International Journal of Research in Agronomy

E-ISSN: 2618-0618
P-ISSN: 2618-060X

NAAS Rating (2026): 5.20
www.agronomyjournals.com
2026; SP-9(1): 40-45
Received: 26-11-2025
Accepted: 29-12-2025

Vivek Pratap Singh
SMS Animal Science, Mahayogi Gorakhnath Krishi Vigyan Kendra, Chaukmafi, Peppeganj, Gorakhpur, Uttar Pradesh, India

Avanish Kumar Singh
SMS Agronomy, Mahayogi Gorakhnath Krishi Vigyan Kendra, Chaukmafi, Peppeganj, Gorakhpur, Uttar Pradesh, India

RP Singh
Krishi Vigyan Kendra, Narkatiaganj, West Champaran, Dr. RPCAU, Pusa, Samastipur, Bihar, India

BK Singh
Krishi Vigyan Kendra, Narkatiaganj, West Champaran, Dr. RPCAU, Pusa, Samastipur, Bihar, India

Corresponding Author:
Vivek Pratap Singh
SMS Animal Science, Mahayogi Gorakhnath Krishi Vigyan Kendra, Chaukmafi, Peppeganj, Gorakhpur, Uttar Pradesh, India

Comparative evaluation of improved berseem (*Trifolium alexandrinum* L.) varieties for fodder yield, yield gap analysis, economics, adoption and horizontal spread through participatory approach

Vivek Pratap Singh, Avanish Kumar Singh, RP Singh and BK Singh

DOI: https://www.doi.org/10.33545/2618060X.2026.v9.i1Sa.4614

Abstract
Berseem (*Trifolium alexandrinum* L.) is an important winter fodder crop; however, its productivity remains low due to poor adoption of improved varieties and scientific management practices. To address this gap, Front Line Demonstrations (FLDs) were conducted by MGKVK during 2017-18 to 2023-24 to evaluate the performance of improved berseem varieties BB-2 and BL-42 under farmers' field conditions. The demonstrations emphasized recommended seed rate, seed treatment with *Rhizobium*, timely sowing and balanced fertilization. Results revealed that improved technologies significantly enhanced green fodder yield, recording an average yield of 819 q ha^{-1} compared to 616 q ha^{-1} under farmers' practice, with yield advantages ranging from 20.45 to 63.98 per cent. Technology index varied from 14.4 to 22.0 per cent, indicating good feasibility of the demonstrated technologies. Economic analysis showed higher gross and net returns along with superior benefit-cost ratio under FLDs. Adoption of key production practices increased markedly, leading to substantial varietal replacement and horizontal spread of improved varieties. The study highlights the effectiveness of FLDs in improving fodder productivity, profitability and technology dissemination in the district.

Keywords: Berseem, front line demonstrations, green fodder yield, yield gap, technology adoption, economics, varietal replacement, horizontal spread

Introduction
Berseem (*Trifolium alexandrinum* L.) is one of the most important winter season leguminous fodder crops and is popularly known as the *"King of Fodders"* due to its high biomass production, superior palatability and excellent nutritive value. It is ideally suited for areas below 1700 m altitude with assured irrigation facilities. Berseem originated in the Nile Valley of Egypt, where it has been cultivated for centuries as an irrigated annual forage crop. The crop performs best under cool to moderately cool climatic conditions and is generally sown from the second fortnight of October to the first fortnight of November under irrigated conditions. In India, berseem varieties are multi-cut in nature and provide highly palatable, succulent and nutritious green fodder ranging from 90 to 110 t ha^{-1} in 4-6 cuttings. The first cutting is taken 30-35 days after sowing, followed by subsequent cuttings at an interval of 20-25 days from November to April. Berseem fodder is rich in nutritional quality, containing 17-22% crude protein, 42-49% neutral detergent fibre, 35-38% acid detergent fibre, 24-25% cellulose and 7-10% hemicellulose, with a dry matter digestibility of about 70%. In addition to fodder production, berseem also improves soil physical, chemical and biological properties through nitrogen fixation. Owing to its rapid growth, excellent regeneration after cutting, longer duration of fodder availability and high biomass yield, berseem is highly suited to sub-tropical regions of northern and eastern India with reliable irrigation (Saini and Chowdhury, 1993; Gupta *et al.*, 2016) [6, 7]. The inclusion of berseem in livestock feeding significantly reduces the cost of feeding milch animals by partially replacing mineral concentrates (Kumar *et al.*, 2021) [8]. In India, major feed resources for livestock include natural grasses, community grazing lands, crop residues, cultivated fodder crops, tree leaves and agro-industrial by-products. However,

