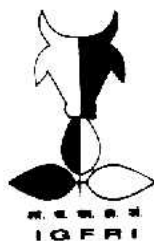




Enteric methane emissions of Indian Livestock from prevalent feeding systems in different Agro Ecological Regions

Sultan Singh

Indian Grassland and Fodder Research Institute, Jhansi
India





Gir cattle



Thapakar



Sahiwal



Murrah buffalo



Bhadawari buffalo



Jalauni sheep



Bundelkhhandi male goat



Feed resources and feeding systems in different agro ecological regions of country

Agro ecological zone	Region	Feed resources	Animal species
1. Western Himalayan region	J & K, hilly areas of Punjab, HP, and Uttranchal	Grasses (C dactylon, Ischoemum angustifolium) Trees (G optiva Celtis australis, Melia azaderach) Berseem, Lucerne, oat, sorghum, maize	C, B, S and G
2. Eastern Himalayan region	Assam, Darjeeling (WB), Sikkim, AP, Manipur, Mizoram, Tripura, Nagaland, Meghalaya	Trees (Bromus trypogen, Potentilla fulgen, Fimbristylis diphyla, Fragaria vesca)	C, B, S and G pigs, Mithun, Yak
3. Eastern plateau and plains region	WB, Jharkahand, Orissa	Rice is main roughage , wheat, maize, bajra, mustard, til, potato, jute	Non descriptive C, B and CB cattle
4. Middle Gangetic plain	Bihar and eastern part of UP	Rice, maize, wheat, pulse, oilseeds and sugarcane are also grown	B, C and G
5. Trans and Upper Gangetic plain	Western UP, Punjab, Haryana, Delhi, Chandigarh and Ganganagar district of Rajasthan.	Wheat , rice , pearl millet, cotton, gram, sugarcane	B, C, S and G
6. Central Plateau and hills	Southern part of UP, south-east Rajasthan, , northern MP and Chattisgarh	Wheat, barley, pearl millet, mung, urad, gram, MSC,GNC, soyabean	B, C, S and G
7. Western plateau and hills	Interior part of Maharastra, south-western part of MP and Gujarat.	Wheat, bajra, sorghum, maize, guar, mung, sugarcane, cotton are main crops.	C, B, S and G
8. Southern Plateau and hills region	Interior parts of AP, Karnataka, TN.	Sorghum, bajra, maize, ragi, paddy, wheat, groundnut, sesame, rape, mustard, linseed, Niger, safflower, sunflower. Coconut, cotton and sugarcane are other crops.	C, B, S and G
9. Western dry zone	Desert part of Rajasthan and northern part of Gujarat.	Bajra, guar, moth, wheat and gram are the main crops.	C, camel, S and G
10. Coastal and Island region	Kerla, Anadman Nicobar islands, Lakhasadeep. Goa, Pondichery, Diu and Danman Dadar Nagar Haveli	Paddy, wheat, gram, banana, tubers, tapioca	C, B, S and G

Feed resources and feeding systems in different agro ecological regions of country

AER	Region	Ration types	Feeding system	Ratios
1. Western Himalayan region	J & K, hilly areas of Punjab, HP, and Uttranchal	Maintenance Growing Lactating	Grass: Grewia leaves SST: Lucerne : CM ₂ WS: Berseem : CM ₂	65:35 60:30:10 30:40:30
2. Eastern Himalayan region	Assam, Darjeeling (WB), Sikkim, AP, Manipur, Mizoram, Tripura, Nagaland, Meghalaya	Maintenance Growing Lactating	Grass: Leucaena leaves PS : Leucaena : CM ₁ Grass: Leucaena : CM ₁	75:25 50:35:15 35:40:25
3. Eastern plateau and plains region	WB, Jharkahand, Orissa	Maintenance Growing Lactating	PS : Green maize PS: Napier: CM ₇ MST: Napier: CM ₇	20:80 30:50:20 20:45:35
4. Middle Gangetic plain	Bihar and eastern part of UP	Maintenance Growing Lactating	WS: Green maize PS: Berseem MST: CM ₇	50:50 40:60 60:40
5. Trans and Upper Gangetic plain	Western UP, Punjab, Haryana, Delhi, Chandigarh and Ganganagar district of Rajasthan.	Maintenance Growing Lactating	WS : Berseem SST : Berseem : CM ₂ WS: Berseem : CM ₃	70:30 60:25:15 30:40:30
6. Central Plateau and hills	Southern part of UP, south-east Rajasthan, , northern MP and Chattisgarh	Maintenance Growing Lactating	Masoor straw (MS) Gram straw : CM ₂ Masoor straw : CM ₅	100 80:20 60:40
7. Western plateau and hills	Interior part of Maharastra, south-western part of MP and Gujarat.	Maintenance Growing Lactating	WS : green sorghum SST : Lucerne/berseem WS : beseem : CM ₄	50:50 55:45 35:35:30
8. Southern Plateau and hills region	Interior parts of AP, Karnataka, TN.	Maintenance Growing Lactating	PS : Leucaena SST : ST:CM ₇ SST : CM ₈	65:35 40:40:20 60:40
9. Western dry zone	Desert part of Rajasthan and northern part of Gujarat.	Maintenance Growing Producing/Lactating	BST : Leucaena BST : Leucaena:CM ₂ BST : CM ₂	75:25 55:30:15 60:40
10. Coastal and Island region	Kerla, AnadmanNicobar islands, Lakhasadeep,.	Maintenance Growing Lactating	PS: Leucaena PS; Leucaena: CM ₉ PS: Leucaena: CM ₉	65:35 45:40:15 30:35:35

PS: Paddy straw; SST: Sorghum stover; CM: Concentrate mixture; MS: Masoor straw; BST: Bajra stover; ST: Sugarcane tops; MST: Maize stover; WS: Wheat straw

