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Seed production of *Brachiaria ruziziensis* in India- seed collection methods and feed opportunities

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Introduction

Brachiaria ruziziensis is an important fodder crop suitable for high rainfall areas and soils with low nutrient supply. Though the area under *B. ruziziensis*cultivation in India is not properly documented, it is widely grown in Kerala (Stür *et al*. 1996) and in parts of Karnataka and Goa. By virtue of its shade tolerance and adaptability, *B. ruziziensis* have wide scope for adoption in other parts of India. In India, *Brachiaria* is mainly planted through root slips as availability of good quality filled seeds is very less. It is known that the proportion of filled to unfilled seeds depends on method of harvest and seed collection method (Hare *et a.l*, 2007). Appropriate method of harvest depends on growth habit, synchrony of crop development, standing seeds, fallen seeds, availability of labour and on previous experience. Hence a study was conducted for first time in India to standardise harvesting and seed collection method in *B.ruziziensis.*

Materials and Methods

The experiment was conducted at SRRS, IGFRI Dharwad between 2012 and 2014. In this climatic condition *B. ruziziensis* flowers and sets seeds during rainy season and matures by the beginning of dry season. The crop was grown following all the management practices. Inflorescences were collected from designated area for reproductive component observations. At maturity, single destructive harvest (SDH) was carried out when seeds of initial flush (20% flowering) dropped. One set of inflorescence were cut with sickles and sweated before threshing. In another set, the inflorescence harvested were shade dried upside down and seeds were harvested at periodic intervals by shaking the inflorescence. Multiple non destructive manual harvesting methods by tying seed heads into living sheaths and knocking down daily into seed nets were tried in *B. Ruziziensis* (Phaikaew *et al.*,1993) in Thailand. Though it was successful in Thailand, was not included in this study as it was labour intensive. Seed filling was tested manually by pressing the dried seeds with thumb and also confirmed with X-ray radiography (Bahukandi *et al.*, 2013). Seed filling was also tested at milky stage of grain by smashing individual seeds. Presence of oozing milky endosperm or hard endosperm (based on the position of raceme) was an indicator for filled seeds. Seeds were germinated between papers to study seed quality parameters. Viability of seeds was tested by tetrazolium (TZ) test. Seed weights were corrected to 10% seed moisture. Macro and micro mineral content in samples were estimated by inductively coupled plasma optical emission spectrometer (ICP-OES) of Perkin Elmer Model Optima 3300 spectrometer (Perkin Elmer, USA) with axial and radial viewing plasma configuration.

Results and Discussion

B. ruziziensis contained 175 inflorescences in1 m^2 having varying number of racemes and spikelets (Table 1). On an average there were 3.2-3.75 racemes per inflorescence. On an average 80-100 spikelet were present in a single inflorescence and it was distributed uniformly within the inflorescence (Table 1). When the number of racemes increased, the number of spikelet decreased there by maintaining the spikelet number in inflorescences. The raceme at the bottom of inflorescence contained more number of filled grains (Table 1). However, in an inflorescence, less than half of the spikelet were filled and rest were unfilled (Table 1).

Table 1. Inflorescence density, spikelet number and grain filling based on number of racemes and position of racemes in *Brachiaria ruziziensis*.

Variables	**Number of racemes**		
	2	3	4
Inflorescence density (no / m2)	52 ± 17	117 ± 25	6 ± 2
Spikelet number(no)			
1st from tip	38.31 ± 4	30.9 ±2.3	24.29 ± 2.6
2nd from tip	37.37 ± 5	34.5 ±1.1	26.64 ± 5.2

3rd from tip	-	35.9 ± 2.1	24.85 ± 5.21
4th from tip	-	-	27.01 ± 9.23
Seed filling (%)			
1st from tip	38.82 ± 4.7	26.0 ±4.0	0.34 ± 2.44
2nd from tip	39.93 ± 5.66	39.97 ± 4.67	2.78 ± 1.34
3rd from tip	-	43.76 ± 5.22	4.27 ± 6.23
4th from tip	-	-	16.88 ± 5.12

There were no significant difference in total seed yield obtained through SDH followed by sweating and SDH followed by shade drying and periodic collection (Table 2). Shade drying ensured drying of seeds without much respiratory loss compared to sweating. Using X-ray radiography it was observed that seed filling percentage in seeds collected by SDH and sweating was very low (10%) compared to SDH and seed collection at interval (30-75%).Viability of seeds tested using TZ was also low in seeds collected by sweating compared to periodical collection (Table 2).

