EFFECT OF FEEDS SUPPLEMENTED WITH ASPARAGUS RACEMOSUS ON MILK PRODUCTION OF INDIGENOUS COWS

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Received -26.11.2015; Reviewed and accepted -03.01.2015

ABSTRACT

Indigenous cows, on farm level, kept on feeding supplemented with powdered root of Shatavari (Asparagus racemosus Willd.). It was observed that feeding Shatavari roots supplemented feed increased percentage milk yield, fat, solid not fat (SNF) and total solids significantly without altering quality and natural attributes of milk. Significant residual effect of feeding Shatavari roots supplemented feed was also observed in terms of percentage increase in milk yield, fat, solid not fat (SNF) and total solids (TS) up to ten days after Shatavari roots supplemented was stopped to cows.

Keywords: Shatavari, Asparagus racemosus, cows, milk yield, milk fat.

INTRODUCTION

India is the largest milk producing nation from 1998 but due to its thriving population; per capita availability is just 281gms/day. The total milk production in 2010-11 was 121.8 MT. (NDDB, 2012; http://www.nddb.org/English/Statistics/Pages/Milk-Production.aspx). In India, the current growth rate of milk production is 4% while increase in demand is 6-8%. Therefore, there is an urgent need to increase milk production. In order to compensate difference between production and its demand NDDB has launched “National Dairy Plan” (NDP) in 2012.

India has highest livestock and bovine population in world, but due to use to inferior breeds and lack of availability of balance feed to animal; there is quite low per animal production on milk. In order to increase milk production while keeping near about constant total bovine population, the large scale studies have been focused on use of hormones and other veterinary medicines for supplementing reproduction performance, which are considered economically but also leads health problem to milch animals. Hence, it arises need for substitutes in some other form and natural ways (such as herbs), which are considered as safe, cheap, locally available and at the same time they also improve production and reproduction performance of milch animals. Indian history is very rich in herbal medicine and one of the oldest surviving systems of health care in the world known as Ayurveda. Ayurveda is a natural remedy and totally based on herbs. These herbs were being used since Pre-Vedic time (stone age) because they were safe to use, cheap and easily available, has no side effect and no residual effect in milk [1].

Ayurveda has recommended several feed additives to increase the milk secretion, some of them are Shatavari (Asparagus racemosus Willd.), Jiwanti [Leptadenia reticulata (Retz.) Wight &Arn], Bhringraj [Eclipta prostrata (L.) L.; syn. Eclipta alba (L.) Hassk], Papaya (Carica papaya L.), Methi [Trigonella adscendens (Nevski) Afan. & Gontsch.], etc. Animal keepers used extracts, leaf, seed and roots ofabovementioned plants as food ingredients with the standard fodder.

The present study was designed to test the galactagogue property of Shatavari (Asparagus racemosus Willd.), family Asparagaceae (Fig. 1) in milking cattle. The tuberous roots of Asparagus racemosus is commonly used in traditional medicine for human being and its supplementation is recommended during last trimester of pregnancy to first trimester after birth to the mother to boost milk quality, immunity of both mother and fetus and to tone the reproductive system and reproductive health. Besides, Asparagus racemosus has been scientifically validated as reproductive system tonic, immune modulator, antioxidant, galactogogue and anti-stress [2].

Fig.1 : (A) Asparagus racemosus Willd.; (B) Asparagus racemosus Willd. dried roots; (C) Asparagus racemosus Willd. Fresh roots.
Asparagus racemosus root contains principal components Steroidal saponins known as “Shatavaris I–IV” (Fig. 2). Shatavarin- I is the major glycoside with 1 glucose and 2 rhamnose moieties attached to sarsasapogenin and Shatavarin- IV contains alkaloids, proteins, starch and tannin. It increases the GPT (Glutamic PyrovateTransminase), GOT (Glutamic Oxaloacetate Transminase) activities which increase the digestibility and nutrient assimilation results for improving the galactogogue activity in lactating animals, when it is supplemented with the fodder [3].