availability of green fodder remains inadequate in several states. Uttar Pradesh faces a green fodder deficit of about 23.6%, whereas Madhya Pradesh has a surplus of 47.5%. Overall, the central zone comprising Chhattisgarh, Uttar Pradesh and Madhya Pradesh shows a green fodder deficit of 4.8% (Roy *et al.*, 2019) [1]. In Uttar Pradesh, cultivated land remains the primary source of green fodder, followed by pasture and fallow lands. Low productivity of fodder crops in the region is mainly attributed to the continued use of old varieties, higher seed rate, improper agronomic practices and the prevalence of biotic and abiotic stresses. Therefore, there is a strong need to create awareness among farmers regarding location-specific improved varieties and scientific cultivation practices to enhance fodder production and productivity. In this context, Front Line Demonstrations (FLDs) were conducted during 2017-18 to 2023-24 to introduce and disseminate improved berseem varieties at farmers' fields. The present study evaluates the impact of FLDs on yield enhancement, yield gaps, technology adoption and horizontal spread of improved berseem varieties in the district.

Methodology

Gorakhpur district falls under the North Eastern Plain Zone of Uttar Pradesh and is agriculturally important for crop-livestock-based farming systems. Mahayogi Gorakhnath Krishi Vigyan Kendra (MGKVK), Gorakhpur conducted frontline demonstrations (FLDs) on berseem (*Trifolium alexandrinum* L.) during the rabi seasons from 2017-18 to 2022-23. A total of 200 FLDs were organized in the operational villages of the KVK, covering an area of 26 ha.

Before initiating the demonstrations, an extensive baseline survey was conducted to identify need-based farmers. Receptive and innovative farmers were selected each year through group meetings, considering the accessibility of the site and the adaptive attitude of the farmers. Skill-oriented training programmes were imparted to the selected farmers on various agro-techniques for enhancing green fodder productivity. The demonstrations were conducted on farmers' fields and were regularly monitored from sowing to harvesting by scientists of MGKVK, Gorakhpur. Field days and group meetings were organized to showcase the performance of the demonstrated technologies to farmers of the same and neighbouring villages, thereby facilitating the horizontal spread of technologies. All critical inputs, including improved berseem varieties BB-2 and BL-42, were demonstrated along with the recommended package of practices, *viz*. proper land preparation, recommended seed rate, time and method of sowing, balanced fertilization @ 30:80:60 kg $N:P_2O_5:K_2O$ ha^{-1}, seed treatment with Trichoderma and Rhizobium culture @ 5 g kg^{-1} of seed, proper irrigation scheduling, weed management, and improved plant protection measures (Table 1). The demonstration plots were closely supervised by MGKVK scientists. Data on green fodder yield and cost parameters were collected separately for FLD plots and farmers' practice plots by KVK scientists. Information on adoption and horizontal spread of technologies was collected from the participating farmers using a structured interview schedule. The prevailing average prices of inputs and outputs during each year of demonstration were used to compute cost of cultivation, net returns, and benefit-cost ratio. The adoption gap index was calculated using the formula suggested by Dubey *et al*. (1981) [5], which represents the percentage deviation of farmers' practices from the recommended improved practices.

$$\text{Adoption gap index (\%)} = \frac{R - A}{R} x100$$

Where,
R= Total no. of improved practices
A= No. of improved practices actually adopted by the farmer

Yield parameters of both demonstrations and check involving farmers practices were recorded. The technology gap, extension gap and technology index were calculated as suggested by Samui *et al.*, and Dayanand *et al.*

$$\text{(A) Impact on yield (\%)} = \frac{Dy - Fpy}{Fpy} x100$$

Where,
Dy= Demonstrated yield
Fpy=Farmer practice yield

(B) Extension gap = Dy - Fpy

(C) Technology gap = Potential Yield (Py) - Demonstrated Yield (Dy)

$$\text{(D) Technology index (\%)} = \frac{Py - Dy}{Py} x100$$

(E) Additional cost in improved technology (Rs/ha) = Cit - Cfp

Where Cit=Cost of improved technology (Rs/ha)
Cfp=Cost of farmers practice (Rs/ha)

