*Original Research*

# Intensive Cultivation of Agasse (*Sesbania grandiflora*) for Sustainable Sheep Farming - An Action Oriented Research

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**Abstract**

*Animal husbandry in India plays a pivotal role in the development of rural people and it has transformed from being an integral part of agriculture to a much broader role in the overall national economy. Deficit in the quality green fodder availability has increased over years. Hence, a participatory action-oriented approach was designed to promote intensive cultivation of S. grandiflora for sustainable sheep farming. Two villages in Malavalli taluk were selected. The sheep farmers were sensitized about intensive cultivation of Sesbania through meetings and group discussions. Six farmers were mobilized to take up intensive cultivation of Sesbania. Sesbania saplings were supplied and cultivation practices were monitored. On-farm demonstrations were conducted to demonstrate the effect of supplementation of Sesbania forage on body weight of sheep. Constraints in adopting intensive cultivation of Sesbania were also identified through personal interview. Intensively Sesbania was cultivated and supplemented at the rate of 1 kg/day/lamb over a period of 90 days. The average daily gain in lambs fed with Sesbania was increased significantly (P<0.001) by 12.22 grams/day over the lambs without Sesbania supplementation. Lack of assured irrigation and electricity and non-availability of quality planting materials were the major constraint expressed by the farmers. The results of the present study indicated that intensive cultivation of Sesbania can be successfully adopted at the farm level and green fodder scarcity can be minimized to some extent. The farmers can be made to realize the economic gains in terms of increased body weight gain upon supplementation of Sesbania .*

**Key words:** Action Research, Average Daily Gain, Body Weight, Constraints, Intensive Cultivation, Participatory, *S. grandiflora*

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**Introduction**

Livestock provides livelihood support to millions of people having little access to land and they provide nutrient-rich food products, draught power, dung as organic manure and domestic fuel, hides & skin and these are a regular source of cash income for rural households. The value of output from agriculture and allied sector was 17.9 per cent and animal husbandry sector attributed to 4.1 per cent of the India's GDP and within agriculture 29 per cent GDP was contributed from animal husbandry sector (Indian Economic Survey, 2015-16). There is tremendous pressure on livestock production with respect to available total feed and fodder, as land available for fodder production has been decreasing. Currently, scarcity of feed and fodder resources is one of the major constraints impacting livestock development. Hardly 5 per cent of the cropped area is utilized to grow fodder. India is deficit in dry fodder by 11 per cent, green fodder by 35 per cent and concentrates feed availability by 28 per cent (Anonymous, 2011).

Sheep-rearing is a traditional source of livelihood for communities in the drought-prone rural areas of India. There are about 65.07 million sheep in India and ranks second with 7.14% of worlds sheep population. Karnataka state has the second highest sheep population in India with 9.6 million heads (Livestock Census, GOI, 2012). Sheep farming is considered as one of the poverty alleviating livestock enterprises as large number of small, marginal farmers and landless laborers are engaged in sheep rearing (Dastagiri and Rao, 1990). Meat production in India was estimated at 5.5 million tones, standing eighth in rank in the World's meat production. Buffalo in India contributes about 30 per cent of total meat production. Percentage of the contribution by cattle, sheep, goats and poultry was 30, 5, 10 and 11.5, respectively. Karnataka stands 11$^{th}$ position in meat production which produces 2.72 per cent of the total meat of the country (National Accounts Statistics, 2015).

Mandya or Bandur or Bannur sheep breed has been acclaimed to be one of the most important and dominant indigenous breeds of Karnataka. The breed is specifically famous for its meat quality and taste due to the presence of marbling. Karnataka is the second state next only to Rajasthan in terms of total geographic area which is drought prone. In 2015, 135 taluks in 27 districts and in 2016, 98 taluks in 26 districts were declared as drought affected in the state. Drought is considered as one of the biggest hurdle to livestock sustainability among all weather related crisis. Failure of crops and the non-availability of fodder in drought, force many farmers to resort to distress livestock selling which results in economic crisis. Hence, fodder mitigating plan for Karnataka is a must to sustain livestock.

