Performance Evaluation of Fodder Oat Varieties through Frontline Demonstrations in Hanumangarh, Rajasthan

ABSTRACT

In semi-arid areas, fodder oats (Avena sativa L.) are an essential crop for sustainable livestock production, especially for small and marginal farmers in the Hanumangarh district of Rajasthan. Through Front Line Demonstrations (FLDs) carried out by Krishi Vigyan Kendra (KVK) Nohar in a number of locations around the Hanumangarh district, this study assessed the performance of the enhanced oat variety Central Oat OS 403. During two consecutive rabi seasons (2022–23 and 2023–24), thirty FLDs were planted across 3.0 hectares in order to evaluate the economic viability, technological gaps, and varietal performance under farmers' field circumstances. The demonstrations compared improved cultivation practices with Central Oat OS 403 against farmers' existing practices using local varieties. Results revealed superior performance of OS 403 with an average green fodder yield of 411 q/ha compared to 360 q/ha under farmers' practice, representing a significant yield advantage of 51 q/ha (14.17% increase). The technology gap was recorded at 51 q/ha, while the extension gap stood at 123 q/ha, resulting in a technology index of 9.53%, indicating good technology transfer efficiency. Economic analysis demonstrated the profitability of improved variety, with OS 403 generating a net return of Rs. 71,445/ha and benefit-cost ratio of 4.10, compared to Rs. 60,800/ha net return and BCR of 3.76 under local practices. The enhanced variety's economic superiority was demonstrated by the Rs. 10,645/ha higher revenue it generated. The study unequivocally shows that Central Oat OS 403 is suited to the semi-arid climate of the Hanumangarh district and has a great deal of promise for raising livestock nutrition, fodder production, and farmer revenue. These results lend credence to the suggestion that OS 403 be widely adopted by successful extension initiatives in Rajasthan's comparable agroclimatic zones.

Key words: Oat (*Avena sativa* L.), frontline demonstration (FLD), adoption, economics, technology gap, technology index

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INTRODUCTION

A significant annual cereal crop in the Poaceae family, oats (Avena sativa L.) are known across the world for their extraordinary potential as a fodder crop because of their large output of green biomass and excellent nutritional value (Ahmad et al., 2013). This winter annual crop is especially well-suited for silage production during India's rabi season because it produces highly palatable green feed with a protein content of 7–10% and an excellent dry matter yield, all while exhibiting remarkable water-use efficiency when compared to other cereal grains (Ahmad et al., 2014). The crop is a popular option for feeding animals because of its high energy content, exceptional regeneration capability, and higher palatability when compared to conventional cereals like wheat and barley (Kumar et al., 2010; Paul et al., 2022). Additionally, it has a high dry matter content, outstanding regeneration potential, and is an energy-rich crop (Kumar et al., 2010). The mainstay of Indian agriculture, livestock production contributes 7% of the country's GDP and serves as the primary source of income and employment for 70% of the country's rural population. With almost 520 million cattle, India has the biggest population of any country in the world, accounting for 15% of all cattle worldwide (Neelar, 2011). 1594 MT of fodder, consisting of 569 MT of dry fodder and 1025 MT of green fodder, are needed annually to feed the current livestock population (Datta, 2013). Low productivity, high commercial feed costs, low yield of green fodder, a limited supply of dry fodder, and antiquated technology are some of the issues facing the sector. Fodder is grown on just 4.9% of India's total planted land (Kumar et al., 1992). The IGFRI Vision-2050 report highlights alarming deficits of 35.6% in green fodder, 11% in dry crop residues, and 44% in concentrate feeds, despite fodder crops occupying merely 4.9% of India's total cultivated area (Kumar et al., 1992, Singh et al., 2015). Front Line Demonstrations (FLDs) allow farmers to directly compare recommended techniques with their traditional ones, making them a useful extension tool for demonstrating improved technology and varieties to agricultural communities. According to Kim et al. (2006), these demonstrations are essential for technology transfer, capacity building, and hastening farmers' adoption of improved cultivars. In order to sustain the large animal population and satisfy the rising demand for milk and meat from the expanding human population, fodder crops are essential (Jitendra, 2017). Livestock production and health are directly impacted by the nutritional makeup of feed and fodder.