Proportions of ingredients in different concentrate mixtures

Ingredients	CM ₁	CM ₂	CM ₃	CM ₄	CM ₅	CM ₆	CM ₇	CM ₈	CM ₉
MSC	35	40	-	-	-	-	40	45	-
Wheat bran	25	-	25	-	25	-	-	-	-
Maize grain	40	-	-	60	-	-	20	-	40
Barley grain	-	60	-	-	40	-	-	-	-
CSC	-	-	35	40	-	-	-	-	-
Oat grain	-	-	40	-	-	60	-	-	-
GNC	-	-	-	-	35	40	-	-	-
Coconut cake	-	-	-	-	-	-	-	-	45
Rice bran							40	55	15
Gram chunni									

CM: Concentrate mixture

Livestock classification based on their body weight

Category	Body weight (kg)	Category	Body weight (kg)
Indigenous male cattle		Indigenous female cattle	
Calves <1 year age (70%)	65-80	Calves <1 year age 70%)	65-75
Calves 1-3 years age	136-157	Calves 1-3 years age	136-157
Breeding bulls	260-320	Milking cows	200-333
Working bulls	260-320	Dry cows	200-363
Breeding+ working bulls	260-320	Heifers	200-250
Others	247-285	Others	200-330
Crossbred male		Crossbred female	
Calves <1 year age (70%)	70-88.5	Calves <1 year age 70%)	75-88
Calves 1-3 years age	154-195	Calves 1-3 years age	165-194
Breeding bulls	280-354	Milking cows	300-352
Working bulls	280-354	Dry cows	300-352
Breeding+ working bulls	280-544	Heifers	165-194
Others	266-336	Others	200-330
Buffaloes male		Buffaloes female	
Calves <1 year age (70%)	70-80	Calves <1 year age 70%)	80-100
Calves 1-3 years age	160-200	Calves 1-3 years age	176-220
Breeding bulls	475-550	Milking cows	400-516
Working bulls	475-550	Dry cows	400-516
Breeding+ working bulls	475-550	Heifers	276-320
Others	450-500	Others	275-416
Goat male		Goat female	
<1-year age (70%)	8.8-21.7	<1-year age (70%)	8.8-21.7
1-2 years age	12-27	1-2 years age	12-25.6
Sheep male		Sheep female	
<1-year age (70%)	14-22	<1-year age (70%)	14-22

Approach/Methodology

Feeds/fodder and feeding systems (diets) were evaluated for different fractions of cell wall, carbohydrates and proteins. These chemical constituents were used for correlation with CH₄ production and were also used to develop the CH₄ production equations for commonly fed feeds/fodder and diets across the country.

Pressure transducer technique was employed for measurement of CH₄ emission on different feeds/fodders and feeding systems (diets) using rumen inoculums of buffalo and sheep.



SF₆ technique was employed to estimate the CH₄ production from lactating Murrah & Bhadawari breed buffaloes fed wheat straw-concentrate diet.

Bhadawari →



Murrah →



Chemical composition of feeding systems

AER	Diets		CP	OM	EE	NDF	ADF	Cellulose	Lignin
AE1	G:grewia	M	7.60	87.63	3.21	64.57	45.31	29.85	9.33
	SST:L:CM ₂	G	12.09	91.68	1.97	61.01	41.09	31.08	8.07
	WS:B:CM ₂	L	12.95	90.06	1.88	49.11	34.55	26.25	5.44
AE2	G:LL M		9.33	87.14	2.75	67.78	45.59	27.45	10.92
	PS:LL:CM ₁	G	11.56	87.37	3.24	52.70	34.15	23.13	5.54
	G:LL:CM ₁	L	15.26	89.90	3.93	53.69	29.21	17.65	7.93
AE3	MST:CM ₈	M	8.42	92.30	1.78	66.77	36.14	30.85	4.95
	PS:NG:CM ₇	G	8.87	85.61	2.46	67.63	39.25	33.37	5.58
	MST:NG:CM ₇	L	10.29	88.22	3.36	63.27	36.00	31.14	4.49
AE4	WS: Oat	M	6.98	90.27	1.44	65.08	37.95	31.77	4.57
	PS:Berseem	G	11.	86.43	1.85	61.95	41.06	31.08	5.20
	MST:CM7	L	11.59	91.19	3.06	58.96	35.01	24.93	6.80
AE5	WS: Beseem	M	9.61	88.40	1.81	57.28	38.56	30.05	4.96
	ST:ber:CM ₂	G	11.68	92.22	2.66	61.00	39.11	30.32	6.41
	WS:bers:CM3	L	13.75	90.45	2.62	52.91	32.62	25.31	4.96
A E6	MS	M	7.69	91.41	1.33	53.66	38.56	28.25	9.38
	GS:CM ₂	G	10.98	90.86	1.84	54.64	41.19	30.58	9.25
	MS:CM ₅	L	12.13	91.84	3.27	45.35	28.78	20.32	7.42
AE7	WS: green sorg	M	6.80	92.05	2.06	71.30	40.63	34.52	4.25
	SST/Luc/Bers	G	10.57	89.92	1.76	58.42	38.94	30.59	7.16
	WS:bers:CM ₄	L	12.14	91.71	3.33	54.89	31.80	25.09	5.10
AE8	PS:LL	M	7.77	85.73	2.64	59.09	39.10	27.25	5.57
	SST:ST:CM ₇	G	11.13	91.59	1.80	69.00	43.75	32.89	7.55
	SST:CM ₈	L	12.15	90.19	3.56	63.38	45.49	30.06	9.80
AE9	BST:LL	M	8.17	92.01	2.15	54.53	34.43	25.56	6.24
	BST:LL:CM ₂	G	11.12	91.75	2.30	49.33	30.01	21.28	6.25
	BJS:CM ₂	L	11.59	91.63	2.17	53.88	31.01	24.04	4.93
AE10	PS:LL	M	9.55	85.25	1.78	57.53	39.16	27.41	5.37
	PS:LL:CM ₉	G	12.96	87.18	3.55	51.20	32.85	21.96	5.20
	PS:LL:CM ₉	L	14.93	88.59	4.93	50.83	28.31	20.02	5.09

