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SURVEY WORK ON ANIMAL NUTRITION IN RAJASTHAN

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A comprehensive Animal Nutrition Survey was carried out in Rajasthan during 1958 to 1960. For this purpose, feeds and fodder samples and related data about the feeding practices, milk production etc., were collected from 16 villages in Jaipur, Ajmer, Jodhpur and Nagaur districts to study the compositions of available fodders and concentrates and the local feeding practices

The results of the composition of feeds and fodder and the observations from the informations on the feeding practices for different categories of animals indicated that though most of the feeds and fodders were normal in composition but due to insufficient quantities of feeds, majority of the cattle were underfed and particularly the shortage of protein was more acute.

During the survey in Bikaner and other parts of Rajasthan, it is observed that Raikas mostly raise their camels only on browsing while camels used for work are partially browsed or entirely stall-fed varying from 20–30 kg fodder and 0 to 2.5 kg concentrates.

No special fodder is grown for camels but some tree leaves are utilized as fodders as well as for browsing and byproducts of some cereals and legumes are also used as fodders. Concentrates like moth (*Phaseolus aconitifolius*), guar (*Cyamopsis tetragonoloba*) or gram (*Cicer arietinum*) seeds are very rarely used.

Leaves of *Pala* (*Zizyphus nummularia*), *Jal* (*Salvadora oleoides*) and *Ker* (*Capparis decidua*) having more than 15% protein are better fodders than *Siniya* (*Crotalrias burhia*) and *Kantala* (*Fagonia cretica*) which are poor and fibrous. *Jal* leaves are remarkably high in calcium (9%) and amongst all local fodders it seems to be the richer in all the nutrients and is not fibrous at all.

I. CATTLE NUTRITION

(A) *Survey of Feeding Practices*

The survey work in Rajasthan was carried out during three seasons viz., monsoon, winter and summer during 1958-59. The total area of the State is about 1,30,000 square miles, lying between 23° 30′ and 30° 12′ latitude and 69° 30′ and 70° 17′ longitude. The major portion of the state is rocky and sandy desert interspersed with forests and fertile tracts. The annual rainfall in the northwestern part is generally less than 25 cm, while in the southeastern upland country sometimes it goes up to 100 cm. The maximum temperatures fluctuate between 110° F and 120° F and the minimum between 40° F and 50° F.

The survey work was carried out in Jaipur, Ajmer, Jodhpur and Nagaur districts. In each district two tehsils were selected and from each tehsil two villages were selected

at random, one for household survey and the other for grasses and fodder survey. The grouping of the villages is given below:

Grouping of villages surveyed in Rajasthan

District	Tehsil	For Household survey	For grassland and fodder survey
Jaipur	Amer	V_1—Rampura	Anantpura
,,	Ramghar	V_2—Thalai	Shainpura
Ajmer	Phulera	V_3—Kishorpura	Tyod
,,	Ajmer	V_4—Chavandia	Makhudra
Jodhpur	Osian	V_5—Umednagar	Gangani
,,	Jodhpur	V_6—Pal	Satalana
Nagaur	Jayal	V_7—Rol	Rajod
,,	Merta	V_8—Falodi	Javali

(a) *Number of animals in Rajasthan*

The cattle population of Rajasthan is about 12.1 million consisting of 4,414,376 cows, 3,560,424 bullocks, 17,625 bulls and 4,080,588 young calves. Moreover, there are 3,439,449 buffaloes, 8,730,163 goats and 7,372,805 sheep. The total animal population including horses, ponies, camels, donkeys and pigs is about 32 millions.