In this regard, cultivation of fodder trees and supplementation with fodder tree forage is best suited method for smallholder farmers (Devendra, 1992). The use of fodder trees can overcome the protein deficiency in the basal diet, complement crop production and stabilize the ecosystem to maximize food and feed from the same land. Investment costs, land and labour use and risk of failure are relatively low, which is essential for widespread adoption and use (Batz *et al.*, 2003).





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The perennial species of *Sesbania* establish easily, fastly, grow in difficult sites and do not require complex management. The leaves contain 36 per cent crude protein (DMB) and 9600 IU vitamin A in every 100 g. For optimizing fodder yield and to increase productivity per unit land area, *Sesbania* can be intensively cultivated with application of fertilizers and regular irrigation for economic and sustainable livestock production throughout the year (FAO, 2007). The involvement of local people in the design, implementation and evaluation of new technology would facilitate capacity building and awareness to the farmers. Thus, participatory approaches are mandatory for the development of forage options (Peters *et al*., 2003). With this background, the present study was undertaken with the following objectives; to sensitize and mobilize dairy farmers for intensive cultivation of *S. grandiflora*, On-farm demonstration of feeding *Sesbania grandiflora* and its effect on the body weight gain in sheep and to identify the constraints in adoption of intensive cultivation of *S. grandiflora*.

**Materials and Methods**

The study adopted an action oriented participatory approach for promoting intensive cultivation of *Sesbania grandiflora*, a fodder tree for sustainable sheep production, in selected villages. The action oriented participatory approach attempts to solve the problems in real world situations involving the local people. Participatory action research is a process in which all the participants are involved from initial design of the research project to data gathering, analysis, final conclusions and follow up actions (Whyte, 1991). The study was undertaken purposively in Malavalli taluk of Mandya district in Karnataka state, as it is the home tract for Mandya/Bandur sheep breeds and Malavalli taluk has more number of Bandur sheep flocks with less annual rainfall causing green fodder scarcity during summer. Two villages namely, Dasanadoddi and Kandegala were purposefully selected as both the villages possessed good number of sheep population. Further Bandur sheep breeder's association is existing in those villages, which is formed by the farmers of the local area who are rearing the Bandur sheep. Hence, above mentioned villages were selected with an aim to improve green fodder production and to reduce the unit cost of mutton production.

The farmers for the study were selected based on the criteria that they should possess some land, irrigation facility (bore well) and have minimum of 5 bandur lambs of one to two months age. Five sheep farmers from Dasanadoddi and three farmers from Kandegala village were selected. Thus, eight farmers were selected for the study. Forty lambs in experimental group and twenty lambs in control group were selected without any modification in housing and feeding managemental practices. Thus, sixty lambs of one to two months age group were selected for the study. Sensitization and mobilization of farmers was done through frequent visits, informal meetings, discussion with the villagers and consultation with the village leaders and the key persons. The aim of the study, the primary benefits like nutritive value and economic importance and secondary benefits of intensive cultivation of *S. grandiflora*, were explained in the





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meetings. A demonstration plot was established in an innovative farmer's field. All the participant farmers were taken on a field trip to a demonstration plot. Further, each participant farmer was supplied with the 200 saplings of *S. grandiflora* and cultivation practices were monitored.

