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Assessment of technological and skill gaps in paddy seed production in Jagtial district

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Abstract

A descriptive survey study was conducted in Jagtial district, Telangana, to assess the technological and skill gaps in paddy seed production and to identify the major constraints faced by farmers. A total of 120 paddy seed-producing farmers were selected from 5 Paddy seed production villages of the Jagtial district using purposive sampling. Data were collected using a structured interview schedule and analyzed through gap analysis and the Garrett Ranking technique. Findings revealed significant technological gaps including practice of growing the same variety in the previous season (30%), knowledge of proper spacing (28.33%) and pest/disease management in the nursery (25.0%). The key skill gaps included highest skill gap (35.0%) was recorded for rouging at the grain formation stage, followed closely by removal of off-types at the tillering stage (31.67%). These two stages are critical for ensuring genetic purity of seed, and the high gaps suggest that farmers either lack identification skills or neglect these practices due to labor or knowledge constraints. The study recommends focused capacity-building interventions, including skill-based training, field demonstrations, and the formation of farmer cooperatives. Addressing these gaps is essential for improving varietal purity, seed quality, and the long-term sustainability of paddy seed production systems.

Keywords: Paddy seed production, technology gap, skill gap, rouging, Garrett ranking, extension interventions

Introduction

Paddy seed production is fundamental to enhancing agricultural productivity, securing national food supply, and improving the livelihoods of farmers across India. Among various inputs, high-quality seed plays a pivotal role—contributing nearly 20–25% to crop yield improvements when adopted effectively (Singh *et al.*, 2017) ^[12]. However, in Telangana—especially in Jagtial district—the potential of paddy seed production is hindered by several technological and skill-based challenges that affect both seed quality and overall productivity.

A number of studies have underscored the limitations in farmers' adoption of recommended seed production practices. Ghritlahre *et al.* (2018) ^[2] identified critical barriers such as restricted access to certified seeds, insufficient knowledge regarding rouging techniques, and poor pest and disease management. Reddy *et al.* (2020) ^[10] further noted that the lack of practical training and limited technical advisory services severely constrain the capacity of farmers to follow scientifically validated seed production protocols.

Scientific methods are crucial in paddy seed production to enhance seed quality, ensure varietal purity, and improve overall farm productivity. However, recent research indicates that many farmers still rely heavily on traditional practices and informal seed sources. Kumar *et al.* (2021) ^[3] observed that such reliance results in inconsistent seed quality and lower germination rates. Similarly, Rani and Rajendran (2020) ^[9] found that essential operations like rouging, maintaining isolation distances, and seed treatment are often overlooked due to limited technical knowledge and lack of practical training.

In South India, a study by Patil *et al.* (2022) ^[8] highlighted that while awareness of certified seed production practices has improved, actual adoption remains low. This gap is attributed to issues such as labor shortages, inadequate access to technical guidance, and minimal exposure to on-field demonstrations. Additionally, Yadav *et al.* (2023) ^[13] emphasized the growing relevance of

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digital and mobile-based advisory services in disseminating timely and accurate information to farmers. However, the reach and effectiveness of these tools remain limited in rural areas due to infrastructural and accessibility challenges. Bhattacharya & Saha reported that limited access to certified seeds and lack of awareness were major barriers in West Bengal. Chander *et al.* (2020) ^[1] highlighted skill deficiencies in key seed production practices like rouging and pest management, similar to the critical skill gaps identified at grain formation and tillering stages.

Kumar *et al.* (2021) ^[4] found that farmers' practical training deficits led to inconsistent seed quality, which aligns with observation of technological gaps such as improper spacing and nursery management.

Mishra & Gupta (2022) ^[5] noted labor shortages and insufficient technical advisory support as constraints on labor and knowledge constraints affecting seed purity maintenance.

Naik & Reddy (2021) ^[6] emphasized the role of extension services in reducing knowledge gaps, supporting the recommendation for capacity-building and field demonstrations.