(b) *Types of feeds available during different seasons of the year*

Bajra (*Pennisetum typhoides*), maize (*Zea mays*) and *jowar* (*Sorghum vulgare*) are the main crops grown in monsoon and the byproducts of these crops form the major bulk of fodder throughout the year. In addition, straws of wheat (*Triticum aestivuns*) and barley (*Hordeum vulgare*) which are usually grown in winter are also available during the summer season. Similarly, byproducts of pulses like *moong*, *moth*, *guar*, gram etc., are also available. Green fodder from the grazing lands and to some extent from the boundaries of the fields is available during the monsoon months while during winter and summer it is very scarce. However, leaves of *ber* (*Zizyphus nummularia* or *Z. jujuba*) and *khejri* (*Prosopis cineratia*) are extensively used during these seasons as green fodder supplements. The estimated fodder production from the above mentioned crops is given below:

Estimated fodder production in Rajasthan

Crops	Yield of fodder (1000 tons)
Bajra	1730
Maize	1159
Jowar	465
Wheat	465
Barley	357
Gram	259
Guar	82
Total	4517

It is evident from the data that the main bulk of fodder comes from the *bajra* and maize crops.

(c) *Feeding practices for different categories of animals in Rajasthan*

Generally the cattle are fed green grasses from grasslands or are allowed to graze during monsoon, with occasional feeding of cereal straws. In winter in most of the places, *bajra*, *jowar* or wheat straw or hay forms the major bulk of fodder supplemented with *khejri* or *pala* leaves. In Jaipur district, however, *dub* (*Cynodon dactylon*) and *kans* grasses are extensively used in some villages. Feeding of maize straw has also been observed in the district. In summer the animals are fed with the above mentioned cereal straws but in addition many cultivators are found to use chaffed barley or wheat straw ("*Khakla*") for feeding their cattle.

With regard to concentrates, cottonseed, *til* (*Sesamum indicum*) cake; *bajra* (*Pennisetum typhoides*) grains and *guar* (*Cyomopsis tetragonoloba*) are in common use. However, these concentrates are not fed in a mixture but a single concentrate is used depending upon the cost and availability in the market, though a few cultivators do feed a mixture of *til* cake and cottonseeds or *til* cake and *guar*.

Quantities of feeds and fodders fed to individual animals were recorded by actual weighment of the morning and the evening ration. Taking into consideration the production of milk by the animals and the quantity of feeds given, the animals were grouped as underfed, adequately fed or overfed. Concise information regarding feeding practices for different categories of animals in the three seasons is given in the following tables.

TABLE I

Feeding of cows

	Animal (%)					
	T.D.N.			D.P.		
	Monsoon	Winter	Summer	Monsoon	Winter	Summer
Underfed	70	57	34	67	92	83
Adequately fed	4	6	17	4	5	3
Overfed	26	37	49	29	3	14
	Extent (%) of underfeeding or overfeeding in cows					
Underfed	47±7.0	52±11.3	45±12.0	47±6.3	69±3.9	47±7.0
Overfed	50±15.0	52±24.2	48±18.2	78±25.6	24±18.3	30±10.3

The data in Table I clearly indicate that almost all the cows are not fed adequately. Majority of them are underfed while a few of them are overfed. However, in summer more animals are overfed with respect to T.D.N. probably because even though the milk yield is less the cattle-owners continue to feed the same amount of fodders and concentrates.

With regard to feeding of D.P., more than 70% of the animals are not getting sufficient protein; particularly in winter the shortage is maximum as a result of which 92% of the animals are underfed.

Having noted the number of overfed or underfed animals it is worthwhile to know to what extent this underfeeding or overfeeding of D.P. and T.D.N. is being done.

The data reveal that the extent of T.D.N. underfeeding is more in winter than in the other seasons, while that for overfeeding is more in summer. Similarly the extent of D.P. underfeeding is maximum (69%) in winter while it is 47% in monsoon and summer. The maximum overfeeding of D.P. observed in monsoon may be due to availability of green fodder from pasture during that period.

Buffaloes

The maximum number (70%) of the buffaloes are underfed with respect to T.D.N. during monsoon, while about 40% of the animals are underfed in winter (Table II). The feeding condition of buffaloes is thus similar to that of cows. With regard to D.P. also the nutritional status of buffaloes is similar to that of cows. These observations clearly indicate that there is an acute shortage of proteinous feeds for milch animals.

