



Intensive cultivation of *Sesbania grandiflora* for sustainable dairy farming - an action oriented approach

PRAMILA¹, K SATYANARAYAN², V JAGADEESWARY³, U KRISHNAMOORTHY⁴,
C S NAGARAJ⁵ and SIDDARAMANNA⁶

Veterinary College, Bengaluru, Karnataka 560 024 India

Received: 13 August 2014; Accepted: 30 March 2015

ABSTRACT

Development and growth of huge livestock population in India are dependent on availability of feed and fodder. But there exists a large gap between requirement and actual availability of feed and fodder at national level including green fodder. The green fodder shortage can be partially met out by intensively cultivating green fodder trees. An action oriented participatory approach was initiated in Chikkaballapur district of Karnataka to promote intensive cultivation of *Sesbania grandiflora*, a perennial fodder tree. The dairy farmers were sensitized and mobilized to take up intensive cultivation of *Sesbania grandiflora*. On-farm demonstrations were conducted to demonstrate effect of supplementation of *Sesbania* forage on milk yield in crossbred lactating cows. Constraints in adopting intensive cultivation of *Sesbania grandiflora* were identified through personal interview using structured interview schedule. The participant farmers cultivated sesbania intensively and the fodder was supplemented @ 5 kg/day/cow. The milk yield increased significantly by 11.97% in cows supplemented with *Sesbania* forage. Lack of assured irrigation and electricity was ranked as the major constraint. Thus, small holder dairy farmers can successfully cultivate *Sesbania grandiflora* (100–200 trees) intensively in 1 or 2 guntas of fallow land with minimal or no inputs and green fodder scarcity can be minimized to some extent. The unit cost of milk production can be reduced by supplementing the *Sesbania* fodder to cross bred milking cows and thereby sustain dairy farming.

Key words: Constraints, Intensive cultivation, Milk yield, Participatory, *Sesbania grandiflora*

Livestock provides livelihood support to millions of people having little access to land. Development and growth of huge livestock population in India are dependent on availability of feed and fodder. Even though availability of feed resources varies from area to area, there is a gap in the availability versus requirement. As per estimates, the deficit of dry fodder, concentrates and green fodder currently is 10, 33 and 35%, respectively, which by 2020 is likely to be 11, 35 and 45% (Planning commission 2011).

Karnataka is the second state next only to Rajasthan in terms of total geographic area which is drought prone. The mean dry matter (DM) availability for the state was 56.46%. The total contribution of crop residues, greens and concentrates to DM in the state was 72.59, 23.6 and 3.81% respectively (Biradar and Vinod 2013). Despite the fact that

crop residues are high in fibre and are associated with a low voluntary intake, they could provide a valuable source of energy for ruminant livestock if supplemented with protein rich feeds. 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).

The perennial fodder tree species of *Sesbania* establish easily, grow in difficult sites and do not require complex management to maintain productivity. *Sesbania* is saline resistant species which is capable of fertilizing drought affected saline lands (Bilquees *et al.* 2014). For optimizing fodder yield and to increase productivity per unit land area, *Sesbania* can be intensively cultivated with application of organic manure or 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

Present address: ¹Veterinary Officer (reddypramila1@gmail.com), Department of Animal Husbandry and Veterinary Services, Government of Karnataka, ²Professor and Head (ksnkmk1960@gmail.com), ³Assistant Professor (jagext@gmail.com), Department of Veterinary and Animal Husbandry Extension Education, ⁵Principal Scientist and Head (csngeetha@yahoo.com), AICRP on Poultry Breeding on Meat. ⁴Professor (ukmthy@yahoo.com), University of West Indies, Trinidad and Tobago. ⁶Senior Technical Officer (sidaramanna@gmail.com), SRS of NDRI, Aduodi, Bengaluru.

following objectives; to sensitize and mobilize dairy farmers for intensive cultivation of *Sesbania grandiflora*, on-farm demonstration of effect of feeding *Sesbania grandiflora* on milk production and to identify the constraints in adoption of intensive cultivation of *Sesbania grandiflora*.

MATERIALS AND METHODS

A participatory action oriented approach, which attempts to solve the real problems in real world situations involving the local people, was adopted for promoting intensive cultivation of *Sesbania grandiflora*. Gudibande taluk of Chikkaballapur district in Karnataka was selected purposively based on two criteria. The taluk being drought prone receiving 650 mm of rainfall and depleted ground waters with low fertile soils was the first criteria. The second criteria being the taluk was declared as highly backward with poor socio-economic conditions and the farmers depend on dairying for earning their livelihood. Two villages namely, Brahmanarahalli and Medimakalahalli were purposefully selected as both the villages have good number of high yielding crossbreds and well managed Milk Producer's Co-operative Societies (MPCS).