Carbohydrate and its fractions in feeding systems

	Diets		TCHO	NSC	SC	C _A	C _{B1}	C _{B2}	C _c
AE1	Grass:grewia	M	76.82	16.08	60.74	18.28	2.65	49.90	29.18
	ST:Leucaena:CM ₂	G	77.61	19.60	58.02	6.67	18.57	49.81	24.95
	WS:B:CM ₂	L	75.22	28.85	46.38	6.56	31.79	44.29	17.36
AE2	G:Leucaena	M	75.06	12.85	62.20	4.38	12.75	47.93	34.93
	PS:LL:CM ₁	G	72.56	23.79	48.77	4.85	27.94	48.88	18.33
	G:LL:CM ₁	L	70.70	23.70	47.01	6.09	27.38	39.54	26.99
AE3	MST:CM ₈	M	82.10	18.51	63.59	13.48	9.08	62.96	14.49
	PS:NG:CM ₇	G	74.27	8.89	65.38	4.00	7.96	70.00	18.04
	ST:NG:CM ₇	L	74.58	14.36	60.22	5.39	13.86	66.28	14.47
AE4	WS: Oat	M	81.86	18.87	62.99	12.32	10.72	63.55	13.42
	PS : berseem	G	73.48	14.19	59.29	11.23	8.08	63.70	17.00
	MST : CM ₇	L	76.53	20.35	56.18	1.68	24.91	52.07	21.35
AE5	WS: berseem	M	76.98	21.47	55.51	12.31	15.57	56.65	15.47
	ST: berseem : CM ₂	G	77.88	19.21	58.66	4.78	19.88	55.56	19.77
	WS:Bers:CM ₃	L	74.07	23.12	50.95	13.22	17.99	52.69	16.10
A E6	MS	M	82.38	30.03	52.35	20.54	15.90	36.20	27.34
	GS:CM ₂	G	78.04	24.79	53.25	8.80	22.97	39.79	28.45
	MS:CM ₅	L	76.43	33.35	43.08	4.15	39.48	33.05	23.32
AE7	WS: green sorghum	M	83.18	15.75	67.43	3.29	15.65	68.77	12.29
	SST/Luc/Bers	G	77.58	21.78	55.80	16.92	11.14	49.77	22.17
	WS:Bers:CM ₄	L	76.23	23.30	52.93	2.11	28.45	53.36	16.07
AE8	PS:LL	M	75.31	19.58	55.73	8.02	17.98	56.23	17.77
	SST:ST:CM ₇	G	78.66	12.49	66.16	2.12	13.77	61.06	23.05
	SST:CM ₈	L	74.48	13.31	61.17	4.73	13.13	50.54	31.59
AE9	BST:Leucaena	M	81.69	30.05	51.64	29.64	7.14	44.87	18.35
	BST:LL:CM ₂	G	78.32	32.00	46.32	25.44	15.41	39.99	19.15
	BJS:CM ₂	L	77.87	26.25	51.62	8.39	25.35	51.07	15.19
AE10	PS:LL	M	73.92	19.95	53.97	16.60	10.38	55.58	17.44
	PS:LL:CM ₉	G	70.68	23.19	47.48	3.32	29.48	49.52	17.68
	PS:LL:CM ₉	L	68.74	25.32	43.41	4.95	31.89	45.39	17.77

