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Awareness and Adoption of Protected Cultivation Techniques in Horticulture

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Protected cultivation is an important horticultural production strategy for improving the efficiency, quality and stability of high-value crops under variable climatic conditions. This paper presents an NSS-oriented field-study framework for assessing awareness and adoption of protected cultivation techniques among horticultural growers in Rajnandgaon district, Chhattisgarh. The study focuses on low-cost and commercially relevant structures and practices including polyhouses, naturally ventilated polyhouses, shade-net houses, low tunnels, mulching, drip fertigation, nursery protection and integrated microclimate management. A participatory research design is proposed, combining baseline household surveys, Participatory Rural Appraisal (PRA), demonstrations, farmer meetings, exposure visits and follow-up assessment. The framework emphasizes that awareness does not automatically translate into adoption because investment requirements, technical knowledge, maintenance, input availability, market linkages and risk perception influence growers' decisions. NSS volunteers can support horticultural extension by conducting local awareness campaigns, facilitating demonstrations and connecting growers with university experts, Krishi Vigyan Kendras, horticulture departments and relevant schemes. The paper provides a practical extension model and indicators for measuring knowledge, participation and adoption without treating unverified field observations as empirical results.

Keywords: Protected cultivation, Horticulture, NSS, Polyhouse, Shade-net house, Farmer awareness, Adoption.

Introduction and Background

Context and problem statement

Horticultural crops are highly responsive to temperature, humidity, rainfall, wind, solar radiation and pest pressure. Increasing weather variability can therefore affect crop establishment, flowering, fruit quality, yield and marketable returns. Protected cultivation modifies the crop environment by using a physical structure and associated management practices to reduce exposure to adverse conditions and create a more favourable microclimate. Depending on the crop and structure, protected systems can support off-season production, improve input-use efficiency, reduce some pest pressures and produce more

uniform quality. Protected cultivation ranges from relatively simple technologies such as plastic mulch, low tunnels and shade nets to more capital-intensive systems such as naturally ventilated polyhouses and climate-controlled greenhouses. Adoption is consequently a continuum rather than a single decision. Growers may first adopt drip irrigation or mulching and later move toward protected structures as their technical confidence; capital availability and market access improve.

Regional significance

Rajnandgaon district has an important horticultural base with vegetable, fruit and ornamental crops. The source field report describes Kopedih village as having vegetables such as tomato, brinjal, chilli, cauliflower, cabbage, knol khol and pointed gourd, along with muskmelon, marigold and field crops. These crop systems provide a relevant context for introducing protected cultivation demonstrations, especially where growers face seasonal price fluctuations, excessive rainfall, heat stress, pest incidence or difficulties in producing quality planting material.

Role of NSS in technology awareness

The National Service Scheme (NSS), guided by the motto 'NOT ME BUT YOU', provides a platform through which students can connect academic knowledge with community needs. The supplied NSS field report demonstrates a participatory model using baseline surveys, door-to-door outreach, rallies, school activities, physical action and follow-up evaluation. The same extension logic can be adapted to protected cultivation by adding technology demonstrations, crop-specific training, cost-and-return discussions, exposure visits and referral support to technical institutions.

Protected cultivation technique	Primary purpose	Typical extension focus	Main adoption consideration
Polyhouse / naturally ventilated polyhouse	Microclimate modification and protected production	Structure, ventilation, crop planning	Capital cost and technical management
Shade-net house	Reduce radiation and heat load; nursery/vegetable production	Net selection, ventilation, crop suitability	Structure quality and crop-market fit
Low tunnel	Early/late season protection of low-growing crops	Installation, ventilation, crop timing	Labour and plastic management
Plastic mulch	Moisture conservation and weed suppression	Laying, irrigation, disposal	Material cost and availability
Drip fertigation	Precise water and nutrient delivery	Scheduling, filtration, fertigation	Water quality and maintenance
Protected nursery	Uniform and healthy planting material	Seedling trays, media, sanitation	Technical skill and hygiene

Study Area, Research Methodology and NSS Intervention Strategy

Study location profile: The proposed field assessment is situated in Rajnandgaon district, Chhattisgarh, using the same rural extension context described in the supplied NSS article. The source report identifies Kopedih, Barga and Torankatta as representative agricultural villages and reports an annual precipitation range of about 1,200–1,400 mm with irregular rainfall distribution. Kopedih is reported as approximately 7 km from the college of horticulture, with a population of 1,321 and 357 farmers. Its cropping pattern includes tomato, brinjal, chilli, cauliflower, cabbage, knol khol, pointed gourd, muskmelon, marigold, rice and wheat/chickpea. These details indicate a diverse production base in which protected cultivation awareness can be assessed crop by crop.

Research design: A descriptive, participatory field-study design is proposed. The target population would comprise adult farmers and horticultural households in the selected villages. A structured questionnaire should measure

- socio-economic characteristics
- awareness of protected cultivation
- knowledge of individual technologies
- current adoption status

- (v) sources of technical information
- (vi) perceived benefits
- (vii) constraints
- (viii) Willingness to adopt. PRA tools such as social mapping, resource mapping, and problem ranking and seasonal calendars can be used to complement the survey.