Table 2. Effect of harvesting method on seed yield and its components in *Brachiaria ruziziensis*

Method	**SDH and sweating**	**SDH and seed collection at intervals**		**LSD (P<0.05)**
Total seed yield (kg/ha)	150.54 ± 3.42	145.79 ± 5.26		NS
Total filled seed yield (kg /ha)	12.2 ± 7.22	71.49 ±10.51		27.3
		2DAH	20DAH	
Grain filling (%)	10 ± 1.2	75.8±1.5	5.25±1.9	9.26
Germination (%)	7 ± 2.2	22.6 ± 3.2	1 ± 1.2	6.56
Viability of non germinated seeds (%)	12 ± 0.22	87±2.2	30±1.2	9.38
1000 seed weight (g)	2.75 ± 0.78	7.8 ±.056	2.8±0.22	1.19

Sweating could cause increase in temperature within the seed lot and higher rate of respiration which would cause damage to seeds, resulting in nonviable seeds (Hopkins *et al.*, 2003).

Quality filled seeds were obtained through SDH and periodic collection. At the same time unfilled seeds were well separated from filled seeds otherwise was combined when collected through sweating. Unfilled seeds were more in quantity and occupied large storage space.

Table 3. Comparison of chemical and mineral composition in filled and unfilled seeds of *Brachiaria* with major grain crops of Karnataka

Parameters	**Brachiaria filled grains**	**Brachiaria unfilled seeds**	**Ragi***	**Bajra***	**Sorghum***	**Maize***
	............................(%)............................					
Crude Protein	17.53	14.40	8.9	12.5	10.8	9.7
Ether Extract/Crude Fat	3.70	5.34	1.5	4.9	3.4	4.2
Crude Fibre	16.70	19.85	5.7	2.8	2.8	2.6
Neutral Detergent Fibre (NDF)	42.41	48.42	23.8	17.2	11	13.2
Acid Detergent Fibre (ADF)	23.72	26.23	9.7	4.5	4.3	4.4
Hemicellulose	18.69	22.19	-	-	-	-
Lignin	8.76	8.92	-	1.0	1.1	1.4
Macro minerals	............................(%)............................					
Ca	0.07	0.05	0.5	0.04	0.03	0.07
P	0.15	0.16	0.34	0.33	0.33	0.34
Mg	0.10	0.11	0.18	0.13	0.18	0.14
S	0.02	0.03	-	-	-	-
Na	0.0025	0.0018		0.01	0.02	0.01
K	0.16	0.22	0.53	0.42	0.43	0.43
Micro minerals	.... (mg/kg dry matter)............................					
B	6.17	5.90	-	-	-	-
Cu	58.68	50.72	7	6	5	5
Zn	29.48	27.94	31	32	24	34
Fe	80.01	74.57	1208	47	120	790
Mn	32.78	34.48	-	21	12	

* Data from www.feedipedia.org. Blank spaces (-) indicate that data was not available.

The crude protein content of Brachiaria seed was high compared to common grains. The hemi cellulose and lignin content in Brachiaria seeds were from husk as the analysis was done for whole grains (Table 3). In comparison to that millet hulls, bajra bran, sorghum bran, and maize bran which contained 11.5, 2.1, 5.0, 2.2 % lignin respectively, brachiaria seed lignin content was on high side (Table 3). However lignin and hemicelluloses content was much less compared to Brachiaria stem (www.fedipedia.org) that is used as fodder. Brachiaria seeds contained macro minerals like Ca (516-697ppm), P (1531-1593 ppm), Mg (1026-1073 ppm), K(1585-2245 ppm) and micro elements like Boron (6ppm), Copper (50-58ppm), Zinc (27-29ppm), Iron (74-80ppm) (Table 3). The chemical composition in Brachiaria seeds was much higher compared to the grains like bajra, ragi, sorghum and maize which are normally used as feed. Aluminium (29-39 ppm), Nickel (1-1.3 ppm), lead (1.5-2 ppm) and cadmium (0.02-.43 ppm) were also present. Based on the nutrient composition, the unfilled Brachiaria seeds can be a potential resource for animal feed.

Conclusion:

Seed harvesting and seed collection methods in *Brachiaria ruziziensis* is reported for the first time from India. SDH followed by shade drying and periodic collection of seeds ensured collection of properly filled seeds and good quality seeds were well separated from bulky unfilled seeds. Further, the possibility of using unfilled seeds as animal feed was explored. At exploratory level, this looks promising. However, effect of this new feed on animal productivity needs further confirmation.

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