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USE OF AZOLLA AS A SUBSTITUTE POULTRY FEED AND ITS EFFECT ON GROWTH AND PRODUCTION : A REVIEW

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ABSTRACT

It is known that feeding poultry is the largest cost among the rest of the other costs involved in the production process, which amounts to 70% of the total cost, Therefore, it has become necessary when it is wanted to increase production in poultry projects to search for feed materials or ingredients that are unconventional, affordable to reduce the cost of production to a minimum without any side effects on the growth and production of birds, and from these materials Azolla, which is characterized by the speed and intensity of growth in addition to the nutritional value of this plant.
Keywords: Azolla, poultry

Introduction

Azolla is a non-traditional food that is used as a substitute for the regular poultry feed (Alalade and Iyayi, 2006). It is distinguished by its high nutritional value and an adequate cost, thus satisfying the need of poultry farmers (Pillai *et al*., 2002). Azolla was used in Asia and some parts of Africa in poultry feeding. Livestock and pigs (Rana *et al*., 2017) due to the scarcity and high price of traditional protein sources used in poultry feed (Atawodi *et al*., 2018). Azolla or waterweed, duckweed ferns, water lettuce, natural plant, young fern belonging to the Azollaceae family, of which several types have been described including *A. Pinnata* (Becking, 1979) and *A. microphylla* (Sanginga and VanHover, 1989) and *A.nilotica* (Lejeune and Van Hover, 2002). It spreads in the tropics and subtropics, and warm regions (Pillai *et al*., 2002; Alalade and Iyayi, 2006). Azolla floats on fresh and shallow water surfaces, such as: rivers, canals, ponds, swamps and sewage (Becking, 1979), and in flooded rice fields (Namra *et al*., 2010). Azolla grows according to a symbiotic relationship between it and the blue-green moss (Anabaena-azollae), as this moss grows in pockets on the Azolla leaves, as Anabaena-azollae fixes atmospheric nitrogen, providing it for his needs and the needs of his host (Peters, 1978). Azolla also provides carbon and medium suitable for the growth and development of moss (Peters, 1976; Van Hover, 1989), thus Azolla becomes a plant with a high protein content, a large number of mineral elements, vitamins, chlorophylls, carotenoids and amino acids, as well as an important nitrogen source, which allows in Entering it into fodder and livestock feed compositions (Lumpkin, 1989; Kamalasanana Pillai *et al*., 2005), These Azolla characteristics have made it what is described as a super plant, as it is characterized by rapid growth, creating a very large green mass in just two or three days (Bauer, 1990). Ease of cultivation, high production and good nutritional value has been suggested to be a beneficial and good quality nutritional supplement (Singha and Subudhi, 1978; Prabina and Kumar, 2010).

Botanical description

Azolla is a floating plant on water surfaces, of triangular and circular shapes, of 3-4 cm in length and of 15 cm in length as in *A. nilotica* (Van and Lejeune, 2002). Its small leaves overlapping each other cover the stems and hide them, transverse roots grow vertically, in the lower part of the stem, and they absorb food directly from the water and in the species that grow in shallow water, they root to the soil, to absorb food from them.

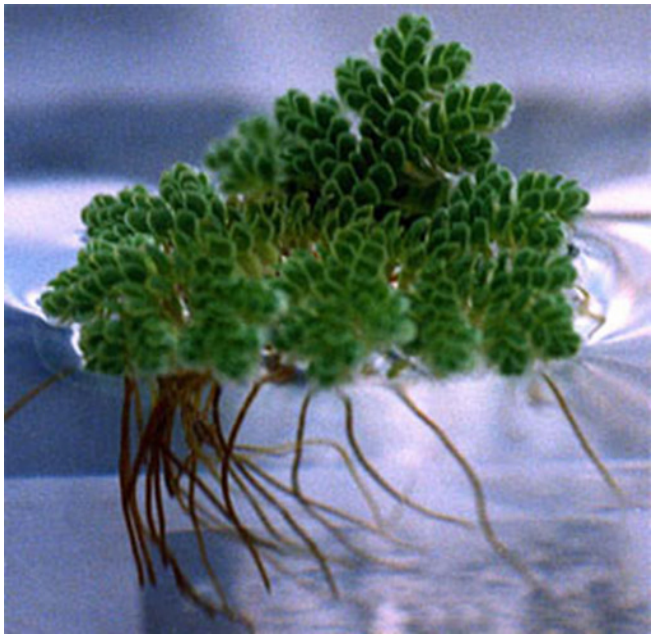

Fig. 1 : Azolla (leaves and roots)