TABLE II

Feeding conditions of buffaloes

	Animal (%)					
	T.D.N.			D.P.		
	Monsoon	Winter	Summer	Monsoon	Winter	Summer
Underfed	70	40	36	60	69	83
Adequately fed	2	5	7	2	9	2
Overfed	28	55	57	38	22	15
	Extent (%) of underfeeding or overfeeding of nutrients					
Underfed	48±10.8	38±13.0	14±5.5	38±9.3	58±8.0	53±3.6
Overfed	34±12.9	48±9.4	48±10.3	38±10.7	13±2.2	23±9.6

Considering the number of animals underfed with respect to T.D.N. and the extent of underfeeding, it is evident that the maximum underfeeding is prevalent in monsoon. This is probably because of the fact that most of the animals are not fed any concentrate but are entirely maintained on whatever grazing is available supplemented with some dry fodder. As regards D.P. the extent of underfeeding is maximum in winter because in spite of higher milk production in that season, the animals are fed the same amount of concentrate as in the other seasons.

Bullocks

The extent of underfeeding and overfeeding of bullocks with regard to T.D.N. and D.P. revealed that even though there is practically no work in summer and medium work in winter the bullocks are fed almost at the same rate as in monsoon (Table III). As a result the overfeeding of T.D.N. and D.P. is more in winter and maximum in summer. The extent of underfeeding of D.P. in all the three seasons of the year is very high indicating a general lack of proteinous feeds. These observations on bullocks and

similar to those made on cows and buffaloes indicate an overall shortage of proteinous feeds in Rajasthan.

TABLE III

Feeding bullocks

	Animal (%)					
	T.D.N.			D.P.		
	Monsoon	Winter	Summer	Monsoon	Winter	Summer
Underfed	63	30	34	70	86	83
Adequately fed	4	5	5	1	10	1
Overfed	33	65	61	29	4	16
	Extent (%) of underfeeding or overfeeding of nutrients					
Underfed	40±10.2	29±12.4	30±11.1	42±10.9	67±6.8	71±3.2
Overfed	16±8.0	57±12.2	73±20.6	11±5.6	12±8.2	31±14.6

II. PREGNANCY AND CALVING RATIONS

Any special pregnancy ration is usually not given except that during the last week of pregnancy the normal concentrate feeding is started by some cattle-owners. However, during the first 15-35 days after calving the animals are given 3-5 kg of jaggery, 15-20 kg *bajra* grains and 8 to 10 kg of barley or wheat together with 4 kg of *til* oil. Moreover, some cultivators feed 8 to 10 kg of *methi* (*Trigonella forenum-graecum*) along with about 2 kg of dillseeds or *ajma* (*Tradryspermum ammi*).

(d) *Methods adopted for the preservation of fodders*

The general practice of preserving fodder is to sun-dry the grasses as well as cereal fodders. *Jowar* grown for fodder purposes is cut at the flowering stage and sun-dried, which is locally known as *Chipta*, while straws of cereal crops are usually cut into small pieces and preserved in the form known as *Kutti* or *Khakla*. Silage making was not observed in any of the villages surveyed. Moreover, quite often leaves of trees like *Khejri* and *Pala* are also dried and stored in bags or in heaps.

(e) *Approximate milk yield of cows and buffaloes*

The morning and evening milk yields of individual animals were recorded by actual weighment. In all, the yields of 114 cows and 96 buffaloes were recorded. The villagewise average milk yield for different seasons are given for cows and for buffaloes together with the results of the statistical analysis of the data.

From the data collected it is observed that more cows are kept in Jodhpur and Nagaur than in Jaipur and Ajmer districts (Table IV-A). The results also reveal that the cows in Jaipur and Ajmer are poor yielders, the average yield being about 1.7 kg while in the other two districts the milk yield is comparatively high; particularly in Nagaur the average milk production is as much as about 3.5 kg.

The average milk production in winter season is of the order 2.5 kg which is the maximum, while in summer it is the least (1.9 kg). The overall average daily milk production per milking cow in Rajasthan is 2.3±0.14 kg.

