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Yak rearing on high altitude pastures of northeastern Himalaya of India: Their utilization strategies and rejuvenation

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Introduction
Yak rearing on alpine pastures is the main occupation of the highland pastoral nomads (Brokpa and Dokpas) of north-east (NE) India. These pastoral nomads living in the remote mountains solely rely on high altitude pastures for their nutritional and livelihood security because of virtual existence of agricultural activities in this area. They rear yaks under transhumance and utilize various pastures while migrating from low land winter pastures to high altitude alpine pastures during summer. Therefore, the temperate and alpine pastures are the major feed resources for the yaks. The indiscriminate use of pastures and impending climate change results in their degradation that may affect the productivity of the animals reared on them. In this study, an attempt was made to evaluate the status of pastures used for yak rearing in NE India and an initiative has been taken to test the adaptability of palatable high yielding temperate grasses for pasture development and rejuvenation.

Materials and Methods
A survey was conducted to assess the status of alpine and temperate pastures and yak rearing practices of northeast Himalayan region of India (i.e. Arunachal Pradesh and Sikkim). Samples of pasture biomass (composite grasses) and fodder trees of different yak rearing areas were collected and evaluated for their nutritional composition. To assess the adaptability and biomass production potential of high yielding temperate grasses and legumes for establishing and rejuvenating the degrading pastures, experimental plots were developed at different field sites, varying from 1850m to 3650m altitude in yak rearing areas of Arunachal Pradesh and Sikkim.

Results and Discussion
Field survey revealed that the yak rearing pastoral nomads (Brokpas and Dokpas) practices two-pasture utilization strategy viz., summer and winter pasture grazing. Yaks graze at summer pastures from May to September, when high altitude pastures are lush after melting of snow and onset of full vegetative growth of the herbages. During winter (October to March), high altitude ranges are covered under snow and animals return to low altitude pastures and graze the partially dried biomass of temperate grasses, shrubs and fodder trees (Chatterjee, 2003). It was also observed that the quality of high altitude pastures is degrading due to increased livestock pressure per unit pasture area, over grazing, infestation of unpalatable wild weeds (Rumex spp.), indiscriminate use of pastures and changing climatic scenario.

Some of the natural edible grass species found in yak rearing region of NE-India are Kyllinga monocephala, Poa annua, Fimbristylis squarrosa, Eragrostis spp. Alopecurus spp., Pogonatherum crinitum, Eriochloa spp. etc. The proximate composition of the pooled pasture grasses collected from different yak tracts of Arunachal Pradesh is given in Table 1.

| Table 1 Average per cent proximate composition of pasture grass biomass (DM basis) collected from different natural pastures of Arunachal Pradesh |
|---|---|---|---|---|---|---|
| Pasture location | Altitude (m above msl) | OM (organic matter) | CP (crude protein) | CF (crude fibre) | EE (ether extract) | TA (total ash) | NFE (Nitrogen free extract) |
| Mandalap Phudung | 2800 | 91.42±1.25 | 9.58±2.54 | 18.50±1.22 | 2.86±1.21 | 8.58±0.63 | 60.48±0.85 |
| Lubrang | 3000 | 97.60±0.79 | 5.35±3.10 | 20.85±2.00 | 1.12±1.10 | 2.36±1.09 | 70.32±1.02 |
| Chander | 3000 | 92.91±1.96 | 12.06±5.33 | 23.57±3.24 | 2.92±0.57 | 7.09±1.96 | 54.35±0.48 |
Basu et al. (2005) also reported similar values for the average crude protein; ether extract and crude fibre contents of 11.9, 1.65 and 22.89%, respectively for the composite pasture herbage of Sela-pass (at 4242m above msl) in Arunachal Pradesh. They identified fourteen grass species and no legume growing on the grassland extensively grazed by the yaks. Hills of north-eastern Indian Himalayas are endowed with various species of fodder trees. Yaks are fed with the fodder tree leaves during winter feed scarcity. Some of the commonly used fodder trees are Buddleja asiatica, Symplocos racemosa, Salix humbolditiana, Acer cambelli, Costanopsis spp., Ligustrum myrsinites, Acer hookeri, Berberis spp., Quercus wallichiana, Embelia spp., Artocarpus lakoocha, Ficus spp., Reevesia pubescens, Bambusa spp. etc. Among these fodder trees, Salix is fast growing tree that can also be grown at high altitude arid region along with other shrubs. The average crude protein content of fodder tree leaves varied from 6.81 to 19.43 % (DM basis) and the highest values were found in Quercus wallichiana and Reevesia pubescens (Paul et al., 2010).

To assess the adaptability and biomass production, various temperate grasses and legumes viz.,, cocksfoot (Dactylis glomerata), perennial ryegrass (Lolium perenne), tall fescue (Festuca arundinacea), Timothy (Phelum pretense), white clover (Trifolium repens) and red clover (Trifolium pretense) were tested in experimental plots. Results of experimental trial revealed that Dactylis glomerata was the most suited, fast growing and high yielding temperate grass. Biomass yield of Dactylis glomerata grown in experimental plots at different locations is depicted in Table 2. Whereas, Lolium perenne and Trifolium repens were the other grass and legume species that were comparatively low yielding, but suitable for establishing grass-legume based pastures.

Table 2: Adaptation, growth and biomass yield (first cut) of Dactylis glomerata grown in different experimental plots

<table>
<thead>
<tr>
<th>Location</th>
<th>Altitude (msl)</th>
<th>Average number of stems per plant hill</th>
<th>Average plant height (in inch)</th>
<th>Fresh biomass (kg/m²)</th>
<th>Plant growth and adaptation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rabum, North Sikkim</td>
<td>1850 m</td>
<td>24</td>
<td>21.0</td>
<td>0.160</td>
<td>Excellent</td>
</tr>
<tr>
<td>Lachung, North Sikkim</td>
<td>2600 m</td>
<td>18</td>
<td>18.0</td>
<td>0.132</td>
<td>Good</td>
</tr>
<tr>
<td>Zeema, North Sikkim</td>
<td>3000 m</td>
<td>23</td>
<td>18.0</td>
<td>0.140</td>
<td>Very good</td>
</tr>
<tr>
<td>Yhathang, North Sikkim</td>
<td>3650 m</td>
<td>6</td>
<td>7.0</td>
<td>-</td>
<td>Poor growth</td>
</tr>
<tr>
<td>Lhagyala Gonpa, Arunachal Pradesh</td>
<td>2800 m</td>
<td>26</td>
<td>30.9</td>
<td>0.273</td>
<td>Excellent</td>
</tr>
<tr>
<td>Merkmu, Arunachal Pradesh</td>
<td>3000 m</td>
<td>56</td>
<td>29.6</td>
<td>0.825</td>
<td>Excellent</td>
</tr>
</tbody>
</table>

Conclusion
It is concluded that the alpine and temperate pastures are major feed resources for yaks reared by transhumant nomads. Therefore, degrading high altitude pastures could be rejuvenated by introducing suitable temperate grasses and legumes species like Dactylis glomerata, Lolium perenne and Trifolium repens for sustainable yak husbandry practices. Lower altitude pastures could be rehabilitation by establishing silvo-pastures with suitable fodder trees to supplement feed for yaks during winter scarcity period.

References


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