Protein and its fractions in different feeding systems

	Diets		CP	NDIN	ADIN	SP	NPN	P _A	P _{B1}	P _{B2}	P _{B3}	P _C
AE1	Grass:grewia	M	7.60	50.51	26.81	13.70	26.15	3.55	10.14	35.78	23.69	26.81
	SST:L:CM ₂	G	12.09	24.86	12.32	52.31	59.40	31.02	21.28	22.81	12.54	12.32
	WS:B:CM ₂	L	12.95	21.09	11.56	36.59	33.71	12.36	24.23	42.30	9.52	11.56
AE2	G:LL	M	9.33	59.96	29.91	11.34	15.72	1.81	9.53	28.68	30.05	29.91
	PS:LL:CM ₁	G	11.56	33.98	14.56	11.31	24.46	2.78	8.53	54.70	19.41	14.56
	G:LL:CM ₁	L	15.26	43.96	14.82	19.59	25.20	4.94	14.64	36.44	29.13	14.82
AE3	MST:CM ₈	M	8.42	37.72	22.02	38.94	49.93	19.44	19.49	23.32	15.70	22.02
	PS:NG:CM ₇	G	8.87	25.58	11.81	38.49	44.56	17.13	21.36	35.91	13.76	11.81
	ST:NG:CM ₇	L	10.29	29.65	10.97	52.85	47.26	24.93	27.92	17.48	18.68	10.97
AE4	WS: Oat	M	6.98	30.02	21.14	37.21	50.29	18.71	18.49	32.76	8.88	21.14
	PS: berseem	G	11.10	24.06	8.56	37.44	45.82	17.20	20.28	38.49	15.49	8.567
	MST:CM ₇	L	11.59	24.08	10.80	45.46	34.78	15.81	29.64	30.44	13.28	10.80
AE5	WS: bers	M	9.61	18.44	13.55	38.6	44.62	17.29	21.37	42.95	4.88	13.55
	SST:ber:CM ₂	G	11.68	20.10	8.72	46.28	36.19	16.75	29.53	33.60	11.38	8.72
	S:bers:CM ₃	L	13.75	14.31	8.73	39.32	34.26	13.47	25.85	46.36	5.57	8.73
A E6	MS	M	7.69	17.04	9.95	25.34	48.72	12.35	12.99	57.61	7.09	9.95
	GS:CM ₂	G	10.98	12.65	10.96	43.30	32.58	14.10	29.19	44.04	1.69	10.96
	MS:CM ₅	L	12.13	18.65	7.339	30.49	31.74	9.68	20.81	50.85	11.31	7.33
AE7	WS: green sorg	M	6.80	57.0	14.49	40.55	46.35	18.79	21.75	2.43	42.52	14.49
	SST/Luc/Bers	G	10.57	24.80	14.75	39.51	51.40	20.31	19.20	35.68	10.04	14.75
	WS:bers:CM ₄	L	12.14	16.24	9.04	24.24	29.32	7.10	17.13	59.51	7.20	9.04
AE8	PS:LL	M	7.77	43.20	17.47	8.27	17.99	1.48	6.78	48.51	25.73	17.47
	SST:ST:CM ₇	G	11.13	25.61	10.98	32.78	33.29	10.91	21.86	41.60	14.63	10.98
	SST:CM ₈	L	12.15	18.24	11.68	32.50	31.64	10.28	22.21	49.25	6.56	11.68
AE9	BST:LL	M	8.17	35.48	14.55	23.33	32.11	7.49	15.83	41.18	20.93	14.55
	BST:LL:CM ₂	G	11.12	27.13	12.95	23.89	21.16	5.05	18.82	48.96	14.17	12.95
	BJS:CM ₂	L	11.59	19.65	10.81	37.18	38.82	14.43	22.74	43.16	8.83	10.81
AE10	PS:LL	M	9.55	37.43	11.36	18.56	25.55	4.74	13.81	44.00	26.06	11.36
	PS:LL:CM ₉	G	12.96	28.68	9.14	16.25	9.63	1.56	14.68	55.06	19.54	9.15
	PS:LL:CM ₆	L	14.93	49.58	8.22	13.98	14.51	2.02	11.95	36.42	41.36	8.22

Energy, intake and dry matter digestibility of feeding systems

	Ingredient		GE	DMI	DDM
AE1	Grass :Grewia	M	4.07±0.03	1.86±0.01	53.60±0.52
	SST: Lucerne : CM ₂	G	4.09±0.04	1.97±0.01	56.89±0.25
	WS: Berseem :CM ₂	L	4.21±0.05	2.44±0.03	61.98±0.27
AE2	Grass : Leucaena	M	4.34±0.05	1.77±0.03	53.38±0.70
	PS: Leucaena : CM ₁	G	4.21±0.09	2.28±0.02	62.30±0.67
	Grass :Leucaena:CM ₁	L	4.27±0.07	2.24±0.01	66.14±0.27
AE3	MST: CM8	M	4.22±0.04	1.80±0.02	60.75±0.24
	PS: Napier : CM ₇	G	4.08±0.02	1.78±0.02	58.32±0.72
	MST : Napier : CM ₇	L	4.05±0.06	1.90±0.02	60.85±0.38
AE4	WS: Oat	M	3.94±0.11	1.84±0.01	59.33±0.18
	PS: Berseem	G	4.11±0.05	1.94±0.01	56.91±0.50
	MST : CM ₇	L	4.08±0.05	2.04±0.01	61.63±0.36
AE5	WS:Berseem	M	4.21±0.09	2.10±0.01	58.86±0.26
	SST: Beseem: CM ₂	G	4.08±0.05	1.97±0.01	58.43±0.39
	WS:bers:CM ₃	L	4.20±0.05	2.27±0.02	63.49±0.25
A E6	MS	M	4.50±0.04	2.23±0.01	58.85±0.13
	GS: CM ₂	G	4.02±0.05	2.20±0.05	56.81±0.19
	MS: CM ₅	L	4.02±0.05	2.65±0.02	66.47±0.19
AE7	WS: green sorghum	M	4.21±0.06	1.68±0.00	57.25±0.31
	SST/Lucerne/Berseem	G	4.32±0.04	2.05±0.02	58.56±0.60
	WS: Berseem: CM ₄	L	4.36±0.03	2.19±0.02	64.12±0.22
AE8	PS: Leucaena	M	3.91±0.05	2.03±0.01	58.44±0.38
	SST:ST:CM ₇	G	4.03±0.03	1.74±0.01	54.81±0.31
	SST:CM8	L	4.14±0.02	1.89±0.01	53.46±0.61
AE9	BST: Leucaena	M	4.24±0.06	2.20±0.01	62.08±0.33
	BST:LL:CM ₂	G	4.41±0.05	2.43±0.01	65.52±0.29
	BJS:CM ₂	L	4.16±0.02	2.23±0.07	64.74±0.79
AE10	PS: Leucaena	M	4.16±0.07	2.09±0.01	58.39±0.70
	PS:LL:CM ₉	G	4.18±0.05	2.35±0.03	63.31±0.65
	PS:LL:CM ₉	L	4.29±0.05	2.36±0.04	66.84±0.64

In vitro dry matter digestibility of feeding systems in different ruminant inoculums

