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Utilization of Non- Conventional Feeds For Enhancing the Animal Production

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Introduction

India's Milk Production has increased from a mere 17 million tons in 1951 to 198 million tones in 2020, with a share of close to 20% of world milk Production. The annual growth rate of milk was 6.27 per cent, during 2014-15 there after a steady increase. In 2019-20, milk production increased by 5.68 per cent as compared to the previous year. The per capita availability of milk was 407g per day in 2019-20. India ranks first in bovine population holding of about 51 percent of Asia and about 19% of world bovine population but the productivity of these animals is very low. In India, inadequate supply of nutrients is always a problem primarily due to shortage of grains, fodders and over dependence on crop residues for the feeding of dairy animals. The gap between availability and demands of feeds is very wide. Currently, total DM requirement for Indian livestock is 623 million tones MT (62% for cattle and 38% for buffaloes), which will be about 670MT (53% for cattle and 47% for buffaloes) in the year 2025. DM availability through all the feed resources in the country was 509.5. MT in the year 2003 which is likely to be 633.1 MT in the year 2025.CP requirement in year 2003 was 59 MT, which is likely to grow to 66 MT by the year 2025. The TDN requirement in corresponding years is estimated as 354 and 387 MT against the availability of 238.5 and 371.0 MT, respectively. The critical assessment indicated that straw and stoves supplied 69% of the available DM while it is envisaged that these will contribute 76% in the year 2025. The CP availability during 2004 was about 32 MT and likely to be 45 MT by the year 2025. This analysis showed that presently there is a shortage of nutrients and it will continue to persist in coming years. Therefore, concerted efforts have to be made to bridge the gap between supply and demand of nutrients for improving the animal productivity as animals maintained on the poor plane of nutrition cannot exhibit their production potential.

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To bridge the gap between supply and demand of nutrients we have to explore new feed resources in the country, which are not being utilized due to one reason or other. For example abundant availability of monsoon grasses, and some industrial by products such as cottonseed hulls, sugarcane bagasse. Monsoon grasses are utilized to some extent by allowing the animals for grazing but large chunk remained unutilized because of lack of management and proper method of their preservation at right stage of maturity. Similarly, industrial by products are not being utilized of their poor palatability and low nutritional value these are not being utilized for animal feeding. Similarly, by products of food processing industry such as fruit and vegetable wastes are available in abundance in many pockets in the country but due to their high moisture content there is problem for their handling and transportation therefore, these are not being utilized optimally to make use of their nutrients. Traditional crop residues such as straws of wheat and paddy and stoves of sorghum and maize are also not being properly utilized as these are not harvested completely due to the mechanized harvesting and the residual crop are being burnt for the early preparation of land for next sowing, which not only reduce the availability of straws but also create environmental pollution.

Monsoon Grasses

After the scorching heat of may and June, monsoon season starts and the empty field fill with natural grasses such as dub grass (*Cynodon dactylon*). During the summer season, animals loose their productivity and also the body weight due to the non availability of adequate nutrients as they usually maintained on straws and stoves. Fresh early vegetative dub grass, also known as Bermuda grass, contains 21.9% CP, which decreased up to 10% on maturity (Ranjhan, 1998). Other grass such as Baru *(Sorghum helepens*), wild cholai, kamakki, Gadbad (*Trianthema protulascastrum)* etc are also available in plenty. Grazing on grasses provide the nutrients and resulted in recovering the loss of body weight and productivity. In addition to this grass various other vegetation also provides the nutrients and wide choice for the animals to select most nutritious part of the available vegetation. In dry areas including the desserts the monsoon grasses are the sole source of nutrients for animals to maintain them. In addition to the grasses, tree leaves also from the source of nutrients during monsoon season, especially for the goats and sheep. In certain areas, where stall feeding is practiced, 'cut and carry ' grasses in are the source of nutrients in monsoon season.

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However, keeping in view the abundance, the grasses , harvested at the right stage of maturity may be preserved in the form hay, to feed the animals in scarcity period. Through this approach appears simple but it involves labour and hence this is the big impediment. In certain pockets tree leaves are preserved, known as pala, for the supplementation of green biomass to the animals.

