



**P-ISSN: 2349-8528**

**E-ISSN: 2321-4902**

[www.chemijournal.com](http://www.chemijournal.com)

IJCS 2020; 8(4): 3778-3781

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Received: 10-05-2020

Accepted: 15-06-2020

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## Assessment of suitability of perennial fodder sorghum varieties CoFS-29 and CoFS-31 for fodder and seed production in Kalyana Karnataka region

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**DOI:** <https://doi.org/10.22271/chemi.2020.v8.i4av.10231>

**Abstract**

Fodder sorghum varieties, CoFS-29 and CoFS-31 are multi-cut varieties, released by Tamil Nadu Agriculture University, Coimbatore. A study was undertaken to know the suitability, green fodder and seed production potential of these two varieties in Kalyana-Karnataka region of Karnataka state. The study was carried out for three continuous years at five different Krishi Vigyan Kendra's of University of Agricultural Sciences, Raichur. Fifty farmers, ten each in each KVK were purposively selected. Farmers growing annual fodder sorghum (SSV-74) variety and having irrigation facilities were considered for the study. A kilogram each of both CoFS-29 and CoFS-31 seeds was distributed as critical inputs. The seed rate for both the varieties is 2 kg per acre and that of SSV-74 is 12 kg per acre. The parameters namely green fodder yield, seed yield, seed shattering, palatability, milk yield and its composition in HF cross bred cows and economics were studied. Based on these parameters, it is concluded that CoFS-31 multi cut fodder sorghum variety is superior, better and more profitable to farming community compared to CoFS-29 and SSV-74.

**Keywords:** CoFS-29 and 31, perennial fodder sorghum, green fodder yield, seed yield, cross bred cattle, milk yield, economics

**Introduction**

Forages are although not directly used for human consumption but they are the source of protein and fat *i.e.* meat, egg, milk and other dairy products that become available to human beings through intermediaries like cattle, sheep, goats, poultry etc. Fodder crops play a vital role in agriculture since continuous supply of nutritious green fodder in sufficient quantity is basic requirement for livestock to cater milk production and also to maintain the health of the livestock. India possesses huge livestock population, but the condition of majority of these animals is deplorably poor, both due to under feeding and malnutrition, which primarily is ascribed to fluctuating supply of poor quality green fodder.

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 ft tall and produces more dry matter tonnage than grain sorghum (Pandey and Roy, 2011) [4]. The SSV-74 is a sweet sorghum cum forage variety released by the University of Agricultural Sciences, Dharwad (Package of Practice, 2013) [3]. Its annual fodder sorghum variety, difficult for farmers to feed to livestock for entire year. Thus, regular year round supply of quality green fodder is the basic need for a rapidly growing livestock population.

To fulfill this demand, Tamil Nadu Agriculture University (TNAU), Coimbatore released two multi-cut fodder sorghum varieties - CoFS-29 and CoFS-31 during 2001 and 2014 respectively and for general cultivation in Tamil Nadu. However, information on its agronomic and animal husbandry aspects, especially location specific requirements, milk yield and composition in cross bred cows are meager. With this background, the present study was undertaken to know the suitability, fodder and seed production potential of these two varieties in comparison with SSV-74 variety in Kalyana-Karnataka region of Karnataka state. Also, to know the palatability, milk yield and their compositions in HF cross bred cows after feeding of these

three fodders. Economics parameters were calculated both on agronomical and animal husbandry aspects.

### Materials and Methods

The present study was carried out for three continuous years (2017-18, 2018-19 and 2019-20) at five different ICAR-Krishi Vigyan Kendras viz., KVK, Kalaburagi, KVK, Raichur, KVK, Gangavathi (Koppal dist), KVK, Hagari (Ballari dist) and KVK, Kawadimatti (Yadgir dist) of University of Agricultural Sciences, Raichur. The study was conducted through on farm trials at different locations in each of the KVKs falling under five districts of Kalyana-Karnataka region. Fifty farmers, ten each in each KVK were purposively selected and followed up continuously for three years starting from 2017-18. Forage crops grown at five farmers were harvested continuously for fodder purpose (Farmers for Fodder- FF) whereas crops grown with other five farmers were monitored for seed yield (Farmers for Seed – FS) throughout the study period. Dairy farmers who were growing fodder sorghum (SSV-74) and with irrigation facility were considered for the study. A kilogram each of both the varieties of CoFS seeds was distributed as critical inputs. The seed rate for both the varieties is 2 kg per acre and that of SSV-74 is 12 kg per acre. The parameters namely green fodder yield, seed yield, seed shattering, palatability, milk yield and its composition in HF cross bred cows were studied. Economic parameters were calculated on the basis of prevailing market prices.

