



Research Paper

Assessment of the seed hub project for quality seed production and farmer participation in the Hamirpur district of the Bundelkhand region

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ABSTRACT

The introduction of high-yielding pulse varieties is vital for sustainable production in rainfed regions. To strengthen seed quality and availability, the Pulse Seed Hub Program was launched at Krishi Vigyan Kendra (KVK) in 2016–17 with farmer participation through buyback agreements. Between 2017–18 and 2021–22, KVK produced 2,239.01 quintals of quality seed, covering 2,759.7 hectares and benefiting 2,866 farmers. Fieldpea dominated production (1,346.73 q), with IPFD 12-2 emerging as the most preferred variety due to superior yield and market demand, while chickpea (JG-14, RVG 202, JG-36) and lentil (IPL-316) were widely adopted for their adaptability and disease resistance. Demonstrations confirmed superiority over farmers' older varieties, with mean yield gains of 22.8% in chickpea, 27.8% in fieldpea, and 24.3% in lentil. The program generated a gross income of ₹ 1.63 crores, with a net profit of ₹ 62.31 lakhs reinvested in seed facilities. Farmers received 20% higher procurement prices than support rates, adding ₹ 19.84 lakhs in extra remuneration and enabling entrepreneurial diversification. Beyond economic benefits, the initiative created employment for rural youth, women, and farm workers. Overall, the Seed Hub Program enhanced varietal replacement, improved farmer livelihoods, and demonstrated a replicable model for strengthening pulse production in rainfed agro-ecosystems.

Key words: Hamirpur, Participatory seed production, Pulses, Seed hub, Quality seed

INTRODUCTION

Pulses are vital to global food and nutritional security, especially in developing countries where they serve as a primary source of protein for large populations. They are rich in dietary fiber, essential minerals, vitamins, and bioactive phytochemicals such as antioxidants, offering significant health benefits (Uebersax *et al.* 2023, Srivastava *et al.* 2010). With an average protein content of 22.36%, considerably higher than that of major cereals (12.51%), pulses also provide lower carbohydrate levels (62.68% vs. 71.90%) and greater amounts of iron, folate, potassium, and dietary fiber. These nutritional advantages make them indispensable for combating malnutrition and promoting balanced diets (Siddiq *et al.* 2022).

India, the largest producer and consumer of pulses globally, cultivates these crops on approximately 30.37 m ha, yielding 26.96 mt with an average productivity of 888 kg/ha. Within India, the Bundelkhand region of Uttar Pradesh, comprising the districts of Hamirpur, Jalaun, Jhansi, Lalitpur,

Mahoba, Banda, and Chitrakoot, plays a pivotal role in pulse production. Spanning over 7.1 m ha, this region contributes nearly 57% (1.35 mt) of the state's total pulse output, earning it the designation of the "Pulse Bowl" of Uttar Pradesh (Sharma and Sisodia 2018, Pandey *et al.* 2019, Kumar *et al.* 2017). In Hamirpur district alone, pulses occupied 166,000 hectares out of a total 325,800 hectares in 2021–22, accounting for over 50% of the cultivated area (Sah *et al.* 2021). The predominant pulse crops include field pea, lentil, chickpea, black gram, pigeon pea, and green gram, which are integral to the region's cropping systems, farm economy, and daily diets.

Despite their significance, pulse cultivation in this rainfed agro-ecological zone faces multifaceted challenges. These include limited irrigation infrastructure, imbalanced nutrient application, low levels of mechanization, dependence on farm-saved seeds, crop losses due to stray animals, and underutilization of land during the kharif season (Sah *et al.* 2021). However, the region holds considerable potential for both vertical and

horizontal expansion of pulse cultivation. Strategic interventions such as the promotion of location-specific, high-yielding, short-duration, and disease-resistant varieties; optimization of nutrient and water management; and adoption of integrated crop management practices can significantly enhance productivity (Purushottam *et al.* 2012, Choudhary *et al.* 2020, Mishra *et al.* 2017, Dwivedi *et al.* 2018).

