

Exploitation of paddy straw varieties to improve nutritive value and digestibility in ruminants

POONAM PANDEY¹ and ANIL KUMAR²

Govind Ballabh Pant University of Agriculture and Technology, Pantnagar, Uttarakhand 263 145 India

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Small improvements of only 1% digestibility could result in increase in milk, meat and drought power outputs ranging from 3 to 8% (Kristjanson and Zerbini 1998). The present study was conducted to use paddy straw varieties to improve nutritive value and digestibility in ruminants. Such a strategy would benefit farmers as it provides more grain for human consumption and better quality straw for animal feeding.

Paddy straw samples of 18 varieties were collected categorized in 3 groups on the basis of plant height as dwarf (70–90 cm), medium (91–110 cm) and tall varieties (above 110 cm). The representative sample of each straw variety was sun dried till constant weight and ground through 2 mm sieve for determination of chemical composition and nylon bag digestibility. Samples required for fibre analysis were further ground using 1 mm sieve. Digestibility of paddy straw samples was determined using nylon bag technique. Rumen fistulated animals (3) were fed green oat *ad lib.* just after feeding of concentrate mixture prepared from 30 parts of GNC, 32 parts of deoiled rice bran, 35 parts of wheat grain, 2 parts of mineral mixture and one part of common salt. The feed was served once a day at 9 AM. The animals were allowed drinking water twice a day.

The organic matter (OM) and crude protein (CP) were determined by ISI (1968) method, and neutral detergent fibre (NDF) and acid detergent fibre (ADF) were estimated as per Goering and Van Soest (1970). Cellulose was estimated as the difference between ADF and lignin content including silica. Lignin was determined as per Van Soest and Wine (1968). Results were analyzed using analysis of variance technique of Snedecor and Cochran (1968) considering plant height as a variable.

The dry matter content (Table 1) in 18 paddy straw varieties ranged from 85.07 (lowest in Sundari) to 92.31%

(highest in Narendra 118). Significant ($P<0.05$) difference in DM content among paddy straw varieties was observed. The overall higher DM was in dwarf varieties, followed by the medium and tall varieties. Similarly, CP content was also higher in the dwarf varieties and was the highest in IR 50 (6.51%) and the lowest in tall varieties (4.80%, in T₃ and Sundari) with a significant difference among varieties. Atharuddin (1989) also reported variation in CP. The average NDF and ADF content was lower in dwarf varieties than in the tall varieties. The hemicellulose, cellulose, lignin and ash content differed significantly ($P<0.05$) among straw samples of different paddy varieties. A difference of 7.9, 10.0, 2.8 and 6.5 units was observed in hemicellulose, cellulose, lignin and total ash content, respectively. The variations in chemical constituents of present study corroborate favourably to the findings of other researchers for DM, CP, NDF, ADF and of other constituents reported by Chaudhary *et al.* (1988) and Sohane and Singh (1999). Straw of different paddy varieties vary in their chemical composition, digestibility and intake, and such variations may be attributed by genetic make-up of the plant, and also to different agronomic and management practices during growth of the plant or during harvesting, method and period of storage.

The digestibility of DM, OM, CP, NDF and ADF differed significantly ($P<0.05$) among different paddy varieties (Table 2). A difference of 15.08 units in DM digestibility among different varieties was observed. The overall higher DM digestibility was in dwarf varieties while highest was in Narendra 118 (62.36%). Similarly, variation in digestibility of OM, NDF and ADF was 16.52, 21.22 and 27.49% units in different straw varieties, respectively. Though CP digestibility was higher in tall variety but highest was 33.08% in IR 50 (dwarf variety). A variation of 17.60 units in CP digestibility was observed among varieties. Such a wide variation in CP digestibility of paddy straw was also reported by Srivastava (1990) and Tripathi (1990). Variation among paddy straw varieties could be due to the variation between plant components as evident from the result of chemical

Present address: ¹Research Associate, Animal Biotechnology Lab Dairy Cattle Nutrition Division, NDRI, Karnal 132 001.