Shatavari roots’ having a vital activity in man and animals as per the literature. But no systematic study was carried out on its performance on milk herd and also in organized sectors the pricing of milk depends upon its fat and solid not fat (SNF) content of milk. If milk production of animals increases at the cost of decrease in fat and SNF; then it will not be profitable marketing point of view. Therefore, this study was carried out to evaluate the effect of Shatavari on its galactogogue activity in relation to its major constituents with following objectives:

- To standardize the doses of Shatavari powdered root for enhancing milk production in indigenous cows
- To study effect of Shatavari root powder on milk yield and composition after its feeding
- To calculate the techno-economic feasibility of milk production

MATERIALS AND METHODS

Ten indigenous cows of same ages and same stages of lactation were selected randomly. The cows were placed in the same shade and received identical treatment regarding ration (feed), watering etc. Amount of ration depends on body weight of the animal and also with the nature of its production. The body weights of the animals were calculated using Sheaffer’s formula in which the body measurement were used to calculate the body weight [4]. The formula is,

\[
\text{Body weight} = \frac{(G^2 \times L)}{300} \quad \text{Equation (1)}
\]

Where "G" is heart girth and “L” is length of body in inches.

Cows ate 2 to 2.5 kg of dry matter and buffaloes ate 2.5 to 3 kg dry matter per day for every 100 kg of live weight. The following formula was applied to calculate amount of fodder [5].

**Total dry matter = \left\{\frac{(2/3 \text{ as a roughages} \times [2/3 \text{ dry roughages}]) + (1/3 \text{ green roughages}) + (1/3 \text{ as concentrate mixture})}{3} \right\} \quad \text{Equation (2)}**

Along with calculated amount of fodder, different amounts of Shatavari powdered root were also fed to selected herd of milch animals as shown in Table 1.

All ten lactating cows were divided into 5 different groups (having two cows in each group) viz. T1, T2, T3, T4 and T5 were first put on the control ration for a period of 10 days and thereafter, the cows were put on rations formulated for different treatments [6]. The entire feeding experiment was divided into three phases viz. Phase I, Phase II and Phase III. During each phase the feeding schedule was in the sequence as described below.

1. **During phase I**, the cows in the respective group were fed rations namely control (T1), T2, T3, T4 and T5 for a period of 10 days; treatment phase (T.PHASE I) and on the 11th day, the cows in all the 5 groups were fed with control fodder for a period of next 10 days; residual phase (R. PHASE I).

2. **During phase II** the cows under the respective groups were again put on control (T1), T2, T3, T4 and T5 fodder from 21st day for a period of 10 days; treatment phase (T.PHASE II) and then cows under all the 5 groups were put on the control fodder on the 31st day and continued on this fodder for next 10 days; residual phase (R. PHASE II).

3. **In phase III**, the cows under the respective groups were put again on control (T1), T2, T3 T4 and T5 fodder from 41st day for 10 days; treatment phase (T. PHASE III) and on the 51st day, all the cows were put on the control fodder and continued on the same for next 10 days; residual phase (R. PHASE III).

Thus, each feeding schedule was repeated thrice on the same group of cows which gave 6 observations under each treatment. Observations recorded during the experiment are the milk yield and its composition.

The proximate analysis was done by the methods as shown in Table 2.

Statistical analysis technique of randomized block design was carried out on the data, with main plot as five treatments of feeding Shatavari root powder with three replications [7]. The statistical model followed is given as under:

\[
Y_{ij} = \mu + S_i + b_j + \epsilon_{ij}
\]

Where \( Y_{ij} \) = Response of ithshatavari root powder in the jth replication (i =1, 2, 3…., t; j = 1, 2, 3……, r)

\( \mu \) = General mean effect

\( S_i \) = Effect due to the of ith treatment

\( b_j \) = Effect due to the of jth replication

\( \epsilon_{ij} \) = Error effect due to random component assumed to be independent normally distributed with mean zero and variance.

