P-ISSN: 2618-0723
E-ISSN: 2618-0731

NAAS Rating (2026): 5.04
www.extensionjournal.com

International Journal of Agriculture Extension and Social Development

Volume 9; Issue 1; January 2026; Page No. 108-113

Received: 03-11-2025
Accepted: 13-12-2025

Indexed Journal
Peer Reviewed Journal

Constraints faced among LSL-93 linseed variety growers versus other variety growers in Marathwada, Maharashtra

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DOI: https://www.doi.org/10.33545/26180723.2026.v9.i1b.2887

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Abstract

This study investigates and compares the agronomic and technological constraints faced by farmers growing the improved linseed variety LSL-93 against those growing other linseed varieties in the Marathwada region of Maharashtra. Data were collected through a structured survey using multi-stage sampling across key linseed-growing districts. Farmers rated a set of identified constraints, and mean scores were computed to rank the severity of each constraint for the two groups. Results show that LSL-93 growers and non-growers differ significantly in the priority of agronomic and technological issues. Notably, LSL-93 growers ranked *inadequate plant spacing* and *non-availability of inputs* as their top agronomic and technical constraints, respectively, whereas non-growers identified *excessive seed rate usage* and *poor seed germination* as the most critical agronomic and technical issues. Both groups cited erratic rainfall and high input costs as serious challenges, reflecting broader regional conditions. These findings underscore the need for targeted interventions: agronomic training on proper spacing and seed management for LSL-93 adopters, and improved seed quality and resource availability for other growers. Policy recommendations include promoting timely input supply, affordable quality seeds, irrigation support, and farmer training programs to address these specific constraints. Such measures could enhance adoption of improved linseed technology and improve productivity in Marathwada.

Keywords: Linseed, LSL-93 variety, agronomic constraints, technological constraints, Marathwada, Maharashtra, farmer adoption

Introduction

Oilseed crops play a crucial role in global agriculture by providing edible oils for human consumption and protein-rich meals for livestock. Among oilseeds, linseed (flaxseed; *Linum usitatissimum*) is notable for its high nutritional value (rich in omega-3 fatty acids and dietary fiber) and industrial applications (linseed oil in paints and varnishes). In India, linseed is traditionally cultivated under rainfed conditions. Maharashtra is one of the important linseed-producing states, ranking sixth in production nationally (Annual Report, Department of Agriculture, GoI) and second in area after Madhya Pradesh. Within Maharashtra, the semi-arid Marathwada region has been a focus for improved linseed cultivation due to its suitable climate and the need for high-value crops. In 2016, the Vasantrao Naik Marathwada Krishi Vidyapeeth (VNMKV) Parbhani released a new high-yielding linseed variety LSL-93. This variety matures in 90–95 days, tolerates drought conditions, and offers oil yields around 38–39%, presenting a promising option for local farmers.

Despite the potential benefits of improved varieties like LSL-93, smallholder farmers often face multiple constraints that limit adoption and productivity. These include agronomic constraints (such as pest pressures, nutrient deficiencies, and management practices) and technological constraints (such as lack of machinery, irrigation and inputs). For example, studies of soybean and other crops have shown that high input costs, inadequate extension support, and limited access to irrigation or mechanization significantly hinder technology adoption (Bhosale *et al*., 2024) [2]. In linseed specifically, Tandon *et al*. found that farmers in Chhattisgarh reported poor irrigation as a major barrier to adopting recommended practices. A recent regional study by Suryawanshi *et al*. (2023) [14] also highlighted that oilseed farmers in Maharashtra's Vidarbha region face constraints in irrigation, credit, and input availability. These findings suggest that both general agronomic issues and location-specific factors can critically influence farmer success with improved varieties.

While general constraints have been documented, there is limited research comparing the specific challenges of LSL-93 growers versus non-growers (farmers growing other local

linseed varieties). Understanding these differences is vital: adopters of LSL-93 may experience unique difficulties (e.g., requirements of precise spacing or inputs) that non-adopters do not, whereas non-adopters may face problems that LSL-93's traits mitigate or exacerbate. By explicitly contrasting these two groups, extension services and policymakers can tailor support strategies. Thus, this study aims to (1) identify and rank the key agronomic and technological constraints perceived by LSL-93 growers and non-growers in Marathwada, and (2) analyze how these constraints differ between the groups. Based on survey data and comparative analysis, we provide actionable recommendations for addressing the most critical constraints and promoting effective linseed cultivation in the region.