(F) Additional returns (Rs/ha) = Nrit - Nrfp

Where, Nrit = Net returns of improved technology (Rs/ha)
Nrfp =Net returns of farmers practice (Rs/ha)

(G) Effective gain (Rs/ha)= Arit - Acit

Where, Arit=Additional returns of improved technology (Rs/ha)
Acit=Additional cost of improved technology (Rs/ha)

$$\text{(H) Benefit cost ratio (BCR)} = \frac{\text{Gross return (Rs/ha)}}{\text{Gross expenditure (Rs/ha)}}$$

The yield gap was also comprising at least two components i.e. Yield gap I and Yield gap II (Mondal, 2011). Yield Gap I refer to the difference between potential yield and farm yield obtained at demonstration plots, while Yield Gap II, reflecting the effects of biophysical and socio-economic constraints, was the difference between yield obtained at the demonstration plot and actual yield obtained on farmers' fields. The yield gaps (table 3) were estimated as follows:

Yield Gap I= $[(Y_P - Y_D)/Y_P]x100$
Yield Gap II= $[(Y_D - Y_F)/Y_D]$ 100

where,
Y_P is the potential yield
Y_D is the demonstration plot yield
Y_F is the existing farmers yield

However, data about adoption and horizontal spread of technologies were collected from the farmers with the help of interview schedule. Data were subjected to suitable statistical methods. The following formulae were used to assess the impact on different parameters of fodder production.

$$\text{Impact on Yield (\% Change)} = \frac{YD_p - YC_p}{YC_p} \times 100$$

Where,
YD_p= Yield of demonstrated plot
YC_p= Yield of control ploT

$$\text{Impact on Adoption (\% Change)} = \frac{A_{ad} - A_{bd}}{A_{bd}} \times 100$$

Where,
A_{ad} =No. of Adopters after demonstration
A_{bd}=No. of Adopters before demonstration

$$\text{Impact on Horizontal spread (\% change)} = \frac{A_{iad}\text{ (ha)} - A_{bd}\text{ (ha)}}{A_{bd}\text{ (ha)}} \times 100$$

Where,
A_{iad}= Area increased after demonstration
A_{bd}= Area before demonstration

Results and Discussion

Green fodder Yield performance

In berseem (*Trifolium alexandrinum* L.), the first cutting was taken 30 days after sowing, followed by subsequent cuttings at an interval of 20-25 days. The data presented in Table 1 indicate that berseem varieties had a significant influence on green fodder yield across 5-6 cuttings. Green fodder yield varied significantly among the varieties at different cutting stages. Among the evaluated varieties, BB-2 recorded the highest total green fodder yield (847 q ha^{-1}), which was significantly superior to BL-42 (791 q ha^{-1}). In some farmers' fields, berseem was harvested up to eight cuttings, resulting in higher cumulative green fodder production. The BB-2 variety was highly preferred by farmers owing to its higher green fodder yield and greater number of cuttings compared to the traditionally cultivated varieties in the region. The observed variation in green fodder yield among varieties can be primarily attributed to their genetic potential and growth characteristics. These findings are in conformity with earlier reports by Kale and Takawale (2025) [9], who also observed significant differences in fodder yield performance among berseem varieties, thereby supporting the results of the present study.

Impact of Frontline Demonstrations on Green Fodder Yield

The impact of frontline demonstrations (FLDs) on the yield enhancement of berseem fodder is presented in Table 1. The results revealed that the overall mean green fodder yield in the demonstrated plots was 819.60 q ha^{-1} for variety BB-2 and 790.50 q ha^{-1} for variety BL-42, whereas the corresponding yields under farmers' practice (control plots) were 578.13 q ha^{-1} and 653.75 q ha^{-1}, respectively. The demonstrated plots recorded a significant increase in green fodder yield over farmers' practice, with yield advantages of 43.72% in BB-2 and 20.97% in BL-42. During the demonstration period, the percentage increase in yield ranged from 17.19 to 63.00% in BB-2 and 17.29 to 25.39% in BL-42 across different years. The substantial improvement in green fodder yield under FLDs clearly indicates the positive impact of improved varieties and recommended production technologies over existing farmers' practices. These findings highlight the effectiveness of frontline demonstrations as a tool for enhancing fodder productivity in the demonstrated areas.