TABLE IV-A

Milk yield of cows (kg per day)

	Jaipur		Ajmer		Jodhpur		Nagaur		Weighted Av.	S.E.	*F* value villages	C.D.
	V_1	V_2	V_3	V_4	V_5	V_6	V_7	V_8				
Monsoon	1.7	0.9	1.9	1.6	2.4	3.2	2.8	2.9	2.3	0.18	3.14**	1.34
Winter	—	—	0.9	3.6	1.6	2.0	6.0	2.3	2.6	0.25	12.28**	1.65
Summer	2.3	2.0	—	1.0	1.6	2.5	2.0	4.1	2.0	0.18	2.67*	1.57

TABLE IV-B

Milk yield of buffaloes (kg per day)

	Jaipur		Ajmer		Jodhpur		Nagaur		Weighted Avg.	S.E.	*F* value villages	C.D.
	V_1	V_2	V_3	V_4	V_5	V_6	V_7	V_8				
Monsoon	1.8	1.2	2.2	1.6	6.4	4.4	5.2	6.8	2.7	0.64	1.98*	3.2
Winter	5.1	2.0	4.6	2.8	—	3.9	8.1	4.1	4.4	0.44	3.23*	2.9
Summer	2.5	2.2	2.1	—	3.4	3.4	7.5	3.4	3.6	0.52	1.47*	—

The variation in the average milk production of buffaloes observed in different areas is similar to that noted for cows, the maximum milk yield of about 5.2 kg being obtained in Nagaur district. The average daily milk yield is maximum in winter and minimum in monsoon. The overall average daily milk production per milking buffalo in Rajasthan is 3.8 ± 0.26 kg.

(B) *Study on the composition of fodders from Rajasthan*

(i) *Stagewise composition of bajra fodder*

Samples of *bajra* fodder were collected at the flowering and mature stages from eight villages. From each village two composite samples of each stage were obtained by collecting samples from six different fields in different directions.

From the results of composition of the fodder at the two stages, a striking difference in protein and crude fibre contents is evident (Table V). The protein content at the flowering stage is 9.6% which is more than twice that in the mature fodder. In the cases of other nutrients also the variation is significant except in calcium and ether extract. On the whole in the flowering stage the fodder is richer in protein, ether extract and minerals but somewhat low in N.F.E.

The villagewise variation in the composition indicated that the fodder from Satlana, Gangani and Rajod were richer in protein (8 to 9%) as compared to only 5% in the fodder from the other villages. Moreover, the fodder from the first four villages had somewhat higher crude fibre and phosphorus contents.

(ii) *Composition of a common roughage from household survey*

During the household survey, samples of *bajra* straw, which is commonly fed to animals, were collected from eight houses in each of the eight villages. Two composite samples were prepared by pooling fodders from four households in each case.

TABLE V

Composition of bajra fodder at flowering and mature stages (%)

	Crude protein	Ether extract	Nitrogen free extract	Crude fibre	Phosphorus	Calcium
Stages (average of 16 results)						
Flowering	9.6	1.9	47.1	28.4	0.24	0.54
Mature	3.7	1.3	52.0	82.7	0.20	0.36
Villages (average of 4 results)						
Min.	4.2	1.2	45.6	26.1	0.14	0.28
Max.	9.6	1.9	53.5	74.5	0.34	0.17
F Values						
Stages	64.10**	9.66	9.90*	10.42**	4.83*	2.83
Villages	3.44**	0.75	1.66	2.64*	3.42*	1.86
C.D.						
Stages	1.88	0.42	3.28	2.74	0.07	——
Villages	3.81	——	——	5.46	0.18	——

From the results (Table VI) it can be observed that the fodder collected from household survey contains only 2.62% protein as against 3.72% in the sample of mature stage collected for the stagewise study. Similarly the former is more fibrous indicating that it is less nutritive than the latter. The reason for this variation may be the effect of storage or stage of harvest or the season.

Among the villages, the fodder from Rampura, Chawandia and Rol had more than 8% protein while the protein content in the fodder from the other villages varied between 1.5 and 3%. The fodder from Tholai, Pal, Umednagar and Falodi was somewhat lower in phosphorus.