Azolla leaves consist of two lobes, the first: an anterior dorsal lobe (chlorophyllous lobe), this contains small

pockets, in which algae grows (Anabaena-azollae), and the second: a ventral lobe partially submerged in water, colorless, Cuban in shape, aids buoyancy (Peters, 1977; Lumpkin and Plucknett, 1980; Van Hover, 1989), the small pockets line with a sheath surrounded by mucilage (Peters, 1976).

Azolla growing conditions

Acidic soils, with a pH smaller than 3.5, are not suitable for Azolla growth, but rather soils with a pH between 5.5 - 5.6 are preferred (Singh, 1977). It tolerates cold conditions of -5ºc, although most species ideally grow at a temperature between 18-28° C, and other species live below 30°C (IRRI). With long lighting durations of 20 hours/day with all metallic elements available (Kannaiyan and Kumar, 2005).

The importance of the Azolla

Azolla is a nitrogenous fertilizer that is successful in increasing soil fertility, is used in water purification, limits the growth of weeds and jungles, and improves rice yields (Van Hove and Lejeune, 2002), It also maintains the water level, reduces its evaporation, and works to regulate soil salinity, which contributes to its reclamation (Van Hove and Lejeune, 1996). It is used as a biofertilizer on coffee plantations (Anand Titus and Geeta Pereira, 2007), and Azolla has been incorporated in the formulation of diets for fish (Nwanna and Falay, 1997) and poultry (Basak *et al*., 2002)

Chemical composition

Sanginga and Van Hover (1989) pointed out the variation in the nutritional content of the Azolla plant, according to a number of factors, including the difference in interaction with environmental conditions, such as: temperature, light, fertilization and soil quality, as all these factors affect the composition of the plant and its external appearance, as well as That algae bind to plants greatly influences its chemical composition (Balaji *et al*., 2009). Mozafar *et al.* (1990) also showed that Azolla microphylla contained 25.33% crude protein, 11.06% crude fiber, 3.01% ether extract, total ash content of 23.59%, P ratios of 1.7%, and 1.05% Ca. As well as good proportions of lysine, arginine, histidine, isoleucine, serine, tryptophan, while Ali and leeson (1995) and Alalade and Iyayi (2006) noted Azolla's high content of leucine, lysine, arginine and valine, and that the levels of tryptophan and sulfur amino acids were low. Becerra and others (1995) found that Azolla microphylla contained 26.7% crude protein, 15.1% ash, and a moisture content of 94.4%, while the proportions of phosphorous, calcium, ether extract, and crude fiber were 0.4, 0.8, 4.6, and 11.2 respectively. Parathsarathy and others (2003) noted that the actual and virtual A.pinnata metabolism capacity was 1855 and 1529 kcal / kg DM, respectively. (Alalade and Iyayi, 2006) studied A.pinnata's total energy content, and it was documented to have reached 2039 Kcal / kg DM, while it reached 1807 Kcal / kg DM under other conditions (Balaji *et al*., 2009).

Pillai *et al.* (2005) indicated that Azolla is a plant with a high protein content of protein, essential amino acids, vitamins such as (vitamin A, vitamin B12 and beta-carotene) as well as minerals such as calcium, phosphorous, potassium, iron, copper, and magnesium. The results of Letermea *et al* (2010) also showed that Azolla is an excellent source of protein, essential amino acids, vitamins (A, B_{12}, beta-carotene), and minerals (calcium, phosphorous, potassium, copper, iron, and magnesium).