²Professor, Animal Nutrition Department, College of Veterinary Sciences

Table 1. Chemical composition of different paddy straw varieties

Type of variety	Name of variety	Chemical composition								
		DM	OM	CP	NDF	ADF	Hemicellulose	Cellulose	Lignin	TA
Dwarf varieties (70–90 cm)	Govind	90.14	85.90	5.86	70.65	30.30	20.35	36.30	6.80	14.10
	IR 36	89.10	82.65	5.28	75.10	48.90	26.60	33.76	7.90	17.35
	IR 54	87.50	85.50	5.86	76.90	48.65	28.25	35.31	5.60	14.50
	IR 24	85.78	83.85	5.95	70.00	47.30	22.70	33.36	6.20	16.15
	IR 50	91.00	85.10	6.51	75.30	49.25	26.05	33.81	8.70	14.90
	Narendra 118	92.31	84.90	4.20	70.98	46.756	24.23	32.74	6.90	15.10
	Mean	89.31	84.65	5.61	73.15	45.19	27.96	34.21	7.02	15.35
	±SE	±0.97	±0.49	±0.29	±1.10	±2.74	±1.07	±0.50	±0.43	±0.45
Medium varieties (90–110 cm)	Manher	86.31	83.60	6.11	71.84	45.50	26.30	29.14	8.20	16.40
	Indrasan	90.91	81.80	4.99	78.00	54.30	23.70	39.14	7.60	18.20
	BBL 307	88.00	84.40	4.99	76.20	50.65	25.55	37.71	6.70	15.60
	4–1–2–1									
	PR 110	90.84	86.80	5.08	76.00	48.00	28.00	34.10	5.80	13.20
	Ratna	85.33	82.61	6.46	71.85	49.05	22.80	34.33	6.80	17.39
	IR 68	90.89	83.00	5.51	71.10	50.05	21.05	35.73	6.70	17.00
	Mean	88.71	83.70	5.52	74.16	49.59	24.57	35.02	6.97	16.30
	±SE	±0.94	±0.65	±0.23	±1.08	±1.09	±0.94	±1.30	±0.31	±0.65
Tall varieties (110 cm-above)	IET	90.11	85.85	4.94	74.7	49.05	25.65	36.01	7.10	14.15
	8585									
	Slundari	85.07	81.70	4.80	76.95	51.70	25.25	35.42	6.80	18.30
	Tilak chandan	90.91	88.20	6.24	76.00	51.30	24.70	37.77	7.30	11.80
	T3	88.89	86.50	4.80	74.20	49.95	24.25	33.81	8.40	13.50
	Narendra 80	91.00	82.60	5.16	78.00	50.35	27.65	34.43	6.20	17.40
	Kasturi	88.71	84.70	4.85	70.40	47.85	22.55	32.79	8.10	15.60
	Mean	89.12	84.93	5.13	75.04	50.03	25.01	35.04	7.32	15.13
	±SE	±0.82	±0.91	±0.21	±0.99	±0.53	±0.63	±0.66	±0.31	±0.91

Table 2. Digestibility coefficient of different paddy straw varieties

Type of variety	Name of variety	Chemical composition							
		DM	OM	CP	NDF	ADF	Hemicellulose	Cellulose	
Dwarf varieties (70–90 cm)	Govind	54.26	56.34	20.43	56.69	51.44	69.66	70.14	
	IR 36	51.06	51.98	23.71	55.43	52.36	61.73	75.94	
	IR 54	53.05	52.65	23.09	53.64	50.95	58.27	69.01	
	IR 24	49.00	50.06	28.00	43.46	37.03	56.86	55.67	
	IR 50	59.68	60.49	33.08	59.73	55.96	66.88	67.36	
	Narendra 118	62.36	61.14	17.53	64.68	52.98	66.45	63.67	
	Mean	54.90	55.44	24.31	55.61	50.12	63.31	66.96	
	±SE	±1.91	±1.73	±2.06	±2.65	±2.48	±1.92	±2.55	
Medium varieties (90–110 cm)	Manher	47.28	45.89	15.48	44.27	36.97	56.90	52.24	
	Indrasan	52.94	53.34	22.66	56.02	57.53	52.54	77.76	
	BBL 307 4–1–2–1	52.07	51.07	26.43	52.29	54.59	47.72	65.35	
	PR 110	62.06	52.41	31.96	54.64	64.27	47.56	77.19	
	Ratna	47.80	49.07	16.81	44.78	39.98	55.13	59.86	
	IR 68	48.72	49.46	23.73	47.06	45.49	50.79	67.71	
	Mean	51.81	51.87	22.84	49.84	49.81	51.77	66.68	
	±SE	±2.06	±2.13	±2.28	±1.91	±3.99	±1.43	±3.69	
Tall varieties (above 110 cm-)	IET 8585	54.05	54.82	26.67	51.71	49.04	56.83	64.78	
	Slundari	47.32	46.93	17.43	54.20	48.44	65.99	69.96	
	Tilak chandan	49.61	52.30	28.10	50.01	45.19	60.01	61.73	
	T3	52.91	54.54	29.36	56.59	50.41	69.32	66.02	
	Narendra 80	54.66	54.44	32.38	55.47	59.47	48.18	77.22	
	Kasturi	47.43	48.24	16.54	45.19	36.78	63.17	54.62	
	Mean	50.99	51.88	25.08	52.20	48.22	60.58	65.72	
	±SE	±1.23	±1.29	±2.44	±1.56	±2.75	±2.79	±2.84	

composition. Such variation in paddy straw digestibility was reported by Atharuddin (1989) and Srivastava (1990). In the present study straw of a few paddy varieties such as IET 8585, Narendra 118, PR 110, IR 50, Narendra 80, Govind and IR 52 showed higher nutritive value. It is concluded that considerable variations exist in chemical composition and digestibility of nutrients in straw of different varieties of paddy. Existence of such variation needs to be exploited by plant breeders in selecting the varieties that provide straw of higher nutritive value for ruminants.

SUMMARY

Irrespective of plant height and grain yield significant variation exists in the chemical composition and *in situ* degradability of paddy straws. Plant breeding programmes could be aimed for simultaneous improvement in grain yield and straw quality traits so that higher productivity in terms of quality straw and grain may be obtained.

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