TABLE VI

Composition of Bajra straw from household survey %

Villages	C Protein	E Extract	N.F.E.	C Fibre	Phosphorus	Calcium
Minimum	1.5	1.1	44.4	28.0	0.04	0.16
Maximum	3.7	1.8	52.1	41.4	0.31	0.56
Av. (16)	2.62	1.53	48.46	37.17	0.12	0.30
S.E.	0.181	0.047	0.508	0.832	0.019	0.028

(C) *Composition of concentrates*

The common concentrates used for feeding different categories of animals were cottonseed, *til* cake, *bajra* grains, *guar*, barley grains and gram *churi*. Samples of

these concentrates were analysed (Table VII). In the case of barley and gram *chuni* the samples were available only from four villages.

TABLE VII

Composition of concentrates from household survey %

		C Protein	E Extract	N.E.F	C Fibre	Phosphorus	Calcium
Cotton Seed	Av.	19.5	17.6	36.9	21.1	0.55	0.21
	S.E.	0.40	0.37	0.84	0.47	0.03	0.00
Til Cake	Av.	41.6	14.0	30.2	2.6	10.07	2.07
	S.E.	1.18	1.01	1.09	0.28	0.06	0.14
Bajra grains	Av.	11.5	6.9	78.1	0.81	0.38	0.12
	S.E.	0.40	0.17	0.56	0.09	0.02	0.03
Guar seed	Av	28.1	4.8	59.1	3.9	0.40	0.16
	S.E	0.84	0.17	0.59	0.51	0.02	0.01
Barley grains	Av.	0.1	1.8	80.8	4.2	0.32	0.10
	S.E.	0.24	0.36	1.35	0.34	0.02	0.02
Gram *chuni*	Av.	18.7	5.8	64.4	6.1	0.36	0.22
	S.E.	0.56	0.36	1.23	0.53	0.04	0.02

The cotton seeds from Rajasthan have a protein content of 19.52% which is about 20% higher as compared to cottonseeds from Punjab and Saurashtra while the N.F.E. content is only 36.86% as compared to 40.12 and 41.96% in the cottonseeds from Punjab and Saurashtra. Cottonseeds from Rajasthan are poorer in minerals than cotton seeds from Gujarat.

Til cake is commonly fed in Rajasthan, while in Punjab, *Sarson* cake and in Saurashtra and Bombay groundnut cake is found to be in common use. The average percentage composition of *til* cake is 41.64 protein, 14.04 fat, 30.17 N.F.E., 2.53 crude fibre, 1.07 phosphorus and 2.07 calcium. Compared to this, *sarson* cake from Hissar is low in protein having only 29.36%. *Til* cake contains a remarkably high amount of calcium which, on an average, is 2.07% as against 0.94% in *sarson* cake and only 0.32% in groundnut cake. The phosphorus content in *til* cake is also correspondingly high amounting to 10.07%. Thus, *til* cake provides both calcium and phosphorus in adequate amounts.

The *bajra* grains from Rajasthan are similar in composition to those from Punjab except that the ether extract content of the former is 6.85% as compared to only 4.74% in the latter. Samples from different villages vary in protein and calcium contents.

The composition of *guar* sceds from different villages was observed to vary considerably. The protein content of *guar* from Falodi was as low as 24.75% while that from Kishorpura was as high as 32.16%. However, on an average the *guar* seeds from Rajasthan are richer in protein and ether extract and lower in crude fibre as compared to those from Punjab having 24.62% protein, 3.84% ether extract and 7.77% crude fibre.

Barley grains from Rajasthan do not vary much in composition as compared to barley grains from Punjab. Between the samples from different villages of Rajasthan the only variation observed is that the ether extract content of grains from Kishorpura and Chavandia was only 1.24% as against 2.42% in the samples from the other villages.

Gram *chuni*, being a byproduct, has variable composition depending upon the extent of hulls included in it. This is quite evident when gram *chuni* from Saurashtra is compared with that from Rajasthan. The average composition of the former is 16.02% protein, 2.91% ether extract, 58.90% N.F.E., 16.68% crude fibre, 0.22% phosphorus and 0.44% calcium. The higher amount of protein, ether extract, phosphorus and low crude fibre and calcium in Rajasthan samples indicate the exclusion of hulls.