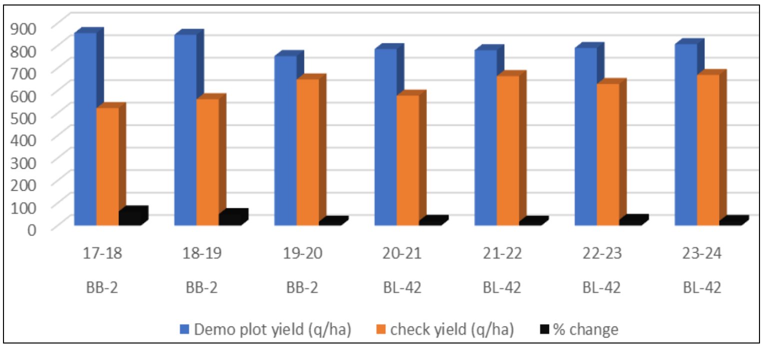


Fig 1: Impact of technological interventions on sustainable productivity of Berseem crops

Technology Gap, Extension Gap and Technology Index under FLDs

The comparative analysis of technology gap (TG), extension gap (EG) and technology index (TI) for berseem varieties BB-2 and BL-42 under front line demonstrations is presented in Table 1. The results revealed noticeable variation between the two varieties, reflecting differences in adoption level and field performance under farmers' conditions.

The technology gap was lower in BB-2 (153.4 q/ha) as compared to BL-42 (209.5 q/ha), indicating that the demonstrated technology in BB-2 was relatively more effective in approaching the potential yield. The higher technology gap observed in BL-42 may be attributed to variability in soil fertility, irrigation scheduling, and management practices across farmers' fields.

The extension gap, which represents the difference between demonstrated yield and farmers' practice, was considerably higher in BB-2 (268.7 q/ha) than in BL-42 (136.8 q/ha). This clearly indicates a wider scope for yield enhancement in BB-2 through effective extension efforts, training programmes and timely availability of quality inputs.

The technology index, which reflects the feasibility and suitability of the demonstrated technology, was recorded to be 15.3 per cent in BB-2 and 21.0 per cent in BL-42. The lower technology index in BB-2 suggests better adaptability of the technology under local conditions, whereas the higher value in BL-42 indicates the need for refinement in agronomic practices and stronger extension support for achieving higher productivity.

Overall, the results demonstrate that front line demonstrations were effective in reducing yield gaps and improving green fodder yield of berseem. However, the presence of technology and extension gaps highlights the importance of continued capacity building, field-level guidance and dissemination of recommended practices to realize the full yield potential of improved berseem varieties. These results are in conformity with those reported by Khadda *et al.* (2021); Jain *et al.* (2019) [3, 4].

Impact of Front Line Demonstrations (FLDs) on Berseem in relation to Yield Gap

The impact of front line demonstrations (FLDs) on berseem in relation to yield gaps during 2017-18 to 2023-24 is presented in Table 2. The analysis of Yield Gap I and Yield Gap II provides insight into the extent of research-field and extension gaps under farmers' conditions.

For berseem variety BB-2, Yield Gap I ranged from 14.4 to 16.5 per cent during 2017-18 to 2019-20, with a mean value of 15.33 per cent. The relatively low Yield Gap I indicates that the demonstrated technology was effective in narrowing the gap between potential yield and realized yield under FLD conditions. Yield Gap II for BB-2 was comparatively higher, varying from 22.15 to 39.01 per cent, with an average of 23.74 per cent. This highlights a substantial difference between demonstrated yield and farmers' practice, indicating considerable scope for enhancing productivity through improved adoption of recommended practices such as quality seed use and seed treatment with *Rhizobium* culture.