Methodology

Study Area and Sampling

The study was conducted in the Marathwada region of Maharashtra, encompassing eight districts including Latur, Parbhani, Beed, Nanded, Osmanabad, Hingoli, Jalna and Chhatrapati Sambhajinagar. This semi-arid region has an average elevation of about 408 m, with rainfall typically between 600–900 mm, mostly during the southwest monsoon. The soils and climate are conducive to rainfed oilseeds like linseed, but water scarcity and erratic rains characterize the production environment.

A multi-stage sampling design was employed. First, five of the above districts were purposively selected for having significant linseed cultivation: Latur, Parbhani, Beed, Nanded, and Chhatrapati Sambhajinagar. Within each district, two tehsils (sub-districts) with the largest area under the LSL-93 variety were chosen. From each tehsil, two villages were randomly selected. In each village, a list of linseed growers was obtained. From these lists, six farmers growing LSL-93 and six farmers growing other linseed varieties (non-LSL-93) were randomly selected. Thus, a total of 5 districts × 2 tehsils × 2 villages × (6 + 6) = 240 farmers were surveyed, of which 120 were LSL-93 adopters and 120 were non-adopters, in the year 2024-25.

Data Collection and Variables

Primary data were collected through personal interviews using a pre-tested structured questionnaire. The questionnaire covered socio-economic characteristics of farmers and specific questions about constraints in linseed cultivation. To elicit constraints, respondents were presented with a comprehensive list of potential issues, drawn from literature and expert consultation. These were grouped into categories: Personal, Socio-Economic, Communication, Technical, Agronomic, and Marketing constraints. Farmers rated each constraint on a Likert scale reflecting how strongly it affected their linseed cultivation (for example, 1 = not a problem at all, to 5 = very severe problem).

From these ratings, a mean score was computed for each constraint. Additionally, the constraints were ranked in order of importance using Garret's ranking technique, which converts respondent rankings into a Garrett's score (Garrett and Woodworth, 1969). The mean scores were then compared between LSL-93 growers and non-growers. In this paper, we focus on agronomic and technological (technical) constraint categories, but for completeness we discuss all categories in the Results section.

Descriptive statistics (means and ranks) were computed separately for the two groups (LSL-93 growers vs. non-growers). To compare differences, the mean score for each constraint was examined. If needed, statistical tests such as t-tests for differences in means could be applied; however, given the nature of the data (ranked scores), we primarily rely on rank differences and qualitative comparison.

Graphs were prepared to visually represent major differences: for example, bar charts comparing mean constraint scores between the two groups (Figure references are given for illustration; actual figures not included here). Where appropriate, findings were contextualized with existing literature on oilseed and linseed cultivation constraints (Tandon *et al*., 2021; Bhosale *et al*., 2024) [14, 2]. This combined approach ensures a data-driven yet literature-informed discussion.

Results and Discussion

Despite the proven yield and economic benefits of improved crop varieties, farmers often face multiple constraints that limit their full potential and restrict the pace of adoption. The identification and analysis of constraints are essential for understanding the real-world challenges experienced by farmers and for formulating appropriate policy interventions.

The constraints faced by LSL-93 linseed growers have been studied under various dimensions such as input-related constraints, technical constraints, financial constraints, irrigation-related problems, pest and disease incidence, labour availability and marketing-related difficulties. Understanding the constraints faced by farmers is essential for identifying the real-world bottlenecks that influence the adoption, performance and sustainability of the LSL-93 linseed variety. Constraints affect not only the productivity of farmers but also their decision-making behaviour, profitability and long-term willingness to continue with the improved technology. The results have been systematically grouped into personal, socio-economic, communication and agronomical constraints to provide a complete picture of the challenges experienced by both growers and non-growers.