Patil & Rao (2019) ^[7] identified socio-economic factors influencing adoption rates, which focus on farmer-specific constraints affecting technology uptake.

Reddy & Rani (2020) ^[11] stressed the need for skill development programs targeted at seed producers, directly backing your call for skill-based training and farmer cooperatives.

In light of the existing challenges, the present study aims to conduct a detailed assessment of the technological and skill-related gaps among paddy seed-producing farmers in Jagtial district, Telangana. The research also examines the information-seeking behavior of farmers to understand how they acquire and apply knowledge related to seed production. By identifying the major constraints faced in the field and evaluating current knowledge systems, the study seeks to recommend location-specific, practical interventions. These insights are intended to guide the development of more effective, farmer-friendly strategies that enhance productivity, promote the adoption of improved practices, and contribute to the sustainable growth of the paddy seed sector in the region.

Objectives

1. To analyze the socio-economic profile of seed-producing farmers.
2. To identify technological and skill gaps in paddy seed production.
3. To assess constraints and record farmer suggestions.
4. To understand farmers' information management behavior.

Methodology

The study employed a descriptive survey research design to systematically assess the technological and skill gaps among paddy seed-producing farmers. This approach enabled the collection of both qualitative and quantitative data to gain insights into prevailing practices, constraints, and information behavior patterns of farmers.

The research was conducted in Jagtial district of Telangana, a prominent area for paddy seed production. Five villages—Gullapeta, Laxmipur, Kalleda, Nagaram, and Polasa—were purposively selected based on their active involvement in certified seed production and accessibility. A purposive sampling technique was employed to select 120 farmers engaged in paddy seed production. From each village, 24 farmers were chosen based on their participation in seed production during the last two cropping seasons, ensuring representation of varying farm sizes and experience levels.

Primary data were collected using a structured interview schedule, which included closed- and open-ended questions. The tool was pre-tested for reliability and content validity, and necessary modifications were made before administering the final version. Quantitative data were analyzed using descriptive statistics such as frequencies, percentages, mean scores, and ranking. Skill gaps were assessed using the Gap Index formula in use to identify the technology and skill gaps in paddy seed production. Garette ranking technique was calculated to identify the most pressing issues faced by the farmers.

Results and Interpretation

Key Findings

1. Socio economic profile of the farmer

S. No.	Variable	Majority Category	Frequency (n)	Percentage (%)
1	Age	Middle Age (36–55)	91	75.83
2	Education	Primary School (Up to 5th)	32	26.67
3	Farming Experience	Medium (15–20 years)	52	43.33
4	Irrigation Source	Bore Wells	84	70.00
5	Mass Media Exposure	Medium (9–11)	58	48.33
6	Innovativeness	High (7–8)	58	48.33
7	Socio-Political Participation	Low (6–8)	62	51.67
8	Risk Taking Ability	Medium (8–10)	50	41.67

The majority of farmer seed growers in the study were middle-aged, had primary education, and possessed moderate farming experience. Most relied on bore wells for irrigation and had medium levels of exposure to mass media. A large portion

showed high innovativeness, but low participation in socio-political activities. However, risk-taking ability was moderately strong, indicating openness to trying new agricultural practices.

