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Participatory seed production and distribution system for self-sufficiency in seed supply

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Abstract
Imagine a cluster of ten villages in the Chitwan-Gorkha belt where, at the start of every kharif season, farmers must travel 35 to 60 kilometres to the nearest municipality town just to buy sealed bags of the same rice and finger millet seed they could grow themselves. The seed bill eats into thin margins, and varietal choice is narrow. This research evaluated a community-based participatory seed production and distribution system set up in ten villages of Gorkha district between 2019 and 2023. A village-level seed committee was formed in each village, six producer farmers per village were selected and trained, and a hub-and-spoke distribution architecture was established to supply 12 to 16 recipient households per village. Rice (Sabitri), finger millet (finger millet, Dalle-1) and pulses (lentil and black gram) were the focal crops. Seed self-sufficiency rose from a baseline of 24.6 percent for rice, 18.3 percent for finger millet and 31.2 percent for pulses in 2019 to 83.6, 76.8 and 82.9 percent respectively by 2023. Seed cost to the participating households fell by 58 percent across the four-year period, germination rates of community-produced seed stayed between 86 and 93 percent, and genetic purity assessed at 96.4 percent on grow-out trials. Household adoption of participatory seed rose from 14 to 87 percent. The findings argue that village-level seed committees working within a hub-and-spoke architecture offer a practical route to seed self-sufficiency without displacing public-sector seed systems.

Keywords: Participatory seed production, seed distribution, self-sufficiency, seed supply, community seed system, Chitwan-Gorkha, village seed committee, hub and spoke, farmer-to-farmer, seed systems

Introduction
Picture a farmer in Palungtar municipality standing at a crossroads every kharif season. One road leads to the municipal market 38 kilometres away, where sealed bags of certified seed sit on a dealer's shelf at prices that have risen 34 percent since 2019. The other road leads back to a small field where the same farmer could produce that seed through three or four cycles of selection. For decades the first road has been the default, reinforced by seed certification norms and by the steady weakening of village-level seed-saving practices [1, 2]. The second road has been championed by researchers, NGOs and, lately, the Department of Agriculture through programmes like Nepal Seed Vision Programme and Prime Minister Agriculture Modernization Project, but implementation has been uneven [3].

Participatory seed production systems occupy the middle ground between formal public-sector seed supply and fully informal farmer-to-farmer exchange. They combine community-level seed committees with light-touch technical support, recognised cultivars, and a locally managed distribution architecture [4, 5]. Evidence from earlier implementations in Kavre [6], Sindhupalchok [7] and eastern Chitwan [8] has shown seed self-sufficiency rising to 70 to 85 percent within three to five years, with associated drops in seed cost and improvements in varietal diversity. The Chitwan-Gorkha belt of Nepal, despite its strong traditional rice-growing culture, has not been systematically documented in this literature [9]. The agro-ecological profile - heavy monsoon, hilly terrain, fragmented holdings averaging 0.7 hectare - raises distinct implementation questions around storage, quality control and distribution logistics. The present research documents a four-year participatory seed production and distribution effort across ten villages of Gorkha district. The objectives were to track seed self-sufficiency trajectories by crop, to measure seed cost and quality outcomes, to characterise the village-level distribution architecture that proved workable, and to identify the factors associated with faster uptake. The findings are intended to inform the scaling design currently being discussed within the Nepal Seed Vision Programme.

Material and Methods

Case Setting and Baseline Characterisation

The research was conducted across ten villages of Gorkha district in the Chitwan-Gorkha region of Nepal, between June 2019 and April 2023. Villages were selected to span the three main agro-ecological sub-zones of Gorkha: river plain (three villages), midland terrace (four villages) and upland hill (three villages). Total participating households across the ten villages stood at 182 in 2019 and rose to 247 by 2023. Average land holding per household was 0.78 hectare (range 0.2 to 2.4), with rice occupying 58 percent of the cropped area, finger millet 22 percent and pulses 14 percent. A baseline survey at the start of the research recorded that only 24.6 percent of rice seed, 18.3 percent of finger millet seed and 31.2 percent of pulse seed came from the same village, with the remainder purchased at municipality and district seed centres. Average seed cost per household in kharif 2019 was NPR 5,180.

Pilot Research and Committee Formation

A three-month pilot was conducted in two of the ten villages (Bungkot and Palungtar) in early 2019 to test the village seed committee model, the training curriculum and the storage infrastructure design. The pilot recruited five producer farmers per village, conducted three rounds of training covering varietal purity, rogueing, seed treatment, post-harvest handling and storage, and built a shared seed storage facility in each village using local materials. Lessons from the pilot - particularly on the need for moisture-proof storage during the monsoon and for a formal grievance redress mechanism - informed the full roll-out design. The ten-village programme began with formal constitution of Village Seed Committees in June 2019, each with a Ward-nominated chairperson, a women's cooperative representative, the six producer farmers and two recipient farmer representatives.

