COMPARATIVE STUDY BETWEEN THE PERCENTAGE OF PROTEIN IN FOUR COMMON GRASSES OF BHOPAL DURING RAINY SEASON

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ABSTRACT
There is an evidence that use of internal nitrogen stores is important for survival and competitive ability of grasses. Plant nitrogen sources can be divided into two different categories: protein and non-protein nitrogen. Average Protein % in protected land i.e. ungrazed was found greater as compared to that of the grazed area during the growing and vegetative period i.e. between July to Sept.

Key Words: Protein, Nitrogen, Grasses, Vegetative Season, Defoliation.

INTRODUCTION
The persistence and spreading of perennial and annual grasses have been attributed to several factors. Its remarkable ability to survive extremely low light condition and its fast growth response to improved light conditions was investigated previously. One of the potential of grass is its important trait could be the accumulation of storage compound and their effective use for fast re-growth in early spring. A role of storage compound in plant survival and re-growth after cutting was extensively studied with forage species but the information on wild species is very limited. The role of carbohydrates, which was usually the prevailing storage compounds in plants was originally considered as predominant for plant re-growth. However several late experiments showed only weak or no relationship between the amount of storage carbohydrates and the rate of re-growth.

On the other hand there was found close positive correlation between protein or Nitrogen concentration in remaining organs and the re-growth rate. The ability of plants to take up and assimilate inorganic nitrogen is lowered or stopped both in early spring and after defoliation and the plant demand for protein is met by the N uptake from soil after the restoring of positive Carbon balance of the whole plant. Thus the availability and mobilization of Nitrogen reserve must be considered as an important factor in survival and competitive ability in both annual as well as perennial plants. Nitrogen is primarily stored in the form of storage protein, amino acid & nitrates. All types of N storage compound often vary seasonally in their concentration. High amplitude in amino acid content during vegetations compared to protein and close correlation between the depletion rate of amino acid are the main N storage compound. In comparison to storage protein amino acids are readily available for growth process and their good solubility facilities rapid mobilization of N in spring as well as after defoliation.

Protein
The role of protein in N storage was underestimated for long time. The identification

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and functions of vegetative storage proteins were recently summarized in two reviews focused on woody plants\(^1\) and herbaceous species\(^2\). Cys and Bewley (1990a) provided the evidence of utilization of VSP’s in herbaceous plants and defined the following criteria for recognizing of VSPs:

1. Protein that display preferential synthesis during development of storage organs.
2. Proteins that are depleted from storage organs during reactivation of meristem and
3. Protein whose abundance greatly exceeds that of other proteins in perenniating organs.

Storage proteins may serve as an example of difficulties in classifying storage compounds. The same protein may have in some case both the storage and metabolic role, especially as an enzyme.\(^5\) Moreover vegetative storage protein are usually not located in specific storage compartments. Storage of Nitrogen in form of catalytically active protein requires high energy loss in comparison to other type of N decomposition of storage protein needs then less energy than reduction of nitrate.\(^7\)

The aim of this contribution is to show comparison in concentration of protein in between four common grasses namely *Apluda mitica, Themeda quadravalvis, Cynadon dactylon* and *Eragrostis gangitica* in grazed and ungrazed land of Bhopal forest.

**MATERIAL AND METHODS**

Samples of *Apluda mitica, Themeda quadravalvis, Cynadon dactylon* and *Eragrostis gangitica* are collected from grazed land near MANIT campus and protected i.e. ungrazed land near Manav Sangralaya for consecutive 3 years (2003-2005). Average annual rain fall during the study period of 3 years for (July – Sept) growing / vegetative season was 173.4 mm. Humidity was 80% and temperature was 30°C (max) & 21.8°C (min), soil at the study site was loamy site, well drained, black, red, pH slightly acidic 6.8.

In each of the experimental plots 10 to 20 plants/ grasses were collected to get sufficient amount of biomass for chemical analysis. Immediately after sampling the plants were divided into root & shoot parts. The samples were dried at 80°C for 24 hours as it contained lots of moisture. The micro-kjeldahl nitrogen was calorimetrically for all shoot & root samples and crude protein estimated by NX6.25.