Industrial Byproducts in Animal Ration

(i) Sugarcane Byproducts (SB): India is one of the major sugarcane producing countries and many a times it is difficult to manage the bumper crop for crushing. Sugarcane tops are being utilized for animal feeding in many areas in India, in spite of its Poor nutritive value and palatability. Chopped sugarcane tops are mixed with wheat straw and water soaked concentrate mixture/ oilcake and this mixed ration is offered to animals to overcome the palatability problem. Sugarcane bagasse (SB) is another crop residue, which is abundantly available (about 35.55 MT) from sugar mills. Though the nutritive value of SB is poor than the straws due to its higher lighter lignin content, however, efforts have been made to utilize it as a source of roughage with varying success. Addition of banana tops to basal ration of either chopped whole sugarcane or of chopped cane stalk the intake of dry matter increased by approximately 20% without altering the apparent digestibility of the ration. Higher intake was due to increased efficiency of microbial fermentation of dietary dry matter in rumen which in turn was brought about through improved availability of substrates (mainly protein and amino acids) to these microorganisms.

(ii) Cottonseed Hulls (CSH): Cottonseed hulls can be utilized for the feeding of ruminants as a source of roughage as it is having low protein and high fiber contents. Though the availability of CSH in the country is limited due to the lack of cotton decortications facilities, however, it can be utilized for animal feeding. Complete feed system for utilizing the CSH opens a new vista to balance the nutrients in the diet of animals. CSH does not need any processing to reduce its particle size and it can be mixed with other feed ingredients with the held of normal mixers. Moreover, molasses, a cheap and easily available energy source, can be absorbed in higher quantity over CSH as it is having higher molasses absorption capacity than other feed ingredients .in an experiment at National Dairy Research Institute, Karnal, complete feed CSH at 60% level was

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evaluated. Growth rate of the calves was found better than those fed on wheat straw based complete feed (Table 2). Voluntary feed intake and growth rate of CSH based complete feed were significantly higher than straw based feed, however physical form of CSH based feed did not make any significant difference on the feed intake as well as growth rate of calves.

(iii) Other hulls: Availability of groundnut shell, the outer covering of groundnuts, is abundant as India is leading producer of groundnut. Groundnut shells are fibrous and poor in protein and mineral contents. Unlike cottonseed hulls, these are very brittle, hence can be turned in to powder form and can be utilized for animal feeding at lower level in ration, when fiber is not a limiting factor.

Horticultural Residues in Animal Feeding

India is the second largest producer of vegetable in the world and its share is over 13 percent of the produce globally. It is estimated that the annual yield of fruit and vegetables in India is about 64.6 and 86.0 million tones, respectively. Horticultural byproducts as feed can be classified in the following categories:

1. Byproducts of fruits processing industry
2. Byproducts of vegetable processing
3. Byproducts of other horticultural crops.

All the categories of horticultural products are being processed to some extent and during the processing varying type of residues are obtained. These residues contain sizable nutritional value (Table 3) besides good quality of fiber, however, these contain high moisture content, which make them perishable. Therefore they must be utilized after quickly processing to make best use in animal rations. Keeping in view their low protein and high carbohydrate contents, they must be enriched with protein supplements. Since the availability of these residues is seasonal, therefore, these may be preserved by adopting technologies.

Table 1. Chemical composition of various industrial Byproducts (% DM basis)

Particulars	CP	CF	ASH	EE	NFE	CA	P	
Brewer's yeast	-	49.9	1.5	8.5	1.3	38.8	0.13	1.56
Spent barley	-	27.8	12.6	4.9	8.0	46.7	0.16	0.65
Cottonseed hulls	3.9	30.0	3.6	8.8	43.7	0.13	0.06	-

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Groundnut shell	4.9	68.4	7.4	0.6	18.7	0.25	0.06	-
Groundnut haulm	14.7	30.9	11.8	3.6	38.9	2.27	0.39	-
Rich hulls	-	3.8	43.9	21.6	1.7	29.0	0.08	0.08
Cassava leaves	-	29.0	16.7	8.6	6.2	39.5	1.17	0.62
Potato haulm	-	10.9	27.0	13.5	4.3	44.3	0.05	0.15
Orange pomace	6.9	13.1	7.1	2.8	70.1	-	-	-
Orange peels	-	6.8	6.2	3.7	1.9	81.4	1.30	0.12
Cabbage waste	-	20.0	10.3	27.3	3.5	38.9	5.95	0.46
Tomato waste	-	27.8	27.6	6.6	22.0	19.0	-	-
Apple pomace	-	5.5	16.4	-	-	-	0.03	0.12
Grape pomace	-	13.4	33.3	6.6	7.0	-	-	-
Sunflower head (Seed free)	-	7.2	15.8	11.4	2.9	62.6	-	-
Coconut fiber	-	1.8	19.3	5.4	2.9	70.6	0.3	0.1
Pea pods	-	15.4	23.4	4.6	2.2	54.4	-	-
Carrots waste	-	16.7	8.7	8.1	1.9	64.6	-	-
Okra waste	-	20.0	34.5	7.6	9.8	28.1	-	-

To give information about the scope of horticultural residues in the animal ration, following examples are cited.