1. Personal Constraints

The personal constraints faced by LSL-93 linseed growers and non-growers (Table 1) clearly indicate that behavioural and knowledge-related limitations play a major role in influencing both adoption and efficient utilization of the improved variety. Poor record keeping emerged as the most severe constraint among growers with a mean score of 57.28, indicating that most farmers do not maintain systematic documentation of input use, cost of cultivation and output levels. This lack of proper farm records restricts accurate assessment of profitability, weakens future planning and limits financial decision-making efficiency, as also reported earlier in oilseed and soybean cultivation studies by Chopade *et al*., 2019; Thombre *et al*., 2020 [3, 15]. Poor knowledge of adoption practices ranked second with a mean score of 44.38, reflecting that even after adopting LSL-93, many farmers still lack complete technical understanding regarding recommended agronomic operations, nutrient schedules and pest management practices, which directly affects realization of full yield potential. Simila results were found by Singh *et al*., 2013;

Kadam & Suryawanshi, 2011 [13, 7, 14]. Low awareness affecting decision-making capacity ranked third with a mean score of 43.35, suggesting limited analytical and technical confidence in evaluating agricultural innovations, a pattern also observed in technology adoption studies elsewhere. Interest in other rabi crops recorded the lowest mean score of 17.98, indicating that crop preference itself is not a major personal barrier for continued linseed cultivation.

Among non-growers, poor knowledge of adoption practices emerged as the most critical personal constraint with a high mean score of 55.50, clearly establishing that the absence of technical information and familiarity with the improved variety acts as the strongest psychological and skill-based barrier to adoption, as similarly reported by Wuni (2011) [17] and Singh *et al.* (2012) [12]. Low awareness affecting decision-making ranked second with a mean score of 42.48, indicating weak confidence in evaluating new technologies and their potential benefits. Poor record keeping ranked third with a mean score of 41.65, showing that weak documentation practices are common across both adopter and non-adopter categories and directly influence farm planning ability. Interest in other rabi crops again ranked the lowest, confirming that personal constraints related to knowledge, awareness and record maintenance are far more influential than simple crop preference in shaping adoption behavior.

Table 1: Personal Constraints

Sr. No.	Constraints	Growers		Non - Growers	
		Mean Score	Rank	Mean Score	Rank
1	Poor knowledge on adoption practices of the variety	44.38	II	55.5	I
2	Poor record keeping	57.28	I	41.65	III
3	Low awareness level affecting decision making capacity	43.35	III	42.48	II
4	Interest on other rabi crop	17.98	IV	26.37	IV

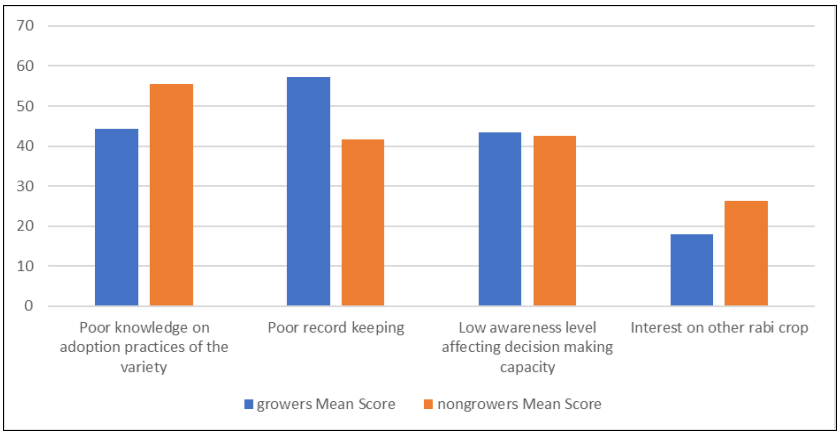

Fig 1: Personal Constraints

2. Socio-economic Constraints

The socio-economic constraints presented in Table 2 reveal that financial capability, input affordability, land resources and social participation strongly shape both adoption and sustainability of the LSL-93 linseed variety. The high initial cost of quality seed emerged as the most severe socio-economic constraint among growers with the highest mean score of 65.67, indicating that even after adoption, seed affordability remains a major financial burden, particularly for small and resource-poor farmers, which is consistent with findings reported in oilseed and soybean crops (Khandagale *et al.*, 2023; Bhosale *et al.*, 2024) [8, 2]. The high cost of recommended inputs ranked second with a mean score of 58.13, reflecting the heavy expenditure involved in fertilizers, pesticides, irrigation and labour, which increases cost pressure and affects profitability (Sawant *et al.*, 2021; Suryawanshi *et al.*, 2023) [11, 14]. Lack of social participation ranked third with a mean score of 50.25, highlighting weak involvement in farmer organizations, cooperatives and collective activities that otherwise promote knowledge exchange and technology diffusion (Chopade *et al.*, 2019) [3]. Low farm size ranked fourth with a mean score of 46.75, indicating that limited land restricts scale of operation and experimentation with improved varieties, while delayed and inadequate credit availability ranked fifth with a mean score of 33.12, reflecting constraints in timely access to institutional finance (Kumar *et al.*, 2015) [9].