AER	Feeding systems	IVDMD			AER	Feeding systems	IVDMD		
		Buffalo	Sheep	Goat			Buffalo	Sheep	Goat
AE1 M	Grass : G optiva	42.19	45.86	39.13	AE6 M	MS	55.20	52.59	49.99
AE1 G	SST: Lucern: CM ₂	45.03	42.08	43.59	AE6 G	GS: CM ₂	52.96	52.88	53.55
AE1-L	WS: Bers:CM ₂	62.14	64.32	58.79	AE6-L	MS: CM ₅	56.34	60.73	63.44
AE2 M	Grass : Leucaena	40.15	43.36	46.62	AE7 M	WS: green sorghum	42.74	49.85	51.64
AE2 G	PS: LL : CM ₁	49.64	54.14	60.05	AE7 G	SST/Lucern/Bers	40.89	43.23	51.54
AE2-L	Grass :LL:CM ₁	60.54	55.27	52.91	AE7-L	WS: Bersem: CM ₄	49.54	55.46	65.84
AE3 M	MST: CM ₈	48.17	55.85	53.98	AE8 M	PS: Leucaena	36.47	41.72	54.89
AE3 G	PS: Napier : CM ₇	53.51	58.77	47.98	AE8 G	SST:ST:CM ₇	37.20	38.94	46.01
AE3-L	MST : Napier : CM ₇	59.98	62.946	50.37	AE8-L	SST:CM ₈	39.13	41.22	43.81
AE4 M	WS: Oat	48.30	53.90	59.72	AE9 M	BST: Leucaena	47.35	48.34	53.93
AE4 G	PS: Berseem	62.79	62.82	42.56	AE9 G	BST:LL:CM ₂	46.86	49.30	58.01
AE4-L	MST : CM ₇	52.27	58.97	53.86	AE9-L	BJS:CM ₂	53.39	56.67	54.13
AE5 M	WS: Berseem	47.09	50.32	51.58	AE10 M	PS: LL	39.38	47.55	55.18
AE5 G	SST: Bersm: CM ₂	46.55	52.37	47.88	AE10 G	PS:LL:CM ₉	40.84	42.47	55.32
AE5-L	WS:bers:CM ₃	51.95	57.72	61.27	AE10-L	PS:LL:CM ₉	53.28	57.72	71.66

Correlation between CH₄ production and chemical constituents feeding systems

Chemical constituents	Buffaloes	Goats	Sheep
CP	-.134	- 0.317	-.229*
OM	.266**	0.212*	.417**
EE	-.422**	- 0.214*	-.414**
NDF	-.009	0.117	.045
ADF	-.127	0.164	.235**
Cellulose	-.073	- 0.035	.014
Hemi cellulose	.130	- 0.010	-.198*
Lignin	-.365**	0.035	.244**
Energy	-.032	- 0.031	.011
IVDMD	-0.104	- 0.390**	-.191*

Correlation between CH₄ production and N fractions

N fractions	Buffaloes	Goats	Sheep
TN	-.134	- 0.37	-.229*
NDIN	-.448**	- 0.345*	-.623**
ADIN	-.272**	- 0.275*	-.292**
Soluble protein	.387**	0.513**	.376**
NPN	.450**	0.470**	.504**
P _A	.412**	0.478**	.412**
P _{B1}	.284**	0.456**	.263**
P _{B2}	-.053	- 0.212*	.111
P _{B3}	-.341**	- 0.255**	-.529**
P _C	-.145	0.222*	-.159

Correlation between CH₄ production and carbohydrate fractions

CHO fractions	Buffaloes	Goats	Sheep
TCHO	.353**	0.202*	.508**
NSC	.115	- 0.087	.107
SC	.083	0.185*	.172
Starch % NSC	-.104	- 0.216*	-.168
C _c DM	-.365**	0.035	.244**
C _{B2} DM	.278**	0.141	.012
C _{B1} DM	.031	- 0.155	.031
C _A DM	.091	0.087	.082

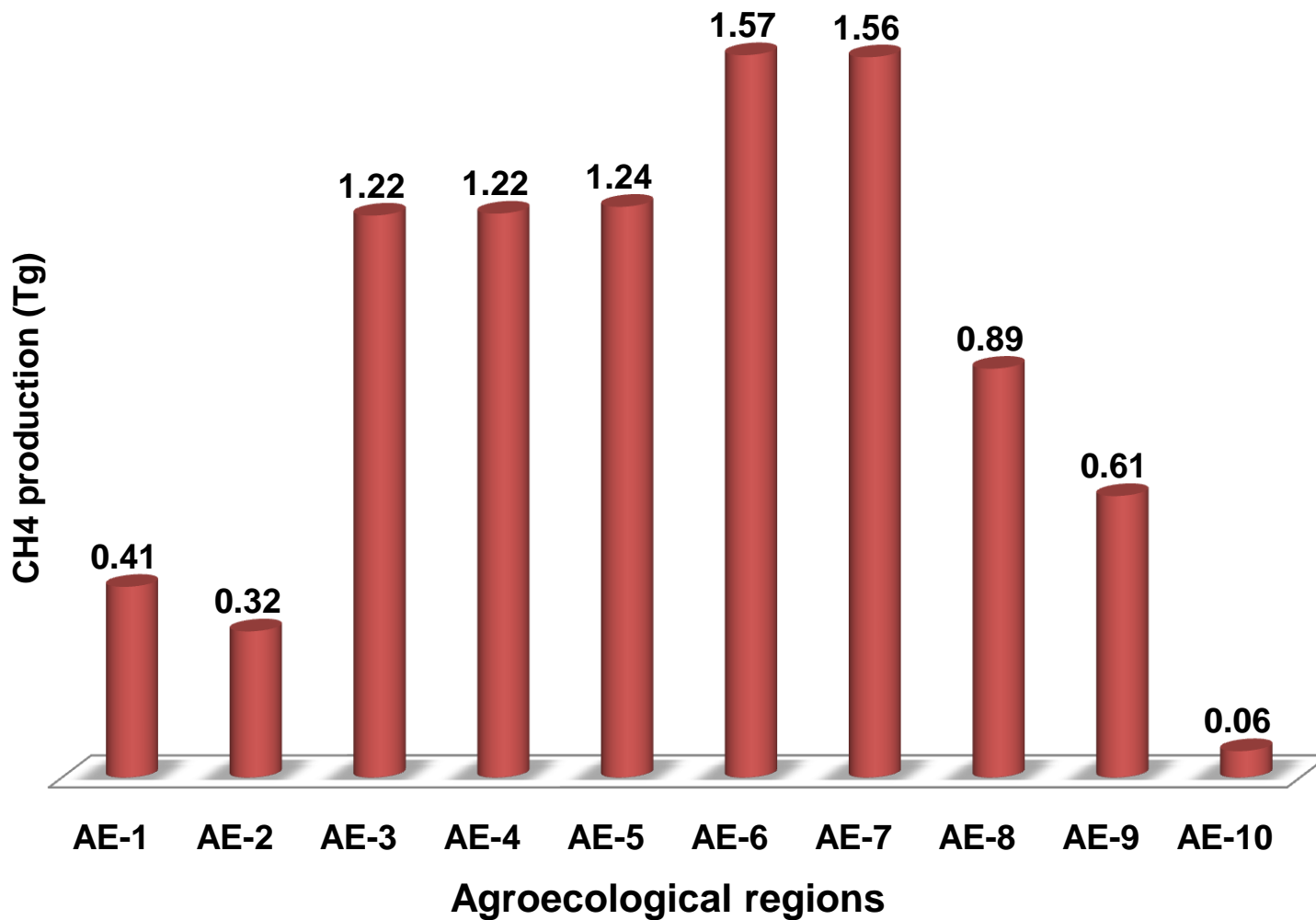
Methane emission factors for different ruminant species

