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Effect of feeding fresh azolla (*Azolla pinnata*) on milk production of Konkan kanyal goat

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Abstract
The experiment was carried out on twenty Konkan Kanyal goats. The experimental animals were randomly divided into five treatment group's *viz.* T_1 - Basal feed (Guinea grass + Tree leaves + Paddy straw) + 400 gm conc. T_2 - Basal feed + 300 gm conc. + 100 gm fresh Azolla, T_3 - Basal fed + 200 gm conc. + 200 gm fresh Azolla, T_4 - Basal feed + 100 gm conc. + 300 gm fresh Azolla and T_5 - Basal feed + 400 gm fresh Azolla. The results was revealed that the Basal diet + 300 gm Azolla + 100 gm concentrate was found superior in respect to dry matter intake 1119.10 g/day and milk production 60.30 liter (60 days).

Keywords: Feed analysis, dry matter intake, water intake, milk production, konkan kanyal goat

Introduction
The goat is multipurpose animal to provide meat, hide, hair and manure for soil. The contribution of goats in supplying meat is high and it has significant role in rural economy and nutrition. Now in rural areas goat rearing plays vital role in solving the problem of unemployment. The economic returns from goat keeping are high as compared to other farming enterprises. Goat farming can be profitable occupation of farmer and can fit into mixed farming system.

In India requirement of green fodder is 1061.00 million MT and availability is 395.20 million MT whereas in case of dry fodder requirement is 589.00 million MT and availability is 451.00 million MT Anonymous, 2015 [1]. It indicates that there is deficit gap between the requirement and availability of fodder. Fodder and feed are used to supply protein source to the animal and also supplying energy, water, vitamins, minerals, different type's essential and non- essential amino acids.

The demand for milk and meat in India is creating new potential in the profitability of animal husbandry as an occupation. Yet, at the same time, there is a substantial decline in fodder availability. The area under forest and grasslands is decreasing as is the amount of various crop residues available for feed, largely due to the introduction of high yielding dwarf varieties. The shortage of fodder is therefore compensated with commercial feed, resulting in increased costs of meat and milk production. Moreover, as commercial feed is mixed with urea and other artificial milk boosters, it has a negative effect on the quality of milk and the health of the livestock. The search for alternatives to concentrates led us to a wonderful plant Azolla, which the promise of providing a sustainable feed for livestock. Azolla is a floating fern and belongs to the family of Azollaceae. Azolla hosts symbiotic relation with blue green algae and *Anabaena azollae* which is responsible for the fixation and assimilation of atmospheric nitrogen. Azolla in turn provides the carbon source and favorable environment for the growth and development of the algae. It is this unique symbiotic relationship that makes azolla a wonderful plant with high protein content.

Material and Method
Selection of animal
Twenty lactating goats of nearness age and body weight of same lactation were selected randomly and allocated in to five treatments T_1, T_2, T_3, T_4 and T_5 and four replications. The main aim of using this on lactating goats is to identify the clear cut effect of feeding fresh Azolla on milk production and quality of lactating goats. The selected lactating goats were tested under different treatment by adopting Randomized Block Design (RBD).

Feeding Management of Goats

All the selected goats were dewormed and were vaccinated against FMD and Enterotoxaemia. Feeding trial of 08 weeks duration (during 20th July, 2018 to 10th October, 2018) was conducted by providing required amount of nutrients as per NRC [7], through prepared experiment feeds of treatments combination and keeping the roughages part as constant for all the treatment groups.

The commercial concentrate mixture was used for feeding. Azolla with concentrate mixture and roughages fed to goats were analyzed for proximate constituents. The goats were fed at 4 per cent DM of their body weight. The roughages to concentrate ratio while feeding as maintained at 70:30. The concentrate feed and fodder requirements of goat were calculated every starting of the period by considering preceding milk production at the end of each period. The experimental feed was offered to goats at 9.00 am and 11.00 am during morning session and at 3.30 pm and 5.30 pm in evening session.

Treatment details

T_1 Basal feed [Guinea grass (2kg) + Tree leaves (Jackfruit leaves -1 kg and Gliricidia -1 kg) + Paddy straw] + 400gm conc. + 0 gm Fresh Azolla

T_2 Basal feed + 300gm conc. + 100gm Fresh Azolla

T_3 Basal feed + 200gm conc. + 200gm Fresh Azolla

T_4 Basal feed + 100gm conc. + 300gm Fresh Azolla

T_5 Basal feed + 0gm conc. + 400gm Fresh Azolla

Result and Discussion

Chemical composition

The chemical compositions of experimental feeds were the Jackfruit tree leaves consisted of (91.58%) organic matter, (35.25%) dry matter, (15.08%) crude protein, (22.00%) crude fibre, (2.21%) ether extract, (8.42%) total ash, (52.29%) nitrogen free extract, (4.08%) acid insoluble ash, (2.31%) calcium and (0.38%) phosphorus. While the chemical composition of Gliricidia leaves indicates (90.60%) organic matter, (21.73%) dry matter, (21.20%) crude protein, (20.62%) crude fibre, (4.82%) ether extract, (9.40%) total ash, (43.96%) nitrogen free extract, (5.90%) acid insoluble ash, (1.55%) calcium and (0.33%) phosphorus.

