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Effect of cutting management on seed yield, dry fodder yield and seed quality of multicut fodder sorghum

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Abstract: Field investigation was carried out to find out the effect of number of cuttings on seed yield and quality parameters of multicut fodder sorghum cv. CoFS-29 at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad during 2012-13. The experiment was laid out in the Randomized Complete Block Design with four replications, comprising of five cutting management practices *viz.,* uncut (control) crop, one cut crop, two cuts crop, three cuts crop and four cuts crop. The results showed that with increasing frequency of cuttings from zero to four cuttings, the seed yield and quality parameters have been reduced drastically. Among the five cuttings, the uncut crop has produced significantly the maximum number of productive tillers per plant (9.95), panicle length (42.48 cm), dry fodder yield per hectare at harvest (88.89 q ha^{-1}), seed yield per hectare (576.4 kg), 1000 seed weight (6.08 g), seed germination (70.00), seedling length (28.15 cm), seedling vigour index (1971) and seedling dry weight (47 mg $seedlings^{-10}$) and the least EC value (0.225 dSm^{-1}) followed by the one and two cuts crops. On the contrary, all these seed yield attributing and quality parameters were minimum in the four cuts crop. Thus, it is concluded that cutting of the crop at vegetative stage for fodder purpose is not advisable for seed production of multicut fodder sorghum since the uncut (no cutting) crop has recorded significantly higher seed yield and quality attributing components as against the four cuts crop. The next higher seed and fodder yields with comparable quality parameters could be obtained from the one cut crop.

Key words: Cutting management, Multicut fodder sorghum, Seed yield, Seed quality

Introduction

Forages are the mainstay of animal wealth and their production is the backbone of livestock industry. Obviously, there is a huge gap between demand and supply of feed and fodder in India, the present feed and fodder resources of the country can meet only 48 per cent of the live stock requirement, with a vast deficit of 35.6 per cent green fodder, 10.95 per cent dry fodder and 44 percent concentrate (Anonymous, 2013). This deficit may be due to non- availability of quality seeds of improved forage varieties and lack of improved cultivation techniques for enhancing the average commercial forage and seed yields. Sorghum [*Sorghum bicolor* (L.) Moench.] is one of the most important and widely grown crops in the world for food, feed, fodder, apart from fuel in some parts of the semi-arid tropic of Asia, Africa, the Americas and Australia. It is generally cultivated in such agro-climatic areas where there exists too dry and hot climate for cultivation of other cereals due to its sustained tolerance to drought and heat stresses. The importance of sorghum as a commercial forage crop is growing in many regions of the world due to its high productivity and efficient utilization of water even under drought conditions. In India, it is principally grown as an important *kharif* crop since it is highly palatable and digestible as for as the nutritional quality is concerned. It is also suited for silage and hay making. The productivity and availability of quality seeds are the important factors for increased fodder productivity and it is particularly more important in the forage crops like perennial forage sorghum that is mainly grown for green fodder but it is potentially shy yielder due to its very low seed productivity. Further, the frequent cuttings of the green fodder for feed purpose will not only deplete the starch reserves but also adversely affect seed setting. Defoliation is most important factor which influences both productivity and quality in forage species Bassegio *et al*. (2013). Therefore, a concerted effort is required to augment the seed production of cultivated fodder sorghum crop as well as other pasture crops. The forage seed productivity could be augmented by adopting the proper agronomic practices. In recent past, several varieties have been developed and released for cultivation of forage sorghum under the various agro-climatic conditions in the country and also in Karnataka.

Single cut fodder sorghum is generally a seasonal crop but multicut varieties behave as perennial crop that can extend the green fodder supply throughout the year. Plant height, number and length of leaf in ratoon crop were less than the base crop (Duncan and Moss, 1987). In grass *Setaria sphacelata*, Dwivedi *et al*. (1999) reported that defoliation/cutting suppressed the seed yield over uncut crops. There are results showed that, the highest seed yield was obtained from treatment with no cutting before the seed crop (Farid and Hassan, 1990). The number of cuttings practiced in perennial multicut forage sorghum will ultimately decide about its fodder and commercial yields. The earlier practice is to follow two or three cuttings only. Now, a need is felt to follow as many as five cuttings in a multicut fodder sorghum in a year in order to save on the seed cost and to supply sustained green forage to the dairy and drought animals. Accordingly, CoFS-29, a multicut fodder sorghum was released by TNAU, Coimbatore in 2001 for general cultivation in Tamil Nadu. The agronomic suitability of this variety for seed production has not been tested systematically with respect to the cutting management of multicut perennial fodder sorghum in Karnataka State particularly under Dharwad conditions and the effect of cutting on cutting management on seed yield and quality of multicut perennial fodder sorghum has been investigated under Dharwad conditions.