A critical constraint in realizing this potential is the limited availability of quality seeds at the village level, as quality seed accounts for a 20-25% increase in crop productivity (Ali and Gupta 2012). Participatory seed production models have emerged as effective mechanisms to bridge this gap by involving farmers directly in the production and dissemination of improved seed varieties (Ramakrishna *et al.* 2023). The integration of informal seed enterprises and farmer-led initiatives into the formal seed supply chain ensures timely access to quality seeds, particularly in remote and underserved areas (Singh *et al.* 2018, Kumar *et al.* 2020). Given the low commercial interest of the private sector in pulse seed production, owing to its low value and high volume, public sector institutions have a crucial role in facilitating decentralized seed systems.

In response to these challenges, the Department of Agriculture, Cooperation & Farmers Welfare (DAC&FW), Government of India, launched a flagship initiative in 2016 titled “*Creation of Seed Hubs for Increasing Indigenous Production of Pulses in India*”. With a total outlay of ₹ 225.31 crores, the program aimed to strengthen the pulse seed production system through the establishment of seed hubs across eight ICAR institutes, 47 All India Coordinated Research Project (AICRP) centres in State Agricultural Universities (SAUs), and 98 Krishi Vigyan Kendras (KVKs). KVK Hamirpur was among the selected centers, tasked with enhancing the availability of quality pulse seeds, promoting scientific seed production technologies, and ensuring sustainable and profitable seed systems through farmer participation (Ramakrishna *et al.* 2023).

This paper presents the outcomes of the Seed Hub initiative implemented at KVK Hamirpur from 2017-18 to 2021-22. It evaluates the performance of pulse varieties, seed production trends, farmer preferences, and economic returns to the farmers in the Bundelkhand region.

MATERIALS AND METHODS

Project background

The Seed Hub Project was assigned to Krishi Vigyan Kendra (KVK), Hamirpur, during 2016-17. A one-time grant of ₹ 50 lakhs was sanctioned in the first year for establishing infrastructure such as a seed processing plant and storage facility. Additionally, ₹ 1 crore was allocated as a revolving fund to meet expenses related to seed production, procurement, and processing. Under the project Major emphasis was placed on Rabi pulses, as kharif pulses such as black gram, green gram, and pigeonpea were often damaged due to erratic rainfall and unrestricted grazing (locally termed *Anapratha*). During 2017-18, seed production was carried out exclusively at the KVK farm, covering an area of 12 hectares. From 2018 onwards, a participatory seed production program was initiated with selected farmers.

Farmer selection and training

Farmers were selected based on well-equipped farms with appropriate irrigation, infrastructure, and assured irrigation. Some of the selected farmers were already involved in the seed production program of National Seed Corporation (NSC) and possessed the necessary experience for ensuring the production of high-quality seeds. Farmers of selected villages were trained by conducting on- and off-campus training programs for good agronomic practices, seed quality, seed certification procedures, viz., online registration, isolation distance, rouging, field inspection, and seed processing. Need-based telephonic advisory as well as field visits were carried out by the scientists of KVK.

Seed distribution and crop varieties

Breeder and foundation seeds of pulses were distributed to selected farmers for producing foundation and certified seeds. Varieties not older than 10 years were prioritized to ensure relevance and adaptability (Table 1). In the district, there was a consistent demand for wilt-resistant, short- and medium-duration, heat-tolerant varieties of chickpea. To address this demand, JAKI 9218, JG-14, RVG 202, and JG 36 were introduced in the seed production program. Similarly, for fieldpea, varieties such as IPFD12-2, IPFD10-12, IPFD 2014-2, IPFD6-3, and Aman, as well as lentil varieties KL320, PL9, and IPL316, were selected for seed production based on their high yield, short duration,

and disease resistance. The varieties of which seed was produced under the seed hub were also demonstrated at farmer's field of Hamirpur District under various schemes run at KVK, like Cluster Frontline Demonstration (CFLD) Pulses, National Innovation on Climate Resilient Agriculture (NICRA), and Centre of Excellence Pulses as per the target.

