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Proximate composition of *Asparagus racemosus* (Shatavari) root powder green maize and soybean straw

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Abstract
Aim: This experiment was conducted to investigate the proximate composition of *Asparagus racemosus* (Shatavari) root powder, green maize & soybean straw used as animal feed.
Place of the study: The experiment was carried out in the Department of Agricultural Botany, Forage Research Project laboratory, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist.-Ahmednagar, Maharashtra, India.
Methodology: Official methods of analysis of Association of Official Analytical Chemists (AOAC) was used to determine the proximate composition.
Results: The proximate analysis of *Asparagus racemosus* (Shatavari) root powder, feed and fodder resulted in the following findings: dry matter (DM%) 91.2, crude protein (CP%) 7.12, ether extract (EE%) 1.3, Nitrogen free extract (NFE%) 63.13, total ash (TA%) 8.8, organic matter (OM%) 91.2, neutral detergent fibre (NDF%) 36.22 & acid detergent fibre (ADF%) 16.2. The proximate composition of green maize & soybean straw showed following results: dry matter (DM%) 22.86, crude protein (CP%) 9.68, ether extract (EE%) 1.94, Nitrogen free extract (NFE%) 48.11, total ash (TA%) 9.05, organic matter (OM%) 90.95, neutral detergent fibre (NDF%) 65.71 & acid detergent fibre (ADF%) 44.6. The proximate composition of soybean straw found following results: dry matter (DM%) 91.01, crude protein (CP%) 5.05, ether extract (EE%) 0.92, Nitrogen free extract (NFE%) 46.89, total ash (TA%) 6.18, organic matter (OM%) 93.82, neutral detergent fibre (NDF%) 66.35 & acid detergent fibre (ADF%) 54.15.
Conclusion: It can be deduced from these results of this study that *Asparagus racemosus* root, green maize & soybean straw contained appreciable amounts of nutrients and minerals that aid its nutritional properties. Supplementation of *Asparagus racemosus* root powder reduces the production losses and veterinary cost incurred on treatment.

Keywords: *Asparagus racemosus*, shatavari, proximate composition, green maize, soybean straw

Introduction
Asparagus racemosus immunomodulatory qualities have been extensively established, and its therapeutic use has been mentioned in Indian and British Pharmacopoeias, as well as in traditional medical systems such as Ayurveda, Unani and Siddha. Herbs and their derivatives are thought to be less dangerous than allopathic veterinary medications (Hashemi and Davoodi 2011) [1]. Shatavari strengthens the immune system by boosting macrophage formation and inducing excess TNF-alpha and interleukin-1 (IL-1) production, which boosts macrophage phagocytic activity (Rege *et al.* 1989, Thatte and Dahanukar 1989, Dhuley 1997, Ray 2004) [2, 3, 4, 5]. Sarsasapogenin and oligospirostanoside glycosides in shatavari root are responsible for its immunomodulatory activities (Handa *et al.* 2003) [6]. Its anti-inflammatory and antioxidant properties are also due to the presence of other phytochemicals (Wiboonpun *et al.* 2004, Kamat and Venkatachalam 2004, Lalana *et al.* 2011) [7, 8, 9].
Several herbs have been reported to help humans and animals enhance their overall health, milk production and reproduction. A special mention should be made of *Asparagus racemosus* (Shatavari) among them. Pandey *et al.* (2005) [10] found that *A. racemosus* (shatavari) possesses galactagogue and mammogenic properties via increasing blood protein and cellular proliferation in the mammary gland to increase lactation. Shatavari feeding may influence feeding patterns, influence the growth of beneficial microorganisms in the rumen, or stimulate the secretion of various digestive enzymes, which may improve nutrient utilisation efficiency or stimulate milk secreting tissue in the mammary glands, resulting in improved dairy animal

productivity and reproduction (Bakshi and Wadhwa, 2000) [11]. A medicinal plant may have antibacterial, immune-stimulation, coccidiostat anthelmintic, antiviral or antioxidative effects (Uegaki *et al*., 2001) [12]. According to Kumar *et al.* (2014) [13], feeding Shatavari root powder increased postpartum animal productivity by increasing milk supply and total milk immunoglobulins, as well as reducing the service period and services/conception. These herbs were utilised in pre-vedic times because they were safe to use, inexpensive and readily available and they had no side effects or milk residue (Krishna *et al*., 2005) [14].

Shatavari has been considered as completely safe for long-term usage in Ayurveda, even during pregnancy and breastfeeding. As a result, it is advised throughout the final and first trimesters of pregnancy to replenish the mother's vitality and increase both the mother and the foetus immunity. As a result, it may be taken on a regular basis since Shatavari's medicinal substance is useful for the mother's and foetus's correct health, growth and development.

Soybean is a major cash kharif crop in Madhya Pradesh's Malwa area. In the years 2011-13, the state's average annual soybean output was 70.56 lakh MT (Data.gov.in, 2015) [15]. As a result, a huge quantity of straw, which is made up of stem, leaf, and pod husk, is accessible as a by-product of threshing. This straw is only used by farmers in this region to feed unproductive animals such as bullocks and to a lesser extent, pregnant dry and growing animals. When it is fed to lactating cattle or buffaloes, several farmers in the area claim that it causes progressive deterioration in physical condition, a decrease in milk output and eventually impaction. Soybean straw mixed with wheat straw is fed to a small number of farmers. As a result, the majority of the straw is wasted and burned. Given the foregoing, it was important to investigate the possibilities of using this straw more effectively in the ration of lactating animals. The purpose of this study was to determine the proximate composition of *A. racemosus* (Shatavari) root powder, green maize, and soybean straw.

