Maize can be replaced with wheat and rice in the diets of quails

The scientists at Department of Animal Nutrition, Punjab Agricultural University, Ludhiana, India, conducted experiments with an attempt to replace maize with wheat and rice kani from the diets of one week old 500 growing commercial quails. The birds were grouped into 10 groups of 40 birds in each in a way that average weight of all the groups was similar. Maize based control diet (T₁) was formulated. Four experimental diets replacing 25 and 50 per cent of maize of control diet with wheat (T₂ and T₃) or rice kani (T₄ and T₅) were formulated and fed ad libitum to a duplicate group of quails up to 5th week. Significant (P ≤ 0.05) effects of replacing maize with wheat or rice kani were recorded. Replacement of 25 per cent maize with wheat showed significantly (P ≤ 0.05) higher body weights than the control and the diet containing rice kani replacing 25 per cent of maize. The gain in weight of the quails fed control diet (T₁) and diets replacing 25 per cent of maize either with wheat or rice kani were significantly (P ≤ 0.05) less than the other dietary treatments. The quails fed diet replacing 50 per cent of maize with wheat showed significantly (P ≤ 0.05) more gain in weight than the quails fed diet replacing 50 per cent of maize with rice kani. No significant differences in the feed consumption due to dietary treatments were observed. It was concluded that wheat and rice kani both can replace 50 per cent of the dietary maize without affecting the growth performance of the quails [Sethi APS, Sikka SS and Chawla JS, Effect of partial replacement of maize with wheat and rice kani on the performance of egg type starter quails, Indian J Poult Sci, 2006, 41(1), 64-67].

Cowpea as protein source in the ration of growing sheep

Cowpea [Vigna unguiculata (Linn.) Walp.] is an important legume crop, grown extensively and the grains contain 200-300 g crude protein and about 600 g carbohydrate/kg seed. The protein content, total soluble sugars, starch and mineral matter vary from 179 to 275, 138 to 198, 507 to 670 and 31 to 46 g/kg, respectively; and richer in leucine, lysine, phenylalanine and sulfur containing amino acid than Arachis hypogaea Linn. seeds. The use of cowpea grain does not apparently present any serious nutritional problem, although protease inhibitors have been found in the seed. Thus, a growth trial of 120 days was conducted by researchers at Plant Animal Relationship Division, Indian Grassland and Fodder Research Institute, Jhansi, India on 15 growing sheep to evaluate cowpea grains as an alternate protein source of groundnut cake (GNC). Animals were divided in three groups of five animals in each, and offered dry mixed grasses (Cenchrus ciliaris Linn., Sehima nervosum (Rottl.) Stapf with small proportion of Chrysopogon fulvus (Spreng.) Chiov. and Dichanthium annulatum Stapf and concentrate mixtures to meet their nutrient requirement. In the concentrate mixture of G1 (control group), GNC was the sole source of protein, while in the G2 and G3 groups, 50 and 100% of GNC was replaced by cowpea grains on N basis. After 75 days of feeding, a metabolism trial (7 days) was conducted to determine the dry matter intake (DMI), nutrients utilization and N-balance. Rumen liquor and blood samples were collected to estimate the rumen and blood metabolites, respectively. For eating pattern, observations were recorded for three consecutive days. Change in body weight of animals was recorded at 15 days interval. Crude protein (CP) and cell wall polysaccharide contents were higher in GNC than in cowpea grain. DMI (g/kg W₀.75) was higher (P < 0.05) in G2 and G3 (85.8 ± 3.23 and 88.6 ± 1.40) compared to G1 (80.0 ± 2.44). In total DMI, consumption of roughage was higher (P < 0.05) in G3 than G1 and G2. Digestibility of nutrients (CP and fiber fractions) was similar amongst the dietary groups. Results deduced that inclusion of cowpea grains in concentrate mixture of lambs had positive effect on roughage intake, nitrogen-balance, nutritive value and body growth besides the rumen metabolites. It is thus concluded that cowpea grains can completely substitute GNC as protein source in concentrate mixture of growing lambs [Singh Sultan, Kundu SS, Negi AS and Singh PN, Cowpea (Vigna unguiculata) legume grains as protein source in the ration of growing sheep, Small Rumin Res, 2006, 64 (3), 247-254].
Feed/Fodder

**Maize may be replaced by wheat or bajra for egg production of Japanese quails**

The researchers at Department of Livestock Production and Management, CCS Haryana Agricultural University, Hisar, India worked on six weeks old 221 female Japanese quails (*Coturnix coturnix japonica*) to find out the effect of replacement of maize with wheat or bajra as an alternative source of energy in the diet and kept in battery up to 22 weeks of age. These birds were subjected to five treatment groups i.e. control (T1), replacing maize with 50 per cent bajra (T2), 75 per cent bajra (T3), 50 per cent wheat (T4) and 75 per cent wheat (T5). There was no significant effect on egg production and feed conversion ratio (kg of feed/dozen eggs) in quails by replacing maize with bajra or wheat. Feeding cost of producing one dozen eggs in T1, T2, T3, T4 and T5 groups were Rs. 3.59, 3.42, 3.33, 3.65 and 3.74, respectively. It may be concluded that maize can be replaced with bajra or wheat up to 75 per cent as an alternative source of energy in the ration of laying quails depending on the cost and availability of these ingredients. Moreover 75 per cent maize may be replaced by bajra for economic egg production in quails [Agarwal Seema, Gupta SC and Chopra SK, Replacement of maize by wheat and bajra on the egg production performance of Japanese quails, *Indian J Poult Sci*, 2006, 41(1), 87-90].

