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1. Recent Advances in Yak Nutrition Research (4-9 Sep 2000)

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The yak nutrition research group in Qinghai Academy of Animal and Veterinary Sciences has made systematical studies in the field of digestion metabolism (DIM), energy metabolism (EM), nitrogen metabolism (NM), nitrogen supplementary techniques (NST) and so on. They have made significant achievements in yak nutrition since 1985 as following topics: The rumen DIM was tested on 1 to 3-year-old yaks with permanent rumen fistula at different raising conditions. The DIM parameters such as pH, TCA-P, NH₃-N, VFA were determined. The results showed that each parameter was affected by the different raising conditions. The higher the nutritional level, the higher the main parameters, but the lower the pH value.

The fasting EM was tested on 1 to 3-year-old yaks with closed circuit respiratory mask and fasted at different altitudes, and relevant experiments of metabolism were included too. The results indicated that the fasting heat production (FHP) of yaks was stable at the altitudes of 2300 - 4300 meters and the zone of thermoneutrality was 8 - 14 °C. Yaks only started to produce heat when the air temperature dropped from -20 °C. At relative lower altitude (2300 meters), FHP = 302.13 kJ/kgW^{0.75}, Mem = 458 kJ/kg W^{0.75}, and Km = 0.66. These values were similar to the results of most previous studies on cattle at similar altitude, but different from cattle when yaks were kept at higher altitudes.

Under natural grazing condition, the growing yaks were systematically studied for their intake, digestion and utilization of protein in grasses during different phenological periods. Protein requirements for maintenance and growth were estimated and utilization of non-protein N in yaks was also tested. Nutrient fluctuation in grasses on the alpine frigid meadow was systematically surveyed. In view of studies above, the protein balance between different phenological periods, and between animal and pasture were discussed.

Taking into account of protein shortage in cold season, some direct nitrogen supplement methods were suggested. It was found, in the proper ratio of energy and protein, molasses-urea block could be given to yaks in the limitation for 200 days during the cold season. In this way the digestible protein for yaks could be increased by 35%, which basically kept the level for maintaining balance and subsequently reduced the bodyweight loss. During warm season, indirect nitrogen supplement such as nitrogen fertilizer could also get a positive effect.

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2. Grass and Legume Variety Trials in Eastern Tibet (4-9 Sep 2000)

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Approximately 28% (42,510,000 ha) of Qinghai's high elevation rangelands are considered to be in deteriorated condition. Revegetation of these degraded rangelands requires improved forage grasses adapted to the harsh Tibetan environment (Limbach 1998, Sheehy 1998). In May 1999, high altitude grass varieties of *Poa*, *Festuca*, *Deschampsia*, *Bromus*, *Stipa*, *Agrostis*, *Dactylis*, *Phleum*, *Elymus*, and *Agropyron* and legume varieties of *Medicago*, *Onobrychis*, *Astragalus*, and *Lupinus* were broadcast at 2 replicate locations in Guoluo Prefecture: Dawu Seed Farm (3512 m), Maqin County and Jimei Research Area (3968 m). Each location contained 75 plots (3-m by 3-m) with varieties randomized within 3 blocks, 25 plots to a block (= replicates); 2-way analysis of variance (ANOVA), randomized block design. Seedlings were monitored for emergence and survival. Seeds were also analyzed in the laboratory for germination characteristics. ANOVA showed significant differences ($P < 0.0001$) among varieties for seedling emergence and survival. Differences between locations were significant ($P < 0.0001$) for emergence, though marginally significant ($P = 0.054$) for survival. Coefficients of determination (R^2) ranged between $R^2 = 0.78$ and 0.86 . Best varieties: *Poa compressa*, *Poa pratensis* var. *alpinum*, *Dactylis glomerata*, *Festuca ovina*, *Agrostis alba*, *Phleum pratense*, *Deschampsia caespitosa*, *Trisetum flavescens*, *Elymus trachycaulus*, Tibetan Mixture, and two varieties of *Medicago sativa*. Comparisons between the field and laboratory indicated that laboratory germination tests do not predict success in the field. Also, differences in performance within species points out that different genotypes (seedlots) of the same species can perform very differently.

