Study of chemical composition and mineral content of sun dried Azolla pinnata

Shailesh Kumar Gupta, Ramesh Chandra, Dipak Dey, G Mondal and Kuladip Prakash Shinde

Abstract

In present study sun dried sample of Azolla pinnata was used for chemical composition analysis. The proximate composition, fibre fractions of cell wall constituents and minerals composition were estimated by standard methods. The proximate composition and cell wall constituent and trace minerals (Cu, Zn and Fe) of sun dried Azolla were estimated by standard methods. Dry matter, Crude protein, Organic matter, Ether extract and Total ash were 90.00±0.77, 22.05±0.72, 81.05±0.44, 3.25±0.76 and 18.94±0.31. The NDF, ADF, hemicellulose, lignin and cellulose content were 48.25±0.48, 37.14±0.11, 11.11±0.29, 8.07±0.25 and 28.87±0.64. The Zn (ppm), Cu (ppm), Mn (ppm), Fe (ppm) and Ca (%) was 30.02±2.39, 26.29±1.41, 348.17±7.26, 533.12±96.56 and 0.33±0.03.

Keywords: Chemical composition, mineral content, sun dried Azolla pinnata

Introduction

Azolla is an aquatic fern. Azolla forms a symbiotic relationship with blue green algae, Anabaena Azollae which fixes atmospheric nitrogen (N2). Azolla is a source of protein, minerals, vitamin, and trace minerals. Azolla is a good source of protein for livestock, poultry and aquaculture species. It also contains certain compounds such as carotenoids, bio-polymers, and probiotics. Azolla is a rich source of essential amino acids. Azolla is a good source of minerals like calcium, phosphorous, magnesium, potassium, iron, zinc etc. Due to nutritional properties Azolla is used for feeding in animals (Parthasarathy et al., 2003; Reddy, 2011; Chatterjee et al., 2012) [22, 26, 10].

Materials and Methods

The experiment was done at National Dairy Research Institute, Karnal, Haryana. For production of Azolla prepared 3 x 1 m size pit with help of bricks by removing roots and other plant. The sheet was spread and poured 15 kg of soil or make a soil bed 1 to 2 cm. thick evenly. Add water in pit upto height of about 10-15 cm. Spread out the sheet evenly without any holes and fix the edges either with mud and bricks. Pour approx 15 kg of soil or make a soil bed 1 to 2 thick evenly. Around 2.5 kg. cow dung and 15 -20 gm. of SSP mixed in 10 litter of water to make slurry and poured into water bed. Then added about 100-150 g fresh A. pinnata culture. Harvesting was done after totally covered of bed by Azolla within 5 to 7 days. Just after harvesting washing was done with clean water. Sun drying of Azolla was prepared by removal of maximum moisture. Powdered dried Azolla made by crushing with the help of hands.

The six samples of dried Azolla pinnata were used for chemical composition analysis. The percentage of Dry Matter (DM), Organic matter (OM), Crude Protein (CP), Ether Extract (EE) and Total Ash in sun dried Azolla were determined according to AOAC (2005) [4]. The fibre fractions of cell wall constituents such as NDF, ADF, Cellulose, Hemicellulose and Lignin were estimated as per Van Soest et al. (1991) [31]. The important trace minerals (Cu, Zn, Mn and Fe) and Ca were estimated by Atomic absorption Spectrophotometer. AAS uses acetylene as a fuel and air as an oxidant, specific hollow cathod lamp were used for determination of each element. The procedures described in AAS data book (1988) was followed.

Result and discussion

The proximate composition, fiber content and minerals content of Azolla pinnata was presented in Table 1 to 3. The wide variation in CP, EE, TA, OM, TDN, NDF, ADF, Hemicellulose, Cellulose and Lignin content of sun dried Azolla may be due to soil structure, environmental factors and management.
Proximate composition of sun dried Azolla Pinnata

The proximate composition of sun A. pinnata was presented in Table 1. The dry matter content (%) of sun dried A. pinnata was 90.00±0.77 which was similar to the values reported by Cherrell et al. (2014) [12] i.e. 89.73%, Nvanath (2015) [13] i.e. 89.91% and D. Srinivas et al. (2012) [11] i.e. 93.00% in sun dried Azolla.