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The availability of nutrient-rich fodder is essential to the development of any dairy enterprise (Surje et al., 2015). Crop patterns, climate, socioeconomic conditions, and cattle types all have an impact on India's unequal distribution of fodder output. In addition to grown fodder, cattle and buffalo are frequently supplemented with a few harvested grasses and top feeds (Shashikala et al., 2017, Sheoran et al., 2008, Singh et al., 2015). Oats are grown in states like West Bengal, Madhya Pradesh, Orissa, Bihar, Punjab, Haryana, and Uttar Pradesh. The "Central Oats OS 403" oat variety was created by the Forage Section of the Department of Genetics & Plant Breeding at CCS Haryana Agricultural University in Hisar using the pedigree technique of breeding. Identified under the AICRP on Forage Crops & Utilization, released, and notified for cultivation in the North West Zone of India under normal fertility, timely sowing, and irrigation conditions (Jindal et al., 2020). The northern Rajasthani district of Hanumangarh has particular agroclimatic difficulties because of its semi-arid climate, which receives little rainfall, and its sandy, undulating topography, which is a component of the Thar Desert environment. Due to water scarcity in the district, which is crossed by the Ghaggar River, drought-tolerant crops like oats are especially important for the production of sustainable feed. Nohar tehsil, which is situated at 29.18°N 74.77°E and has an average elevation of 186 meters, reflects the region's typical semi-arid climate. In light of this, the current study assessed the productivity and quality of several oat cultivars for use as fodder in the district of Hanumangarh. The current study was conducted to evaluate the performance of various oat varieties through Front Line Demonstrations in the Hanumangarh district of Rajasthan, taking into account the severe fodder shortage, the potential of oats as a high-yielding fodder crop, and the necessity for location-specific varietal evaluation under semi-arid conditions. The goal of the project is to find high-performing cultivars that are appropriate for the area's agroclimatic conditions and show the local farming community how they might increase livestock productivity and fodder production.

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MATERIALS AND METHODS

Hanumangarh district's Nohar tehsils are located at.18°N 74.77°E. It is 186 meters (610 feet) above sea level on average. Nohar is a semi-arid region, and Hanumangarh receives 253.3 mm of rain on average per year. Basic physicochemical characteristics, such as pH, EC, OC, and accessible nutrients, were assessed in the soil samples that were gathered. The Frontline demonstration on OS 403 was held at 26 NTR, Phephana, and 24 NTR villages between Rabi 2022–2023 and 2023–2024. The local check was Kent, an existing variety. Thirty frontline

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protests took place in different villages over a six-hectare area. In demonstration plots, KVK Nohar (Hanumangarh) planted the high-yielding oat variety OS 403, contrasting it with farmers' current methods of producing green fodder.

In order to examine the variations between potential and demonstration yields, extension gap, and technology index, data on fodder oat production were gathered from FLD plots as well as from regional farming practices frequently employed on the same fields. Farmers were shown important inputs including high-quality seed and an enhanced set of techniques in demonstration plots, while current methods were viewed as local checks. Green fodder yield data were collected independently from farmers' practices (FP) and improved practices (IP) in order to compare the performance of the various varieties. Frequency and percentage were among the statistical tools used in the collection, tabulation, and analysis of the data. The equations given by Samui et al. (2000) were used to compute the extension gap, technology gap, and technology index.

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RESULTS AND DISCUSSION

Frontline Demonstration (FLD)

In order to showcase recently released agricultural production technology and associated management techniques in farmers' fields, ICAR came up with the innovative idea of Frontline Demonstration. Showcasing the efficacy of these new technologies is the primary goal of these demos.