Azolla's applications in poultry diets

Productive performance

Basak *et al.* (2002) used three levels (5, 10, 15%) of Azolla instead of sesame cake in chicken diets, and noted that the level of 5% led to a significant increase in the mean body weight (1637 g) live compared with the control treatment. (1579 g), while it was noted that the levels of 10 and 15% led to a decrease in the mean live body weight. In contrast, Parthasarathy *et al.* (2002), that elevated levels of Azolla (10, 15, 20%) led to greater body weights compared to control, and the level was 5%, with significant differences. Mhanthesh *et al.* (2018) indicated that the body weight of broilers in the treatment containing Azolla increased by 30% with 70% in commercial diet, as the live body weight was 2250 g in the sixth week compared to the control treatment, which was 2102g.The use of Azolla in feeds has been shown to affect the palatability of broilers to diets, and that it leads to lower consumption rates (Bested and Morento, 1985). However, palatability was not affected by increased levels of Azolla, and these levels did not affect the feed consumed compared to control groups (Basak *et al*., 2002; Parthsarathy *et al*., 2002; Balaji *et al*., 2009; Dhumal *et al*., 2009). While Naghshi *et al.* (2014) observed a significant decrease in the rate of feed consumption in the Azola addition treatments compared to the control group.

Basak *et al* (2002) noted significant differences in the rate of the nutrient conversion factor when adding Azolla at levels 0, 5, 10 and 15% to broiler diets during the age of 2-6 weeks, It noticed that the best dietary conversion factor at the age of 2-6 weeks in the group of the two treatments containing 10 and 15% Azolla increased in the food conversion factor compared to the control treatment, as the food conversion factor was 2.5 for the level 15%, and 2.38% for the level 10%, compared to 2.17 for the control group, which did not differ from the 5% level, as the conversion factor was 2.06, meaning that the increase in the level was not positive. During the period 5-6 weeks. Mishra *et al.* (2016) noted that the addition of Azola at levels 0, 5, 7.5, and 10% improved the nutrient conversion factor for levels 5 and 7.5% compared to the control and the 10% treatment. While Rana *et al* (2017) conducted his study that included five treatments, the first was a control, the second and the third, Azolla was added to the diets at levels of 2.5 and 5%, while the same levels were added to the fourth and fifth treatments with the Exogenous feed enzyme viz. enzyme, and it was noted from the results that the food conversion factor for the level 2.5% with the addition of the enzyme, then the levels 2.5 and 5% compared to the control treatment, and 50% with the enzyme did not differ from the control, and the researcher concluded that the addition of dried Azola at a level of 2.5% has a positive effect. It was also found that adding Azola with two percentages of 30% with 70% of the commercial diet improved the food conversion factor, which reached 1.97 for the level of 30% compared to 2.12, compared with the commercial diet 100% (Mhanthesh *et al*., 2018), and when adding Swain *et al* (2018) 10 and 20% of fresh Azolla to duck diets showed a significant decrease in the feed conversion factor for the two treatments, reaching 5.23 and 4.27), respectively, when compared with the control treatment, which amounted to 6.36

Blood serum qualities

Acharya *et al.* (2015) noted that adding azola to duck diets did not affect indicators of glucose, cholesterol, total protein, albumin, and globulin, but noted a significant decrease in triglycerides at level 5% azola compared to control 0%, and level 10% of Azolla. The use of azola in broiler diets at levels 5 and 7.5% did not affect hemoglobin concentration, blood volume and total white blood cell count compared to the control treatment. It was also found that there were no significant differences in the percentage of mononuclear cells, with a significant increase in the percentage of heterozygous cells for the same two levels (5, 7.5%) from Azolla compared to the control treatment. And that the concentration of 7.5% recorded a significant decrease in the number of acid cells compared to the control treatment. Also, the treatment of Azola addition 5% and 7.5% recorded a significant increase in the percentage of lymphocytes compared to the control treatment. However, no significant differences were found in the ratio of heterogeneous cells to lymphocytes (Mishra *et al*., 2016). While between Islam and Nishibori (2017) in their study the addition of different percentages of Azolla (0%, 5%, 7%, 5% Azola + 1ml multivitamin and 1ml acidifier / liter water) to broilers led to a decrease in both cholesterol and glycerides(TG) and low-density lipids (LDL) for level 5% azola when compared to control treatment. As for the level of 7%, it led to a significant decrease in the concentrations of total cholesterol, TG and LDL, to a degree less than the level 5%. Also, the treatment of 5% Azola + 1ml multivitamin and 1ml acidifier/ liter water did not record any differences with the control treatment in the same characteristics.

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