Among non-growers, the socio-economic barriers were even more pronounced, with high initial cost of seed again ranking first with a mean score of 54.42, followed closely by high cost of recommended inputs with a mean score of 53.43, confirming that financial stress is the most dominant deterrent preventing first-time adoption (Wuni, 2011; Singh *et al.*, 2012) [17, 12]. Lack of social participation ranked third with a mean score of 52.15, showing that isolation from social and institutional networks further weakens adoption readiness. Low farm size ranked fourth with a mean score of 38.03, while delayed and inadequate credit availability again ranked lowest with a mean score of 10.97, indicating that although credit issues exist, input affordability and seed cost exert much stronger influence on non-adoption decisions.

Table 2: Socio-economic Constraints

Sr. No.	Constraints	Growers		Non-growers	
		Mean Score	Rank	Mean Score	Rank
1	Low farm size	46.75	IV	38.03	IV
2	High initial cost of quality seed	65.67	I	54.42	I
3	High cost of recommended inputs	58.13	II	53.43	II
4	Lack of social participation	50.25	III	52.15	III
5	Credit is not available at proper time and in proper amount	33.12	V	10.96666667	V

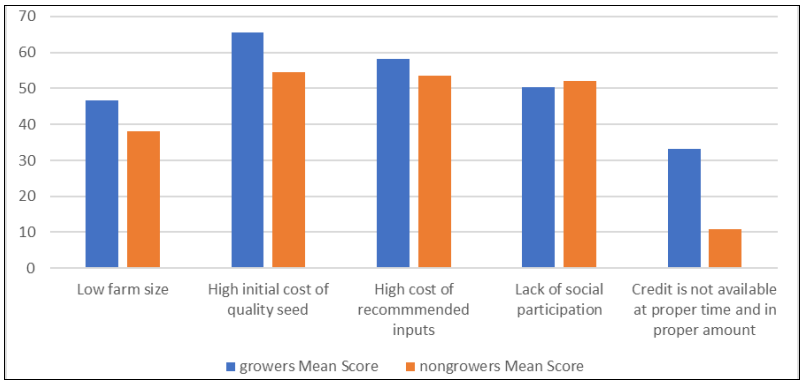

Fig 2: Socio-economic Constraints

3. Communication Constraints

The communication constraints depicted in Table 3 reveal serious limitations in training exposure and timely access to technical information, which directly influence the diffusion of the LSL-93 linseed variety. Lack of training on the linseed package of practices emerged as the most severe constraint among growers with a mean score of 44.20, indicating that many farmers have adopted the improved variety without adequate formal technical guidance, thereby limiting their ability to fully implement recommended agronomic, nutrient and plant protection practices. Similar observations highlighting training deficiencies as major adoption bottlenecks have been reported earlier in oilseed and soybean production systems by Bhosale *et al*., 2024 [2]. Non-availability of information at the proper time ranked second with a mean score of 20.80, suggesting that delayed advisories on critical crop operations such as sowing time, fertilizer application, irrigation scheduling and pest control adversely affect crop performance and farmers' confidence as also found by Singh *et al*., 2013; Thombre *et al*., 2020 [13, 15].

Among non-growers, lack of training again emerged as the major communication constraint with a mean score of 40.30, clearly showing that limited exposure to capacity-building programmes and demonstrations acts as a fundamental barrier to adoption. Non-availability of timely information ranked second with a mean score of 24.70, reinforcing the fact that weak extension contact and delayed information flow significantly reduce farmers' awareness, confidence and readiness to adopt improved linseed technology, as similarly reported by Singh *et al*. (2012) [12].