The composition of Guinea grass contained (93.77%) organic matter, (24.80%) dry matter, (8.24%) crude protein, (33.71%) crude fibre, (1.71%) ether extract, (6.23%) total ash, (50.11%) nitrogen free extract, (3.31) acid insoluble ash, (3.17%) calcium and (1.40%) phosphorus. The nutrients obtained in Paddy straw contained (84.17%) organic matter, (93.20%) dry matter, (2.25%) crude protein, (29.87%) crude fibre, (1.52%) ether extract, (15.83%) total ash, (50.53%) nitrogen free extract, (9.89%) acid insoluble ash, (0.19%) calcium and (0.05%) phosphorus.

In treatment T_1 (400g conc.) contains organic matter, dry matter, crude protein, crude fibre, ether extract, total ash, nitrogen free extract, acid insoluble ash, calcium and phosphorus were 89.75, 90.73, 18.23, 13.00, 4.18, 10.25, 54.34, 4.21, 1.88 and 0.31 per cent, respectively. While the chemical composition of T_2 (300g Conc. + 100 g Azolla) replaced with fresh Azolla indicates (86.64%) organic matter, (70.25%) dry matter, (18.88%) crude protein, (13.02%) crude fibre, (3.56%) ether extract, (13.36%) total ash, (51.17%) nitrogen free extract, (7.74%) acid insoluble ash, (2.06%) calcium and (0.32%) phosphorus.

The chemical attributes of T_3 (200 g conc. + 200 g Azolla) content (85.36%) organic matter, (49.52%) dry matter, (21.05%) crude protein, (16.28%) crude fibre, (3.26%) ether extract, (14.64%) total ash, (44.77%) nitrogen free extract, (8.31%) acid insoluble ash, (2.21%) calcium, (0.35%) phosphorus. The chemical composition of T_4 (100g conc. + 300 g Azolla) indicates (84.08%) organic matter, (28.84%) dry matter, (22.19%) crude protein, (16.67%) crude fibre, (2.01) ether extract, (15.92%) total ash, (43.21) nitrogen free extract, (9.27%) acid insoluble ash, (2.36%) calcium and (0.39%) phosphorus.

The chemical composition of T_5 (400g) concentrate replaced with fresh Azolla indicates (81.78%) organic matter, (7.02%) dry matter, (22.08%) crude protein, (17.20%) crude fibre, (2.47%) ether extract, (18.22%) total ash, (40.03%) nitrogen free extract, (11.56%) acid insoluble ash, (2.68%) calcium and (0.44%) phosphorus.

Dry matter intake

The average total dry matter intake (Table - 1) in treatment T_1, T_2, T_3, T_4 and T_5 was 800.99, 881.56, 987.33, 1119.10 and 902.53 g/d. The dry matter intake of animals fed with treatment T_4 was significantly higher over the treatments T_1, T_2, T_3 and T_5. These results may be due to higher palatability of Azolla than feeding concentrates. The findings observed in this study were in lower agreement with Rajmane and Deshmukh [9] reported DMI intake of three complete ration containing sorghum straw (CR I), soybean straw (CR II) and corn cobs (CR III) 615, 924 and 782 g/day for, respectively and Shital *et al.* [11] who observed the dry matter intake as 340, 350 and 330 (g/d) in treatment T_1 (control), T_2 (15 % concentrate was replaced with Azolla meal), T_3 (25 % concentrate was replaced with Azolla meal) in goats fed Azolla.

Table 1: Average dry matter intake

Treatments	Body weight (kg)	DMI		
		Total intake (g/day)	Intake per 100 kg BW (kg)	Intake per kg $W^{0.75}$ BW (g)
1. T_1	22.43^{b}	800.99^{d}	3.81^{d}	38.05^{d}
2. T_2	22.90^{ab}	881.56^{c}	4.12^{bc}	41.15^{cd}
3. T_3	23.53^{a}	987.33^{b}	4.49^{b}	44.94^{b}
4. T_4	24.70^{a}	1119.10^{a}	5.02^{a}	50.17^{a}
5. T_5	24.22^{a}	902.53^{c}	4.05^{c}	40.49^{c}
6. SE±	0.69	7.75	0.13	1.33
7. CD (5%)	2.13	23.89	0.41	4.10

Figures having similar superscripts do not differ significantly.

Water intake

In animals body water provide through different feed, drinking water and its metabolic process. Water intake was recorded daily and presented in Table - 2.