**Cotton seed feed is beneficial for buffalo heifersí growth**

The effect of different level of cotton seed in concentrate mixture (0, 30 and 60 parts) on growth performance, feed conversion efficiency and the feed cost per kg gain was studied for 120 days by the scientists at Department of Animal Production, Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan, India. The 18 surti buffaloes heifers were divided into 3 groups of six each (164.0 kg, 20-28 months age). The average daily gain in body weight in T1, T2 and T3 groups was 533, 583 and 654g, respectively that were significantly (P<0.05) higher in T3 group as compared to T2 and T1. Heart girth, abdominal girth and hip width were also significantly (P<0.05) higher in T3 groups as compared to T2 and T1 groups. The feed conversion efficiency (DMI/kg gain) was similar (P<0.05) in all the groups. The feed cost per kg gain was Rs. 43.76, 41.81, and 38.91 in T1, T2 and T3 groups, respectively. Thus, it may be inferred that inclusion of cotton seed in the concentrate mixture up to 60 per cent level have beneficial effect on growth rate with lowest feed cost per kg body weight gain [Jat HR, Chaudhary JL and Bugalia HL, Effect of feeding cotton seed on body measurements and feed conversion efficiency in growing buffalo heifers, *Indian J Dairy Sci*, 2005, 58(3), 198-200].
Maize (Zea mays Linn.) is an important cereal fodder crop of India. It has high production potentiality, wide adaptability and multiple uses. The time of sowing decides the duration of phenological stages and morphological developments resulting in fodder and grain yield. Estimation of chemical composition and nutritive value of fodder crop at different stages of growth will have practical importance as the proper stage at which the fodder crop has to be cut for feeding animal can be evaluated to obtain maximum nutrient. Thus a trial was conducted by researchers at Main Forage Research Station, Anand Agricultural University, Anand, Gujarat, India for this purpose on alluvial soils of Anand during kharif season. The treatments included three sowing dates in main plots, three harvesting stages (tasseling, silking and milking) and two varieties ('African Tall' and 'Gujarat Maize-2') in sub-plots were tested in split-plot design with three replications. The periodical observations were recorded and representative green fodder samples were collected immediately after harvesting and oven dried (75°C) for dry matter content. The results indicated that maize variety ‘African Tall’ may be sown on 30 June for obtaining higher crude protein and digestible dry matter production [Gour Vinay, Patel PC, Patel MR and Patel NN, Effect of sowing date and harvesting stage on forage of maize, Forage Res, 2006, 31(4), 267-268].

Opuntia from semi-arid regions in India contain crude protein, 92 g/kg dry matter, which is higher than the commonly used dry roughages (straw, strovers and grasses) in ruminant feeding. Although opuntia feeding with conserved fodder maintained adult sheep, however, high N loss in urine led to negative N balance. Therefore, additional N source is needed. Thus, researchers at Division of Animal Nutrition, Central Sheep and Wool Research Institute, Avikanagar, Rajasthan and Plant Animal Relationship Division, Indian Grassland and Fodder Research Institute, Jhansi, Uttar Pradesh, India carried out investigations to study the effect of supplementing opuntia cladodes in Cenchrus ciliaris Linn. hay-based diets with or without groundnut meal as N source on rumen fermentation, intake, digestion and urinary excretion of purine derivative in sheep.

Prickly pear cactus [Opuntia ficus-indica (Linn.) Mill.] and roughage (C. ciliaris)-based diets with or without an organic N source supplement (50 g groundnut meal) were compared to a roughage plus 200 g concentrate-supplemented diet. Intake, nutrient utilization, rumen fermentation, excretion of urinary purine derivatives and microbial N supply in Malpura hoggets were assessed. Sheep offered opuntia in combination with cenchrus hay had low feed intake, apparent digestibility of dry matter, crude protein and energy, nutritive value, plane of nutrition and N balance. However, 50 g groundnut meal supplementation improved these in a way that the values were similar to cenchrus plus 200 g concentrate supplemented diet. Excretion of purine derivatives and microbial N as well as microbial protein supply was poor in sheep on opuntia diets. It was concluded that opuntia cladodes and roughage diets require an additional supplementation of organic N source, which improve dry matter intake, apparent digestibility, nutritive value, plane of nutrition and ruminal N and NH₃-N. However, impaired microbial protein supply on opuntia diets needs further studies. The opuntia diets could be advantageous, when appropriate N supply is emphasized, as sheep may have similar digestion than those on common diets and may reduce considerably drinking water consumption [Misra AK, Mishra AS, Tripathi MK, Chaturvedi OH, Vaithyanathan S, Prasad R and Jakhmola RC, Intake, digestion and microbial protein synthesis in sheep on hay supplemented with prickly pear cactus [Opuntia ficus-indica (L.) Mill.] with or without groundnut meal, Small Rumin Res, 2006, 63 (1-2), 125-134].
Vegetable wastes as complete feed for goat bucks