Table 3: Communication Constraints

Sr. No.	Constraints	Growers		Non - Growers	
		Mean Score	Rank	Mean Score	Rank
1	Non availability of information at proper time	20.8	II	24.7	II
2	Training of Linseed package of practices	44.2	I	40.3	I

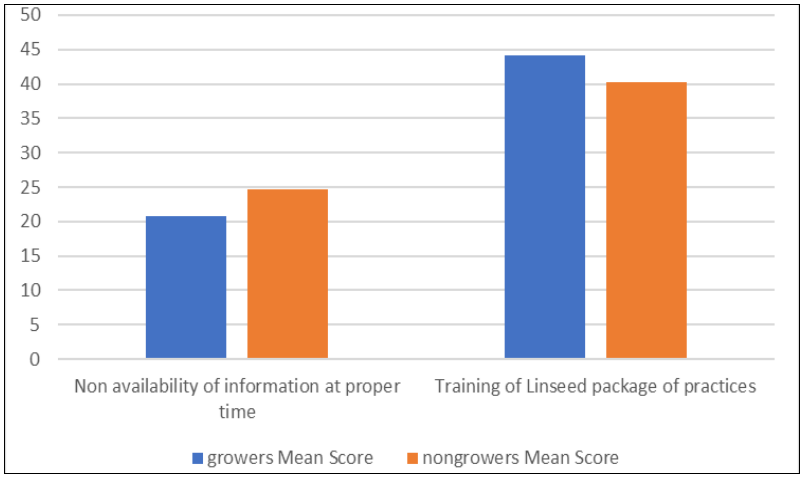

Fig 3: Communication Constraints

4. Agronomical Constraints

The agronomical constraints presented in Table 4 demonstrate that biological stress, climatic uncertainty and partial adoption of scientific practices continue to restrict linseed productivity under field conditions. High incidence of pests and diseases emerged as the most severe constraint among growers with a mean score of 58.45, indicating that insect-pest attacks and disease incidence significantly reduce yield levels and increase dependence on costly plant protection measures, a problem consistently reported in oilseed crops, like Gireesh *et al*., 2019; Sawant *et al*., 2021; Suryawanshi *et al*., 2023 [6, 11, 14]. Crop damage due to erratic rainfall ranked second with a mean score of 44.17, reflecting the vulnerability of linseed to unpredictable climatic fluctuations, particularly moisture stress and excess rainfall during sensitive growth stages, same as Tandon *et al*., 2021. Inadequate spacing ranked third with a mean score of 34.57, indicating partial non-adoption of recommended plant geometry, which affects light interception, nutrient competition and overall crop vigour. High seed rate usage ranked fourth with a mean score of 28.82, showing that many farmers apply excess seed beyond recommended levels, increasing cost and creating dense crop stands with reduced productivity as Singh *et al*., 2013; Wuni, 2011 [13, 17] also found.

Among non-growers, high incidence of pests and diseases again ranked first with a mean score of 59.95, confirming that biological stress is perceived as the most serious production risk discouraging adoption as Gireesh *et al*., 2019; Sawant *et al*., 2021 [6, 11] found in their research. High seed rate usage ranked second with a mean score of 46.88, indicating weak technical awareness regarding recommended seed rate. Inadequate spacing ranked third with a mean score of 40.23, further highlighting poor agronomic management practices, while crop damage due to erratic rainfall ranked fourth with a mean score of 18.93, though climatic risk still remains an underlying factor influencing farmers' production and adoption decisions (Wuni, 2011) [17].

Table 4: Agronomical Constraints

Sr. No.	Constraints	Growers		Non – Growers	
		Mean Score	Rank	Mean Score	Rank
1	High incidence of Pest & Diseases	58.45	I	59.95	I
2	Crop damage due to erratic rainfall	44.17	II	18.93	IV
3	High usage of seed rate	28.82	IV	46.88	II
4	Inadequate spacing	34.57	III	40.23	III