Material and Methods

A field study was conducted at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad during *kharif* 2012 to upto completion all cutting management treatments on medium deep black soil which is porous, well drained in nature and having medium fertility. The treatments consisting of five cutting management practices *viz*. Uncut as a control (C_0), One cut (C_1), Two cuts (C_2), Three cuts (C_3) and Four cuts (C_4) were laid out in completely randomized block design with four replications. The seeds of multicut fodder sorghum cv. CoFS-29 procured from the Indian Grassland and Fodder Research Institute (IGFRI), Southern Regional Research Station, Dharwad and were sown in the last week of June at spacing of 30 cm between the lines and 10 cm between the plants with a seed rate of 10 kg ha^{-1} in the gross plot size of 3.6 x 2.0 m. The recommended dosage of fertilizer 100:40:40 N, P_2O_5 and K kg ha^{-1} were applied in the two splits, the half dose of N and entire dose of P_2O_5 and Potash were applied at the time of sowing and the remaining half dose of N was applied to soil 30 days after sowing. Furudon 3G granules @ 10 kg ha^{-1} were also applied to prevent shoot fly incidence. All other operations were carried as per recommended package and practices.

At crop maturity stage, the seed panicles were harvested for the first time from the main plants of fodder sorghum crop without resorting to any cuttings for fodder purpose in each replication and they were considered as seeds of uncut (C_0) crop. After harvest of the panicles, main plants were cut manually with a sickle by leaving 5 cm height ground level and the cut plants are encouraged for their regrowth as ratoon crop and further setting of seeds by adopting recommended cultivation practices mentioned above. As when as the ratoon crop matures, the seed panicles were harvested manually and were considered as seeds of one cut crop (C_1). Subsequently their plants were again cut manually and allowed for their regrowth and seed settings. This cutting cycle was repeated until the seeds were obtained from the two cut crop (C_2), three cut crop (C_3) and four cut crop (C_4). The observations on seed yield parameters *viz.,* number of productive tillers per plant, panicle length (cm), seed yield per panicle (g), seed yield per hectare (kg), dry fodder yield hactare (q) and harvest index were recorded after harvest from the respective number of cutting managements practices and quality parameters *viz.,* 1000-seed weight, seed germination (%), seedling length (cm), seedling vigour index, seedling dry weight (mg^{-10} seedlings) and electrical conductivity (dSm^{-1}) were tested as per ISTA rules (Anon., 2014) and vigour index was determined according to Abdul-Baki and Anderson (1973). The data collected in respect of various parameters on seed yield and quality attributes were analyzed statistically as described by Gomez and Gomez (1984).

Results and Discussion

The results of this study revealed the significant and consistent effect of cutting management treatments on various seed and fodder yield attributing and quality parameters studied. As number of cuttings increased from zero (uncut) cut crop to four cuts crop, there was a sharp and significant reduction in all the fodder and seed yield attributing characters. Among the five cutting treatments, the uncut (no cutting) crop recorded significantly maximum seed yield (576.4 kg) and dry fodder yield (88.89 q) per hectare which was followed by the one and two cuts crops (Table-2) as against the four cut crop (368.1 kg and 62.50 q ha^{-1}, respectively). The significantly highest fodder and seed yield noticed in the uncut crop may be attributed to the maximum number of productive panicles per plant (9.95), panicle length (42.48 cm), seed yield per panicle (1.11 g) and plant (11.05 g) and harvest index (6.09 %) noticed in the uncut crop as seen in this study (Table 1). All these yield attributing parameters were reduced significantly and drastically with the increase in cutting management from the uncut crop to four cuts crop. The major impact of cutting of the crop at vegetative stage for fodder purpose was seen on the amount of seed setting as indicated by the seed weight per panicle and harvest index which

Table-1: Panicle and seed yield parameters as influenced by number of cuttings in multicut fodder sorghum cv. CoFS-29

Treatments	Productive panicles $plant^{-1}$	Panicle length (cm)	Seed yield/ panicle (g)	Seed yield/ plant (g)
C_0 : Uncut crop (Control)	9.95	42.48	1.11	11.05
C_1 : One cut crop	9.48	41.28	1.07	10.16
C_2 : Two cut crop	8.75	40.00	1.04	9.10
C_3 : Three cut cop	8.10	38.40	0.99	8.01
C_4 : Four cut cop	7.30	37.45	0.97	7.07
S.Em±	0.12	0.17	0.02	0.09
C.D (p=0.05)	0.36	0.53	0.05	0.28

Table-2: Seed yield and dry fodder yield components as influenced by number of cuttings in multicut fodder sorghum cv. CoFS-29