Table 1: Proximate composition of sun dried Azolla Pinnata (on DMB)

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Nutrients</th>
<th>Percent (DM%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Dry matter</td>
<td>90.00±0.77</td>
</tr>
<tr>
<td>02</td>
<td>Crude Protein</td>
<td>22.05±0.72</td>
</tr>
<tr>
<td>03</td>
<td>Organic matter</td>
<td>81.05±0.44</td>
</tr>
<tr>
<td>04</td>
<td>Ether extract</td>
<td>3.25±0.76</td>
</tr>
<tr>
<td>05</td>
<td>Total Ash</td>
<td>18.94±0.31</td>
</tr>
</tbody>
</table>

The crude protein content (% DM) of sun dried A. pinnata was 22.05±0.72 which was almost similar with values observed by D. Srinivas et al. (2012) [13], Ara et al. (2015) [5] and Anitha et al. (2016) [8]. The higher CP content was reported by Indavra and Ravi (2014) [16] and Roy et al. (2016) [27]. The lower values have been reported by Tamang and Samanta (1993) [30], Ali and Lessons (1995) [2], Alalade and iyai (2006) [1] and Sujatha et al. (2013) [29]. The organic matter content (%) DM of sun dried A. pinnata was 81.05±0.44 which was almost similar to the values observed by Chatterjee et al. (2013) [11] i.e. 80.53±0.59%. The lower values in Azolla reported by Khare (2014) [16], Cherrell et al. (2014) [12] and D. Srinivas et al. (2012) [13].

The ether extract content (% DM) of sun dried A. pinnata was 3.25±0.76. The EE value 3.35%, 3.33% and 3.24% were reported by Ghodake et al. (2011) [14], Khare et al. (2014) [17] and Gupta (2017) [15]. The lower values have been reported by D. Srinivas et al. (2012) [13] and Kumar (2015) [19]. The higher ether extract content was reported by Arvindraj et al. (2012) [6], Mandal et al. (2012) [20] and Cherrell et al. (2014) [12]. In present study Total Ash (TA) content (% DM) of sun dried A. pinnata was 18.94±0.31 which was found closer with findings of Ara et al. (2015) [5] i.e. 18.10% and Rawat et al. (2015) [25] i.e. 18.80%. Ali and Leesoon (1995) [2], Cherrell et al. (2014) [12] and Bhattacharyya et al. (2016) [8] reported higher values (36.10%, 24.26% and 32.25%) than present findings. The lower total ash in Azolla reported by Basak et al. (2002) [7], Ghodake et al. (2011) [14] and Mandal et al. (2012) [20].

Fibre fractions of sun dried Azolla Pinnata

The Fibre fractions of sun Azolla pinnata was presented in Table 2. NDF content (% DM) of sun dried A. pinnata was 48.25±0.80. Similar NDF value was reported by Sharma (2013) [28] i.e. 46.89%, Querebin et al. (1986) [24], Tamang and Samanta (1993) [30] and Arvindraj et al. (2012) [6] reported higher NDF values (67.80, 67.70 and 68.43).

Table 2: Fibre fractions of sun dried Azolla Pinnata (%)

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Nutrients</th>
<th>Percent (DM%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>NDF</td>
<td>48.25±0.48</td>
</tr>
<tr>
<td>02</td>
<td>ADF</td>
<td>37.14±0.11</td>
</tr>
<tr>
<td>03</td>
<td>Hemicellulose</td>
<td>11.11±0.29</td>
</tr>
<tr>
<td>04</td>
<td>Lignin</td>
<td>8.07±0.25</td>
</tr>
<tr>
<td>05</td>
<td>Cellulose</td>
<td>28.87±0.64</td>
</tr>
</tbody>
</table>