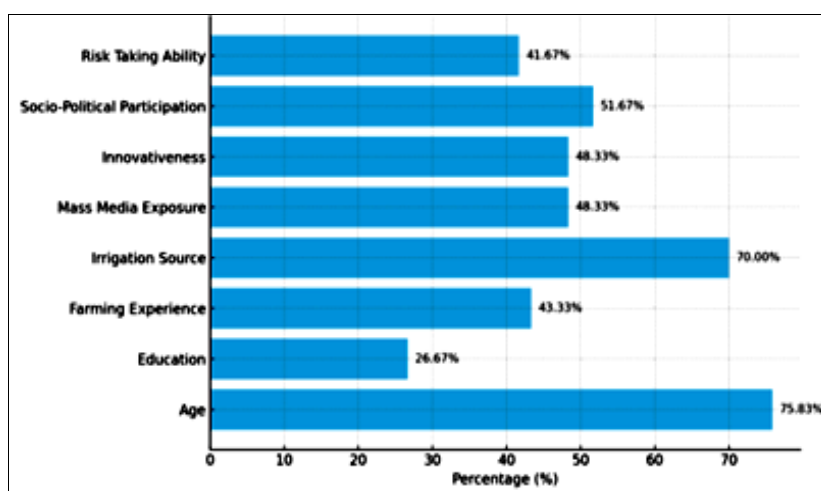


Fig 1: Majority category profile of farmer seed growers

2. Technology Gap Index of Recommended Practices (n = 120 Farmers)

$$\text{Gap Index (\%)} = \frac{(\text{Recommended} - \text{Actual}) \times 100}{\text{Recommended}}$$

S. No.	Technology Practice	Recommended (n=120)	Actual Adoption	Gap Index (%)	Rank
1	Same variety grown in previous season	120	84	30.0	I
2	Proper spacing knowledge (20 cm row × 15 cm plant)	120	86	28.33	II
3	Pest/disease management in nursery	120	90	25.0	III
4	Manuring in nursery	120	92	23.33	IV
5	Cleaning tools/equipment to avoid genetic & physical mixture	120	94	21.67	V
6	Seed treatment with fungicide (carbendazim/mancozeb)	120	98	18.33	VI
7	Weedicide application in nursery	120	100	16.67	VII
8	Maintaining isolation distance of 3 meters or time isolation	120	102	15.0	VIII
9	Transplanting 3 seedlings at 2–3 cm depth	120	104	13.33	IX
10	Adequate irrigation and drainage facility	120	106	11.67	X
11	Following proper seed rate (fine: 10 kg, coarse: 15 kg)	120	108	10.0	XI
12	Seed procurement from authenticated sources (SAU/Research/Dept.)	120	114	5.0	XII

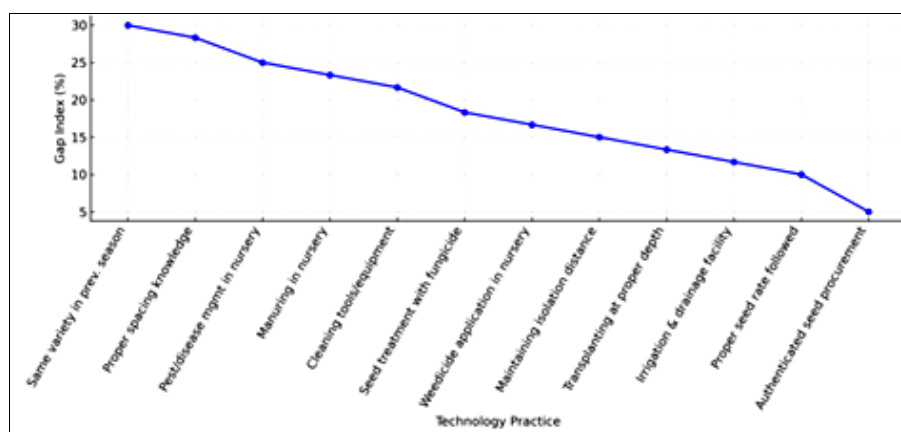


Fig 2: Technology gap index in paddy seed production practices

Technology Gap Index (TGI)

The Technology Gap Index was assessed for 12 recommended practices in paddy seed production among 120 farmers. The results revealed that significant gaps exist in several key areas. The highest gap (30.0%) was recorded for the practice of growing the same variety in the previous season, which ranked first among all practices. This suggests that a considerable number of farmers either lack awareness of varietal rotation or continue with traditional preferences, potentially compromising genetic purity and seed quality. The second and third highest gaps were seen in knowledge of

proper spacing (28.33%) and pest/disease management in the nursery (25.0%), indicating insufficient technical know-how and limited access to scientific agronomic recommendations. Moderate gaps were observed in nursery manuring (23.33%), cleaning of tools and equipment to avoid physical/genetic mixture (21.67%), and seed treatment with fungicides (18.33%). These practices are essential to ensure healthy seedlings and prevent contamination but appear to be inadequately adopted. Practices such as maintaining isolation distance (15.0%), transplanting at the correct depth with proper seedling number (13.33%), and adequate irrigation and drainage (11.67%)

showed relatively lower gaps, indicating a moderate level of awareness and adherence.