1. **Apple pomace:** Apples is a main fruit crop in the country and sizable part of this fruit is processed for manufacturing the juice, Jam and other products. Apple pomace, the residual material from pressing the apples for juice extraction, contains pulp, peels and cores. Its moisture content is about 85%. Apple yields about 25 to 35% of fresh pomace, which is highly palatable for animals and can be fed as fresh or after preservation or processing .its nutrients content in terms of DCP and TDN is 1.62, and 64.84% respectively. Apple pomace can be preserved by sum drying and takes 52 h for complete drying with occasional stirring (Sharma et al. 1989).Urea treatment of apple pomace under air tight condition for 2 days following its drying increased its nitrogen content, which was found similar to the maize grain. When the urea treated apple pomace replaced the maize grain in the concentrate mixture of growing and lactating cows, the growth and

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milk production performance remained uninfluenced and cost of feeding reduced significantly.

Table 2: Performance of Growing and Lactating Cows on Feeding Urea Treated Apple Pomace in Place of Maize Grain in Concentrate Mixture

Parameters	Control	Urea Treated AP
Growth		
DM intake (kg)	483.6	4834
DM intake (kg)	483.6	4834
Live wt gain (kg)	53.0	51.9
Daily wt gain (g)	541.6	529.8
Cost/kg gain (Rs)	13.8	10.75
Lactation		
DM Intake (kg)	6154	6268
Milk production (kg)	5137	5248
Total fat production (kg)	233.7	232.0
DM intake/kg milk yield (kg)	1.2	1.2
Feed cost/kg milk (Rs.)	1.25	1.04

(Sharma *et al*. 1989)

Apple pomace can be preserved following ensiling process. Apple pomace and straw can be mixed in equal quantity and mixed with 4 kg urea. The mixture can be kept under air tight conditions after covering it with polythene sheet for 3 to 6 months (Singhal et al., 1991). This technology not only preserves the apple pomace but also improves nutritive value of straw. Thus, the utilization of apple pomace not only improves the financial viability of apple

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processing industry, but enhances the feed availability in the country. Similar technology may be applied for the residues obtained from the pineapple, orange and other similar residues having high moisture content and low protein value for the feeding of animals.

Other residues: Maize bran, residue obtained from the wet milling of maize grain for starch production, is also a moist residue. This can also be fed as such and in case of abundant availability, can be preserved by ammo- nization along with straws (Singhal and Sharma., 1991, Singhal and Grant, 2000).Spent grain, a residue from brewery industry, having sizable nutritional value can also be preserved by the ammonization process (Singhal and Sharma ,1991).

Sea Weeds for Animal Feeding:

India is having a 2000 km long coastal line and there is abundant availability of sea weeds, which have sizable nutritional value, however, instead of boon these are considered problem as they block the water ways. Sea weed is a novel phyto -nutrient resource with great potentialities. The kind of sea weed used as feed includes *Ascophyllum nodosum, Alaria esculanta, Fucus vansecan Laminaria and Sargassum.* These algae contain abundant and balanced nutrition which can enhance animal performance, immune status and productivity of animals. Sea weed meal of good quality has constituted up to 10% of cattle feeds with good results, and 35 g a day have been fed experimentally to sheep with increased gains as compared to control animals. Sea weeds imbibe many rare minerals from the sea. These rare minerals are transformed to cheated organic matter which can be absorbed by the animal.

Table 3. Chemical Composition of Seaweeds (DM basis)

Type	Ascophyllu Mnodosum	Laminaria digitata	Alaria esculenta	Palmarira palmate	Porphyra sp.	Porphyra Yezoensis	Ulva sp.
	Brown	**Brown**	**Brown**	**Red**	**Red**	**Red**	**Green**
Water (%)	70-85	73-90	73.86	79.88	86	ND	78
Ash%	15-25	73-90	73-86	15-30	8-16	7.8	13-22
Protein (%)	5-10	8-15	9-18	8-25	33-47	43.6	15-25
Fat (%)	2-7	1-2	1-2	0.3-0.8	0.7	2.1	0.6-0.7