Economical feasibility was calculated on the basis of increase in yield and major milk constituents.
RESULTS

Yield
The effect of feeding shatavari during treatment phase and residual phase were shown in Fig. 3. The result indicates that there was significant increasing ($P > 0.05$) effect on milk yield of the experimental cows. Similarly, when the average value on milk yield of these animals compared with respect to control animals among different phases was somewhat closer to each other within the phases, except phase II and phase III, in which it was observed the gradually increasing trend in all treatments. This may be due to the effect of shatavari root powder supplemented as fed with fodder.

![Fig. 3: Effect on milk yield due to Shatavari feeding.](image1)

**NOTE:** For graphs T. PHASE= Treatment Phase and R. PHASE= Residual Phase.

Fat
As shown in fig. 4, there was significant increasing ($P > 0.05$) effect on milk fat content due to feeding shatavari. Similarly, when average values on milk fat content of these animals compared with respect to three different phases was somewhat closer to each other within the treatments.

Protein
Fig. 5 indicates that there was significant increasing ($P > 0.05$) effect on milk protein content of the experimental cows. Similarly, when the average values on milk protein content of these animals compared with respect to three different phases was somewhat closer to each other within the treatments.

Lactose
As reflected from Fig. 6, there was significant decreasing ($P < 0.05$) effect on lactose content in milk of the experimental cows. Similarly when the average value on lactose content in milk of these animals compared with respect to three different phases was somewhat closer to each other within the treatments.

![Fig. 4: Effect on milk fat due to Shatavari feeding.](image2)

![Fig. 5: Effect on milk protein due to Shatavari feeding.](image3)

![Fig. 6: Effect on milk lactose due to Shatavari feeding.](image4)
Total solids

As per Fig. 7, it was observed in present investigation that there was significant increasing (P> 0.05) effect on total solid content of milk of the experimental cows. Similarly when the average value on total solid content of milk of these animals compared with respect to three different phases significant changes were observed.

pH & acidity

As per Fig. 8 and 9, it is concluded that there were no significant (P< 0.05) effect on pH and acidity due to feeding shatavari as a supplement in fodder.

DISCUSSION

Yield

Patel and Kanitkar was observed significant increase in milk yield in buffaloes on feeding five hundred grams of fresh roots of Asparagus racemosus per day [3]. A similar result reported by Tanwar, he was evaluated the effect of shatavari (Asparagus racemosus) on milk production in lactating dairy animals and found that shatavari induced significant increase in daily milk production [8].

It was also found that shatavari induced significant increase (10.43%) in daily milk production in buffaloes in treatment group [9].

Similar observations were observed in present investigation. The increase of milk yield due to the shatavari roots because it contains shatavarin-I, II, III and IV which are stimulating the hypothalamus or directly to pituitary gland and antagonist dopamine receptors are increases in pro-lactin secretion [10]. Lahar et al. was demonstrated that shatavari roots is a rich source of minerals and trace elements such as calcium, copper, magnesium, iron, manganese, nickel, and zinc [11]. Presence of calcium in the powder correlates with the analytical results for galactagogue effect. The sufficient supply of the mineral nutrition to lactating cows is also a reason behind increase in milk yield.

Fig. 8: Effect on pH of milk due to Shatavari feeding

Fig. 9: Effect on acidity of milk due to Shatavari feeding.

Fat

A close look of the data indicates that, animal in T1 (control group) having lower fat in all level of treatments as compared to
treatment group. In T4 there was gradual increasing trend in fat percentage observed in all phases. It was due to the activity of shatavari powder in the animal digestive tracts and provides spontaneous secretion effect and stimulating the prolactin hormone [10].

Safaa was found that twenty lactating ewes were fed on basal diet and supplemented with black seed (Nigella sativa) at the rate of 5 gm/day/animal, and concluded that fat percentage was increased significantly (p>0.05) in the treated group than control group [12]. This improvement in fat content may be due to increasing ruminal activity and stimulating high amount of acetic acid production and acetate propionate rate in rumen, which are precursors of fatty acids of up to 16 carbon atoms in length.

Shatavari root powder containing ration at different levels on experimental cows the fat percent was increased due to increasing supplemented ration at level of T4 (200gm) then decreased slightly, it may be due to conversion of plant lipids in to triglycerides as β-oxidation of fat may be more in digestive tract [13].