Notably, the lowest gaps were observed in following proper seed rate (10.0%) and procurement of seed from authenticated

sources (5.0%), suggesting that these practices are widely followed, likely due to institutional linkages or routine practices facilitated by local seed agencies.

Skill Gap Index of Recommended Practices (n = 120 Farmers)

$$\text{Gap Index (\%)} = \frac{(\text{Recommended} - \text{Actual})}{\text{Recommended}} \times 100$$

S. No.	Skill Practice	Recommended (n=120)	Actual Skill Level	Gap Index (%)	Rank
1	Roguing at grain formation stage (based on panicle, grain traits)	120	78	35.0	I
2	Removing off-types at tillering stage (height, leaf width, yellowing)	120	82	31.67	II
3	Knowledge of seed treatment method with fungicide	120	92	23.33	III
4	Roguing at flowering stage (flag leaf orientation, early/late flowering)	120	96	20.0	IV
5	Practicing roguing at all stages (tillering, flowering, grain formation)	120	98	18.33	V
6	Proper seed cleaning (removal of weed seeds, chaff, damaged/foreign particles)	120	104	13.33	VI

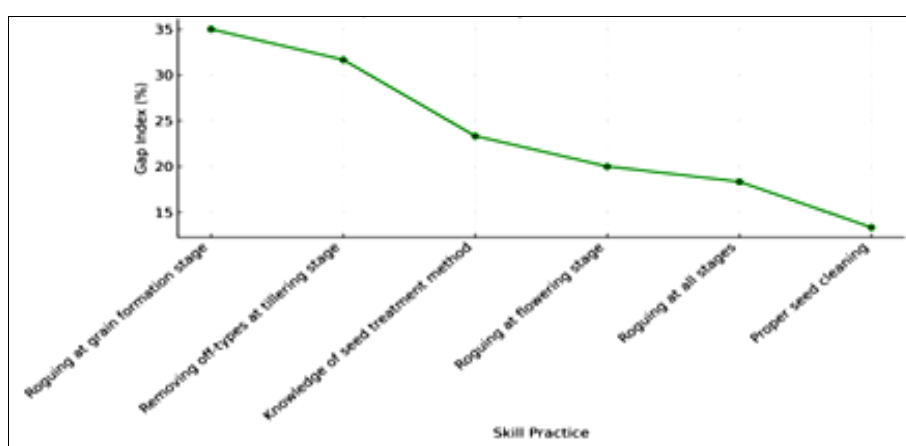


Fig 3: Skill gap index in paddy seed production practices

Skill Gap Index (SGI)

The Skill Gap Index analysis for six core seed production skills revealed that roguing-related skills were most deficient among farmers.

The highest skill gap (35.0%) was recorded for roguing at the grain formation stage, followed closely by removal of off-types at the tillering stage (31.67%). These two stages are critical for ensuring genetic purity of seed, and the high gaps suggest that farmers either lack identification skills or neglect these practices due to labor or knowledge constraints.

A moderate gap (23.33%) was observed in knowledge of seed

treatment with fungicides, reflecting partial awareness but likely inadequate hands-on understanding or demonstration of the methods.

Skill gaps for roguing at flowering stage (20.0%) and performing roguing at all critical stages (18.33%) were comparatively lower, indicating some level of engagement but still below the desired competency levels.

The lowest gap (13.33%) was seen in seed cleaning skills, implying that basic post-harvest handling practices are relatively well understood and practiced, likely due to repetition and simplicity.