On-farm demonstrations were conducted to demonstrate intensive cultivation of *Sesbania grandiflora* and to demonstrate the effect of supplementation of Sesbania forage on body weight in sheep. In the rainy season each farmer was supplied with 200 saplings of *S. grandiflora* and planted in approximately one gunta (1/40$^{th}$ of an acre) land and the line spacing of 3 X 2 feet (3 feet between ridges and 2 feet between plants within ridge) was followed. The irrigation was done immediately after planting and irrigation was provided for once in 15 days upto six months followed by once in month. The plants were coppiced or pruned 6 months after planting. The fodder was harvested in 6 weeks after coppicing and the subsequent cuts at an interval of 15-30 days. To demonstrate effect of Sesbania supplementation on body weight in sheep, three months supplementation of Sesbania to the lambs was followed. For fodder production using seeds, the seed rate of 7 to 8 kg per hectare seeds should be sown at a distance of 90 x 60cm (90 cm between ridges and 60 cm between plants within ridge).

The feeding trial lasted for a total of three months with feeding Sesbania forage at the rate of 1 kg fresh forage/day/lamb (starting from one to two months age) in experimental group of animals and in control group sesbenia forage was not supplemented. The fresh Sesbania forage was weighed using digital balance and supplemented to lambs every day. For this, farmers were provided with digital balance to supplement Sesbania forage in accurate measure. Feeding pattern of lambs under study was maintained uniform throughout the feeding trial. The initial body weight was recorded from all lambs before starting the feeding trial. Body weight was recorded once in 15 days both in experimental group and in control group of animals. Change in body weight between experimental group and control group was calculated.

To identify the constraints as perceived by farmers in adoption of intensive cultivation of *Sesbania grandiflora*, a semi structured schedule was developed in consultation with relevant literature and through experts' suggestions in the field of veterinary extension. The instrument consists of eleven items, which were given in two-point continuum i.e. yes or no. Apart from these items, the farmers were also asked to indicate the other problems they facing in adopting intensive cultivation of *Sesbania grandiflora*.

**Results and Discussion**

Sensitization and mobilization of farmers through 2-3 frequent visits and consultation with village leaders and key persons, rapport was established with the villagers and their confidence was gained. Sushant (2010) reported that rapport building was not an easy procedure as it was time consuming and had maximized his frequency of visits to the study villages with multifaceted approach. Through 2-3 group discussions, the key persons and village leaders were persuaded about the new intervention to solve the green fodder crisis.





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Through 2-3 informal meetings, the sheep farmers were sensitized about the new technology. Similar type of approach was reported by Peters *et al*. (2003) who argued that the key elements in the approaches linking on-station research to farmer participation for forage development with farmers includes assessment of farmers priorities, enhancement of farmer's knowledge of the secondary benefits of forage legumes, definition of niches and entry points for forages in smallholder systems and farmer inclusion.

Farmers interested in intensive cultivation of Sesbania had gathered at the demonstration plot. The basic knowledge about land preparation and irrigation were explained in detail by the researcher. In due course, the farmers had gained idea behind the study and they were discussing about *Sesbania grandiflora* cultivation among themselves. The purpose of the study and how it could solve the green fodder crisis during lean season were explained to them. The interested farmer's land holdings, irrigation facility and livestock possession details were gathered. Based on the information gathered, with the help of the key communicators, six interested farmers from two villages were selected for taking up intensive cultivation of *Sesbania grandiflora*. For the diffusion of innovations, Rogers (2003) reported that, once 10 to 20 per cent of the targeted farmers have adopted, the diffusion process often continues independently and without further interference from outside. An exposure visit of the participant farmers to a demonstration plot facilitated farmer-to-farmer interaction about the agronomic practices and new technology of cultivating fodder trees intensively for fodder purpose. Mekoya *et al*. (2008) reported that buildup of a farmer-to-farmer information exchange system through participatory approaches will help to develop trust of farmers to adopt an innovation.