Suggested sample and measurement plan

Indicator	Suggested measurement
Awareness score	Number/percentage of protected cultivation technologies correctly identified
Knowledge score	Correct responses on structure selection, irrigation, ventilation, sanitation and crop management
Adoption status	Not adopted / trial adoption / regular adoption
Adoption intensity	Number of protected practices used and area under each practice
Information source	NSS, KVK, university, horticulture department, input dealer, farmer-to-farmer, digital media
Constraint index	Ranked severity of cost, technical skill, maintenance, inputs, labour and marketing barriers
Training need	Farmer-selected priority topics for demonstrations and follow-up

NSS intervention framework

The intervention should be delivered in sequential phases so that awareness is linked to practical learning and post-training support:

1. Baseline survey and PRA: document existing knowledge, cropping systems, resource availability and perceived barriers.
2. Awareness campaign: conduct door-to-door communication, village meetings, posters, short videos and simple local-language materials.
3. Demonstration-based learning: establish or visit demonstration units for shade nets, low tunnels, mulch, drip fertigation and protected nurseries.
4. Crop-specific technical sessions: explain structure selection, nursery raising, irrigation, fertigation, ventilation, sanitation, pest management and record keeping.
5. Cost and scheme orientation: explain capital requirements, maintenance costs, available institutional support and the need to verify current eligibility with the competent department.
6. Exposure and peer learning: connect farmers with successful protected-cultivation growers and nearby technical institutions.
7. Follow-up assessment: measure change in awareness, trial adoption, regular adoption and unresolved constraints.

Expected Results and Discussion

Because the supplied source document contains water-conservation data rather than protected-cultivation survey data, numerical adoption results for protected cultivation are not claimed here. Instead, the following result framework identifies the outcomes that should be measured after implementation.

Result dimension	Baseline measure	Post-intervention measure	Interpretation
General awareness	Farmers aware of protected cultivation	Farmers recognizing ≥ 3 relevant techniques	Change in basic awareness
Technical knowledge	Correct responses before training	Correct responses after training	Learning gain
Participation	Attendance in NSS sessions	Participation in demonstrations/exposure visits	Community engagement
Trial adoption	Existing use of any technique	Farmers testing a new practice	Initial technology uptake
Regular adoption	Area and practices currently used	Area/practices maintained after follow-up	Sustained adoption
Perceived benefits	Pre-training expectations	Experience after trial	Farmer perception of usefulness
Constraints	Ranked barriers	Barriers remaining after support	Implementation gaps

Likely adoption pattern

Low-cost practices are generally expected to be easier for first-time adopters than complete protected structures. Mulching, drip irrigation, nursery protection and simple shade-net applications can serve as entry points because they can be introduced incrementally. Polyhouses and more sophisticated structures require greater capital, construction quality, crop planning, ventilation management, pest exclusion, maintenance and reliable markets. Consequently, a farmer may demonstrate high awareness without adopting a capital-intensive structure. The research instrument should therefore distinguish awareness, intention, trial use and sustained adoption rather than using a single yes/no adoption variable.

Potential role of NSS volunteers

NSS volunteers can contribute most effectively as community facilitators rather than as substitutes for technical specialists. Their functions can include household contact, mobilization for demonstrations, documentation of farmer questions, distribution of verified extension material, support during exposure visits and follow-up communication. Technical recommendations on structural design, crop-specific fertigation, pesticide use or engineering should be delivered or validated by qualified horticulture experts, KVK personnel or the relevant government department.

Constraints and Barriers to Adoption

- High initial investment: Structural components, covering material, irrigation systems and accessories can require substantial capital.
- Technical knowledge gap: Farmers may know the name of a technology without understanding ventilation, irrigation scheduling, fertigation or sanitation.
- Maintenance and replacement: Plastic covering, nets, drip components and other materials require periodic inspection and replacement.
- Market uncertainty: Protected cultivation can increase production potential, but profitability depends on crop choice, timing, quality, price and market access.
- Input and service availability: Reliable planting material, spare parts, technical services and skilled labour are important for sustained operation.
- Risk perception: Farmers may hesitate to invest when previous infrastructure projects have suffered from poor maintenance or weak follow-up.
- Training accessibility: Seasonal farm operations can restrict attendance, making repeated short sessions and flexible timing more suitable.

Strategic Recommendations and Policy Action Plan

1. Create village-level protected cultivation demonstration points jointly supported by NSS units, the horticulture department, KVKs and the college.
2. Use crop-specific modules for tomato, chilli, nursery crops, cucurbits and ornamentals rather than presenting protected cultivation as one uniform technology.
3. Prioritize low-cost entry technologies such as mulch, drip fertigation, shade nets and protected nurseries before capital-intensive structures where appropriate.
4. Provide hands-on training in ventilation, irrigation scheduling, fertigation, sanitation, pest exclusion and routine structure maintenance.
5. Develop simple cost-of-adoption worksheets covering initial investment, recurring costs, expected production period and market considerations.
6. Establish a referral mechanism so NSS volunteers can connect farmers with qualified technical agencies and current government support information.
7. Conduct follow-up visits after 3–6 months to document actual trial adoption, maintenance problems and farmer feedback.
8. Include women and young farmers in demonstrations and decision-making because household labour, nursery management and market activities can influence adoption.

Conclusion

Awareness and adoption of protected cultivation are related but distinct dimensions of horticultural technology uptake. An effective NSS programme should therefore move beyond one-time awareness campaigns toward demonstration, practical training, institutional linkage and follow-up. The participatory model described in the supplied NSS field report—baseline assessment, community mobilization, structured activities and follow-up evaluation—provides a useful framework for horticultural technology extension. For protected cultivation, the strongest emphasis should be placed on crop-specific demonstrations, technical handholding, realistic cost information and market-oriented planning. The present paper provides a research and intervention framework; actual percentages of awareness or adoption should be inserted only after the proposed field survey and follow-up measurements are completed.

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