(D) *Composition of tree leaves*

(i) *Neem* leaves (*Azadirachta indica*): The results of seasonal variation in the composition of *neem* leaves along with the minimum and maximum values from the different villages are given in Table VIII.

TABLE VIII

Composition of Neem *leaves in different seasons* (%)

	C Protein	E Extract	N.F.E.	C Fibre	Phosphorus	Calcium
Seasons:						
Monsoon	15.32	5.86	47.46	18.47	0.19	1.22
Winter	15.76	5.36	53.19	15.18	0.14	1.44
Summer	18.62	6.93	51.19	13.48	0.19	0.82
Villages:						
Min.	15.4	4.7	47.4	14.1	0.16	0.64
Max.	18.4	6.5	52.7	17.7	0.18	2.26
F values:						
Villages	8.95**	21.65**	5.48	18.32**	18.68**	4.85*
Seasons	1.22	0.81	1.50	1.72	0.58	4.79**
C.D.						
Seasons	1.84	0.48	3.78	1.65	0.01	0.39
Villages	—	—	—	—	—	0.64

The protein contents in *neem* leaves in monsoon and winter are 15.32 and 15.76% but in summer the protein content is 18.62%. In the same way the ether extract content is higher and the crude fibre and calcium contents lower in summer.

A similar trend was also observed in the *neem* leaves from Saurashtra. In fact, season is found to have profound effect on all the nutrients, while the composition does not vary significantly from village to village except in calcium. *Neem* leaves from Toyd, Rajasthan had 2.26% calcium while those from Gangani had only 0.64%.

(ii) *Khejri* leaves (*Prosopis cineratia*): The composition of *Khejri* leaves during different seasons and the minimum and maximum values for the samples from the villages are given in Table IX.

TABLE IX

Composition of Khejri *leaves in different seasons* (%)

	C Protein	E Extract	N.F.E.	C Fibre	Phosphorus	Calcium
Seasons (average of 26 results)						
Monsoon	14.34	4.26	52.57	18.61	0.18	1.94
Winter	17.49	4.23	54.04	14.41	0.16	2.00
Summer	15.39	4.48	56.76	13.04	0.18	1.92
Villages (average of 6 results)						
Min.	14.3	3.8	52.1	14.4	0.14	1.32
Max.	18.8	4.8	56.3	16.7	0.19	2.79
F. Values						
Cuttings	17.99**	0.69	15.35**	26.76**	2.00	0.09
Villages	6.01**	1.24	3.02*	0.40	1.33	4.98**
C.D.						
Cuttings	1.50	——	1.46	2.15	——	—
Villages	1.72	——	2.46	——	——	0.73

The effect of season in the case of *Khejri* leaves is found on the protein, N.F.E. and crude fibre contents. The leaves are richest in protein in winter but highest in N.F.E. and least fibrous in summer. A similar trend of seasonal variation in *Khejri* leaves was also observed in Kaira district (Gujarat).

Significant variations in the composition of leaves from different villages from Rajasthan are particularly observed in respect of protein and calcium contents. The leaves from Rajod were richest in protein having on an average 18.82% of this nutrient but for calcium content the villages fall into two groups, the leaves from the first four villages having calcium content of more than 2% while those from the remaining four contained about half the quantity.

(iii) *Pala leaves* (*Zizyphus nummularia*): The results of analysis of *pala* leaves collected during different seasons, and the minimum and maximum values from eight villages are presented in Table X.