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3. Availability and Utilization of Shrubs As the Protein Sources for the Yaks Grazing on Alpine Grass Meadow of Tibetan Plateau, China (4-9 Sep 2000)

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The distributions of alpine shrubs on Qinghai-Tibetan Plateau of China are reviewed based on information available, the interaction between alpine shrubs and yaks, and the roles of alpine shrubs in yak farming system are discussed. Based on the nutritional evaluation and beneficial analysis, the utilization of shrubs as protein supplements for the grazing yaks on alpine grass meadow are proposed.

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4. Potential of Alpine Shrubs in Qilian Mountain Regions (4-9 Sep 2000)

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The seasonal dynamics of the concentrations of total extractable condensed tannins (CT), crude protein (CP), acid detergent fiber (ADF) and crude ash (CA) of five shrubs growing in the alpine of Qilian Mountain regions of Gansu, China were determined from June to September, 1999. And the DM disappearance of these shrubs in yak rumen was also estimated. The results showed that different feeding shrubs had different concentrations of CT declining markedly along with the maturity. The concentrations of CT varied from 58.10 to 102.6 g/Kg DM in June. While in August, almost all declined to under 50 g/Kg DM. The CP contents ranged from 13.91% to 23.30% in August which also declined along with the maturity. The changes of the ADF and CA contents were inconsistent among the shrubs, except for the gradual increase of ADF content in *Caragana jubata* and gradual decrease in *Spiraea alpina* in whole season. The DM digestibility of the *Salix.*, *Spiraea alpina* and *Dasiphora fruticosa* was 69.85%, 63.00% and 65.68% in August, respectively, which was somewhat higher than that in June and July. Negative relationships between 48h dry matter degradability and the CT content ($r = -0.24$, $P > 0.05$) and ADF content ($r = -0.065$, $P > 0.05$) were detected. By conclusion, the shrubs are good feed sources in the alpine region due to their high content of protein, although the CT content has negative influence on DMD. It is suggested that the best utilization season of shrubs should be after August.

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5. Urea Enriched Finger Millet (*Eleusine Coracana*) Straw: Effect of Feeding on Yak (4-9 Sep 2000)

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It is known since long, that simple nitrogenous compound are broken down in the rumen by the microbes and utilized to build microbial protein, yet opinion differ on the utilization of such nitrogenous compound. Urea treatment to straw increases the feeding value of straw by increasing the digestibility and intake. The other factors affect the feeding value of urea enriched straw. The present experiment was designed to find the suitability of the use of urea enriched straw in yak. Three yaks were subjected to feeding trial with three ration i. e. Phase I: millet straw, Phase II: 200g urea/30kg straw and Phase III: 400g urea/30 kg straw.

Urea treatment did not increase the dry matter intake in yak. The dry matter digestibility percentages (58.6, 58.6 and 61.2) were almost similar. Crude protein digestibility (%), digestible crude protein (kg/ 100 kg DM) and nitrogen balances were significantly affected between the three rations. DCP (kg/100kg DM) increased from 2.09 to 5.36 and then to 8.74. The results of the biochemical characterization of the SRL and serum also revealed the differences among the animals. The treatment of straw with urea effected total nitrogen & TVFA in SRL and urea in serum. Ammonia nitrogen in SRL and serum glucose remained unaffected.

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6. Rumen Ciliate Protozoal Fauna of Yak (*Bos Grunniens*) in China With the Description of *Entodinium Monuo* n.sp. (4-9 Sep 2000)

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Rumen ciliate species and composition were surveyed on the domestic yaks kept in Tibet, Sichuan and Inner Mongolia, China. As a result of survey, 12 genera including 36 species with 18 formae were identified. The species compositions were slightly different among the different keeping areas of yaks, i.e. that of Tibet was the simplest, in contrast, that of Inner Mongolia was the most abundant and similar to that of the cattle kept in the same area, suggesting that the rumen ciliate of yaks is affected by that of cattle kept together or in neighboring area, and the yaks of Tibet may have the most similar ciliate composition to that of the wild yaks. A new species of the genus *Entodinium* was recognized from the yaks in all areas examined with high frequency of appearance, and then it was described as *Entodinium monuo* n.sp. This new species was not detected from the cattle fed together with yaks in Inner Mongolia. The generic composition was similar to each other in yaks kept in respective areas, and *Entodinium* was the most predominant, which values were 51.9% to 61.0%. The ciliate density was estimated as 10⁵/ml on average in every host animals kept in respective areas.