In the case of berseem variety BL-42, Yield Gap I varied from 19.3 to 22.0 per cent during 2020-21 to 2023-24, with a mean of 20.95 per cent, which was higher than that observed in BB-2. This suggests relatively greater constraints in achieving the potential yield of BL-42 under field conditions. Yield Gap II for BL-42 ranged from 14.74 to 20.25 per cent, with a mean value of 17.29 per cent, indicating a comparatively narrower extension gap and gradual improvement in farmers' adoption of the demonstrated technology over the years.

Overall, the results clearly demonstrate that FLDs played a significant role in reducing yield gaps in berseem cultivation. The lower Yield Gap I observed in BB-2 reflects better adaptability and feasibility of the technology, while the relatively higher Yield Gap II emphasizes the need for intensified extension efforts to further improve farmers' yield levels. For BL-42, the higher Yield Gap I coupled with a lower Yield Gap II suggests the need for refinement of production practices along with continued capacity building of farmers. The findings underscore the importance of sustained extension interventions to bridge both research and adoption gaps and to realize the full yield potential of improved berseem varieties under farmers' field conditions. The findings are in line with that reported by Singh *et al*. (2020) [10].

Economics of Berseem cultivation under Improved Technology (IT) and Farmers' Practice (FP)

The economic impact of front line demonstrations (FLDs) on berseem cultivation, as presented in Table 3, clearly demonstrates the superiority of improved technological interventions (IT) over farmers' practice (FP) in terms of profitability. The adoption of improved varieties along with recommended production practices resulted in higher gross and net monetary returns with only a marginal increase in the cost of cultivation.

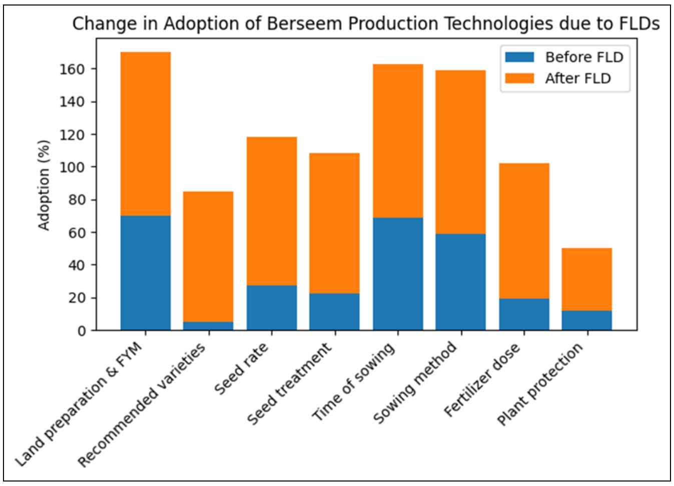
For berseem variety BB-2, the average cost of cultivation under IT (₹36,400/ha) was only 3.88 per cent higher than FP (₹35,023/ha). However, this marginal increase in cost led to a substantial enhancement in returns, as evident from the 47.84 per cent increase in gross monetary returns and a remarkable 127.63 per cent increase in net returns over farmers' practice. The average additional cost of cultivation (₹1,377/ha) generated an additional net return of ₹25,490/ha, indicating a highly favourable cost-benefit relationship. The benefit-cost ratio (BCR) improved significantly from 1.66 under FP to 2.33 under IT, with an average effective gain of ₹24,113/ha, thereby establishing the economic viability of BB-2 under FLD conditions.

In the case of berseem variety BL-42, the average cost of cultivation under IT (₹37,175/ha) increased marginally by 1.97 per cent over FP (₹36,463/ha). The demonstrated technology recorded an average 20.98 per cent increase in gross monetary returns and a 45.28 per cent increase in net returns over farmers' practice. The additional cost of cultivation (₹713/ha) resulted in an additional net return of ₹12,963/ha, while the BCR improved from 1.79 to 2.13 under IT. The average effective gain of ₹12,250/ha further confirms the economic advantage of adopting improved technology in BL-42.