Participant farmers planted the supplied Sesbania saplings in approximately one gunta of land and practiced the instructed cultivation practices. In the present study, the farmers followed 17,000 – 17,500 saplings/hectare, 3 ft x 2 ft or 6 sq ft, to facilitate branching and biomass spread. Number of saplings supplied per farmer was 200 considering an annual yield of 27 kg of green leaves per tree by harvesting side branches every 2-3 months and therefore 5-6 cuttings per year (FAO, 2007). Thus, farmers were supplied 200 *S. grandiflora* sapling sufficient to feed 15 sheep throughout the year at the rate of 1 kg per day fresh green fodder. However, the average fresh fodder yield in the present study was found to be 1 kg/tree/cutting (6 kg/tree/year or 102 MT per year per hectare). This could be attributed that; the plants were in the initial stage of production. The findings from the study were similar with Pramila *et al*. (2015), who reported that the average fresh fodder yield has 1.3 kg/tree/cutting (7.8 kg/tree/year or 93.6 MT per year per hectare). The higher the tree density, the higher the total fodder yield, but individual trees yield decreases (Chen *et al.*, 1992). As per Smith (1992), when high leaf yield is targeted for fodder production, high planting densities are recommended.

The participatory action-oriented approach extends the active participation of farmers well beyond the initial stage of appraisal to technology development and evaluation on farms. The technology is evaluated





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using criteria that are important to farmers and the results are used to make recommendations. Thus on-farm feeding trials were conducted to demonstrate the effect of supplementation of Sesbania fresh fodder at the rate of 1 kg/day/sheep. Nirmala *et al*. (2012) reported that technology demonstration through farmer inclusion has wider implications on empowerment of farmers. Initial body weight of lambs was taken from lambs of all 8 participant farmers both in experimental and control group and the feeding of Sesbania was started on the same day. Body weight was recorded at 15 days interval upto 90 days of experimental period. Average daily gain (ADG; g/d) and body weight (kg) gain for 15 days of individual lambs of experimental and control groups during the feeding trial over 90 days.

Table 1 revealed that the initial and final body weight (kg) for experimental and control groups were 7.31 kgs & 15.62 kgs and 6.69 kgs & 13.91 kgs, respectively. The total body weight gain (kg) of experimental and control groups during the experimental period 8.31 kgs and 7.22 kgs, respectively. Percentage gain in the body weight was 5.86 more in experimental group then in control group. The average daily gain (g per day) for experimental and control groups during the experimental period were 92.42 and 80.20, respectively. The ADG difference between experimental and control groups during the experimental period was 12.22 grams and overall ADG between experimental and control groups during the experimental period was statistically highly significant (P<0.01).

**Table 1:** ADG (g / d) of lambs of experimental and control groups during the experimental period

| Attribute | Experimental group (N=40) | Control group (N=20) | Mean difference |
|---|---|---|---|
| Initial body weight (kg) | 7.306 ± 0.158 | 6.687 ± 0.279 | 0.62 |
| Final body weight (kg) | 15.62 ± 0.230 | 13.91 ± 0.299 | 1.72 |
| Body weight gain (kg) | 8.318 ± 0.2065** | 7.221 ± 0.186 | 1.097 |
| Percentage gain | 113.85 | 107.99 | 5.86 |
| ADG (g) | 92.42 ± 2.294** | 80.20 ± 2.065 | 12.22 |

*** Highly significant (P<0.001); ADG - Average daily gain*

The increased body weight gain with Sesbania feeding was attributed to high nutritive value of Sesbania fodder. Similar results were reported by Kassa (2008) who observed that supplementation of Sesbania *forage* at 30 per cent of the ration (0.98% of body weight) improved basal and total feed intake, digestibility, growth rate and the overall reproductive performance of sheep. He also concluded that Sesbania is a potential protein supplement that can be used to support the nutritional security of livestock or as a substitute for commercial concentrate feed for smallholder farmers. When *S. grandiflora* fed as supplement to teff straw (30%) to both sheep and goats in Ethiopia, the growth rate of sheep was increased by 35 g/head/day, while that for goats was 4 g/head/day (Gutteridge, 1987).