Livestock category	CH ₄ g /day /head
Cattle crossbred (male)	
< one year	21.0317
1 – 1.5 year	29.6708
Breeding	96.9185
Work	112.2449
Breeding + work	99.0314
Other	72.9948
Cattle crossbred (Female)	
< one year	21.5439
1 – 2.5 year	40.3079
Milking	100.8445
Dry	81.2349
Heifer	47.9742
Other	54.9628

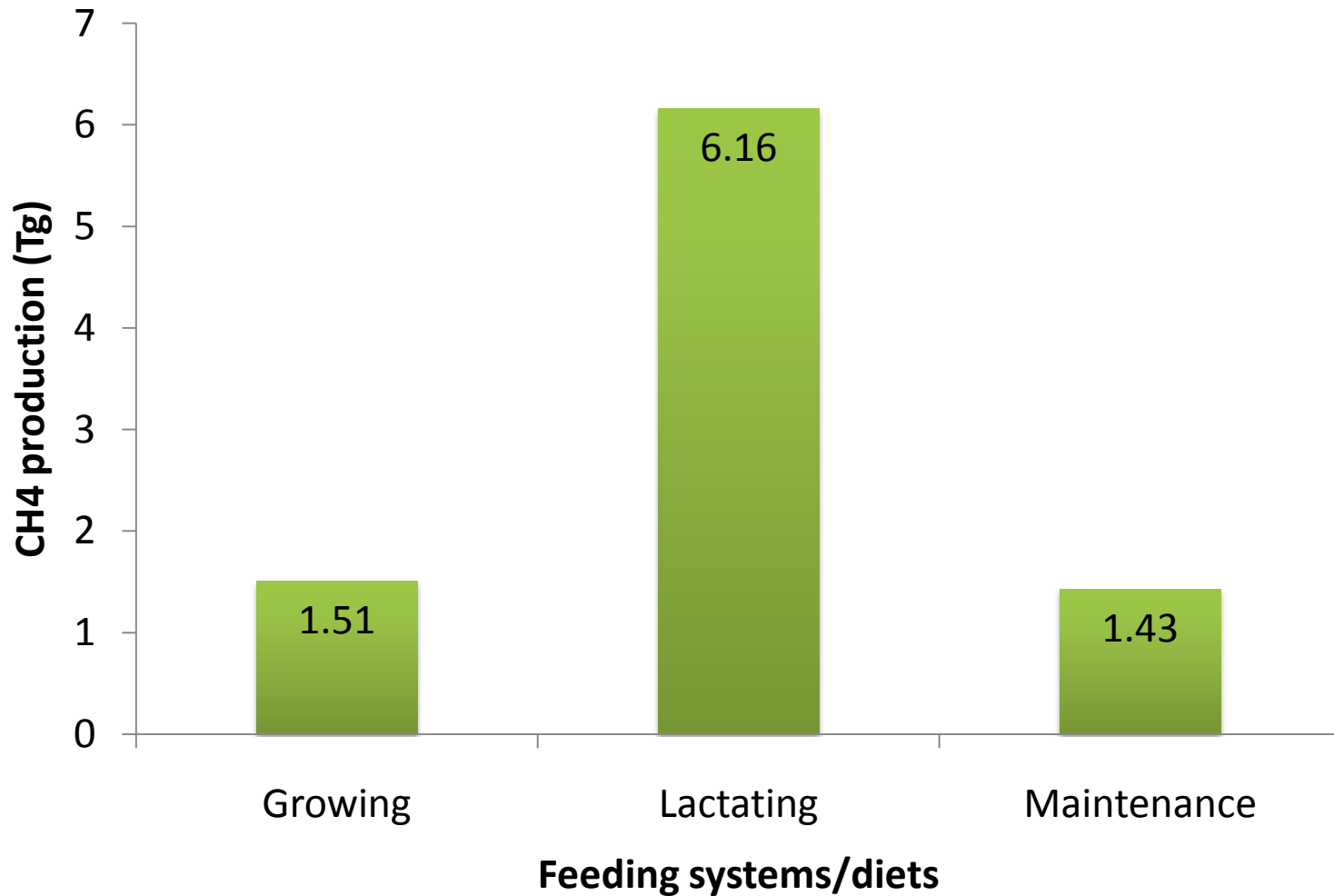
Cattle Indigenous (male)	
< one year	21.4239
1 – 1.5 year	31.2951
Breeding	99.8437
Work	101.2912
Breeding + work	101.1519
Other	71.0611
Cattle Indigenous (Female)	
< one year	20.7075
1 – 3 year	42.9336
Milking	101.1519
Dry	80.0693
Heifer	64.3712
Other	71.5443