The observed findings of water intake as per the average daily and total water intake were 1.20 and 72.21, 1.19 and 71.65, 1.24 and 74.24, 1.32 and 79.29 and 1.22 and 72.99 in treatment T_1, T_2, T_3, T_4 and T_5, respectively. However, lower values were reported for water intake Wagh [12] reported 0.720, 0.780, and 0.830 lit/day in Osmanbadi kids. Bhilawade [3] recorded the comparable results of water intake 0.821, 0.954, 1.110 lit/day in Osmanabadi kid fed with lucern grass, Jawar straw and concentrate and Qinisa and Boomker [8] recorded that 1.4 ± 0.4 lit/day water intake in goat.

Table 2: Average daily and total water intake of goat (lit)

Treatments	Water intake/day/goat (lit)	Total water intake/goat (lit)
T_1	1.20^{c}	72.21^{c}
T_2	1.19^{d}	71.65^{d}
T_3	1.24^{b}	74.54^{b}
T_4	1.32^{a}	79.29^{a}
T_5	1.22^{bc}	72.99^{c}
SE+	0.01	0.46
C.D. (5%)	0.02	1.43

Figures having similar superscripts do not differ significantly.

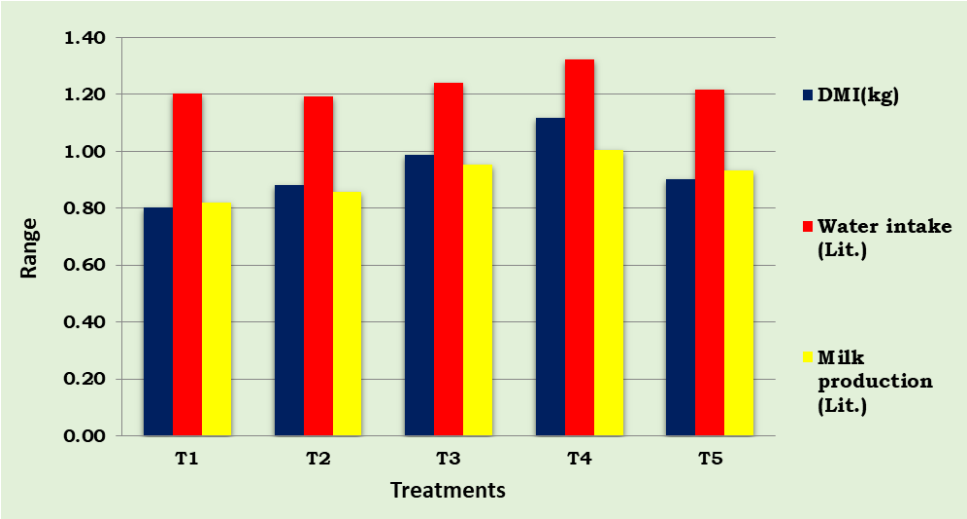
Milk production

The average daily and total milk production (Table - 3) of treatment group T_1 were 0.82 and 49.10, T_2 were 0.86 and 51.47, T_3 were 0.95 and 57.21, T_4 were 1.00 and 60.30 and T_5 were 0.93 and 55.96 lit/day, respectively. The treatments T_4 were significantly higher than T_3 followed by T_5, T_2 and T_1. Similar results were observed by Ravindra *et al.* [10] as 19.87 per cent more milk as compared to control group in lactating Barberi goat fed 40 per cent replacement of Gram straw with Azolla. Gulshan and Hem [5] reported that feeding fresh Azolla were increase 200-250 ml per day (10-15%) milk production in cattle and 8-10 per cent increase in meat by weight in goat. Bacchu *et al.* [2] also reported milk yield increased 19.32 per cent in buffaloes fed with Fresh Azolla. Nidhi *et al.* [6] recorded 11.85 per cent increase of milk in cows fed Azolla and Chatterjee *et al.* [4] reported 11.00 per cent milk yield was increased.

Table 3: Average daily and total milk production

Treatments	Dry matter Intake (g)	Daily average milk Production (Lit.)	Total milk Production (Lit.)	Daily Increase milk production (%)
T_1	800.99^{d}	0.82^{e}	49.10^{e}	0.00
T_2	881.56^{c}	0.86^{d}	51.47^{d}	4.83
T_3	987.33^{b}	0.95^{b}	57.21^{b}	16.53
T_4	1119.10^{a}	1.00^{a}	60.30^{a}	22.82
T_5	902.53^{c}	0.93^{c}	55.96^{c}	13.98
SE+	7.75	0.00	0.20	-
C.D. (5%)	23.89	0.01	0.63	-

Figures having similar superscripts do not differ significantly



Graph 1: Effect of DMI in milk production of Konkan Kanyal goat

Conclusion

Goat is the multipurpose animal in India and therefore, goat milk has tremendous important value and it's containing higher amount of Ca, Mg and P than cow, buffalo and human milk. Hence it can be concluded that the feed containing Basal diet + 300 gm Azolla + 100 gm concentrate was found superior to increased milk production of Konkan Kanyal goats.

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