Seed buy-back

The farmers agreed to follow all the instructions related to quality, purity, other management practices, and sell seeds to the KVK based on the price offered by the University. For the buy-back policy, a Memorandum of Understanding (MoU) was signed between farmers and KVK. Seeds produced by farmers were bought back by KVK at either the MSP or prevailing mandi rate, whichever was higher, and an additional 20% incentive was provided to farmers for their participation.

Data collection

The yield data and per cent increase over the farmer's practice were calculated in the respective scheme (Table 3). The economics of seed sale was calculated based on prevailing rates in Mandi, MSP, and the rate decided by the university (Table 3).

RESULTS AND DISCUSSION

The introduction of high-yielding varieties of pulses is imperative to ensure sustainable production and to meet the increasing demand (Kandir *et al.* 2021). The data in Table 1 show the quality seed production of high-yielding pulse varieties produced under the Seed Hub scheme. KVK produced 77.38, 415.54, 448.94, 469.61, and 827.54 quintals of seed during the years 2017-18, 2018-19, 2019-20, 2020-21, and 2021-22, respectively. As the area is largely dominated by field pea, to meet the demand, various varieties of field pea (IPFD 12-2, IPFD 10-12, IPFD 2014-2, IPFD 6-3, Aman) were taken up for seed production. A total of 1,346.73 quintals of field pea seed was produced during 2017-2022.

Table 1. Improved, high-yielding varieties of pulses were taken for quality seed production under the Seed Hub during 2017-18 to 2021-22 by KVK.

| Crop | Variety | Release Year and Institute | Yield (q/ha) | Duration (days) | Characteristics/Features |
|------------------|---------------|---|--------------|-----------------|--|
| Chickpea | JG-14 | 2009, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur (MP) | 20-25 | 110 | Heat-tolerant variety, suitable for late-sown situations. It is resistant to wilt, and has better milling quality. |
| | RVG 202 | 2012, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior (MP) | 20 | 102 | Suitable under irrigated and late sown conditions. It is moderately resistant against wilt, dry root rot, and collar rot. |
| | JG 36 | 2016, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur (MP) | 18-20 | 110-120 | Semi-spreading plant with dark brown seeds. Tolerant to wilt. |
| | JAKI 9218 | 2006, Dr. Panjabrao Deshmukh Krishi Vidyapeeth (PDKV), Akola | 18-20 | 93-120 | Resistant to Fusarium wilt, root rot, and collar rot, Suitable for both irrigated and rainfed areas |
| Field pea | Aman | 2009, Indian Institute of Pulses Research, Kanpur | 22-25 | 120-130 | Powdery mildew resistance, tolerant to rust |
| | IPFD12-2 | 2017, Indian Institute of Pulses Research, Kanpur | 22-25 | 110 | Round-seeded, White coloured, resistant to pod borer and powdery mildew disease, moderately resistant to aphids and leaf miner |
| | IPFD6-3 | 2016, Indian Institute of Pulses Research, Kanpur | 19-20 | 115-120 | Round, creamy white coloured seed resistant to powdery mildew, tolerant to rust |
| | IPFD10-12 | 2014, Indian Institute of Pulses Research, Kanpur | 21-22 | 110-115 | Resistant to powdery mildew, dwarf type, green seeds |
| | IPFD 2014-2 | 2018, Indian Institute of Pulses Research, Kanpur | 22-23 | 105-110 | Tan-colored mottled seed with resistance to powdery mildew |
| Lentil | KL320 | 2009, Chandra Shekhar Azad University Of Agriculture & Technology, Kanpur | 14 | 128 | Moderately resistant to wilt and rust |
| | IPL316 | 2013, Indian Institute of Pulses Research, Kanpur | 18-20 | 102-112 | Wilt and rust resistance. Seeds are brown with red cotyledons and large (3.1g/100 seed wt.) |
| | Pant Lentil-9 | 2017, GBPUA&T, Pantnagar (Uttarakhand) | 13-16 | 113-135 | Resistant to wilt, rust, and Ascochyta blight diseases. |

Among the field pea varieties, IPFD 12-2 was largely preferred by farmers owing to its higher yield potential and strong market demand. Its widespread adoption has led to significant horizontal expansion across the district. Consistent with these observations, Singh *et al.* (2023) also reported superior yields of IPFD 12-2 compared to other varieties. In contrast, IPFD 14-2, a tan-violet-seeded variety, was identified as a high-yielding type; however, it was less preferred by farmers due to relatively lower market demand. IPFD 10-12, a green-seeded field pea variety, was widely adopted by farmers. Its seeds retain their green colour even after drying, making the variety suitable for diverse culinary preparations (MULLaRP 2022).