Livestock category	CH4 g /day /head
Goat Male	
< one year	4.3514
> one year	7.2331
Goat Female	
< one year	4.3339
> one year milking	8.113
Dry	6.7792
Sheep Crossbred Male	
< one year	5.2082
> one year	13.814
Sheep Crossbred Female	
< one year	5.3056
> one year	10.9177
Sheep Indigenous Male	
< one year	4.801
> one year	11.5133
Sheep Indigenous Female	
< one year	4.8274
> one year	9.337

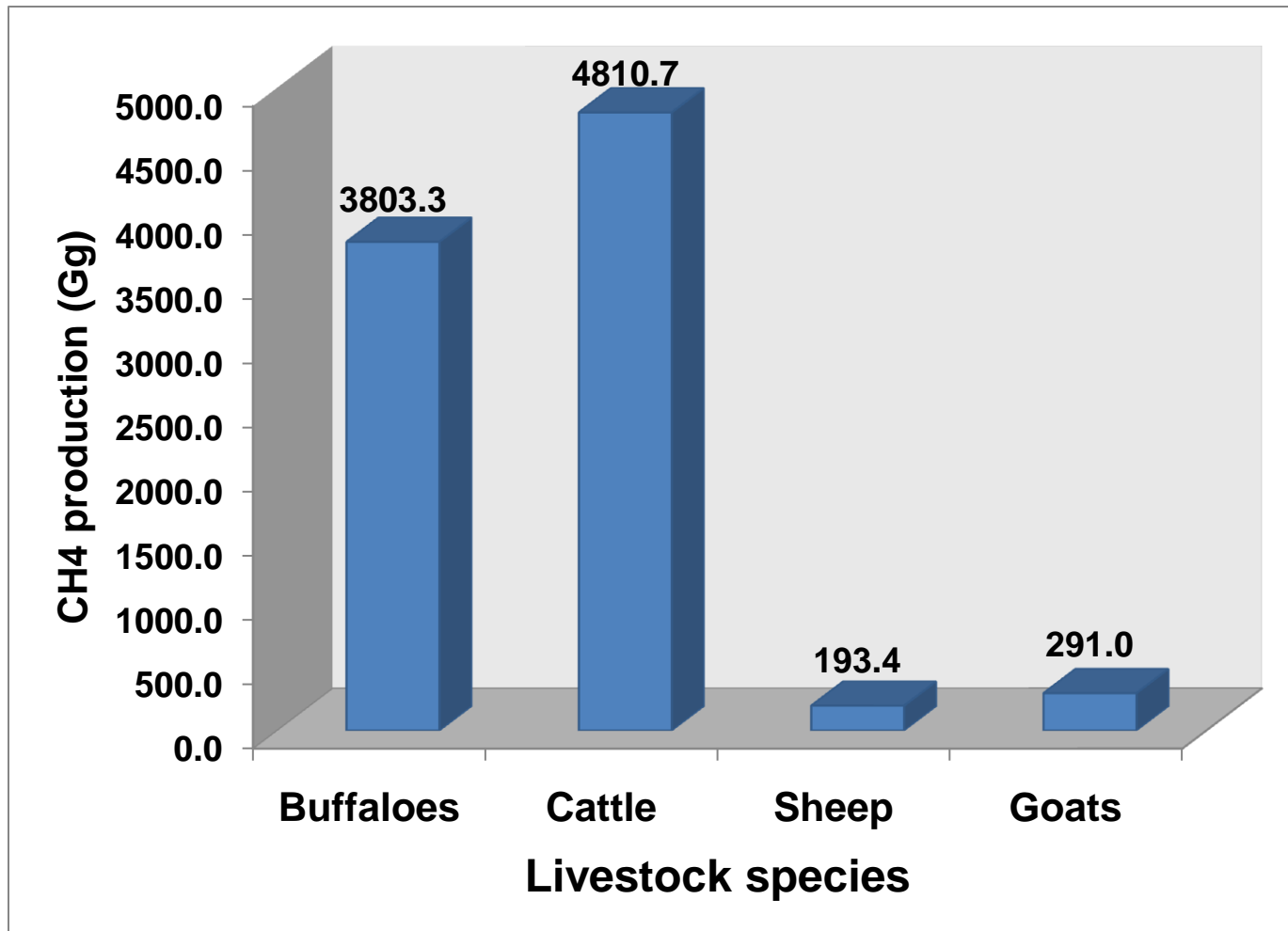
Enteric methane production (Tg) from livestock in different Agroecological regions of India