TABLE X

Composition of Pala *leaves in different seasons* (%)

	C Protein	E Extract	N.F.E.	C Fibre	Phosphorus	Calcium
Seasons (average of 16 results)						
Monsoon	14.24	3.16	51.78	20.00	0.19	1.70
Winter	14.62	5.23	57.76	11.74	0.16	2.17
Summer	14.76	5.91	60.70	8.20	0.16	2.07
Villages						
Min.	12.8	4.1	54.0	11.0	0.14	1.50
Max.	16.6	5.8	59.4	15.6	0.21	2.40
F Value						
Seasons	0.21	22.41**	61.82**	86.48**	3.44	4.30
Villages	1.40	1.72	7.45**	1.65	1.81	2.96*
C. D.						
Seasons	——	0.92	1.60	1.95	——	0.37
Villages	——	——	2.62	——	——	0.60

No effect of season is observed on the protein content of these leaves as was seen in the case of all the other kinds of leaves, probably for the same reason the phosphorus content has also not been found to vary from season to season. (The leaves were found to be richest in ether extract and N.F.E. and least fibrous in summer.) Highly significant village to village variations were found in the case of N.F.E. content in the leaves from Anantpura being about 60%, while that in leaves from Satlana, Gangani and Javali was about 54%.

(d) *Stagewise composition of grasses*

The samples of grasses were collected at the flowering and mature stages. The chemical composition of the grasses is given in Table XII. However, Table XI enlists the grass species analysed in this study.

With regard to the distribution of different species of grasses, *barunth* or *bunt* (*Cenchrus biflorus*) is found to prevail all over the area. *Zerna* (*Digitaria marginata*) is predominant in Anantpura and Tyod while *ganthiu or narda* (*Elusine flagellifera*) is predominant in Satlana and Rajod.

The effect of maturity on the composition of the grasses was found to be highly significant in almost all the nutrients while in the case of Saurashtra grasses the maturity effect was significant in case of protein. However, the trend of variation is similar in both cases. At the flowering stage the grasses are richer in nutrients than at the mature stage. The Rajasthan grasses appear to be more nutritive than those from Saurashtra because of variation in the natural flora of grasses, stage of growth, climatic conditions, etc.

As far as villagewise variation in the composition of grasses is concerned significant differences have been noted in the protein and phosphorus contents. The grasses

TABLE XI

Local name	Botanical name	Village	Proportion of grasses with local names (Percent)
Bhurat	*Cenchrus biflorus*	Anantpura	*Bekarya* 25, *Zerna* 50
Dhaman	*Cenchrus ciliaris*		*Barmud* 25.
Bekarya	*Indigofera cordifolia*	Shainpura	*Sevan* 50, *Motia* 50.
Karad	*Dichanthium annulatum*	Tyod	*Zerna* 40, *Karad* 20. *Mukada* 20, *Korachinki* 20.
Dabh or Dabdi	*Desmostachya bipinnata*	Makhupura	*Koral* 30, *Buni* 35. *Kalabhurat* 35.
Tantia	*Eleusine flagellifera*	Satlana	*Cud* 5 *Malechha* 30.
Narda	*Eragrostis tremula*		
Dhaman	*Cenchrus ciliaris*		*Ganthia* 60, *Dhaman* 5.
Kalabhurat	*Cenchrus bifloris*	Gangani	
Karad	*Sehima nervosum*		*Bhurat* 50, *Dabh* 50.
Korachinki or	*Brachiaria ramosa*		
Motia	*Cyperus rotundus*	Javali	*Dobdi* 30, *Bhurat* 35.
Malechha	*Paspalidium flavidum*		*Karsinki* 35.
Mukada	*Eleusine scindicum*		
Gantil	*Dactyloctenium aegypitium*		*Narda* 90, *Bhurat* 10
Zerna	*Digitaria margtnata*	Rajod	
Sevan	*Lasiurus sindicus*		

TABLE XII

Composition of grasses at flowering and mature stages (%)

	C Protein	E Exract	N.F.E.	C Fibre	Phosphorus	Calcium
Stages (average of 16 results)						
Flowering	9.02	2.07	45.93	30.09	0.21	0.40
Mature	4.93	1.72	51.52	32.43	0.15	0.37
Villages (average of 8 results)						
Min.	4.6	1.7	43.3	27.9	0.11	0.38
Max.	9.0	2.0	51.2	34.0	0.25	0.76
F. values						
Stages	66.46**	15.42**	23.27**	5.32*	12.10**	19.78**
Villages	3.74*	0.44	2.18	1.89	2.96*	1.36
C.D.						
Stages	1.50	0.19	2.40	2.08	0.04	0.16
Villages	2.10	—	—	—	0.08	—

from Satlana and Rajod, where *ganihiu* is predominant, have been found to be high in protein contents (8–9%) while those from Anantpura where *zerna* grass is predominant the protein content has been recorded to be 4.56%. The higher phosphorus content was recorded in the samples from Shainpura and Tyod (0.75%) and the least (0.38%) in the samples from Anantpura.