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**Graphical Representation of Yield of Grasses in a One Season**

![Graph showing yield of grasses over a season](image)
RESULTS AND DISCUSSION

1. SHOOT

After consecutive 3 years study of grasses, at their vegetative growth period the average the content of protein % was highest in ungrazed area. The Eragrostis gangitica of ungrazed contained 21% of protein, the highest among the 4 grasses. The percentage of Cynadon dactylon was 19% and that of Themeda quadravalvis and Apluda mutica were 14% and 11.02% respectively in their shoots.

Table 1
% Protein in Shoot

<table>
<thead>
<tr>
<th>No</th>
<th>Species Name</th>
<th>Average Grazed % Protein</th>
<th>Average Ungrazed % Protein</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Apluda mutica</td>
<td>7.8</td>
<td>11.02</td>
</tr>
<tr>
<td>2</td>
<td>Themeda quadravalvis</td>
<td>11</td>
<td>14</td>
</tr>
<tr>
<td>3</td>
<td>Cynadon dactylon</td>
<td>10.23</td>
<td>19</td>
</tr>
<tr>
<td>4</td>
<td>Eragrostis gangitica</td>
<td>10.03</td>
<td>21</td>
</tr>
</tbody>
</table>

% Protein in Root

<table>
<thead>
<tr>
<th>No</th>
<th>Species Name</th>
<th>Average Grazed % Protein</th>
<th>Average Ungrazed % Protein</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Apluda mutica</td>
<td>2.8</td>
<td>3.29</td>
</tr>
<tr>
<td>2</td>
<td>Themeda quadravalvis</td>
<td>10.06</td>
<td>10.07</td>
</tr>
<tr>
<td>3</td>
<td>Cynadon dactylon</td>
<td>4.37</td>
<td>9.1</td>
</tr>
<tr>
<td>4</td>
<td>Eragrostis gangitica</td>
<td>4.43</td>
<td>8.16</td>
</tr>
</tbody>
</table>

There was approximately difference of 10% protein value in Cynadon dactylon & Eragrostis gangitica species found in protected and unprotected land & this can due to the grazing. Grazing leads to defoliation and has many affected on a stand of grass. The reserve protein are usually located in roots and rhizomes of perennial grass (Cynadon dactylon) and in seeds & roots of annual grass like (Apluda mutica, Themeda quadravalvis). The leaf and stem protein represents the actively metabolizing matter of living plant and leaves contain a high level of protein. During early vegetative growth in July-Aug the protein is maximum and the grazing period is also the same. When the grass is being grazed, the shoot left ungrazed tries to again grow in the favourable condition. As they grow, there occurs the mobilization of reserved proteins and grass is in a vulnerable position and recovery is dependent on how close the cutting occurred. The new growth has occurred from dormant but situated close to the crown. Similarly, if leaf falls due to any exposure of wind, water or animal, protein present in grass as the reserve is used for new growth. During normal leaf senescence, leaf protein breaks down to amino acid and are mobilized back to plant. But due to defoliation, there is immediate lose of protein and no gain. So this is clearly seen in grazed field where there is almost difference of 10% of protein in grasses like Cynadon dactylon & Eragrostis gangitica as they are food for animals. In Themeda quadravalvis and Apluda mutica species, the difference is very little of 2 to 3% as they are the food till they are green and decrease can be just due to any injury to plant which results in the protein break down.
Roots

There is no defoliation or mechanical injury in the roots of the 4 species of grass but, there too change is the percentage was seen. But as compared to shoot the difference seen less than of 4% in Cynadon dactylon and Eragrostis gangitica and less than 1% in Apluda mutica and negligible in Themeda quadravalvis of grazed grass. The reason attributed to this is due to the over grazing reduces the percentage of protein in the shoot, which then stimulates the breakdown of protein into amino acid and later utilized for further growth of plant. Storage roots provide the reserved food protein for the growth of the new grass. The soil is the main source of Nitrogen as during rainy reason, the lighting also brings N to the soil through water. So the Nitrogen is continuously being taken from it.

Percentage of Crude in Shoot Spices of Grasses

Percentage of Crude in Root Spices of Grasses
CONCLUSION

So grasses are most negatively affected when grazed during their reproductive period and least affected during dormancy. Spring growth can be increased in grazed area plants are given an opportunity to re-grow without being used again. Same results were obtained that grazing decreases the percentage of protein in the grass plant.

REFERENCES


