



E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2018; 7(6): 1214-1216
Received: 04-09-2018
Accepted: 06-10-2018

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

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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, Mn 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 (N_2). *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, phosphorus, 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 liter 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 *Azolla 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 Cheryl *et al.* (2014) [12] i.e. 89.73%, Nvanath (2015) [21] i.e. 89.91% and D. Srinivas *et al.* (2012) [13] i.e. 93.00% in sun dried *Azolla*.

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

| S. No. | Nutrients | Percent (DM%) |
|--------|----------------|---------------|
| 01 | Dry matter | 90.00±0.77 |
| 02 | Crude Protein | 22.05±0.72 |
| 03 | Organic matter | 81.05±0.44 |
| 04 | Eather extract | 3.25±0.76 |
| 05 | Total Ash | 18.94±0.31 |

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) [3]. The higher CP content was reported by Indira 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 Iyayi (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], Cheryl *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 (2012) [6], Mandal *et al.* (2012) [20] and Cheryl *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 Leeson (1995) [2], Cheryl *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±0.08. 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* (%)

| S. No. | Nutrients | Percent (DM%) |
|--------|---------------|---------------|
| 01 | NDF | 48.25±0.48 |
| 02 | ADF | 37.14±0.11 |
| 03 | Hemicellulose | 11.11±0.29 |
| 04 | Lignin | 8.07±0.25 |
| 05 | Cellulose | 28.87±0.64 |

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 Iyayi (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) [15] 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 Iyayi (2006) [1] reported lower value i.e. 10.20%. Cellulose content of sun dried *A. pinnata* was 28.87±0.04 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 close 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 Iyayi (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*

| Minerals | Value |
|----------|--------------|
| Zn (ppm) | 30.02±2.39 |
| Cu (ppm) | 26.29±1.41 |
| Mn (ppm) | 348.17±7.26 |
| Fe (ppm) | 533.12±96.56 |
| Ca (%) | 0.33± 0.03 |

The average value of Zn (ppm) in present study was 30.02±2.39. The Zn content was similar with finding of Alalade and Iyayi (2006) [1] i.e. 27.59 ppm. Querubin *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 Iyayi (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 Iyayi (2006) [1] and Anitha [3] (2016) 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 Iyayi (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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