The lower values of NDF in Azolla i.e. 23.16%, 40.36% and 36.88% were reported by Buckingham et al. (1978) [9] and Alalade and Iyai (2006) [1]. The ADF content of sun dried A. pinnata was 37.14±0.11 which was close with the findings of Arvindraj et al. (2012) [6] and Chatterjee et al. (2013) [11]. The higher ADF values in different spp. of Azolla was reported by Querebin et al. (1986) [24], Tamang and Samanta (1993) [30] and Indira and Ravi (2014) [16]. Buckingham et al. (1978) [9] and Gupta (2017) [13] reported lower ADF values than present findings (26.58, 25.24 and 25.18%).

Hemicellulose content of sun dried A. pinnata was 11.11±0.29. Tamang and Samanta (1993) [30], Ghodake et al. (2011) [14] and Chatterjee et al. (2013) [11] reported higher values (15.60, 19.59 and 17.80%) than present findings. Alalade and Iyai (2006) [1] reported lower value i.e. 10.20%. Cellulose content of sun dried A. pinnata was 28.87±0.4 whereas Srinivas et al. (2012) reported higher value (36.70%) than present findings. The lower values of cellulose in different spp. of Azolla was reported by Tamang and Samanta (1993) [30], Ghodake et al. (2011) [14] and Arvindraj et al. (2012) [6] reported lower values of cellulose. Lignin content of sun dried A. pinnata was 8.07±0.25 which was found closer with the findings of Chatterjee et al. (2013) [11] i.e. 8.96±0.56. The higher values reported by Querebin et al. (1986) [24] i.e. 27.40% and Alalade and Iyai (2006) [1], i.e. 28.24%.

Mineral composition of Azolla pinnata

The average mineral content of sun dried A. pinnata are presented in Table 3. The average values of Zn (ppm), Cu (ppm), Mn (ppm), Fe (ppm) and Ca (%) was 30.02±2.39, 26.29±1.41, 348.17±7.26, 533.12±96.56 and 0.33± 0.03 in sun dried A. pinnata.

Table 3: Mineral composition of sun dried A. pinnata

<table>
<thead>
<tr>
<th>Minerals</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zn (ppm)</td>
<td>30.02±2.39</td>
</tr>
<tr>
<td>Cu (ppm)</td>
<td>26.29±1.41</td>
</tr>
<tr>
<td>Mn (ppm)</td>
<td>348.17±7.26</td>
</tr>
<tr>
<td>Fe (ppm)</td>
<td>533.12±96.56</td>
</tr>
<tr>
<td>Ca (%)</td>
<td>0.33± 0.03</td>
</tr>
</tbody>
</table>

The average value of Zn (ppm) in present study was 30.02±2.39. The Zn content was similar with findings of Alalade and Iyai (2006) [1] i.e. 27.59 ppm. Querebin et al. (1986) [24] and Kumar (2015) [19] reported higher values of Zn (71.8 and 71.47 ppm). The average value of Cu (ppm) in present study was 26.29±1.41. Alalade and Iyai (2006) [1], Kumar (2015) [19] and Anitha (2016) [3] reported lower values of Cu in different spp. of Azolla (17.4, 16.74, 16.12 and 9.1 ppm). The average value of Mn (ppm) in present study was 348.17±7.26. Alalade and Iyai (2006) [1] and Anitha (2016) [3] reported higher values of Mn values in Azolla (174.42 and 2418 ppm). The average value of Fe (ppm) in present study was 533.12±96.56. The lower and higher values of Fe (ppm) was reported by Alalade and Iyai (2006) [1] and Anitha (2016) [3] in Azolla. The average value of Ca (%) in present study was 0.33± 0.03. The higher values of Ca was reported by Tamang and Samanta (1993) [30] and Parthasarathy et al. (2001) [22] i.e. 1.54% and 1.24 %. The lower values of Ca than present finding was reported by Kumar (2015) [19].

Conclusions

The present findings indicate that Azolla is a rich source of protein, minerals and other essential nutrients. Azolla can be used for feeding of livestock.

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References