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7. Peptide and Amino Acid Metabolism in the Gastrointestinal Tract of Yaks (4-9 Sep 2000)

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The present experiment was conducted to quantify the net fluxes of both free (FAA) and peptide amino acids (PAA) across the mesenteric and stomach portions of the portal-drained viscera (PDV) of three yak cows (172.3±18.6 kg, BW) fitted with sampling catheters in the portal vein, mesenteric artery and mesenteric vein prior to its convergence with the gastrosplenic vein. Blood flow was determined by measuring the dilution of para-aminohippurate (PAH) infused constantly into a distal mesenteric vein. Amino acids in the deproteinized plasma were analysed before and after acid hydrolysis. The increased amino acids after acid hydrolysis were considered as PAA. Portal blood flow was 389 l/hr or 2.32 l/hr kg BW, of which 37% was contributed by the mesenteric vein. There was net appearance of a large quantity of PAA across PDV, which accounted for 92% of the total nonprotein amino acid flux. Net release of PAA and FAA in stomach viscera (SDV) accounted for 78% and 42% of the net release in PDV, respectively. These results suggest that in yaks, peptide possibly is the primary form of amino acid absorption, and that the stomach area probably is the major site of peptide absorption.

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8. Changes of Several Kinds of Nutrition Factors in Yak's Living Environment and the Mineral Concentration in its Circulation (4-9 Sep 2000)

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This paper reported the concentrations of seven mineral elements in yak serum, herbage, and water resource in different seasons of summer, autumn and winter from samples collected from areas around the Qinghai Lake in Qinghai Province. Meanwhile, here also studied the herbage nutritional composition. The results suggested that the mineral element contents and the herbage nutritional composition changed on a seasonal pattern. In yak serum, the sodium (Na) concentration varied from 0.291 to 0.034 mg/mL that was further lower than the normal value. In herbage, the ratios of calcium (Ca) to phosphorus (P) ranged from 4.06:1 to 7.47:1, and of potassium (K) to sodium from 30:1 to 27:1 which indicated that yaks in the area were in a nutritional status of shortage of Na and P, and of a high level of K. On the other hand, the nutritional composition of herbage varied from seasons, especially the protein content in the herbage withered and sampled in February was as low as 31.14% of that in the puerile stage herbage sampled in June. Therefore, yaks were at the condition of shortage of nutrition during the winter time due to the significant loss of the protein in the withered herbage.

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9. Some Problems from Study on Plants Edible by Yaks (4-9 Sep 2000)

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Totally 25 species of plants edible by yak were investigated in this experiment. Nine of them are of excellent edibility, 12-good, and 4-medium. The occurrence of most edible plant by yak was 41.6 to 100% on the pasture plot, but selective edibility was 3 to 27.9%. However, 3.8 to 27.9% of selections were observed for the plants with excellent edibility, such as *Trifolium repens*, *Medicago falcata*, *Festuca supina sehur*, *Festuca lenesis*, *Phleum phlemites*, *Stipa glareosa* and *Poa pratensis*. Experiment results showed that 4.5 to 26.3% of selections were noted for the plants with good edibilities such as *Stipa sibirica*, *Alopecurus brachystakyus*, *Alopecurus venticosus*, *Cleistogenes uguakroca*, *Poa tibetica* *Trifolium bupinastek*, *Melilotus entatus*, *Melilotus suaveolens*, *Vicia amoona fisch*, *Biomus inermus leyss*, *Carex capiliformis*, *Carex melanthea fermis lint*.

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