Overall, the pooled analysis of both berseem varieties revealed that FLDs resulted in an average 34.41 per cent increase in gross monetary returns and an 86.46 per cent increase in net returns, with only a 2.93 per cent increase in cost of cultivation. The improvement in BCR from 1.73 under FP to 2.23 under IT and an average effective gain of ₹18,181.5/ha clearly indicate that improved technological interventions in berseem cultivation are economically viable, farmer-friendly and suitable for large-scale dissemination to enhance fodder-based farm income. The results are in are in consonance with the findings of Satyajeet *et al*. (2024) [2] and Khadda *et al*. (2021) [3].

Impact of FLDs on adoption of fodder production technologies

Front Line Demonstrations (FLDs) significantly improved the adoption of recommended berseem production technologies (Table 4). Adoption of land preparation with FYM increased from 70.0% to 100%, while use of recommended varieties (BB-2 and BL-42) recorded the highest increase from 5.0% to 80.0%. Adoption of the recommended seed rate increased from 27.5% to 90.86%, and seed treatment practices improved from 22.5% to 86.0% after demonstrations. Timely sowing adoption increased from 69.0% to 93.5%, whereas recommended sowing method achieved full adoption (100%). Nutrient management practices showed a substantial rise from 19.0% to 83.0%, and adoption of need-based plant protection increased from 12.0% to 38.0%. Overall, FLDs resulted in a 209.80% cumulative improvement in technology adoption, demonstrating their effectiveness in enhancing farmers' knowledge, confidence and adoption behaviour, which ultimately contributed to improved productivity and profitability of berseem cultivation. These results are in close conformity with the findings recorded in the case of Berseem crop (Singh Bacchu 2016) [11].



Impact of FLDs on Varietal Replacement of Berseem

Front Line Demonstrations (FLDs) effectively facilitated varietal replacement in berseem cultivation (Table 5). Prior to demonstrations, farmers predominantly cultivated old and mixed local varieties with lower productivity. Introduction of improved berseem varieties BB-2 and BL-42 through FLDs resulted in a clear shift towards high-yielding and adaptable varieties. This replacement highlights the role of FLDs in accelerating adoption of improved fodder varieties and enhancing productivity under farmers' field conditions. This finding is in corroboration with the findings of Singh *et al*. (2020) [10].

Impact of FLDs on Horizontal Spread of Different Varieties Berseem

Front Line Demonstrations (FLDs) resulted in a substantial horizontal spread of improved berseem varieties in the district (Table 6). The area under berseem variety BB-2 increased from 5 ha before demonstrations to 30 ha after demonstrations, registering a 500 per cent increase. Similarly, the area under berseem variety BL-42 expanded markedly from 20 ha to 110 ha, showing a 450 per cent increase. The rapid expansion in cultivated area indicates strong farmer acceptance of the demonstrated varieties due to their higher fodder yield potential, better regeneration after cutting and adaptability under local conditions. These results confirm the effectiveness of FLDs in promoting large-scale adoption and dissemination of improved berseem varieties.

Table 1: Gap in GFY of Fodder crops under front line demonstration (FLD)

Name of crop	Year	Technology demonstrated	Potential yield of variety (q/ha)	Under FLD programme		Average yield (qt/ha)		Impact (% change)	TG (q/ha)	EG (q/ha)	TI (%)
				No. of Demo.	Area (ha)	*DP	FP				
Berseem (BB 2)	2017-18	BB-2 seed + Seed treatment with Rhizobium culture @ 250g/ 10kg seed	1000	16	2.00	856 (960-755)	522	+63.92	144	334	14.4
	2018-19	BB-2 seed + Seed treatment with Rhizobium culture @ 250g/ 10kg seed	1000	30	4.00	849 (945-770)	562	+50.98	151	287	15.1
	2019-20	BB-2 seed + Seed treatment with Rhizobium culture @ 250g/ 10kg seed	1000	32	4.00	835 (900-790)	650	+28.46	165	185	16.5
Total/Average				78	10	847	578	+47.79	253.4	268.7	15.3
Berseem (BL 42)	2020-21	BL-42 seed + seed treatment with Rhizobium culture @ 250g/10 kg seed	1000	32	4.00	785 (860-700)	650	+20.77	215	135	21.5
	2021-22	BL-42 seed + seed treatment with Rhizobium culture @ 250g/10 kg seed	1000	30	4.00	780 (810-760)	665	+17.29	220	115	22
	2022-23	BL-42 seed + seed treatment with Rhizobium culture @ 250g/10 kg seed	1000	30	4.00	790 (870-690)	630	+25.40	210	160	21
	2023-24	BL-42 seed + seed treatment with Rhizobium culture @ 250g/10 kg seed	1000	30	4.00	807 (885-730)	670	+20.45	193	137	19.3
Total/Average				122	16	791	654	20.98	209.5	136.8	21
Overall Total/Average				200	26	819	616	34.39	231.45	202.75	