Ten women dairy farmers from Brahmanarahalli Women MPCS and 10 farmers from Medimakalahalli MPCS were selected based on the criteria that they should have bore well irrigation facility and should have minimum two crossbred cows in early lactation, so that the cows would have passed off peak lactation (>8 weeks) during the period of demonstration of effect of supplementation of *Sesbania grandiflora* forage on milk yield. Thus, 40 lactating crossbred cows, without any modification in housing and feeding practices, were selected for the study.

The farmers were sensitized through extension methods and mobilized to take up intensive cultivation of *Sesbania grandiflora*. Further, each participant farmer was supplied with the 100 saplings of *Sesbania grandiflora* and cultivation practices were monitored. The plants were coppiced or pruned 6 months after planting at 2 m height. The side branches were harvested, at 6 weeks (after coppicing) of regrowth, for fodder.

To demonstrate effect of *Sesbania* supplementation on milk yield, 'before-and-after' design was employed. The feeding trial lasted for a total of 8 weeks comprising of 2 weeks without feeding *Sesbania* forage followed by 2 weeks of feeding *Sesbania* forage @ 5 kg fresh forage/day/cow in first trial and switched back to 2 weeks without feeding *Sesbania* forage followed by 2 weeks of feeding *Sesbania* forage in second trial. The roughage component of the diet (crop residues like finger millet straw mixed with dried sorghum stover and hybrid napier) and the quantity of concentrate feed fed to the cows under study prior to feeding trial were maintained uniform throughout the feeding trial. The cows were hand-milked twice a day and milk yield of individual cows were recorded. The mean milk yield without and with *Sesbania* forage supplementation for both the trials was calculated and paired t-test was employed for analyzing significant difference in mean milk yield.

To identify the constraints, personal interview of the respondents was carried out with the help of a structured interview schedule and ranked according to Garrett score.

RESULTS AND DISCUSSION

Sensitization and mobilization of farmers: Through extension methods and consultation with village leaders and key persons, rapport was established with the villagers and their confidence was gained. The village leaders help to get social sanction for development through their influence and skills to bring people together and empower them to take action for their development (Rogers 2003). 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 farmers' knowledge of the secondary benefits of forage legumes, definition of niches and entry points for forages in smallholder systems and farmer inclusion. Ten farmers from each village were mobilized based on their interest, know-how and availability of resources to participate in demonstration. Mekoya *et al.* (2008) reported that build up of a farmer-to-farmer information exchange system through participatory approaches will help to develop trust of farmers' to adopt an innovation.

All 20 participant farmers planted the supplied *Sesbania* saplings in approximately one gunta of land and practiced the instructed cultivation practices. As there were no standard package of practices available for intensive cultivation of fodder trees which can be followed universally, the practices need to be standardized for specific niches. However, intensive cultivation of *Sesbania grandiflora* trees and fodder yield mainly depends on agronomic practices such as tree plant density, age at pruning or coppicing, pruning height, cutting intensity and cutting frequency. Minimum number of saplings supplied per farmer was 100 considering an annual yield of 27 kg of green leaves/ tree by harvesting side branches every two to three months and therefore 5–6 cuttings per year (FAO 2007). Thus, a farmer was supplied 100 *Sesbania grandiflora* trees sufficient to feed a cow throughout the year @ 1 kg/day DM or 5 kg/day fresh green fodder. However, the average fresh fodder yield in the present study was found to be 1.3 kg/tree/cutting (7.8 kg/tree/year or 93.6 MT/year/ ha). This could be attributed to the tenderness of the plants as the interval between coppicing and fodder harvest was just 6 weeks and non application of organic manure or fertilizers.

On-farm demonstrations: On-farm feeding trials were conducted to demonstrate the effect of supplementation of *Sesbania* fresh fodder @ 5 kg/day/cow on milk yield. Nirmala *et al.* (2012) reported that technology demonstration through farmer inclusion has wider implications on empowerment of farmers.

Mean daily milk yield was higher in cows supplemented with *Sesbania* forage, by 12.51% in first trial and by 11.40%

in second trial (average 11.97%), both being significantly ($P < 0.005$) higher than in those not supplemented with *Sesbania* forage. Further, the milk yield response to supplementation and withdrawal of *Sesbania* supplement was quick and was seen as early as on the first or second day of feeding pattern change (Fig. 1). This immediate response drew the attention of the participant farmers in demonstrating the advantage of supplementing *Sesbania* fodder. The findings of the present study were in line with the findings of Vijayakumar *et al.* (2000) who reported 8% increase in milk yield in cows supplemented with fresh *Sesbania grandiflora* fodder @ 5 kg/day/cow over that of control group with no supplementation. Similarly, Mekoya *et al.* (2009) reported that ewes supplemented with *Sesbania sesban* showed a 13% increase in milk production over ewes supplemented with concentrates. In contrast, Srinivasan *et al.* (2010) reported supplementation of *Sesbania grandiflora* @ 5 kg/animal/day for a period of 45 days, showed increase in milk protein where as milk yield and milk fat per cent remained unaltered. However, all these studies were not on-farm trials but the experimental trials.