### Experimental Design

The study was conducted for three successive years starting from 2017-18 to 2019-20 at different agro-climatic zones of Kalyana-Karnataka region. Fodder seeds of each of CoFS 29, CoFS 31 and SSV were sown in half an acre area at each farmer's field and they were respectively named as T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub> wherein SSV(T<sub>3</sub>) as served as check and was grown twice in an year. All the standard crop management practices as per recommendation for SSV-74 (Package of Practice, 2013) [3] and CoFS-29 (Fazlullah Khan *et al.*, 2002) [1] and for CoFS-31 (Iyanar *et al.*, 2015) [2] were followed. Three years data with respect to fodder and seed yield was pooled and data was subjected to statistical analysis.

Second or third lactation HF cross bred cows which were at the stage of mid lactation with similar milk yield levels were chosen for assessing effect of feeding different forages on milk yield and composition. Three animals with each FF farmer were identified during each year for the intended study. Thus 15 animals in each KVK jurisdiction and a total of 45 animals were evaluated for their performance during each year. Three years data with respect to palatability of each fodder type, milk yield, CLR, Fat (%), SNF and Body condition score (0-5) data was pooled and subjected to statistical analysis.

### Roughage and Concentrate Feeding to Lactating HF cross bred Cows

T<sub>1</sub> cows were fed with 15 kg of cereal forage CoFS-29, 5 kg of leguminous fodder (hedge Lucerne) and 8-10 kg of sorghum Stover. Feeding and management practices were similar for all the cows in each group expect for different cereal forages CoFS 31 and SSV 74 fed respectively in groups T<sub>2</sub> and T<sub>3</sub>. All the lactating cows in three groups received a basal diet comprising of roughages and concentrates separately to meet the maintenance and production requirements. Apart from dry and green fodder, concentrate

mixture @1kg per 2.5 liter of milk yield was given. The concentrate mixture was prepared at respective farmer's house with the advice of ICAR-KVK's animal scientists and composed of maize, cotton seed cake, wheat bran, rice bran, mineral mixture and salt. The concentrate was offered daily during morning and evening hours.

### Statistical analysis

In the present study, mean as a measure of central tendency and the standard error as a measure of random error were employed for the statistical analysis. The student's 't' test ( $p \leq 0.05$ ) was used to know the significant variation between the groups (T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub>) as per the procedure described by Snedecor and Cochran (1994).

### Result and Discussion

A field study on assessment of fodder and seed production potential of multicut fodder sorghum varieties CoFS-29 and CoFS-31 are discussed below.

#### Average green fodder yield

The data on average green fodder yield of T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub> are presented in Table 1. The three years average green fodder yield was significantly ( $p \leq 0.05$ ) higher in CoFS-31 than CoFS-29 and SSV-74. Its due to the average plant height of CoFS-31 (280 cm) was higher than CoFS-29 (235 cm). Similarly, average numbers of tillers per plant was more for CoFS-31 (15) than CoFS-29 (13).

The present findings are in agreement with the findings of Iyanar *et al.* (2015) [2]. They observed exceedingly higher green fodder yield of CoFS-31 (192 t/ha/yr) against the check CoFS-29 (167 t/ha/yr). The per cent increase in green fodder yield of CoFS-31 over the check CoFS-29 was 14.9. Vijayakumar *et al.* (2009) [8] recorded 232.5 t/ha/year of CoFS-29 as compared to with 259.7 t/ha/year of CO(CN)4. The higher green fodder yield was recorded compared to our study was due to cultivation of fodders during rainy season (September to November) and station trials (Ullah *et al.*, 2006) [7].