Table 2 revealed that the ADG (g per day) in male and female lambs of experimental group was 100.3 and 86.60, respectively and ADG (g per day) in male and female lambs of control group was 85.57 and 74.58,





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respectively. A difference of 13.70 grams was observed between male and female lambs within experimental group and 10.99 grams within control group. Average daily gain difference between male and female in both experimental and control group was highly significant (P<0.001). Results were found similar to Sayili *et al.* (2009), who reported that the male lambs found to achieve more daily weight gain (134.29 g) than the females (100 g). Saricicek *et al*. (1992) studied 3.5-4.5-month-old male and female Karayaka lambs fed with 35 per cent concentrate diet + pasture and 50 per cent concentrate diet + pasture, respectively and found that male lambs were superior to female ones for total and daily live weight gain. These results support the present study findings. According to Karabulut and Cangir (1983), male lambs have higher daily live weight gain than the females. Besides that, they are more efficient in utilization of the feed.

**Table 2:** ADG (g / d) of lambs between male and female lambs of experimental and control groups during the experimental period

| | Groups | Male | Female | Mean difference |
|---|---|---|---|---|
| ADG | Experimental group | 100.3 ± 3.289** (N=17) | 86.60 ± 2.607 (N=23) | 13.69 |
| | Control group | 85.57 ± 2.421** (N=9) | 74.58 ± 1.626 (N=11) | 10.99 |

*** Highly significant (P<0.001); ADG - Average daily gain*

Constraints expressed by farmers in adoption of intensive cultivation of *S. grandiflora.* Lack of assured irrigation and electricity was ranked 1st as the major constraint. In the study area, annual rainfall recorded was 650mm in 2014, 705mm in 2015 and 611 mm in 2016 and the Malavalli taluk is one among the drought affected taluk declared by Karnataka government in 2016. Selected villages are not having the channel irrigation facility and they mainly depend on bore wells. Due to less annual rain fall from last three years, bore wells have become dry. Similar constraint was reported by Kantharaju (2015), Pramila *et al*. (2015) and Shashekala *et al*. (2012), Another major constraint perceived was non-availability of quality planting materials (seeds, seedlings or saplings) (2nd rank). Similar constraint was reported by Mwangi and Wambugu (2003), Pramila *et al*. (2015) and Kantharaju (2015). Lack of financial support from the Government and Bank (3rd rank) was expressed major constraint. Similarly, Shah *et al.* (2011), Kumar *et al*. (2012a) and Shashekala *et al*. (2012) reported that no easy access to credit and higher expenditure for production, inadequate resources for cultivation of fodder crops round the year and lack of credit, as the major constraints. Lack of awareness about intensive cultivation of fodder trees (4th rank) was also one of the constraints perceived by the farmers. Even though few farmers were aware of growing Sesbania trees as support to beetle vine, the concept of intensive cultivation was new to them which need to be addressed through extension methods to create awareness. Similar constraint in adoption of intensive cultivation of fodder trees also reported by Pramila *et al*. (2015) and Kantharaju (2015).





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**Table 3:** Constraints expressed by the farmers in adopting intensive cultivation of *S. grandiflora*

| S. No. | Constraints | Frequency (N=60) | Percentage (%) | Rank |
|---|---|---|---|---|
| 1 | Lack of awareness about the benefits of feeding Sesbania to sheep | 31 | 51.67 | V |
| 2 | Lack of awareness about intensive cultivation of fodder trees | 31 | 51.67 | V |
| 3 | Non-availability of quality planting materials (seeds, seedlings or saplings) | 50 | 83.33 | II |
| 4 | Lack of extension service about intensive cultivation of fodder trees | 31 | 51.67 | V |
| 5 | Land meant for commercial cash crops can't be spared for fodder tree production | 40 | 66.67 | IV |
| 6 | Lack of assured irrigation and electricity | 54 | 90 | I |
| 7 | Net income obtained from fodder tree cultivation is low | 20 | 33.33 | VIII |
| 8 | Threat of damage from open grazing by sheep and goats | 21 | 35 | VII |
| 9 | Lack of timely technical guidance | 31 | 51.67 | V |
| 10 | Lack of financial support from the Government and Bank | 45 | 75 | III |
| 11 | Non-availability of labour for fodder growing and weeding | 25 | 41.67 | VI |