Materials and Methods

Sample collection & Preparation

The *Asparagus racemosus* (Shatavari) root powder was purchased from the Sivananda Ayurvedalaya, Dist.-Ahmednagar, Maharashtra, India. The feed and fodder sample was collected from Mahatma Phule Krishi Vidyapeeth, Rahuri, university farm. The experimental samples were air-dried under shade and milled into powder through 1 mm sieve and stored in well-dried, labelled plastic bags inside the storeroom at room temperature of 25 °C.

Proximate analysis of *Asparagus racemosus* root powder and fodder

Dried powdered *Asparagus racemosus* root were assessed for dry matter (DM), crude protein (CP), ether extract (EE), Nitrogen free extract (NFE%), total ash (TA%), organic matter (OM%), using the Association of Official Agricultural Chemists (AOAC, 1995) [16] procedures. The neutral detergent fibre (NDF%), acid detergent fibre (ADF%) were determined following the standard techniques established by Van Soest *et al.* (1991) [17].

Statistical analysis

Asparagus racemosus root powder and fodder samples proximate analysis was done in triplicate. Data obtained was processed using SAS proc means (2003) [18] which computed the means and standard errors.

Results and Discussion

Proximate analysis of shatavari root powder

The genus *Asparagus* (Family Asparagaceae, with about 300 species) is a rich source of saponins and saponin, from various parts of the plant, (Oketch-Rabah, 1998) [19].

The proximate composition of *Asparagus racemosus* root powder is given in Table 1. The dry matter content of *Asparagus racemosus* root powder ranged from 92.8 to 96.3% with an average value of 91.2 per cent. Crude protein per cent of *Asparagus racemosus* roots powder was 6.19% on per cent dry matter basis. It was observed that CP content of *Shatavari* root powder were within the range as reported by various authors (Berhane, 2000; Mishra *et al*., 2005; Kumar *et al*., 2009) [21, 22]. Mishra *et al.* (2005) [21] reported that *Shatavari* root contains 4.6 to 6.1% protein. While Saini *et al.* (2016) [23] reported 21.8±0.56% protein in *A. racemosus* root powder. The ether extract content in dried *A. racemosus* root powder was 1.3%. The nitrogen free extract content on per cent dry matter basis was 63.13%. The total ash content was 8.8%. The organic matter content was 91.2%. The neutral detergent fibre & acid detergent fibre was 36.22 & 16.2 respectively.

Proximate analysis of green maize

The proximate composition of green maize was found during this study is presented in Table 1. The DM content was 22.86%, CP 9.68%, EE 1.94%, NFE% 48.11, TA% 9.05, OM% 90.95, NDF% & ADF% was 65.71 & 44.6% respectively. The results obtained in the present trial for proximate composition of green maize are similar to that reported by Negi (1977) [24].

The average ash content in green maize fodder was 9.05%. When ash content is abnormally high, there is a great chance that the forage is contaminated with soil which is not desirable. The optimum content of legume grass forage is near 9.0%. Those with more than 10-18% ash are likely contaminated with increasing amount of soil, excess ash content can have negative effect on lactation for example in cattle, hence the amount of non-fermentable inorganic matter in some dairy cattle diets get high (Afolabi, 1995; Aganga, 1991) [25, 26] on this basis green maize is considered very good for animal feeds.

Proximate analysis of soybean straw

The proximate composition of soybean straw is presented in Table 1. The average DM, CP, EE, NFE, TA, OM, NDF & ADF% was 91.01, 5.05, 0.92, 46.89, 6.18, 93.82, 66.35 & 34.15% on per cent dry matter basis. The values were in agreement with those of other workers (Mule *et al.*, 2008, Tewari, 2008; Naser *et al.*, 2011) [27, 28, 19]. Singh *et al.* (2005) [30] reported higher CP level (10.4%) in soybean straw as compared to the present study. The CF values were higher in most of the varieties of soybean straw. Similar results were also reported by Singh *et al.* (2005) [30] and Patil *et al.* (2014) [31] for soybean straw.

The NDF and ADF content in all varieties of soybean straw was in between the values reported by Sruamsiri and Silman (2008) [32] but lignin content was much higher than reported by Naser *et al.* (2011) [19]. Among different varieties of soybean straw, cell content was highest in variety NRC-12 while ADF, NDF, hemi-cellulose and lignin contents were higher in variety JS 90-41 and cellulose level was higher in variety NRC-12.

Table 1: Proximate analysis of *A. racemosus* root powder, feed & fodder (% DM Basis)

S. No.	Attributes	*A. racemosus* root powder	Green Maize	Soybean straw
1.	DM	91.2	22.86	91.01
2.	CP	7.12	9.68	5.05
3.	EE	1.3	1.94	0.92
4.	NFE	63.13	48.11	46.89
5.	TA	8.8	9.05	6.18
6.	OM	91.2	90.95	93.82
7.	NDF	36.22	65.71	66.35
8.	ADF	16.2	44.6	54.15

Conclusion

Asparagus racemosus (Shatavari) root has optimum amount of crude protein and all essential nutrients which can fully fill the daily need of ruminants hence, it can be used as feed additives. The green maize could meet the maintenance requirement of dairy stock due its palatability & presence of high amounts of easily digestible nutrients. There were variations in approximate composition of different varieties of soybean straw but due to the high level of lignin content it should be used in a limited amount in the ration of dairy animals.

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