Identification of constraints in intensive cultivation of Sesbania grandiflora: Lack of assured irrigation and electricity was ranked as the major constraint (Table 1). In

the study area, annual rainfall for 2011 recorded was 651 mm and 99% of the total irrigated area is irrigated by bore-wells. The ground water in the study area is over exploited resulting in total dryness of the bore-wells during pre monsoon (Mar-May) season. Further, ground water is accessible at 250–300 m depth which require three-phase electricity to pump water. But due to load shedding, water availability for irrigation is a serious problem. Non availability of quality planting materials was ranked as third major problem. Similar constraint was reported by Mwangi and Wambugu (2003), Sayeed *et al.* (2010), Shah *et al.* (2011) and Kumar *et al.* (2012). Though there are regional stations and central fodder seed production farms engaged in production and distribution of fodder seeds, seeds of fodder trees and shrubs are rarely available.

Lack of awareness about the benefits of feeding *Sesbania* to dairy animals and lack of extension service about intensive cultivation of fodder trees and lack of timely technical guidance were ranked as fourth, sixth and ninth problems respectively. Perhaps, all these 3 constraints pointed towards lack of linkage between on-station, on-farm and participatory research. Contact with extension agents not only accounted for farmers gaining certain information but also affects what they put into practice.

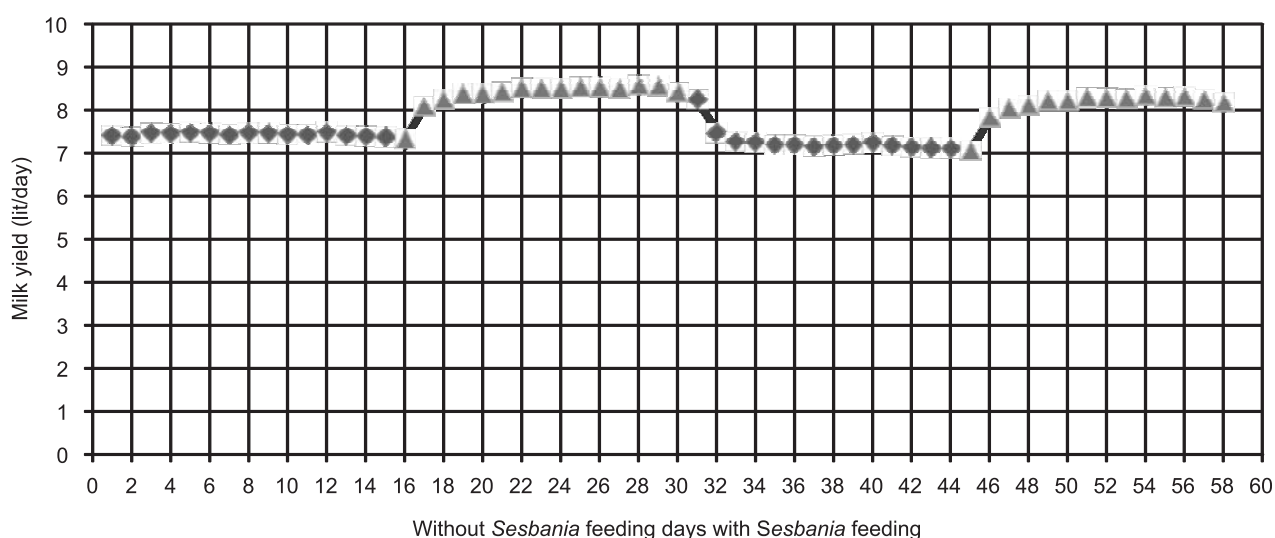


Fig. 1. Daily mean milk yields in crossbred cows without and with *Sesbania* supplementation.

Table 1. Constraints in adopting intensive cultivation of *Sesbania grandiflora*

Constraints	Total score	Average score	Garrettrank
Lack of awareness about the benefits of feeding <i>Sesbania</i> to dairy animals	1057	55.63	4
Lack of awareness about intensive cultivation of fodder trees	1229	61.45	2
Quality planting materials (seeds, seedlings and/or saplings) are not available	1171	58.55	3
Lack of extension service about intensive cultivation of fodder trees	899	44.95	6
Land meant for commercial cash crops cannot be spared for fodder trees	409	51.12	5
Lack of assured irrigation and electricity	1533	76.65	1
Net income obtained from fodder tree cultivation is low	268	38.28	8
Threat of damage from open grazing by sheep and goats	629	44.92	7
Lack of timely technical guidance	637	35.38	9
Lack of financial support from the government	448	28	10
Lack of credit facilities from banks	137	19.57	11

Hence, where knowledge is the main limiting factor, extension will influence both knowledge and adoption of the specific technology. Similar constraints were reported by Sayeed *et al.* (2010).

