Chem Stud. 2024;8(4):3778-3781.
7. Nair PKR. Agroforestry systems and practices. New York: Springer; 2012.
8. Pandey P, Roy S. Sorghum: an important cereal and forage crop. J Cereal Sci. 2011;53:223-229.
9. Patel R. Drought-tolerant forage crops in tropical regions. Forage Res. 2018;44(1):12-19.
10. Patil B, Merwade MN, Tirlapur LN. Influence of inter-row spacing and fertilizer levels on seed production and its economic benefits in perennial fodder sorghum cv. CoFS 29. Seed Res. 2024;44(2):97-101.
11. Santiago A. Nitrogen-fixing trees in silvopastoral systems. Agrofor Syst. 2016;90:401-414.
12. Singh M, Kumar S. Seed production in fodder sorghum under different cropping systems. Indian J Agric Sci. 2017;87(5):652-658.
13. Singh V. Fodder deficit and livestock productivity in India. Asian J Anim Sci. 2019;13(2):101-109.