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Varietal Effect on Fodder Yield

In three villages in the Nohar tehsil of the Hanumangarh district, Krishi Vigyan Kendra, Nohar (Hanumangarh), carried out frontline demonstrations on fodder oats utilizing the high-yielding variety OS 403 with improved techniques, pest management, and enhanced knowledge and adoption of improved methods. In comparison to the local check (oat variety Kent), the high-yielding variety delivered an average increased yield of 51q/ha for OS 403, according to the results (Table 1). The enhanced variety yielded 425 q/ha on average, while OS 403 yielded 397 q/ha. The yields in the local check were 349 q/ha and 371 q/ha. In 2022–2023 and 2023–2024, OS 403 showed a growth rate increase of 14.15 percent. These results are consistent with studies

by Sheoran et al. (2017), Sheoran et al., (2008), Singh et al., (2015) Jindal et al. (2020), Neelar (2011), Ranjan et al. (2025) and Singh and Tetarwal (2022).

Gap Analysis

The technology gap, which quantifies the difference between shown productivity and farmer practice yield, peaked in 2022–2023 at 54 q/ha, followed by 2023–2024 at 48 q/ha, and averaged 51 q/ha, according to the data in Table 1 & Fig 1. Several extension strategies, including the use of high-yielding cultivars, educational initiatives, and enhanced agrotechnologies, are required to reduce this disparity. These programs have the potential to close the extension gap by assisting farmers in implementing new and enhanced productivity technology. These conclusions are supported by the research conducted by Jitendra (2017) and Tetarwal and Singh (2020). For OS 403, the extension gap, which quantifies the yield differential between demonstration and potential yield plots, varied from 109 to 137 q/ha. In both years, the average extension gap for OS 403 was 123q/ha. These discrepancies imply that different field conditions, such as soil fertility, low irrigation water quality, pest infestations, and shifting weather patterns, prevented the full potential yields of better practices. Jitendra (2017) and Singh and Tetarwal (2022) both made similar findings. The technology index illustrates the feasibility of new technologies in farmers' fields by displaying the percentage ratio of the technological gap to prospective yield. OS 403 had the greatest technology index value (10.11%), while 2023–2024 had the lowest (8.95%). The oat crop's average technology index during the course of the three-year FLD program was 9.53%. Tetarwal and Singh (2020), Ranjan et al. (2025) and Singh and Tetarwal (2022) reported similar results.

Economic Performance

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The cost of cultivation, gross return, net return, and benefit cost ratio (BCR) of the oat crop under better techniques and current farmers' practices were displayed in the economic data from the frontline demonstrations (Table 2 and Fig. 2). Compared to local techniques (Rs. 21800/ha and Rs. 22200/ha), the average cost of cultivation was higher for upgraded practices (Rs. 22970/ha and Rs. 23200/ha), respectively. The average gross returns (Rs. 97750/ha and Rs. 91310/ha) of the demonstration plots were substantially greater than those of the farmers' practices (Rs. 85330/ha and Rs. 80270/ha), with average BCRs of 4.26 and 3.94, respectively, as

opposed to 3.91 and 3.62 for the farmers' practices. In 2022–2023 and 2023–2024, the additional net return for better cultivation was Rs. 11250/ha and Rs. 10040/ha, respectively, whereas the additional cost was Rs. 1170/ha and Rs. 1000/ha. These results are in line with those of Singh et al. (2019), Ranjan et al. (2025) and Tetarwal and Singh (2020).

CONCLUSIONS

The Front Line Demonstrations successfully established the superiority of Central Oat OS 403, achieving 14.17% higher yield (411 q/ha) and better economic returns (BCR 4.10) compared to local practices. The demonstrations effectively convinced both participating and neighboring farmers about the benefits of improved variety, with high farmer interest for future adoption. The favorable benefit-cost ratio and technology index of 9.53% demonstrate the economic feasibility and efficient technology transfer of OS 403 under semi-arid conditions. Based on superior performance and farmer acceptance, OS 403 is recommended for wider adoption in Hanumangarh and similar agro-climatic zones, supported by continued extension activities including training programs and field days to facilitate horizontal technology dissemination.