Domestic use or export of fresh or processed fruits and vegetables leave huge amounts of wastes, which are being ploughed back into the field as soil conditioner, or are left on the road side posing great threat to the environment. Otherwise, if used judiciously, these wastes may serve as good sources of nutrients for livestock. Preliminary studies revealed that cabbage leaves, cauliflower leaves and pea pods are good source of crude protein (CP), have low neutral detergent fibre (NDF) and lignin contents, indicating their potential for higher voluntary dry matter intake. These wastes are available in bulk and that too at zero cost, as compared to conventional green fodder. Therefore, researchers at Department of Animal Nutrition, Punjab Agricultural University, Ludhiana, India assessed the nutritional worth of these vegetable wastes as complete feed for goat bucks. The nutritional worth of vegetable wastes like cauliflower (Brassica oleracea Linn. var. italic) leaves, cabbage (Brassica oleracea var. capitata Linn. f.) leaves, pea (Pisum sativum Linn.) pods and pea vines was assessed in comparison to conventional green oats (Avena sativa Linn.) fodder in bucks. Each of the vegetable waste, supplemented with minerals and common salt, was fed ad libum as complete feed, to 3 bucks (Beetle × Anglo Nubian × French Alpine; 6 years old of 62.6 ± 1.1 kg BW). The leaves of cauliflower and cabbage had low (P < 0.05) concentration of cell wall constituents, but high (P < 0.05) concentration of CP, except that CP of pea pods was comparable with cabbage leaves. Cabbage leaves had highest (20.6%) and pea pods had lowest (4.8%) concentration of water soluble sugars. Cauliflower leaves had highest concentration of phenolics (5.9%), comparable with cabbage leaves, but lowest concentration was observed in pea pods (0.3%). The fractionation of proteins indicated that vegetable waste in general had high concentration of water soluble (54-62%) and low concentration of alcohol soluble (8-9%) fractions. Digestibility of nutrients except that of NDF was comparable in cabbage and cauliflower leaves, but higher (P < 0.05) than in other vegetable wastes and conventional green oats fodder. The total purine derivatives excreted in urine were high (P < 0.05) in cauliflower leaves (1.5 mmol/kg BW0.75/day) followed by those fed pea pods, and lowest in those fed pea vines (0.29 mmol/kg BW0.75/day). Allantoin constituted the major portion (69-91%) of purine derivatives excreted in urine. Microbial protein synthesis was high (P < 0.05) in animals fed cauliflower leaves followed by those fed pea pods and low in bucks fed pea vines. The N-excretion as % of N-intake was lowest (P < 0.05) in animals fed pea pods (65.1%) resulting in significantly higher N-retention (24.5 g/day) and apparent biological value (BV), which was comparable to cauliflower leaves and green oats. In spite of maximum CP digestibility, the apparent BV was lowest in cabbage leaves. The metabolizable energy value of both cabbage and cauliflower leaves was significantly higher than that of pea vines. On the basis of chemical composition, digestibility of nutrients and efficiency of utilization of these nutrients, vegetable wastes, like cauliflower and cabbage leaves and pea pods, proved to be excellent unconventional feedstuffs for ruminants, equivalent to any conventional green fodder like green oats [Wadwa M, Kaushal S and Bakshi MPS, Nutritive evaluation of vegetable wastes as complete feed for goat bucks, Small Rumin Res, 2006, 64(3), 279-284].

Gliricidia leaves as fodder for goats

Gliricidia sepium (Jacq.) Walp. syn. G. maculata (H.B. & K) Steud. is a large leguminous tree, valued for its leaves as a source of green manure. The veterinary scientists at Hyderabad, India evaluated nutritional value of its leaves to determine their potential use as fodder for goats. During experiment six Osmanabadi bucks were fed on fresh Gliricidia tree leaves for period of 29 days to determine their nutritive value. The average dry matter intake was 4.07±0.24 kg/100 kg weight. The nutritive value of Gliricidia tree leaves for goats was 10.83±0.18% digestible crude protein and 66.19±0.74% total digestible nutrient. All the bucks showed positive balance for N, Ca and P. The bucks showed a daily body weight gain of 31.08±4.58 g/day on Gliricidia tree leaves feeding [Jadhav SS, Burte RG, Bhambare CV and Khadse RR, Nutritional evaluation of Gliricidia (Gliricidia maculata) tree leaves for goats, Indian J Dairy Sci, 2005, 58(3), 229-230].