(E) *Hemoglobin in the blood of different categories of animals*

The hemoglobin content of the blood of cows, buffaloes, bullocks, calves, sheep and goats from different villages was determined in the three seasons.

The Hb content of buffalo blood (more than 10 g%) was found to be higher than that of cow (about 9 g%). Sheep and goat blood had a Hb content of (7.5 g%). No significant seasonal effect on the Hb content of the blood of these animals was observed.

III. Brief Information on Camel Nutrition in Rajasthan

Information regarding feeds and fodders available and the present feeding practices adopted by the people in camel rearing areas were obtained from several places in Rajasthan.

(a) *Common feeds*

Fodders: No special fodder is grown for feeding camels but the byproducts of some cereal and leguminous crops are generally utilized whenever they are stall-fed. However, some tree leaves are commonly utilized both as fodder as well as browsing. Camels are rarely fed concentrates and if at all they are fed, only the leguminous grains are used as concentrates. The composition of some fodders including leaves in common use is given in Table XIII.

Table XIII

Composition of tree leaves and shrubs

(on oven dry basis)

	Samadi loong (*Prosopis cineratia*)	Phog (*Callilgonum polygonoides*)	Bore palla (*Zizyphus nummularia*)	Jal (*Salvadora oleoides*)	Siniya (*Crotolania burbia*)	Ker (*Capparis decidua*)	Leegaru	Kantala (*Fagonia cretica*)
C. Protein	13.48	11.23	17.60	14.73	6.68	15.29	9.46	8.51
E. Ext.	4.67	2.60	5.03	2.58	3.56	2.39	3.08	5.22
C. Fibre	15.80	13.13	11.60	5.88	44.40	22.88	32.06	30.00
N.F.E	55.97	63.80	55.13	45.63	40.91	51.37	46.27	45.95
Ash	10.08	9.24	10.64	31.18	4.45	7.97	9.13	10.32
Sand	2.28	0.42	1.54	1.13	0.47	0.29	1.48	2.82
P	0.14	0.18	0.20	0.13	0.10	9.14	0.17	0.14
Ca	2.51	1.44	2.29	9.01	1.11	1.21	0.71	1.64

It is evident that *palla, jal* and *ker* having more than 15% protein are comparatively richer than the other fodders. *Siniya, leegru* and *kantala* are poor in protein and are more fibrous. All the fodders are quite rich in calcium and particularly *jal* has a remarkably high calcium content. Among all, *jal* seems to be rich in all nutrients and is less fibrous.

Other fodders and concentrates commonly used for feeding camels are as follows:

Fodders	**Leaves**	**Concentrates**
Jowar kutti	*Neem*	*Moth seeds*
Bajra kutti	*Kantala*	*Guar* seeds
Wheat *bhusa*	*Kenti*	*Gram* seeds
Gram *bhusa*	*Arunj*	
Moth chara	*Sintera*	
Guar chara	*Dhamara*	
Til seed pods		

(b) *Feeding practices*

(i) *Raikas* whose business is to raise and sell camels mostly maintain their herds only on browsing.

(ii) Camels used for some work are partially allowed to browse and they are given 10 to 20 kg of whatever fodder is available.

(iii) Camels regularly used for work for the whole day are completely stall-fed. The range of feeding is found to vary from 20 to 30 kg of fodder and 0 to 2.5 kg of concentrates.

The animals are fed 100–200 g of alum mixed with 0.5-1.0 kg of *gur* (jaggery) after heavy work in the belief that such feeding wipes off the fatigue. Some breeders provide *ghee* (clarified butter) and turmeric to the camels after calving.