Demo= Demonstration; DP= Demonstrated Plot; FP= Farmers' practice; TG= Technology gap; EG= Extension gap; TI= Technology index
* Figures in parentheses indicate lowest and highest yield of demonstrated farmer

Table 2: Impact of FLDs on Berseem crops in relation to yield gap during 2017-18 to 2023-24.

Variety	Yield Gap I (%)			Yield Gap II (%)		
	2017-18	2018-19	2019-20	2017-18	2018-19	2019-20
BB-2	14.4	15.1	16.5	39.01	33.80	22.15
Mean	15.33			23.74		

Variety	Yield Gap I (%)				Yield Gap II (%)			
	2020-21	2021-22	2022-23	2023-24	2017-18	2018-19	2019-20	2023-24
BL-42	21.5	22	21	19.3	17.20	14.74	20.25	16.98
Mean	20.95				17.29			

Table 3: Impact of FLDs on Economics of Berseem Cultivation

Crop/Variety	Year	CoC (Rs/ha)		CoC increase over FP (%)	GMR (Rs/ha)		GMR increase over FP (%)	NR (Rs/ha)		NR increases over FP (%)	ACoC in IT (Rs/ha)	ANR (Rs/ha)	BCR		Effective gain (Rs/ha)
		IT	FP		IT	FP		IT	FP				IT	FP	
Berseem (BB 2)	2017-18	36500	35719	2.19	85600	52200	63.98	49100	16481	197.92	781	32619	2.35	1.46	31838
	2018-19	38600	35950	7.37	84900	56200	51.07	46300	20250	128.64	2650	26050	2.20	1.56	23400
	2019-20	34100	34100	2.10	83500	65000	28.46	49400	30900	56.33	700	17800	2.45	1.95	17100
Average		36400	35023	3.88	84667	57800	47.84	48267	22777	127.63	1377	25490	25490	1.66	24113
Berseem (BL 42)	2020-21	38000	38000	2.01	78500	65000	20.77	40500	27000	45.95	750	12750	2.07	1.74	12000
	2021-22	36200	36200	3.13	78000	66500	17.29	41800	30300	33.12	1100	10400	2.15	1.89	9300
	2022-23	36500	36500	1.67	79000	63000	25.40	42500	26500	56.83	600	15400	2.16	1.75	14800
	2023-24	38000	38000	1.06	80700	67000	20.45	42700	29000	45.24	400	13300	2.12	1.78	12900
Average		37175	36463	1.97	79050	63375	20.98	41875	28913	45.28	713	12963	2.13	1.79	12250
Overall Total/Average		36787.5	35743	2.925	81858.5	60587.5	34.41	45071	25845	86.455	1045	19226.5	12746	1.725	18181.5

CoC= Cost of cultivation; IT= improved technological interventions; FP= Farmers' practice GMR= Gross monetary returns; ACoC= Additional cost of cultivation; NR= Net Returns; ANR= Additional net returns; BCR= Benefit cost ratio.

Table 4: Impact of FLDs on adoption of Berseem production technology

Technology	No. of adopters (N=200)		Change in No. of Adopter	Impact (% Change)
	*Before demonstration	*After demonstration		
Land preparation and FYM application	140 (70)	200 (100.00)	+60	42.85
Recommended Varieties (BB-2 and BL-42)	25 (5)	160 (80)	+170	540
Seed rate (25 Kg/ha)	55 (27.5)	180 (90.86)	+135	227.27
Seed treatment (*Trichoderma* powder and *Rhizobium* culture @ 5 g/kg seed)	45 (22.5)	172 (86)	+127	
Time of sowing (second fortnight of October to the first fortnight of November)	138 (69)	187 (93.50)	+49	35.50
Recommended sowing method	118 (59)	200 (100)	+82	69.50
Fertilizer dose (30:80:60 kg $N:P_2O_5:K_2O$ ha^{-1})	38 (19)	166 (83)	+128	336.84
Need based Plant protection measure (spray of Neem oil 0.15% @ 2-3 ml/litre of water at 50% flowering)	24 (12)	76 (38)	+52	216.67
Overall Impact				209.80