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Tannins	2-10	0.1	0.5-6.0	ND	ND	ND	ND
Potassium	2-3	1.3-3.8	ND	7-9	3.3	2.4	0.7
Sodium	3-4	0.9-2.2	ND	2.0-2.5	ND	0.6	3.3
Magnesium	0.5-0.9	0.5-0.8	ND	0.4-0.5	2.0	ND	ND
Iodine	0.01-0.1	0.3-1.1	0.05	0.01-0.1	0.0005	ND	ND

ND – Not detected

Supplementation of livestock ration with sea weeds improve feed utilization and productivity, provide iodine and other trace elements, builds immunity and reduce incidences of mastitis (due to its active biological ingredients) besides improving the growth rate in heifers by boosting cobalt and selenium level and conception rate. In a recent study at National Dairy Research Institute, Karnal it was demonstrated that supplementation of sea weed (*Sargassum wettai)* @10% of total ration on DM basis can supplement adequate minerals and improved the milk production in sahiwal cows. Sea weeds have great potential for animals feeding, however, their harvesting and processing are the major constraints in their utilization.

Non Conventional Oilcakes for Animal Feeding

Oil cakes of mustard, groundnut, cottonseed, sesame etc are the conventional protein supplements in animal ration, However, some non-conventional oil cakes are also available in sizable quantity in the country as a result of oil extraction from oilseeds of mainly tree origin such as neem, mahuwa, karanj etc. The availability of these oil cakes and areas where these are available in plenty are presented in Table 4. These oilcakes are non-conventional as these are containing one or other incriminating factor, which restricts their utility as feed resource, however, research work carried out to develop the techniques to make them edible in animal ration by removing their incriminating factor completely or partially.

Table 4: Availability of Non- conventional Oilseeds in the Country

Oilseed	**Availability 000 ton**	**Oil %**	**States**	**Incriminating factor**
Mahwa	2176	35	AP, UP, MP, Bihar, Guj.	Sapoglucoside
			Orissa, TN, Karnataka	(Mowrin) Sapogenin
Karanj	111	27	AP, Karnataka, TN Bihar	Karanjin

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Kosum	90	33	Bihar, UP, MP, Orissa	Prussic acid
Neem	418	20	UP, AP, MP, TN.Karnataka	Nimbin and its
			Guj, Raj.	Derivatives
Sal	5504	13	MP, UP, WB, Bihar, Orissa	Tannius
Mesta (Thumba)	153	30	WB,Guj, Bihar	Fiber
Piludi	46	33	Guj., Raj., UP	Not identified
Nahar	6	40	Assam, WB, Orissa, Kar.,	Not identified
			Kerala, Maha	
Kokam	2	40	Maha, Karnataka	Not identified
Undi	4	30	Kerala, kar., Maha AP.,WB	Not identified
Dhupa	10	25	Karnataka, Kerala,TN	Not identified
Mango kernel	15	7	Whole India	
Rubber seed	3360	20	Kerala,TN	Prussic acid
Castor	407	37	Guj. AP Bhihar, Orissa	Ricin, Ricinin

Mudgal and singhal (1993)

The elaborate techniques for the removal of incriminating factors in non-conventional oilcakes have been described by Mudgal and Singhal (1993) besides presenting the data on the performance of animals fed on treated oilseed cakes based diets. In addition of these oilcakes, information has been provided about other protein rich non-conventional feeds such as oak kernel, tobacco seed cake, Plash seeds, Coffee seeds residue, babool seed, cassia tore seeds, taramica seeds etc. The non-conventional feed resources are important for livestock feeding and these must be preserved and processed to make their best, wherever it is possible and feasible.

Future Projections

CP availability in cattle and buffalo rations would continue to be deficient in future, however, magnitude of deficiency is like to narrow down in future .the projections revealed that the overall deficiency of CP was 46.5% in the year 2020 and likely to be narrow down to the magnitude of 31.3% by the year 2025. Similarly, the TDN deficiency was about 32.7% of requirement in the year 2016 and likely to be about 4.2% by the year 2025. Keeping in view these deficiencies, we have to mobilize protein resources for the livestock feeding to bridge the gap between requirement and availability for enhancing the livestock productivity. Since

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importing of the animal feed ingredients have remote possibility, therefore, we have to augment our feed resources and utilize them judiciously to improve the deficiency of nutrients. Sea weeds are having great potential as these are not being utilized currently. Besides this, we have to develop the systems for the preservation and storage of our feed resources and educate the farmers for the benefits of balanced feeding to avoid the feeding excess or deficient nutrients.

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