



Performance of lucerne (*Medicago sativa*) under semi-arid ecosystem of Central Gujarat

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Received: 21 June 2014; Revised accepted: 3 October 2014

ABSTRACT

The present study was conducted to popularize the improved green fodder production technology in Panchmahals district of Central Gujarat. Constraints in lucerne (*Medicago sativa* L.) production were identified through participatory approach. Preferential ranking technique was utilized to identify the constraints faced by the farmers in lucerne production. The results revealed that lack of suitable HYVs, scarcity of irrigation water, weed (*Cuscuta* spp.) infestation and lack of technical knowledge were found to be the four most important factors responsible for the non-adoption of HYVs of lucerne in Panchmahals district of Gujarat. The yield of green fodder from lucerne in demonstrated variety Anand 2 was 610 q/ha as compared to local check (395 q/ha). The percentage increase in the yield over local check was computed to be 54.43. Results of study on economic analysis of the yield performance revealed that the front line demonstrations (Anand 2) recorded higher gross returns (₹ 91 500/ha) and net return (₹ 64 500/ha) with higher benefit cost ratio (3.39) as compared to local check (2.61). Mean difference with respect to farmers' knowledge level after implementation of frontline demonstrations increased with the tune of 37.20. The impact of frontline demonstrations was also analyzed which had reflected significant improvement in knowledge and satisfaction level on the part of farmers.

Key words: Frontline demonstration, Lucerne, Production, Technology, Variety

Livestock feed accounts for 60-70% of the total cost of milk production and the cost offered is costlier and increasing day by day than of green forage. Inadequate and uncertain availability of green fodder has been mainly responsible for low productivity of the livestock in semi-arid ecosystem of Gujarat. Lucerne (*Medicago sativa* L.) gives highly palatable nutritious fodder rich in protein and mineral constituents, and can mitigate the acute shortage of green fodder in the region (Patel *et al.* 2007). Lucerne fodders are not only highly nutritious and succulent but also available up to summer. During recent years, Panchmahals district of central Gujarat has emerged as the leading district in milk production in the state. Farmers of the area are preferring lucerne for green fodder over all other crops owing to its adoptability with higher green fodder productivity. However, the productivity of lucerne (green fodder) in the district is very low as compared to average state productivity. Lack of suitable high yielding varieties as well as poor knowledge about production practices are ascribed as main reasons for low productivity of lucerne. The productivity of green fodder per unit area could be increased by adopting recommended scientific and sustainable management practices using a suitable high yielding variety. In view of the above factors, front line

demonstrations were undertaken in a systematic manner on farmers' field to show the worth of a new variety and convince the farmers to adopt improved management practices of lucerne production for enhancing productivity of green fodder. The study was aimed to find out yield, economics and factors (constraints) affecting non-adoption of green fodder production technology of lucerne.

MATERIALS AND METHODS

The present study was conducted in Panchmahals district of Central Gujarat during 2010-2013 for popularization of the improved green fodder production practices and to find out the constraints in lucerne production, PRA technique was used. Preferential ranking technique was utilized to identify the constraints faced by the respondent farmers in lucerne production. Farmers were also asked to rank the constraints perceived as limiting lucerne production in order of preference. The quantification of data was done by ranking the constraints and then calculating the Rank Based Quotient (RBQ) as per methods given by Sabarathanam (1988), which is as follows:

$$RBQ = \frac{f_i (n + 1 - i_{th})}{N \times n} \times 100$$

wherein, f_i , Number of farmers reporting a particular problem under i^{th} rank; N , number of farmers; and n , number of problems identified. Based on top rank farmers problems

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identified, front line demonstrations were planned and conducted at the farmers' field under Scheme of Krishi Vigyan Kendra-Panchmahals. In all, 120 front line demonstrations were conducted to convince farmers about potentialities of improved variety of lucerne Anand 2 during 2010- 2013. All the participating farmers were trained on various aspects of lucerne production technologies. Recommended agronomic practices and certified seed of lucerne were used for front line demonstrations in 0.25 ha area/demonstration. A one fifth area was also devoted to grow local standard check. The plant height was recorded from base to tip of 50 randomly selected plants from a plot at every cut. Average of different cuts during a year was taken as plant height and recorded. Green fodder yield from one fifth area of each plot was recorded. The plant samples drawn out were first air-dried and put into oven allowing the temperature to reach up to 75°C until the constant weight obtained. The reduction in weight was treated as moisture content in sample and rest was recorded as dry matter. Similarly dry matter yield of plot was worked out by subtracting moisture from green fodder yield. This dry matter was converted into q/ha and recorded as dry matter yield. Air-dried samples were grounded finely for estimation of nitrogen following standard method. Crude protein content in plant was computed by multiplying nitrogen content of plant with 6.25. Protein content thus obtained was multiplied with dry matter yield for the estimation of protein yield. To study on the impact of front line demonstrations, out of 120 participating farmers, a total of 60 farmers were selected as respondent through proportionate sampling. Production and economic data for front line demonstrations and local practices were collected and analyzed. The technology gap and technology index were calculated using the formula given by Samui *et al.* (2000). For obtaining Technical index, Technological gap (potential yield-demonstration yield) was divided with Potential yield multiplied by 100.