In 2017-18 and 2018-19, scarcity of rain falls in all the districts of Kalyana-Karnataka region. Contrarily, in 2019-20, heavy rainfall in some of the areas of Kalyana-Karnataka region where we carried out our farm trials. The better performance of CoFS-29 and CoFS-31 varieties was noticed even in drought and water logging areas. So, both the varieties are well tolerant to drought and water logging areas. The reason might be due to sorghum crop tolerates drought relatively well, though adequate fertility and soil moisture maximizes its yields. The plant becomes dormant in the absence of adequate water, but it does not wilt readily. Growth resumes when moisture conditions improve (Pandey and Roy, 2011) [4].

#### Average fodder seed yield

The data on average fodder seed yield of T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub> are presented in Table 2. The three years average fodder seed yield was significantly ( $p \leq 0.05$ ) higher in SSV-74 than CoFS-29 and CoFS-31. Shattering of seeds to the extent of twenty five per cent in CoFS-29 was attributed as reason for poor seed yield. However this phenomenon was not noticed in CoFS-31 accounting for higher seed yields. The lower fodder seed yield in CoFS-29 was also reported by earlier workers (Iyanar, *et al.*, 2015) [2]. The seeds after physiological maturity in CoFS-31 were found to be intact as compared to CoFS-29.

Its non-shattering behavior of seeds facilitate enhanced seed yield to the tune of 19.1 % than CoFS-29.

### Milk yield and its composition

The data on average milk yield and its composition of T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub> are presented in Table 3. The average three years palatability of green fodder and average milk yield per day per cow and its composition were similar for all the varieties. There was non-significant difference ( $p \geq 0.05$ ) of milk yield and its composition of demonstration and check varieties. However, CoFS-31 has higher numerical values of milk yield (ltr/cow/day), CLR, Fat (%) and SNF compared to CoFS-29 and SSV-74 varieties. The reason for increased milk yield and its composition was due to higher dry matter per cent (25.9) which contributed to higher dry matter yield (49.73 t/ha/yr), reduced fibre content (19.80 %) confers increased digestibility and palatability in CoFS-31 variety (Senthilkumar *et al.*, 2009 and Iyanar, *et al.*, 2015) [6, 2].

### Economic Analysis on fodder seed production

Economic analysis was done for production of fodder seeds are depicted in Table 4. The higher gross cost was seen in T<sub>2</sub> and T<sub>1</sub> varieties compared to T<sub>3</sub> variety. Since, T<sub>2</sub> and T<sub>1</sub> varieties are perennial fodders where three cuttings per year for seed production compared to T<sub>3</sub> variety as annual fodder sorghum where two cuttings per year was carried out. The

BCR of CoFS-31 was significantly higher ( $p \leq 0.05$ ) when compared with CoFS-29 and SSV-74. The economics of our present study was higher than the earlier authors (Wadhwa *et al.*, 2010 and Ramya *et al.*, 2017) [9, 5]. The reason might be due to high labour charges and escalated cost of all inputs for cultivation of fodders for seed production. Also, the earlier authors calculated economics for green fodder and not for fodder seed production.

### Economics analysis on milk yield of HF cross bred cows

Economic analysis was done on milk yield of HF cross bred cows are depicted in Table 5. The gross cost includes cost of green, dry fodder and concentrates which is similar for all the three varieties. There was no much variation of gross returns, net returns and BCR among three groups. However, numerically T<sub>2</sub> group has higher values than T<sub>1</sub> and T<sub>3</sub> which might be due to high crude protein content of CoFS-31. There is paucity of reports available to compare the present results of economic analysis on milk yield of HF cross bred cows with others.

Based on green fodder yield, fodder seed yield, milk yield and its composition, economic analysis on fodder seed production and milk yield of HF cross bred cows, it is concluded that CoFS-31 multi cut fodder sorghum variety is superior, better and more profitable to farming community compared to other two varieties.