Similar observations have been observed in present investigation. Increase in milk fat was may be due to the increase lipogenic activity. The possible mechanism of acetyl-CoA Translocation involved direct fusion of acetate across mitochondrial membrane; this could be due to involved in hydrolysis of acetyl-CoA in mitochondria via acetyl-CoA hydrololysis through rumen lipolysis and biorumenhydrolyzation process and subsequent regeneration of acetyl-CoA in cystol via. lipogenic enzyme acetyl thi kinase and malate dehydrogenase in mammary tissue and approximately 100 folds increase in the rate of fatty acid synthesis.

Protein
Increase in protein content may be because of the increasing digestibility of crude protein provided through shatavari root powder from their daily ration, as shatavari also stimulating the peptidase enzymes as described for mammalian biochemistry [13].

In the absence of similar literature, current experiment was compared with research of Abo El Nor et al., while studying the effect of some medicinal plant seeds in the fodder on the milk productive performance of lactating buffaloes and observe that feeding Lipidium sativum for 12 weeks in lactating buffaloes and observe that percentage of milk protein increased significantly over the control group [14]. The increase in milk protein may be due to increase in efficiency of nutrient utilization by supplementing seeds of Lipidium sativum in fodder.

Similar observations were observed in present investigation. The improvement in protein content may be due to increasing digestibility of crude protein, nourishing effect and improve digestion after feeding shatavari root powder containing ration [12]. Whereas ideal concentration of condensed tannins was from 2 to 3 % of dry matter (DM), since tannins can have a beneficial effect by protecting the protein degraded in the rumen by forming protein-tanin complexes [15]. In present investigation shatavari root powder contain 5.1 mg/g condensed tannins on dry matter (DM) basis was given through feed to the experimental animals and observed similar effect during the study.

Lactose
In absence of similar work on shatavari, current research is compared with research of black seeds effect on milk. It was observed in earlier research that lactose percent was significantly lower in milk of black seeds treated group than control one [16].

Similar observations have been observed in present investigation due to feeding of shatavari roots. The decreasing of lactose content may be due to decrease of serum glucose by treatment of shatavari root powder, whereas glucose and galactose is the precursors of lactose in milk.

Total solid
In absence of literature, current work is compared with earlier similar literature [14]. That research was conducted on fifteen lactating buffaloes divided into 5 groups of three animals in each groups. Medicinal plant seeds were added to basic diet Fenugreek seed (Lipidium sativum). They observed that total solid percentage was significantly increased in treated animals than those of control.

pH and acidity
In absence of similar literature current work cannot be compared with others. The graphical data shows that feeding of shatavari root powder containing fodder at different levels on experimental cows the pH was slightly decreased due to increasing supplemented ration. This may be because of increasing acidity percent in milk also increased fat, protein, total solid percent in milk.

![Fig. 10: Average data 1 (average data of all treatments)](black lines showing effect of feeding of shatavari supplemented fodder during treatment while red lines after treatment)
Economical feasibility
Expenditure on feeding of shatavari and income from extra milk
taken was consideration for economic evaluation of its feeding.
Supplementation of shatavari in cow returned net incremen-
tal income by Rs. 9.75/day/animal.

CONCLUSION
As reflected from fig. 10 and 11, in an average there was
increase 9.25%, 11.60%, 12.48% and 10.87% in milk yield,
3.71%, 5.43%, 13.43% and 4.57% in milk fat, 4.99%, 7.33%,
10.56% and 7.62% in milk protein and 1.36%, 2.57%,
4.98% and 2.97 in total solid of milk while decrease in 1.85%, 2.26%,
2.46% and 1.85% in milk lactose for different treatments T2, T3,
T4 and T5 due to shatavari feeding. Treatment phases had
more pronounced effect of supplementation than the residual
phases. Thus, it may be concluded that Shatavari has
lactogenic properties to improve the milk production and
economical for feeding to dairy animals. The most cost-effective
feeding was T4 (200gm).

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