Table 5: Impact of FLDs on varietal replacement of Berseem

Crop	Previous grown variety	Variety introduced
Berseem	Old and mix variety	BB-2, BL-42

Table 6: Impact of FLDs on horizontal spread of Berseem variety

Crop	Area (ha)		Change in Area (ha)	Impact (% change)
	Before demonstration	After demonstration		
Berseem Variety BB-2	05	30.00	+20.00	500
Berseem Variety BL-42	20.00	110.00	+90.00	450

Conclusion

The Front Line Demonstrations (FLDs) on berseem conducted during 2017-18 to 2023-24 proved to be an effective extension approach for enhancing fodder productivity, profitability and technology adoption under farmers' field conditions. Demonstrations of improved varieties BB-2 and BL-42 along with recommended production practices resulted in significant improvement in green fodder yield, reduction in yield gaps and better realization of potential yield. The economic analysis revealed higher gross and net returns with improved benefit-cost ratio compared to farmers' practice, despite a marginal increase in cost of cultivation. FLDs also led to substantial adoption of improved technologies such as recommended varieties, seed rate, seed treatment and sowing methods. The marked horizontal spread and varietal replacement further indicate strong farmer acceptance and sustainability of the interventions. Overall, FLDs played a crucial role in popularizing improved berseem production technologies and can be effectively used to bridge fodder demand-supply gaps in the region.

References

1. Roy AK, Agrawal RK, Bhardwaj NR, Mishra AK, Mahanta SK. Revisiting national forage demand and availability scenario. In: Roy AK, Agrawal RK, Bhardwaj NR, editors. Indian fodder scenario: redefining state wise status. Jhansi (India): ICAR-AICRP on Forage Crops and Utilization; 2019. p. 1-21.
2. Satyajeet, Kumar A, Dhanda SK, Pareek A, Bhardwaj S, Kannoj. Enhancing production of berseem through integrated crop management practices in Haryana. Legume Res. 2024;47(2):231-233.
3. Khadda BS, Lata K, Kumar R, Khajuria S, Rai AK. An impact and yield gap study of frontline demonstrations on fodder sorghum variety CoFS-29 in Panchmahal district of central Gujarat. Int J Agric Appl Sci. 2021;2(2):141-144.
4. Jain LK, Parewa HP, Ratnoo S. Impact of front-line demonstration on productivity and profitability analysis of cluster bean in Barmer district of Rajasthan. Forage Res. 2019;44(4):282-285.
5. Dubey VK, Singh SB, Saini R, Saini SP. Gap and constraints analysis of wheat production. Indian J Agric Res. 1981;15(1):17-20.
6. Saini SL, Chowdhury RK. Effect of final cutting for fodder on seed yield and seed quality in berseem. In: Proceedings of the XVII International Grassland Congress. Vol II. Palmerston North, Hamilton, Lincoln (New Zealand); 1993. p. 1690-1691.
7. Gupta JJ, Dey A, Bhatt BP, Barari SK. Potential yield and nutritive value of promising forages of eastern India. Range Manag Agrofor. 2016;37:248-252.
8. Kumar V, Sandhu GS, Sahram K. Important tips for pure seed production of berseem. Progressive Farming. 2021;58:28-29.
9. Kale RV, Takawale PS. Growth, forage yield, and quality of berseem (*Trifolium alexandrinum* L.) genotypes under different phosphorus levels. Arch Curr Res Int. 2025;25(9):118-126.
10. Singh AK, Singh RP, Singh RK, Singh VP, Singh AK. Technological options on yield gap analysis, economics, adoption and horizontal spread of pulse crops. Int J Curr Microbiol App Sci. 2020;9(6):3165-3179.
11. Singh B, Singh N. Impact of front line demonstration on adoption of berseem fodder production technology by the farmers. Res J Anim Husb Dairy Sci. 2016;7(1):1-6.