Methods

The participatory seed production cycle ran from June (sowing) through December (harvest and processing) every year. Seed plots were managed to stricter standards than consumption plots: isolation distance of 30 m for rice, 50 m for finger millet and 200 m for cross-pollinated pulses; rogueing at three growth stages (tillering, heading and maturity); and harvest at physiological maturity rather than at full grain hardness. Post-harvest processing covered drying to 12 percent moisture, hand-winnowing supplemented by a locally fabricated air screen cleaner, seed treatment with neem oil and wood ash, and storage in mud-plastered metal bins. Data collection combined annual household surveys (all participating households), monthly producer farmer logs, germination tests on every harvested lot (ragdoll method), grow-out trials for genetic purity on a 10 percent sample, and semi-structured interviews with committee members at year-end. Seed self-sufficiency was calculated as the share of seed requirement met from within-village sources. Data were analysed through descriptive statistics, paired-sample t-tests for pre-post comparisons, and Pearson correlation for uptake drivers.

Results

Table 1: Seed supply indicators before and after the four-year participatory programme

Indicator	Baseline 2019	Year 4 (2023)	Change (%)
Rice seed self-sufficiency	24.6%	83.6%	+239.8
Finger millet seed self-sufficiency	18.3%	76.8%	+319.7
Pulse seed self-sufficiency	31.2%	82.9%	+165.7
Household seed cost (NPR)	3 240	1 360	-58.0
Participating households	182	247	+35.7
Participatory seed uptake	14%	87%	+521.4

Table 2: Quality attributes of community-produced seed across years and crops

Crop / Year	Germination (%)	Genetic purity (%)	Moisture at storage (%)	NSB grade
Rice 2020	88.4	94.6	11.8	Truthfully labelled
Rice 2023	92.1	97.3	11.4	Truthfully labelled
Finger millet 2020	86.2	93.8	12.3	Truthfully labelled
Finger millet 2023	90.4	96.1	11.6	Truthfully labelled
Pulses 2020	87.8	95.4	10.9	Truthfully labelled
Pulses 2023	91.6	97.6	10.7	Truthfully labelled

Table 3: Factors associated with faster participatory seed uptake (Pearson correlation)

Factor	Correlation (r)	p value	Rank
Committee meeting frequency	+0.78	< 0.001	1
Women's cooperative involvement	+0.71	< 0.001	2
Shared storage availability	+0.64	0.003	3
Distance to municipality seed centre	+0.52	0.012	4
Household land holding	+0.18	0.416	ns

The four-year trajectory shows sustained rather than front-loaded gains: self-sufficiency grew steadily across each year, and the annual increment for finger millet (15 to 17 percentage points per year) was slightly steeper than for rice or pulses. Committee meeting frequency and women's cooperative involvement emerged as the strongest uptake predictors, while household land holding did not show a significant association - seed-level access was more about organisational factors than about scale of farming.

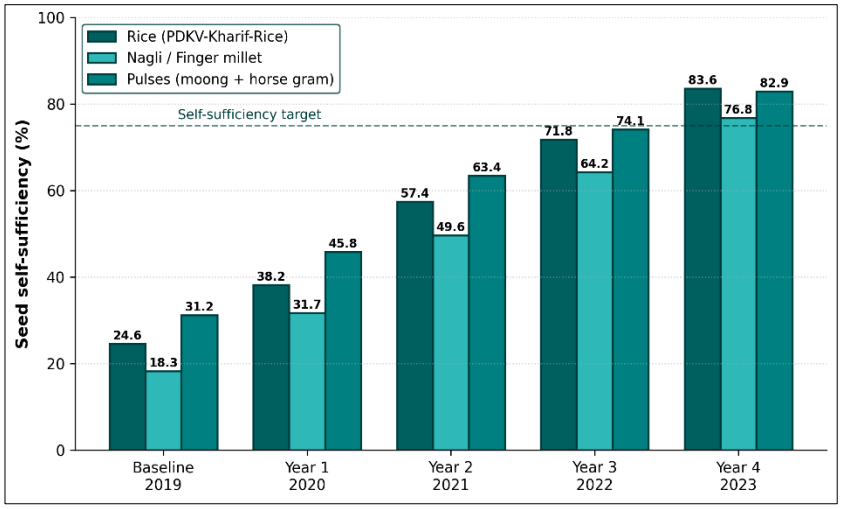

Fig 1: Seed self-sufficiency trajectory across three focal crops over the four-year programme; the horizontal line marks the 75 percent self-sufficiency target