Treatments	Seed yield $hactare^{-1}$ (kg)	Dry fodder yield $hectare^{-1}$ (q)	Harvest index (%)
C_0 : Uncut crop (Control)	576.4	88.89	6.09
C_1 : One cut crop	541.7	84.20	6.07
C_2 : Two cut crop	479.2	75.52	5.97
C_3 : Three cut cop	430.6	68.06	5.96
C_4 : Four cut cop	368.1	62.50	5.57
S.Em±	6.7	1.43	0.14
C.D (p=0.05)	20.7	4.40	N S

Table-3: Seed quality parameters as influenced by number of cuttings in multicut fodder sorghum cv. CoFS-29

Treatments	1000 seed weight (g)	Seed germination (%)	Electrical conductivity (dSm^{-1})
C_0 : Uncut crop (Control)	6.08	70.00 (56.77)	0.225
C_1 : One cut crop	5.88	69.00 (56.15)	0.233
C_2 : Two cut crop	5.46	67.50 (55.22)	0.240
C_3 : Three cut cop	5.21	66.00 (54.21)	0.248
C_4 : Four cut cop	5.05	64.75 (53.56)	0.260
S.Em±	0.05	0.55 (0.34)	0.006
C.D (p=0.05)	0.15	1.69 (1.04)	0.020

*Figures in the parenthesis are arcsine transformed values

Table-4: Seedling parameters as influenced by number of cuttings in multicut fodder sorghum cv. CoFS-29

Treatments	Mean seedling length (cm)	Seedling vigour index	Seedling dry weight (mg^{-10} seedlings)
C_0 : Uncut crop (Control)	28.15	1971	47.00
C_1 : One cut crop	27.08	1868	46.00
C_2 : Two cut crop	25.93	1750	44.50
C_3 : Three cut cop	25.00	1650	42.50
C_4 : Four cut cop	24.03	1556	40.00
S.Em±	0.16	19	0.85
C.D (p=0.05)	0.49	60	2.62

were the highest in the uncut crop and from thereupon, they were reduced drastically to in the four cuts crop. The significantly highest seed weight per plant noticed in the uncut crop may be perhaps due to maximum number of productive panicles per plant, panicle length, seed setting and weight per panicle due to its efficient vegetative growth and higher nutrient accumulation over a longer period of crop growth resulting in the more production of fertile tillers, longer and productive panicles and heavier seeds per panicle in the uncut crop as compared to the four cuts crop. However, fodder and seed yield per hectare were satisfactorily more (84.20 q and 541.7 kg) in the one cut crop followed by the two cuts crop. The similar results on effect of cutting management on fodder and seed yield attributing components were also obtained by the earlier research workers like Shah and Hasan (1999) and Hasan *et al.* (2000) in oat, Sardana and Narwal (2005) in berseem and Bhatt *et al*. (2009) in forage grasses.

In contrast to the uncut crop, the four cuts crop recorded the significantly lowest seed yield (368.1 kg) and dry fodder yield (62.50 q) per hectare due to least number of productive panicles per plant (7.30), panicle length (37.45 cm) , seed weight per panicle (0.97 g) and plant (7.07 g) and harvest index (5.57 %), as seen in this study (Table 1 & 2). Thus, these results revealed the adverse effect of cutting management on fodder yield and seed yield with increase in the cuttings from zero cut to the four cuts. Obviously, the increased cuttings up to four cuttings might have disturbed the normal growth of plants causing slower regrowth, poor production of fertile tillers, delayed inflorescence emergence and poor synchronization of productive tillers which might have ultimately resulted into poor seed setting and weight per plant, as reported by Dwivedi *et al.* (1999) in *Setaria sphacelata.* These results are in conformity with the findings of Purushotham *et al.* (2001) in guinea grass, Bhattacharya *et al.* (2004) in *Stylosanthes*, Hooda *et al.* (2004) in pearl millet, Kumar *et al.* (2008) in marvel grass and Patel *et al.* (2013) in oat.

The cutting management has shown a significant and adverse effect on seed quality parameters studied, the significantly highest 1000 seed weight (6.08 g), seed germination (70.00 %), seedling length (28.15 cm), vigour index (1971) and seedling dry weight (47.00 mg^{-10} seedlings) and lowest electrical conductivity (0.225 dSm^{-1}) were noticed in the seeds harvested from uncut crop followed by the one cut and two cuts crops, whereas, the four cut crop seeds showed the reciprocally inverse values of the seed quality parameters (5.05 g, 64.75 %, 24.03 cm, 1556, 40.00 mg and 0.260 dSm^{-1}, respectively) (Table-3 & 4). The higher seed quality parameters with lower EC value noticed in the uncut crop seeds might be attributed to the better growth resulting in higher seed yield attributing components which might have exerted greater impact on seed quality parameters unlike those obtained from the four cuts crop seeds. Thus, the drastic reduction in seed quality parameters was noticed in the four cuts crop seeds due to increase in the number of cuttings and it might have caused due to severe depletion of starch reserves affecting adversely the seed setting and seed weight per plant . These findings were in conformity with those of Thakral *et al.* (1993), Hasan *et al.* (2000) and Patel *et al.* (2003) in oat crop, Bhatt *et al*. (2009) in forage grasses and Hadi *et al.* (2012) in barley.