Knowledge level of the farmers about improved production practices of lucerne before implementation of frontline demonstration and after implementation was measured and compared by applying student 't' test. Further, the satisfaction level of respondent farmers about extension services provided was also measured based on various dimensions like training of participating farmers, timeline of services, supply of inputs, solving field problems and advisory services, fairness of scientists, performance of variety demonstrated and overall impact of front line demonstrations. The selected respondents were interviewed personally with the help of a pre-tested and well structured interview schedule. Client satisfaction index was calculated as developed by Kumaran and Vijayaragavan (2005).

$$\text{Client satisfaction index} = \frac{\text{The individual obtained score}}{\text{Maximum score possible}}$$

The data thus collected were tabulated and statistically analyzed to interpret the results.

RESULTS AND DISCUSSION

Constraints in lucerne production

The ranking of the problems given by the different farmers are given in Table 1. A perusal of data indicates that lack of suitable high yielding varieties (HYVs) was given the top most rank by 36 respondent farmers. The front line demonstrations participants were provided certified seed of lucerne cv. Anand 2 as critical inputs. Based on the ranks given by the respondent farmers for the different constraints listed out in Table 1, the rank based quotients were calculated and presented in Table 2.

The analysis of data presented in the Table 2 revealed that the lack of suitable HYVs, scarcity of irrigation water and weed (*Cuscuta* spp.) infestation followed by lack of technical knowledge and problems of wild animals were the major constraints of lucerne production. Other constraints, such as aphid infestation, and low soil fertility were also found as factors of low productivity for lucerne production. Among all the constraints, low soil fertility got the least concerns. These findings are in the agreement of the results as reported by earlier workers (Ouma *et al.* 2002, Joshi *et al.* 2005) in maize production.

Table 1 Ranks given by farmers for different constraints (n=60)

Production constraints	Ranks						
	I	II	III	IV	V	VI	VII
Lack of suitable HYVs	36	10	07	06	01	00	00
Lack of technical knowledge	11	17	12	05	08	03	04
Low soil fertility	07	09	05	08	17	09	05
scarcity of irrigation water	27	11	06	05	07	04	00
Problems of wild animals	12	09	11	09	06	05	08
Aphid infestation	07	08	18	10	04	06	07
Weed (<i>Cuscuta</i> spp.) infestation	21	09	13	07	05	02	03

Table 2 Frequency distribution of RBQ values given by farmers (n=60)

Problems	RBQ	Overall rank
Lack of suitable HYVs	89.04	I
Lack of technical knowledge	69.76	IV
Low soil fertility	57.86	VII
Scarcity of irrigation water	79.52	II
Problems of wild animals	63.09	V
Aphid infestation	61.42	VI
Weed (<i>Cuscuta</i> spp.) infestation	77.38	III

Performance of front line demonstrations

A comparison of productivity levels between demonstrated variety Anand 2 and local checks is shown in Table 3. The results of the present study revealed that the improved variety of lucerne Anand 2 recorded significantly higher plant height (46.50cm) than local check (32.70). During the period under study, it was observed that in front

Table 3 Yield attributes, technology gap and technology index of demonstration (Pooled data of 3 years)

Variables	Plant height (cm)	GFY(q/h)	DMY(q/h)	CP (%)	CPY(q-/h)	GFY increase(%)	Technology gap (q/h)	Technology index (%)
Local check	32.70	395	85.71	19.60	16.80			
Anand 2	46.50	610	133.04	21.90	29.14	54.43	90	14.75
SEM	1.43	7.62	1.78	0.28	0.52			
CD	4.59	24.37	5.70	0.90	1.68			