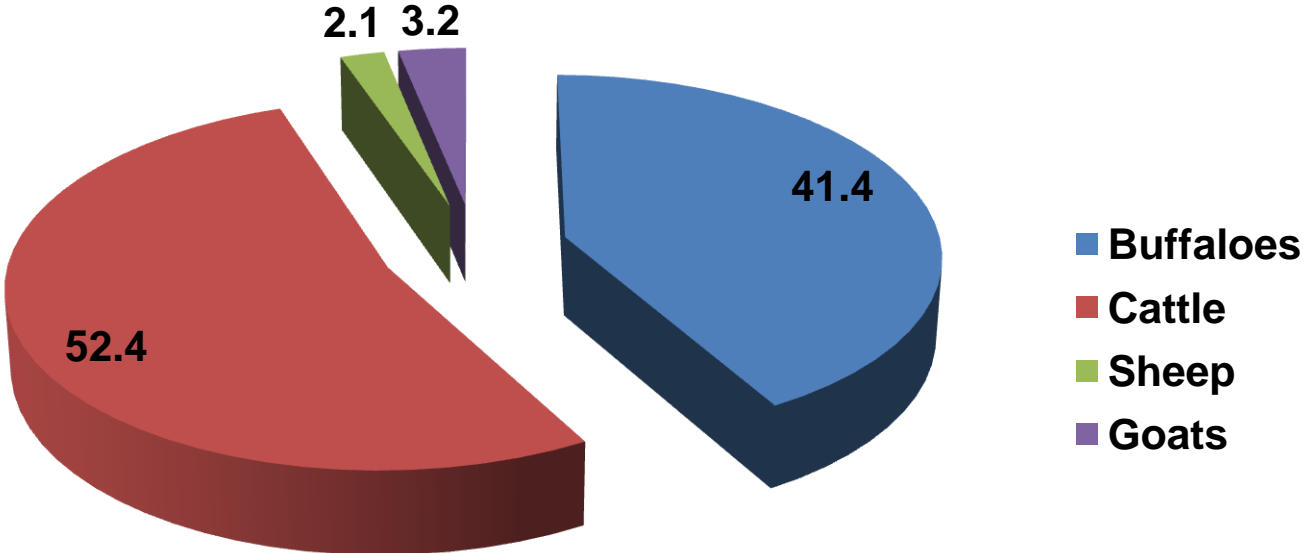
Methane production (Tg) from feeding systems/Diets



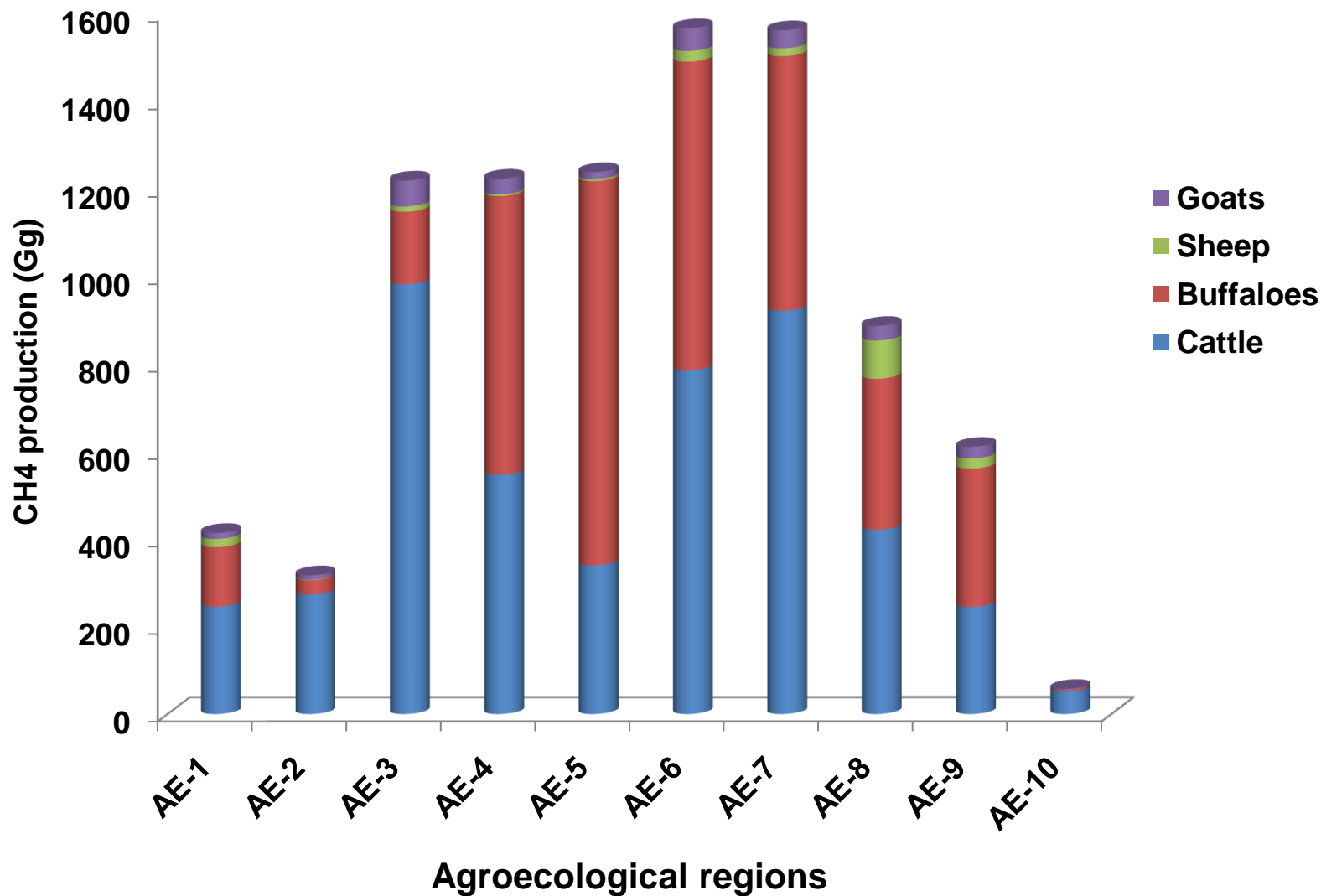
Methane production (Gg) from different ruminant species



Percent methane production by different ruminant species



Methane production (Gg) from ruminant species in Agro ecological regions



Thanks