It can be concluded from the study that cutting of the crop at vegetative stage for fodder purpose is not advisable for seed production of multicut fodder sorghum since the uncut (no cutting) crop has recorded significantly the highest seed yield and dry fodder yield per hectare, and seed quality due to better seed yield attributing components as against the four cuts crop. The next higher seed and fodder yields with comparable quality parameters could be obtained from the one cut crop.

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References

Abdul-Bhaki, A.A and Anderson, J.D.: Vigour determination in soybean by multiple criteria. *J. Crop Sci*., **13**: 630-633 (1973).

Anonymous: International Rules for Seed Testing by International Seed Testing Association. *Seed Sci. and Tech.,* **27:** 215 (2014).

Anonymous: Manual on forage production, utilization and conservation*,* Indian Grassland and Fodder Research Institute, Jhansi (U.P.) p. 90 (2013).

Bhatt, R.K., Tripathi and Tiwari: Effect of cutting management on seed yield and its quality in grasses. *Seed Res.,* **37:** 26-29 (2009).

Bhattacharya, S., Nanda, M.K. and Mukherjee, A.K.: Effect of phosphorus and cutting on biomass and seed production of *Stylosanthes* cultivars. *Forage Res.,* **30**: 96-98 (2004).

Duncan, R.R. and Moss, R.B.: Comparative yield of ratoon cropped temperately and tropically adopted grain sorghum hybrids. *Crop Sci.,* **27**: 569-571 (1987).

Dwivedi, G.K., Kumar. D. and Tomer, P.S.: Effect of cutting management and nitrogen levels on growth, seed yield attributes and seed production of *Setaria sphacelata* cv. Nandi. *Trop. Grassl.,* **33**: 146–149 (1999).

Gomez, K.A. and Gomez, A.A.: Analysis of data from a series of experiments: Statistical Procedures for Agriculture Research, 2nd Edn. p. 316-356 (1984).

Hadi, F., Hussain, F. and Arif, M.: Effect of different nitrogen levels and cutting on growth behavior of dual purpose barley (*Hordeum vulgare* L.). *Scholarly J. Agric. Sci.,* **2**: 263-268 (2012).

Hasan, B., Shah, W.A. and Hasan, B.: Biomass, grain production and quality of oats (*Avena sativa*) under different cutting regimes and nitrogen levels. *Cereal Res. Commun.,* **28**: 203-210 (2000).

Hooda, R.S., Singh, H. and Khippal, A.: Cutting management and N effects on green fodder, grain and stover yield and economics of pearl millet cultivation during summer. *Forage Res.,* **30**: 118-120 (2004).

Kumar, D., Seth, R., Natarajan, S., Dwivedi, G.K. and Shivay, Y.S.: Seed yield response of marvel grass (*Dichanthium annulatum*) to cutting management and nitrogen fertilisation in central India. *Agron. Res.,* **6**: 499-509 (2008).

Patel, M.R., Sadhu, A.C., Patel, P.C. and Yadavendra, J.P.: Effect of cutting management and Nitrogen levels on grain production of oats (*Avena sativa* L.). *Forage Res.,* **29**: 110-111 (2003).

Patel, T.U., Arvadia, M.K., Patel, D.D., Thanki, J.D. and Patel, H.M.: Response of oat (*Avena sativa* L.) to cutting management and times of N application. *Res. on Crops,* **14**: 902-906 (2013).

Sardana, V. and Narwal, S.S.: Effect of row spacing and cutting management of component crops on fodder and seed yield in berseem based intercropping systems. *Forage Res.,* **30**: 184-188 (2005).

Shah, W.A. and Hasan, B.: Grain and fodder yield of oats (*Avena sativa*) as influenced by nitrogen levels and cutting schedules. *Forage Res*., **24**: 185-190 (1999).

Thakral, N.K., Malik, J.S., Lodhi, G.P. and Arora, R.N.: Effect of varieties and cutting management on seed yield and quality in oats. *Forage Res*., **19**: 128-130 (1993).

Bassegio, D., Santos, R.F., Oliveira, E., Wernecke, I., Secco, D. and Souza, S.N.M.: Effect of nitrogen fertilization and cutting age on yield of tropical forage plants. *African J. Agri. Res.,* **8**: 1427-1432 (2013).

Farid, N.I. and Hassan, M.T.: The effect of row spacing and seeding rate on the seed yield of alfalfa (*Medicago sativa* L.). Final report about the test program for seed production of forage crop at Nubian Research Station. 1967 till 1970 Nub. Res. Library (1990).