Constraints in Seed Production perceived by the respondents

S. No.	Constraint	Assigned Rank	Percent Position	Garrett Score	Total Score	Mean Score	Final Rank
1	Difficulty in performing rouging operations	I	4.16	83	9960	83.00	I
2	Lack of knowledge in identifying off-types	II	12.5	73	8760	73.00	II
3	Non-availability of skilled labour	III	20.83	66	7920	66.00	III
4	Laborious process	IV	29.16	61	7320	61.00	IV
5	More seed cost	V	37.5	56	6720	56.00	V
6	Labour not performing operations as recommended	VI	45.83	52	6240	52.00	VI
7	Low risk-taking ability of farmer	VII	54.16	48	5760	48.00	VII
8	Misconception about the purity of seed	VIII	62.5	43	5160	43.00	VIII
9	Increase in cost of cultivation	IX	70.83	39	4680	39.00	IX
10	Lack of knowledge on management aspects of seed production	X	79.16	34	4080	34.00	X
11	Fear of weather condition at harvesting may incur yield loss	XI	87.5	27	3240	27.00	XI
12	Non-availability of technical advice on seed production	XII	95.83	17	2040	17.00	XII

Based on Garrett's ranking

The Garrett ranking method was employed to systematically identify and prioritize the constraints perceived by farmers in the adoption and execution of paddy seed production practices. The analysis revealed several critical issues that hinder the effective implementation of quality seed production protocols in Jagtial district.

The most significant constraint, as indicated by the highest mean Garrett score (83.00), was the *difficulty in performing rouging operations*. This finding underscores the technical complexity of rouging, which involves the identification and removal of off-type plants to maintain genetic purity. The lack of proper training or field-level demonstrations likely contributes to farmers' discomfort and inaccuracies during this process. Closely following this was the *lack of knowledge in identifying off-types* (73.00), highlighting the need for focused capacity-building initiatives aimed at improving farmers' visual and trait-based recognition of varietal purity.

The *non-availability of skilled labour* (66.00) ranked third, indicating that even when farmers are aware of the required practices, they face difficulties in executing them due to workforce limitations. This is particularly relevant in the context of increasing rural–urban migration and limited availability of trained agricultural labourers.

Mid-ranked constraints such as the *laborious nature of seed production* (61.00) and *high seed cost* (56.00) suggest operational and economic deterrents. Although these factors did not rank at the top, they still play a role in dissuading small and marginal farmers from venturing into seed production, which requires more precision, effort, and initial investment than general cultivation.

Lower-ranked but still noteworthy were issues like the *low risk-taking ability of farmers* (48.00) and *misconceptions about seed purity* (43.00). These reflect behavioural and perceptual barriers that may not be easily resolved through technical interventions alone but require sustained extension efforts, trust-building, and demonstration of successful seed producers as role models.

Interestingly, constraints such as the *increase in cost of cultivation*, *fear of weather-related losses*, and *lack of technical guidance* were ranked lowest, with scores ranging from 39.00 to 17.00. This suggests that while these issues do exist, they are not the primary concerns in the eyes of the farmers surveyed. It also implies that farmers are more immediately affected by operational and knowledge-related challenges than broader environmental or institutional factors.

Overall, the results indicate a strong need for targeted training, labour management solutions, and continuous technical support. Extension agencies and seed certification bodies should focus on practical skill development in rouging, improve accessibility to technical know-how, and support the formation of trained labour groups or custom hiring centres. Addressing these top-ranked constraints could significantly enhance the efficiency, reliability, and scalability of paddy seed production in the region.

Suggestions Based on Garrett Ranking Analysis and Farmer Feedback (Sample Size: 120)

Nearly 46.66% of the farmers suggested organizing field-level demonstrations on rouging. Practical training will help them clearly identify off-types and maintain genetic purity in seed production. These demonstrations should be simple, visual, and conducted at the village level during the crop growth stage.