In the case of chickpea, the variety JG 14 was widely adopted by the farming community owing to its unique characteristics, including short growth duration, resistance to wilt, heat tolerance, and high yield potential. These traits enable farmers to successfully cultivate JG 14 even under late sowing conditions (Table 1). Previous studies have also confirmed its superiority (Kantwa *et al.* 2024), and Pal *et al.* (2023) reported significantly higher yields of JG 14 compared to the check variety, while Dubey *et al.* (2024) demonstrated its yield advantage under late-sown conditions relative to other cultivars. RVG 202 and JG 36 were also found suitable for cultivation in the region, with a total production of 708.29 quintals recorded during 2017–2022. In the

case of lentil, the variety IPL 316 was preferred by farmers due to its high yield potential and resistance to wilt (Table 1). Consistent with these findings, Sah *et al.* (2020), Singh *et al.* (2022) and Nare *et al.* (2022) also reported superior yields of IPL 316 in their experiments. The total lentil seed production during 2017–2022 amounted to 183.99 quintals. Similarly, the total seed production of pulses was 2,239.01 quintals from 2017–2022.

Seed produced under the Seed-Hub was distributed through CFLD, NICRA, and Centre of Excellence (CoE) pulse demonstrations during 2018–2023, and variety-wise analysis of these demonstrations shows consistent and substantial yield advantages of improved varieties over farmers' varieties. Across the reported trials, demonstration yields exceeded check yields by 12.8–39.5%, with crop-level mean percent increases of 22.8% (chickpea), 27.8% (field pea), and 24.3% (lentil). JG-14 recorded the largest percent gain (29.78%), followed by JG-36 (23.97%), RVG-202 (20.41%), and JAKI-9218 (12.84%). Sundar *et al.* (2023) also reported substantially higher JG-14 yield under improved practices compared with farmer practice. Among the demonstrated fieldpea varieties, IPFD 12-2 recorded the highest yield performance with 22.4 q/ha, showing a remarkable 38.3% increase over the check variety Rachna. Lentil demonstration increased mean yields from 11.57 to 14.40 q/ha with IPL-316 showing the highest yield

Table 2. Yield performance of varieties under different schemes, 2018-19 to 2021-22.

| Crop | Variety | Year | Name of Programme | Check variety | Yield performance | | |
|-----------|-----------|-------------------|-------------------------|---------------|-------------------|----------------------|--------------------|
| | | | | | Check (q/ha) | Demonstration (q/ha) | Yield increase (%) |
| Chickpea | JAKI9218 | 2018-19 | CFLD | Rdhey | 14.8 | 16.7 | 12.8 |
| | JG-14 | 2019-20, 2020-21 | CFLD & NICRA | Uday | 17.8 | 23.1 | 29.8 |
| | RVG 202 | 2020-21 & 2021-22 | CFLD & NICRA | Radhey | 14.7 | 17.7 | 20.4 |
| | JG 36 | 2021-22 | CFLD & NICRA | Radhey | 14.6 | 18.1 | 24.0 |
| Mean | | | | | 15.5 | 19.1 | 22.8 |
| Field pea | Aman | 2018-19 | CFLD | | 14.8 | 16.8 | 13.5 |
| | IPFD10-12 | 2019-20, 2020-21 | CFLD | Adarsh | 16.1 | 21.3 | 32.3 |
| | IPFD6-3 | 2020-21 | CFLD | Pant P 5 | 15.5 | 18.2 | 17.4 |
| | IPFD 12-2 | 2019-20, 2020-21 | COE Pulses, NICRA, CFLD | Rachna | 16.2 | 22.4 | 38.3 |
| | IPFD14-2 | 2021-22 | COE Pulses | HFP 4 | 16.1 | 22.1 | 37.3 |
| Mean | | | | | 15.7 | 20.2 | 27.8 |
| Lentil | KL-320 | 2018-19 | CFLD-pulse | K-75 | 10.3 | 12.3 | 19.4 |
| | PL9 | 2019-20 | CFLD-pulse & NICRA | K-75 | 11.2 | 14.3 | 27.7 |
| | IPL-316 | 2020-21, 2021-22 | CFLD, NICRA, COE Pulses | IPL81 | 13.2 | 16.6 | 25.8 |
| Mean | | | | | 11.57 | 14.4 | 24.3 |