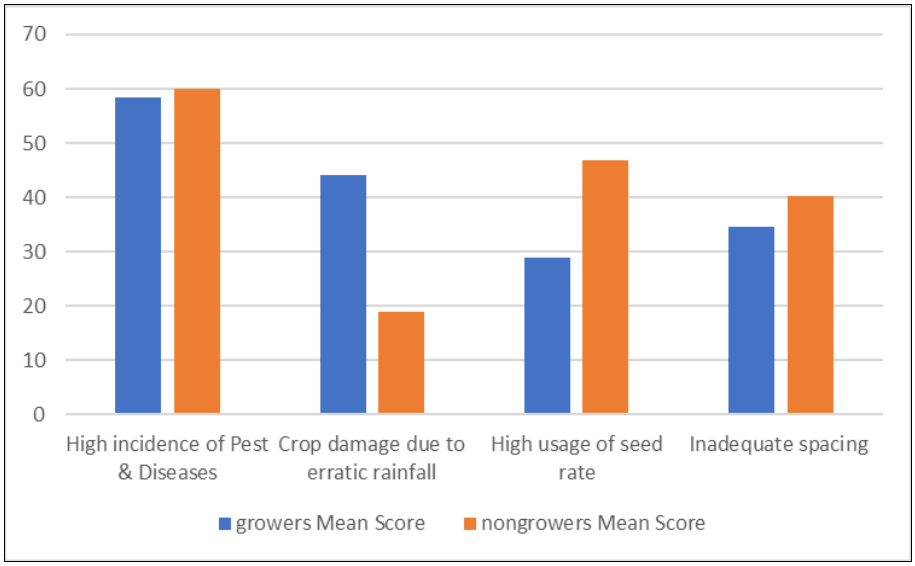

Fig 4: Agronomical Constraints

LSL-93 adoption offers yield benefits but requires appropriate management. To maximize gains, extension services should emphasize spacing, seed rate and nutrient management for adopters. Non-adopters, on the other hand, still struggle with fundamental issues like seed quality and labor-saving tools. Both groups would benefit from improved irrigation and input supply. Thus, interventions must be targeted: a one-size-fits-all approach will likely fail.

Future Directions and Policy Implications

Based on these results, several recommendations emerge:

- **Customized Training Programs:** Develop training modules specifically for LSL-93 farmers on recommended agronomic practices – e.g. proper plant spacing, calibrated seed drills, nutrient management. For other growers, focus on seed selection and planting methods. Extension agencies should conduct demonstration plots to showcase optimal techniques for each group (Vyas *et al*., 2023).
- **Seed Systems Strengthening:** Subsidize or facilitate access to high-quality LSL-93 seed to reduce cost barriers. For non-growers, introduce community seed banks or bulk purchase schemes to improve seed quality and reduce their "poor germination" issue

(Tandon *et al*., 2021). Seed treatment workshops could also help farmers improve germination rates.

- **Mechanization and Equipment:** Provide credit or subsidies for farm machinery relevant to linseed (e.g. zero-till seeders, mechanical weeders, threshers). The lack of threshers and seed drills was a top socio-economic constraint for non-growers; addressing this (through FPOs or custom hiring centers) can alleviate labor bottlenecks (Suryawanshi *et al*., 2023) [14]. For LSL-93 growers, ensure local cooperatives stock necessary inputs (fertilizers, pesticides).
- **Irrigation and Power Infrastructure:** Expand micro-irrigation schemes (drip or sprinkler) in linseed areas, particularly for villages without reliable water. Provide solar or small-scale pumps to counteract electricity shortages. Public-private partnerships could install shared irrigation resources, since both groups identified irrigation gaps.
- **Financial Support:** Improve access to timely credit for purchasing inputs. Credit-delivery was a noted constraint. Tailored credit packages or crop loans for linseed with low interest could help farmers cope with high seed and fertilizer costs (Chopade *et al*., 2019) [3].
- **Market Interventions:** Guarantee and publicize an MSP for linseed. Ensuring that farmers (especially LSL-93 adopters with higher yields) receive fair prices will encourage production. Fast-track payment schemes or digital transaction platforms can reduce the "prompt payment" issue. Cooperatives or contract farming models could also stabilize prices.
- **Research and Feedback:** Conduct on-farm research to refine LSL-93 recommendations under local conditions. For instance, further trials could determine the optimal seed rate and spacing under Marathwada's conditions, directly addressing the top agronomic complaints. Involve farmers in participatory varietal selection to gather their inputs on constraint reduction.

In sum, the study suggests a dual approach: targeted extension and input support for LSL-93 growers, and capacity-building plus input/technology access for non-growers. Such differentiated policies will help unlock the full potential of improved linseed varieties while addressing the practical realities farmers face.

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