Lack of financial support from the government and lack of credit facilities from banks were least ranked constraints. This could be attributed to fewer inputs or no inputs required in cultivating *Sesbania grandiflora* intensively except for planting materials, as fertilizer was not used in the present study. Whereas, Shah *et al.* (2011) and Kumar *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, respectively, as the major constraints.

Participatory extension approaches can be effectively utilized for identifying the opportunities and constraints associated with the forage 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 *Sesbania 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 milk yield by supplementing *Sesbania* fodder. Small holder dairy farmers can reduce unit cost of milk production and sustain dairy farming by intensively cultivating *Sesbania grandiflora* (100–200 trees) in 1 or 2 guntas of fallow land and supplementing the *Sesbania* fodder. The *Sesbania* fodder obtained from the meager land partially fulfills the green fodder needs of 1 or 2 cows round the year or 3 to 4 cows during a lean period of 8 to 12 weeks. If some protective irrigation is provided during lean season, *Sesbania grandiflora* can be intensively cultivated and green fodder scarcity can be minimized to some extent. There is scope for greater use of *Sesbania* species in ruminant feeding systems, particularly as high quality supplements to low quality roughages. Hence, determination of appropriate management systems to maximize yields of fodder and the extent of inclusion in ruminant diet deserves further attention.

REFERENCES

- Batz F J, Janssen W and Peters K J. 2003. Predicting technology adoption to improve research priority-setting. *Agricultural Economics* **28**: 151–64.
- Bilquees Gul, Raziuddin Ansari, Haibat Ali M, Yousuf Adnan, Darrell J, Weber, Brent L, Nielsen, Hans -W. Koyro and Ajmal Khan M. 2014. The sustainable utilization of saline resources for livestock feed production in arid and semi-arid regions: A model from Pakistan. *Emirates Journal of Food and Agriculture* **26**(12): 1032–45.
- Biradar N and Vinod K. 2013. Analysis of fodder status in Karnataka. *Indian Journal of Animal Sciences* **83**(10): 1078–83.
- FAO. 2007. Factsheet-Sesbania sesban. http://www.tropicalforages.info/key/Forages/Media/Html/Sesbania_se.
- Kumar S, Kumar B, Kumar R and Sankhala G. 2012. Farmers' opinion to reduce the constraints in scientific dairy farming practices—a case study. *Indian Journal of Animal Sciences* **82** (7): 762–66.
- Mekoya A, Oosting S J, Fernandez-Rivera S and Van Der Zijpp A J. 2008. Farmers' perceptions about exotic multipurpose fodder trees and constraints to their adoption. *Agroforestry Systems* **73**: 141–53.
- Mekoya A, Oosting S J, Fernandez-Rivera S, Tamminga S and Van Der Zijpp A J. 2009. Effect of supplementation of Sesbania sesban to lactating ewes on milk yield and growth rate of lambs. *Livestock Science* **121**: 126–31.
- Mwangi D M and Wambugu C. 2003. Adoption of forage legumes: the case of *Desmodium intortum* and *Calliandra calothyrsus* in central Kenya. *Tropical Grasslands* **37**: 227–238.
- Nirmala G, Maruthi V and Venkateswarlu B. 2012. Participatory technological empowerment of women groups in rainfed agriculture: An action research in Andhra Pradesh state. *Indian Research Journal of Extension Education* **12**(1): 14–19.
- Peters M, Lascano C E, Roothaert R N and de Haan N C. 2003. Linking research on forage germplasm to farmers: the pathway to increased adoption- a CIAT, ILRI and IITA perspective. *Field Crops Research* **84**: 179–88.
- Planning commission. 2011. *Report of the working group on AHD for XII Plan*, Government of India.
- Rogers E M. 2003. *Diffusion of Innovations*. 5th edn. The Free Press, New York.
- Sayeed M A, Rahman S M A, Alam J, Sarker N R and Begum J. 2010. A profitability study on fodder cultivation and competing crops in selected areas of Bangladesh. *Economic Affairs* **55**(1): 1–14.
- Shah V D, Makwana M and Sharma S. 2011. Economics of production, processing and marketing of fodder crops in Gujarat. *Research study No. 144*, Agro-Economic Research Center, Sardar Patel University, Gujarat.
- Srinivasan S R, Dhanapalan P and Nambi A P. 2010. Clinical assessment of herbal remedies in animals. *Compendium of International Conference on Ethno-veterinary Practices, Thanjavur*. India. Pp.168
- Vijayakumar G, Srinivasan S R and Dhanapalan P. 2000. Effect of supplementation of *Sesbania grandiflora* on milk in bovines. *Cheiron* **29** (1/2): 54–55.