About 35% of respondents recommended forming or strengthening seed producer cooperatives. Such groups can

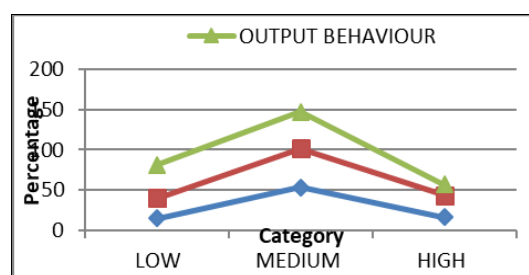
enable collective efforts in seed procurement, labor sharing, input purchase, and technical coordination, thereby reducing individual burden and improving efficiency.

Farmers emphasized the need for structured training programs and field exposure visits to model seed farms. These initiatives can enhance their understanding of critical seed production practices, including isolation, roguing, and seed handling.

In response to the shortage of skilled workers, it is suggested to establish local skilled labor pools or Custom Hiring Centres (CHCs). These can provide trained laborers for technical operations like rouging and field inspections, improving seed quality management.

Distribution of Farmer Seed Growers Based on Information Management Behavior (n = 120)

S. No.	Component	Category	Score Range	Frequency	Percentage (%)	Rank
1	Information Input Behavior	Low	36–47	18	15.00	III
		Medium	47–58	64	53.33	I
		High	58–69	20	16.67	II
2	Information Processing Behavior	Low	26–31	30	25.00	III
		Medium	31–36	58	48.33	I
		High	36–41	32	26.67	II
3	Information Output Behavior	Low	12–14	50	41.67	II
		Medium	14–16	54	45.00	I
		High	16–18	16	13.33	III



Results & Interpretation

More than half of the respondents (53.33%) exhibited a medium level of information input behavior, indicating that a majority of farmers moderately engage in seeking seed production-related information. Only 16.67% of farmers had high input behavior, suggesting that a relatively small group actively acquires knowledge from various sources such as extension personnel, fellow farmers, digital platforms, or institutions. Meanwhile, 15% of farmers demonstrated low input behavior, which could be due to limited awareness, access issues, or reliance on traditional practices. This emphasizes the need to enhance information outreach, particularly for farmers in the low category.

The majority (48.33%) of the farmers had a medium level of information processing behavior, meaning they can somewhat evaluate, store, and apply the information they receive. A significant 26.67% of farmers were classified under high processing behavior, reflecting strong cognitive ability and confidence in using agricultural knowledge effectively. However, 25% of farmers had low processing behavior, indicating difficulties in evaluating or internalizing information, which can hinder technology adoption. These findings underline the importance of skill-building initiatives and participatory learning approaches to strengthen information handling and application.

A majority of farmers (45%) had a medium level of information dissemination behavior, indicating they occasionally share

information with fellow farmers, group members, or during informal interactions. 41.67% exhibited low dissemination behavior, suggesting hesitancy or lack of platforms to communicate their knowledge. Only 13.33% of farmers were in the high category, who could serve as potential farmer facilitators, role models, or trainers. This highlights the need to create more community-based extension platforms, such as farmer field schools, group meetings, and peer-to-peer sharing models, to encourage wider dissemination.

Conclusion

This study on Technology and Skill Gap Analysis in Paddy Seed Production in Jagtial District has revealed significant barriers that hinder the adoption of scientific seed production practices. Key constraints include inadequate knowledge of rouging, lack of knowledge on off types and shortage of skilled labour. The insights gained through Garrett Ranking and farmer responses underline the need for targeted interventions such as on-field demonstrations, hands-on training, cooperative development, and improved access to expert advisory services. These measures can directly address the identified gaps and empower farmers with the necessary skills and confidence to participate effectively in quality seed production. By systematically addressing these challenges, the region can witness improvements in seed quality, production efficiency, and farmer income, thereby contributing to the overall strengthening of the seed supply chain in Jagtial district.

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