gain (Table 2). Dubey *et al.* (2017) and Singh *et al.* (2022) similarly reported higher yields of IPL-316 over farmer practice.

The economic analysis revealed that the program generated a gross income of ₹ 1.634 crores, with a net profit of ₹ 62,30,569 realized by KVK. Year-wise data showed steady growth in participatory production, rising from 271 quintals in 2018–19 to 691 quintals in 2021–22. This expansion was accompanied by consistent increases in farmer benefits. Through the buy-back policy, KVK procured seeds at rates approximately 20% higher than the prevailing Minimum Support Price (MSP), thereby ensuring assured markets and reducing price risks. Farmers earned an additional remuneration of ₹ 19,84,156 over the period, which not only enhanced income stability but also facilitated diversification into entrepreneurial activities such as livestock rearing, agro-processing, and small enterprises. These findings corroborate earlier studies reporting that seed production programmes and buy-back arrangements provide supplementary income and encourage livelihood diversification (Singh and Agrawal 2018, Kumar and Singh 2017, Saraswat 2023).

Institutionally, KVK benefitted from substantial profits, which were reinvested through the Seed

Hub to strengthen and upgrade facilities, thereby improving seed processing and quality assurance. Gross earnings increased from ₹7.36 lakh in 2017–18 to ₹69.85 lakh in 2021–22, while net profits rose from ₹9.42 lakh in 2018–19 to ₹30.53 lakh in 2021–22. This dual benefit model—higher farmer income and institutional sustainability—demonstrates the effectiveness of participatory seed production.

Under the Seed Hub program, KVK has covered an area of 2,759.7 hectares, benefiting a total of 2,866 farmers (Table 4). Due to the inclusion of new, improved varieties, these beneficiaries are now obtaining 20–30% higher yields than before. As KVK Hamirpur falls under a rainfed region, cultivation of long-duration, disease-and insect-prone varieties without proper technical knowledge often leads to higher cultivation costs and lower net returns (Kumbhare *et al.* 2014, Nain *et al.* 2015). Therefore, KVK has primarily focused on promoting short-duration, disease-resistant, high-yielding varieties of pulses, consistent with earlier findings that such varieties are more suitable for rainfed and resource-constrained regions (Kumar *et al.* 2025, Vikaspedia 2020). Furthermore, the organization has provided technical guidance for integrated crop management of pulses, enabling farmers to attain higher yields while minimizing cultivation costs.