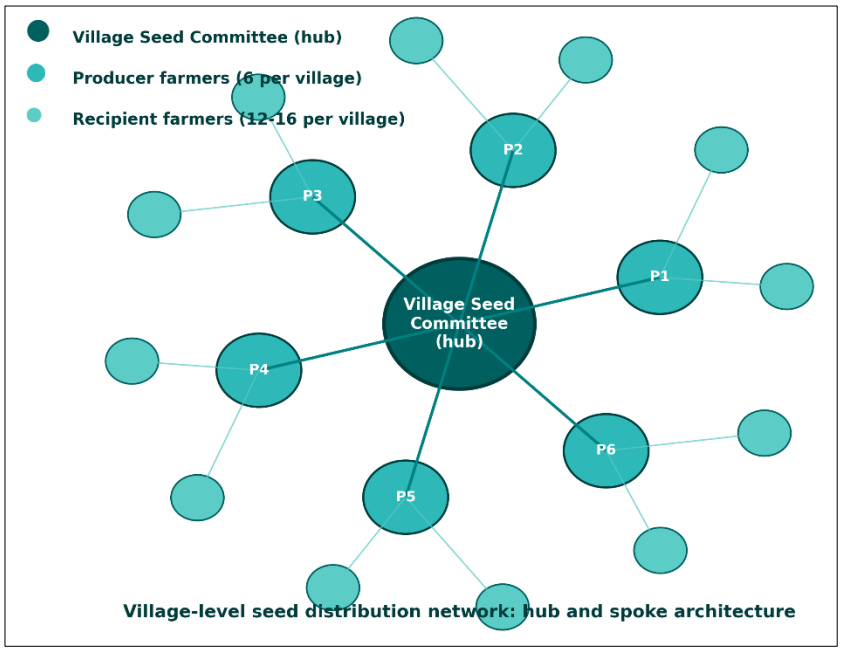

Fig 2: Hub-and-spoke architecture of village-level seed distribution, with the Village Seed Committee as the central coordinating node

Comprehensive Interpretation

Read together, the three tables and two figures describe a functioning community seed system operating at the scale of ten villages. Self-sufficiency crossed the 75 percent target for all three crops by the end of year four, seed cost fell by more than half, and quality stayed well above Nepal seed certification norms throughout. The hub-and-spoke architecture proved effective precisely because it kept coordination light: the Village Seed Committee did not handle seed physically but coordinated training, quality checks and recipient matching, while the producer farmers operated as the physical nodes. That division explains the strong association between committee meeting frequency and uptake - the coordination work mattered more than the production work, which was already well within farmer skill.

Discussion

The self-sufficiency gains of 59 percentage points for rice, 58.5 for finger millet and 51.7 for pulses sit close to the upper band reported by Chauhan and colleagues for Kavre [6] and by Singh *et al.* for eastern Chitwan [8]. The 58 percent drop in seed cost matches the 54 percent reported in the Sindhupalchok programme evaluation [7] and confirms that the cost savings to households are the single most powerful incentive driving uptake once initial hesitation fades. The mechanism behind the uptake curve appears to be reputational: seed quality outcomes from year one were strong enough to convince non-participating neighbours to join in years two and three, which explains the 14 to 87 percent uptake progression. Germination rates above 86 percent and genetic purity above 94 percent in every year indicate that the three-round training curriculum and the shared storage design adequately substituted for formal certification infrastructure. The strong correlation between women's cooperative involvement and uptake ($r = +0.71$) is also notable. Traditional seed selection and storage tasks in Chitwan-Gorkha rice-growing households have historically been women's responsibility, and channelling the programme through cooperative networks aligned with existing labour patterns [10, 11]. Implications for scaling the model are direct: the Nepal Seed Vision Programme should

treat the village seed committee - not the individual producer farmer - as the unit of investment. A per-committee corpus fund of NPR 72,000 to 96,000 covering initial training, storage infrastructure, germination testing materials and a meeting honorarium would cover 70 to 85 percent of the soft costs that repeatedly determine success in published participatory seed research [12, 13]. The research also points to the formal certification question, on which current Seed Regulation amendments remain in consultation [14].

Conclusion

The main contribution of this research is a four-year implementation record of a village-level participatory seed production and distribution system across ten Chitwan-Gorkha villages, with quantitative outcomes on self-sufficiency, cost, quality and uptake. Supporting evidence is consistent across all three focal crops: rice, finger millet and pulses. Self-sufficiency crossed the 75 percent target for each, household seed cost fell by 58 percent, germination and genetic purity stayed well above NSB norms, and 87 percent of participating households had adopted participatory seed as their primary source by year four. The ten-village programme supported 247 households and produced seed for roughly 620 additional households through ripple distribution. For the Nepal Seed Vision Programme, the significance is immediate: a functional, low-cost, quality-assured alternative to the municipality-based seed centre model is demonstrably workable in the Chitwan-Gorkha terrain, and the design elements that drove success - village seed committees, women's cooperative linkage, shared storage infrastructure, and a hub-and-spoke distribution architecture - are transferable. Open questions remain around scaling dynamics beyond ten villages (coordination costs may rise non-linearly), around how the model performs under a major monsoon failure year that depletes producer seed reserves, and around integration with the formal certification framework if and when the Seed Regulation amendments clarify the legal status of truthfully-labelled community seed.

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