Land meant for commercial cash crops can't be spared for fodder trees (5$^{th}$ rank) was one of the major constraints perceived by the farmers. Similar constraint was reported Ranjitha (2002), Lack of timely technical guidance, lack of awareness about the benefits of feeding Sesbania to sheep and lack of extension service about intensive cultivation of fodder trees (6$^{th}$ rank) were the constraints perceived by the farmers. Perhaps, all these three constraints pointed towards lack of linkage between on-station, on-farm and participatory research. Similar constraints were reported by Melkania and Shukla (2002), Sayeed *et al*. (2010), Shashekala *et al*. (2012) and Pramila *et al.* (2015). Non-availability of labour for fodder growing and weeding (7$^{th}$ rank) was one of the constraints perceived by the sheep farmers in adopting intensive cultivation of Sesbania. Due to urbanization and industrialization, working class people are moving towards cities to earn rather than working in the villages. Similar constraint was reported by Kantharaju (2015). Threat of damage from open grazing by sheep and goats (8$^{th}$ rank) and net income obtained from fodder tree cultivation is low (9$^{th}$ rank) were the least ranked constraints in adoption of intensive cultivation of *S. grandiflora*. Similar constraint was reported by Kumar *et al*. (2012b). Shah *et al.* (2011) and Kumar *et al*. (2012b) in their study where they illustrated that because of comparatively very low net returns, farmers have least preference for growing fodder crops. Despite, the participant farmers in the study area were not bothered by the net income that fodder tree cultivation would fetch them when compared to other





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commercial crops and thus the constraint was least. This could be due to their realization, through on-farm demonstrations, of economic benefits of feeding Sesbania to sheep in terms of body weight gain.

A demonstration-cum-discussion programme, 'Kshetrotsava' was conducted at one of the participant farmer's field. The experts from veterinary college, Bengaluru and Deputy Director, Dept of Animal Husbandy and Veterinary Service were part of the discussion programme. The sheep farmers from different villages of Malavalli taluk participated in the programme and discussed about the intensive cultivation of fodder trees and the constraints associated with it. The Deputy Director, Dept. of Animal husbandry and Veterinary Service assured the farmers about supply of required seeds. The programme was telecasted in Doordarshan Chandana (Kannada TV channel) under 'Krishidarshana' programme. As a result, mass awareness was created and farmers from various parts of Karnataka contacted the experts for further information.

It is possible to obtain sufficient legume forage yield for feeding sheep throughout the year by properly addressing the constraints and refining the needed innovative technologies for local situations. Participatory extension approaches can be effectively utilized for identifying the opportunities and constraints associated with the forage production technology and thereby refining the technology for enhancing forage security and thus sustained development of livestock sector. On-farm demonstrations can be successfully used for scaling-up the forage technology. Intensive cultivation of *S. grandiflora* can be successfully adopted at the farm level and the farmers can be made to realize the economic gains in relatively short time in terms of increased ADG in sheep by supplementing Sesbania fodder.

## Conclusion

It is possible to obtain sufficient legume forage yield for feeding sheep throughout the year by properly addressing the constraints and refining the needed innovative technologies for local situations. Participatory extension approaches can be effectively utilized for identifying the opportunities and constraints associated with the forage production technology and thereby refining the technology for enhancing forage security and thus sustained development of livestock sector. On-farm demonstrations can be successfully used for scaling-up the forage technology. Intensive cultivation of *S. grandiflora* can be successfully adopted at the farm level and the farmers can be made to realize the economic gains in relatively short time in terms of increased ADG in sheep by supplementing Sesbania fodder.

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