Table 3. Economic benefits to the farmers and economic benefits to the KVK

| Year | Crop | Quantity procured (q) | Quantity produced by participatory program | Economic Benefit to the farmers | | | | Economic Benefit to the KVK | | | |
|---------|----------|-----------------------|--|----------------------------------|--------------------------|-------------------------|-------------------------|-----------------------------|-------------------------|-----------------------------------|-------------------|
| | | | | Prevailing local market Rate (₹) | KVK Procurement Rate (₹) | Additional amount (₹/q) | Total additional amount | KVK Selling price (₹) | Gross amount earned (₹) | Procurement price paid to farmers | Net profit to KVK |
| 2017-18 | Chickpea | 25.6 | | | | | | 9594 | 245606.4 | | |
| | Fieldpea | 26.5 | | | | | | 9690 | 256785 | | |
| | Lentil | 25.28 | | | | | | 9258 | 234042.2 | | |
| | Total | 77.38 | | | | | | | 736433.6 | | |
| 2018-19 | Chickpea | 207.19 | 160 | 4620 | 5544 | 924 | 147840 | 9594 | 1535040 | 887040 | 648000 |
| | Fieldpea | 152 | 80 | 4000 | 4800 | 800 | 64000 | 6968 | 557440 | 384000 | 173440 |
| | Lentil | 56.35 | 31 | 4475 | 5370 | 895 | 27745 | 9258 | 286998 | 166470 | 120528 |
| | Total | 415.54 | 271 | | | | 239585 | | 2379478 | 1437510 | 941968 |
| 2019-20 | Chickpea | 185.9 | 166 | 4875 | 5850 | 975 | 161850 | 9105 | 1511430 | 971100 | 540330 |
| | Fieldpea | 219.2 | 146.75 | 4200 | 5040 | 840 | 123270 | 7825 | 1148319 | 739620 | 408698.8 |
| | Lentil | 43.82 | 23.4 | 4800 | 5760 | 960 | 22464 | 11166 | 261284.4 | 134784 | 126500.4 |
| | Total | 448.92 | 336.15 | | | | 307584 | | 2921033 | 1845504 | 1075529 |
| 2020-21 | Chickpea | 82.4 | 74.4 | 5100 | 6120 | 1020 | 75888 | 10422 | 775396.8 | 455328 | 320068.8 |
| | Fieldpea | 374.01 | 314 | 4400 | 5280 | 880 | 276320 | 7825 | 2457050 | 1657920 | 799130 |
| | Lentil | 13.2 | 8 | 5100 | 6120 | 1020 | 8160 | 11166 | 89328 | 48960 | 40368 |
| | Total | 469.61 | 396.4 | | | | 360368 | | 3321775 | 2162208 | 1159567 |
| 2021-22 | Chickpea | 207.2 | 168 | 5100 | 6120 | 1020 | 171360 | 9505 | 1596840 | 1028160 | 568680 |
| | Fieldpea | 575 | 495 | 4600 | 5520 | 920 | 455400 | 10315 | 5105925 | 2732400 | 2373525 |
| | Lentil | 45.34 | 28 | 5100 | 6120 | 1020 | 28560 | 10095 | 282660 | 171360 | 111300 |
| | Total | 827.54 | 691 | | | | 655320 | | 6985425 | 3931920 | 3053505 |

Table 4. Area coverage and number of farmers benefited from seed distribution during 2017-18 to 2021-22.

| Year | Lentil | | Chickpea | | Fieldpea | | Total area (ha) | Total no. of farmers |
|---------|-----------|---------------|-----------|---------------|-----------|----------------|-----------------|----------------------|
| | Area (ha) | No. of farmer | Area (ha) | No. of farmer | Area (ha) | No. of farmers | | |
| 2017-18 | 50.56 | 87 | 25.6 | 23 | 33.125 | 32 | 109.285 | 142.6 |
| 2018-19 | 112.7 | 141 | 207.19 | 205 | 190 | 189 | 509.89 | 535 |
| 2019-20 | 87.64 | 167 | 185.9 | 176 | 274.025 | 262 | 547.565 | 605 |
| 2020-21 | 26.4 | 40 | 82.4 | 77 | 467.5125 | 440 | 576.3125 | 557 |
| 2021-22 | 90.68 | 131 | 207.2 | 198 | 718.75 | 698 | 1016.63 | 1027 |
| Total | 367.98 | 566 | 708.29 | 679 | 1683.413 | 1621 | 2759.7 | 2866 |

CONCLUSION

To meet the demand of the district, KVK Hamirpur successfully produced high-quality pulse seeds. Over five years of production (2017-18 to 2021-22), a total of 2,239.01 quintals were produced, covering an area of 2,759.7 hectares. Several preferred varieties gained popularity among farmers, including IPFD12-2 in fieldpea, IPL316 in lentil, and JG 14, JG 36, and RVG 202 in chickpea. These varieties were widely adopted through farmer-to-farmer extension. Furthermore, the active involvement of farmers in the seed production and supply systems enhanced the timely availability of quality seeds, which is essential for maximizing agricultural productivity. Overall, this initiative has played a pivotal role in addressing challenges related to seed quality, technical knowledge, and the replacement of old pulse varieties in the region.

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