GFY-Green fodder yield, DMY-dry matter yield, CP-crude protein, CPY- crude protein yield

line demonstrations, the improved lucerne variety Anand 2 recorded the higher green fodder yield (610 q/ha) in six cuttings with compared to local check (395 q/ha). The percentage increase in the yield over local check was 54.43. More or less yield enhancement in different crops in front line demonstration has amply been documented by Hiremath *et al.* (2007), Mishra *et al.* (2009), Kumar *et al.* (2010) and Dhaka (2010). The average crude protein was recorded 21.90 and 19.60 per cent in the demonstration cv. Anand 2 and local check, respectively. From these results, it is evident that the performance of improved variety was found better than the local check under local conditions. Farmers were motivated by results of agro technologies applied in the front line demonstrations trials and it is expected that they would adopt these technologies in the coming years. Yield of the front line demonstration trials and potential yield of the crop was compared to estimate the yield gaps which were further categorized into technology index. The technology gap shows the gap in the demonstration yield over potential yield and it was 90 q/ha. The observed technology gap may be attributed to dissimilarities in soil fertility, salinity, erratic rainfall and vagaries of weather conditions in the region. Hence, to narrow down the gap between the yields of different varieties, location specific recommendation appears to be necessary. Technology index shows the feasibility of the variety at the farmer's field. The lower the value of technology index more is the feasibility. Result of study depicted in Table 3 revealed that the technology index values were 14.75. The results of the present study are in consonance with the findings of Sawardekar *et al.* (2003), and Hiremath and Nagaraju (2009).

The economics of lucerne (green fodder) production under front line demonstrations were estimated and the results have been presented in Table 4. Economic analysis of the yield performance revealed that front line demonstrations variety Anand 2 recorded higher gross returns (₹ 91 500/ha) and net return (₹ 64 500/ha) with higher benefit cost ratio (3.39) as compared to local checks. These results are in accordance with the findings of Hiremath *et al.* (2007) and Hiremath and Nagaraju (2009). Further, additional cost of ₹ 4 300 /ha in demonstration has acquired additional net returns ₹ 27 950/ha with incremental benefit cost ratio 7.50 suggesting its higher profitability and economic viability of the demonstration. Similar results were also reported by Hiremath and Nagaraju (2009) and Dhaka *et al.* (2010).

Table 4 Economics of frontline demonstrations

Variables	Cost of cultivation (₹/h)	Gross return (₹/ha)	Net return (₹/ha)	Benefit cost ratio
Local check	22 700	59 250	36 550	2.61
Anand 2	27 000	91 500	64 500	3.39
Additional in Anand 2	4 300	32 250	27 950	7.5*

*Incremental benefit cost ratio

Increase in knowledge

Knowledge level of respondent farmers on various aspects of improved lucerne production technologies before conducting the front line demonstration and after implementation was measured and compared by applying students 't' test. It could be seen from the Table 5 that the farmers mean knowledge score had increased significantly by 37.20 after implementation of frontline demonstrations, as the computed value of 't' (6.04) was statistically significant at 5% probability level. The results are in consonance with that of Narayanaswamy and Eshwarappa (1998), and Singh *et al.* (2007). It means that there was significant increase in knowledge level of the farmers due to frontline demonstration. This shows positive impact of frontline demonstration on knowledge of the farmers that might have resulted in higher adoption of improved farm practices.

Table 5 Comparison between knowledge levels of the respondent farmers about improved farming practices of lucerne (n=60)

Before FLD implementation	Mean score		Calculated 't' value
	After FLD implementation	Mean difference	
32.37	69.57	37.20	6.04*

*Significant at 5% probability level.

Farmers' satisfaction

The extent of satisfaction level of respondent farmers over extension services and performance of demonstrated variety was measured by Client satisfaction index (CSI) and results presented in Table 6.

Results of study revealed that the majority of the respondent farmers expressed medium (51.67%) to the high (36.66%) level of satisfaction for extension services and

Table 6 Extent of farmers satisfaction of extension services rendered (n=60)

Satisfaction	Level number	Per cent
Low	7	11.67
Medium	31	51.67
High	22	36.66

performance of technology under demonstrations. Whereas, very few (11.67%) of respondents expressed lower level of satisfaction. These results are in conformity with those reported by Narayanaswamy and Eshwarappa (1998) and Kumaran and Vijayaragavan (2005). The medium to higher level of satisfaction with respect to services rendered, linkage with farmers and technologies demonstrated, etc. indicate stronger conviction, physical and mental involvement in the frontline demonstration which in turn would lead to higher adoption. This shows the relevance of frontline demonstration.

Based on the observation on various aspects it may be inferred that Anand 2 variety of lucerne was found to be superior in terms of green fodder yield, dry matter yield and crude protein over local check. After realizing potential of Anand 2 lucerne, farmers are showing their interest to grow Anand 2 lucerne in place of traditional one. The impact of frontline demonstration was also analyzed which showed that there was significant improvement in knowledge level and satisfaction on the part of farmers.

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