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Table 1 Yield of oat as influenced by improved technologies over farmer practice

Year	Variety	Green Fodder Yield (q/ha)			Local check (q/ha)	Additional yield over check (q/ha)	Increased in yield over local (%)	Ext. Gap (q/ha)	Technology Gap (q/ha)	Technology index (%)
		Max	Min.	Mean						
2022-23										
	OS 403	453	397	425	371	54	14.55	109	54	10.11
2023-24										
	OS 403	406	389	397	349	48	13.75	137	48	8.95
Mean		429.5	393	411	360	51	14.15	123	51	9.53
S.D.		33.2	5.7	19.8	15.6	4.2	0.6	19.8	4.2	0.8
S. Em±		23.5	4	14	11	3	0.4	14	3	0.5

Table 2 Economics of fodder oat as affected by improved technologies over farmer practice

Year	Variety	Total Cost of Cultivation (Rs.)		Gross Returns (Rs./ha)		Net Returns (Rs./ha)		B:C ratio		Additional cost of cultivation (Rs.)	Additional net returns (Rs.)
		IP	FP	IP	FP	IP	FP	IP	FP		
2022-23											
	OS 403	22970	21800	97750	85330	74780	63530	4.26	3.91	1170	11250
2023-24											
	OS 403	23200	22200	91310	80270	68110	58070	3.94	3.62	1000	10040
Mean		23085	22000	94530	82800	71445	60800	4.10	3.76	1085	10645
S.D.		162.6	282.8	4553.8	3577.9	4716.4	3860.8	0.22	0.21	120.2	855.6
S. Em±		115	200	3220	2530	3335	2730	0.16	0.145	85	605

Table 3: Initial soil sample at farmer field

S.no	Soil parameters	Values
1.	pH	7.94
2.	EC(dec./m)	0.45
3.	OC (%)	0.17
4.	Available P_2O_5	29 kg/ha
5.	Available K_2O	424 kg/ha

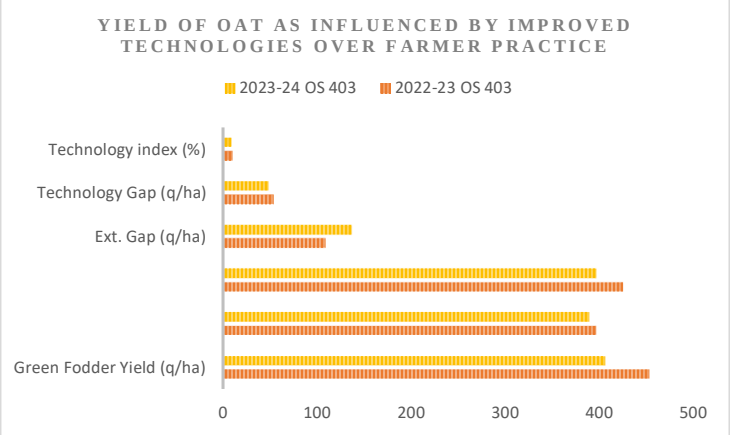

Fig1: Improved technologies over farmer practice

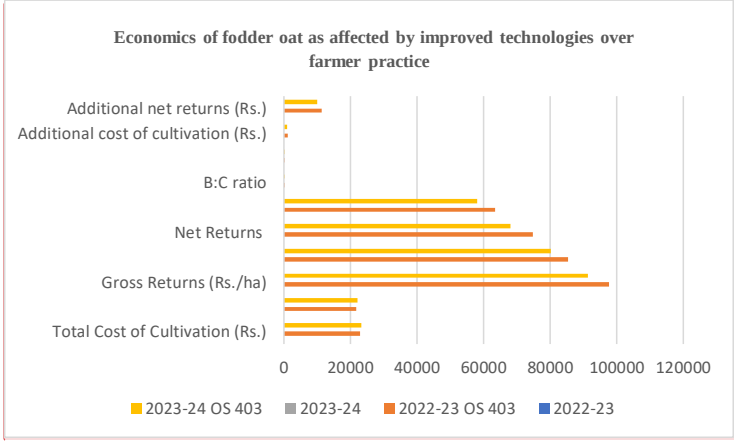

Fig 2: Economics of fodder oat as affected by improved technologies over farmer practice

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