**Table 1:** Pooled Data of Green Fodder Yield (2017-18, 2018-19 and 2019-20)

Institute	Green Fodder Yield (Ton/ha/year)		
	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>
KVK, Kalaburagi	144.17±12.94 <sup>b</sup>	156.17±16.27 <sup>a</sup>	80.67±9.67 <sup>c</sup>
KVK, Raichur	145.17±13.40 <sup>b</sup>	163.00±18.02 <sup>a</sup>	85.83±12.23 <sup>c</sup>
KVK, Gangavathi	148.00±14.21 <sup>b</sup>	161.67±17.12 <sup>a</sup>	87.73±12.53 <sup>c</sup>
KVK, Hagari	145.17±13.27 <sup>b</sup>	157.83±16.01 <sup>a</sup>	84.23±10.65 <sup>c</sup>
KVK, Kawadimatti	140.75±11.68 <sup>b</sup>	156.25±15.60 <sup>a</sup>	78.25±7.78 <sup>c</sup>
Average of green fodder yield (Ton/ha/year)	144.65±13.10 <sup>b</sup>	158.98±16.60 <sup>a</sup>	83.34±10.57 <sup>c</sup>

a,b,c means bearing different superscripts differ significantly ( $p \leq 0.05$ ) between groups of T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub> respectively.

**Table 2:** Pooled Data of Fodder Seed Yield (2017-18, 2018-19 & 2019-20)

Institute	Fodder Seed Yield (Kg/ha/year)		
	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>
KVK, Kalaburagi	608.33±61.50 <sup>c</sup>	826.00±100.81 <sup>b</sup>	2119.50±306.97 <sup>a</sup>
KVK, Raichur	654.83±71.42 <sup>c</sup>	873.67±124.10 <sup>b</sup>	2217.83±329.24 <sup>a</sup>
KVK, Gangavathi	610.50±64.83 <sup>c</sup>	813.43±95.95 <sup>b</sup>	2401.83±393.28 <sup>a</sup>
KVK, Hagari	653.87±74.33 <sup>c</sup>	864.60±118.73 <sup>b</sup>	2307.00±356.62 <sup>a</sup>
KVK, Kawadimatti	536.25±50.93 <sup>c</sup>	654.50±68.49 <sup>b</sup>	2055.25±213.81 <sup>a</sup>
Average of fodder seed yield (Kg/ha/year)	612.76±64.60 <sup>c</sup>	806.44±101.62 <sup>b</sup>	2220.28±319.98 <sup>a</sup>

a, b, c means bearing different superscripts differ significantly ( $p \leq 0.05$ ) between groups of T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub> respectively.

**Table 3:** Pooled Data of 3 years on Milk yield & its composition (2017-18, 2018-19 & 2019-20)

Parameter	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>
Palatability	Highly Palatable	Highly Palatable	Highly Palatable
Milk yield (ltr/cow/day)	12.30±0.89 <sup>a</sup>	12.50±0.97 <sup>a</sup>	12.11±0.76 <sup>a</sup>
CLR (Corrected Lactometer Reading)	27	28	27
Fat (%)	4.03±0.23 <sup>a</sup>	4.16±0.26 <sup>a</sup>	3.93±0.18 <sup>a</sup>
SNF	8.96±0.79 <sup>a</sup>	9.10±0.88 <sup>a</sup>	8.93±0.76 <sup>a</sup>
Body condition score (0-5)	4.00	4.00	4.00

**Table 4:** Pooled data of 3 years of Economic Analysis of fodder seed production

Parameter	T <sub>1</sub> (3 cuttings/year)	T <sub>2</sub> (3 cuttings/year)	T <sub>3</sub> (2 cuttings/year)
Gross cost (Hectre) (Rs)	44,000	51,500	28,700
Gross Returns* (Rs)	1,83,828(612.76 kg @ Rs. 300/-)	2,41,932(806.44 kg @Rs.300/-)	1,11,014 (2220.28 kg @ Rs. 50/-)
Net Returns (Rs)	1,39,828/-	1,90,432/-	82,314/-
B:C Ratio	4.18 <sup>b</sup>	4.70 <sup>a</sup>	3.87 <sup>c</sup>

a,b,c means bearing different superscripts differ significantly ( $p \leq 0.05$ ) between groups of T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub> respectively.

**Table 5:** Pooled Data of 3 years of Economics Analysis on Milk yield of HF cross bred cows

Parameter	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>
Gross cost (Rs/cow /day)	140	140	140
Gross Returns* (Rs)	615.00	625.00	605.50
Net Returns (Rs)	475.00	485.00	465.50
B:C Ratio	1:4.39	1:4.46	1:4.33

\*Cost of Cow Milk- 50 Rs /Lit

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