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Knowledge and adoption dynamics of recommended and indigenous technologies in chilli cultivation: Evidence from Tamil Nadu, India

¹Rajagopalan S, ²Raja Rohini S, ³Rajapreetha M, ⁴Gnanasanjevi G, ⁵Raghuveerapandiyam M, ⁶Pusparani D, ⁷Ragavi D, ⁸Ragul G and ⁹Pravin C

¹Assistant Professor, Department of Agricultural Extension, Nammazhvar College of Agriculture and Technology, Kamuthy, Ramanathapuram, Tamil Nadu, India

^{2,3,5,6,7,8,9}UG Students, Nammazhvar College of Agriculture and Technology, Kamuthy, Ramanathapuram, Tamil Nadu, India

⁴Assistant Professor, Department of Agricultural Extension and Rural Sociology, Adhiyamaan College of Agriculture & Research, Athimugam, Krishnagiri, Tamil Nadu, India

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Corresponding Author: Rajagopalan S

Abstract

Chilli (*Capsicum annum* L.) is an important commercial spice crop that contributes significantly to farmers' livelihoods and the agricultural economy of India. The present study was undertaken to assess the knowledge and adoption levels of chilli growers regarding recommended cultivation technologies and Indigenous Technical Knowledge (ITK), and to identify the major constraints encountered in chilli cultivation. The study was conducted in Ramanathapuram district of Tamil Nadu using an ex-post facto research design. Three major chilli-growing blocks, namely Kamuthi, Mudukulathur, and Kadaladi, were purposively selected, and a total sample of 120 chilli growers was drawn through proportionate random sampling. Primary data were collected using a pre-tested structured interview schedule and analysed using frequency and percentage statistics. The findings revealed that all the respondents possessed complete knowledge and adoption of recommended chilli varieties and sowing seasons. High levels of knowledge and adoption were observed in irrigation management, weed control, harvesting practices, and fertilizer application. However, comparatively lower levels were recorded for seed treatment, micronutrient application, and scientific disease management practices. With respect to Indigenous Technical Knowledge, respondents exhibited substantial knowledge and adoption of traditional seed selection, disease management, water conservation, and harvesting practices, highlighting the continued importance of indigenous farming systems. The study further identified high input costs, pest and disease incidence, labour shortages, lack of credit facilities, inadequate marketing channels, and non-availability of farm machinery as the major constraints affecting chilli cultivation. The study emphasizes the need for strengthening extension services, validating indigenous practices, and integrating scientific and traditional knowledge systems to promote sustainable and profitable chilli production.

Keywords: Chilli cultivation, indigenous technical knowledge, knowledge level, technology adoption, constraints, Ramanathapuram district.

Introduction

Chilli (*Capsicum annum* L.) is one of the most important commercial spice and vegetable crops cultivated in tropical and subtropical regions of the world. It is widely valued for its culinary, nutritional, medicinal, and industrial significance. Rich in vitamins A and C, capsaicin, carotenoids, and antioxidants, chilli contributes substantially to human nutrition and the food processing industry. India is recognized as the world's largest producer, consumer, and exporter of chilli, contributing significantly to global production and trade. The crop is extensively cultivated in states such as Andhra Pradesh, Telangana, Karnataka, Maharashtra, Madhya Pradesh, Tamil Nadu, and Odisha, where favourable agro-climatic conditions support its commercial production (Jha & Das, 2019; Sunidhi *et al.*, 2022) ^[1, 5]. Owing to its high economic value and export potential, chilli cultivation serves as an important source of income and employment for millions of farming households, while supporting value addition and agro-based industries.

Despite its economic importance, chilli productivity is often constrained by several biophysical and socio-economic factors, including pest and disease incidence, climate variability, declining soil fertility, rising input costs, labour shortages, and fluctuating market prices. To address these challenges, agricultural research institutions and State Agricultural Universities have developed scientifically recommended production technologies encompassing improved varieties, quality seed treatment, optimum sowing time, balanced nutrient management, efficient irrigation, integrated weed management, integrated pest and disease management, micronutrient application, and scientific harvesting practices. Adoption of these technologies has been shown to enhance crop productivity, resource-use efficiency, and farm profitability. However, the successful implementation of these recommendations depends largely on farmers' knowledge, awareness, and willingness to adopt them under local farming conditions (Sharma *et al.*, 2015; Sunidhi *et al.*, 2022) ^[4, 5].

Knowledge is considered the cornerstone of agricultural technology adoption, as it enables farmers to understand the benefits, applicability, and management requirements of improved production practices. Farmers acquire knowledge through various formal and informal sources, including extension personnel, Krishi Vigyan Kendras (KVKs), research institutions, input dealers, fellow farmers, mass media, and digital advisory platforms. Effective agricultural extension plays a pivotal role in strengthening farmers' knowledge, promoting skill development, and facilitating informed decision-making, thereby narrowing the gap between research innovations and field-level adoption. Studies have consistently reported that farmers possessing higher levels of technical knowledge are more likely to adopt recommended cultivation technologies, resulting in improved productivity and income.

In addition to scientific recommendations, Indigenous Technical Knowledge (ITK) continues to play a significant role in sustainable chilli cultivation. Indigenous knowledge comprises traditional practices developed and refined by farming communities through generations of experience and interaction with local ecosystems. In chilli cultivation, these practices include traditional seed selection and storage, botanical seed treatments, organic nutrient management, herbal pest control, moisture conservation techniques, and indigenous post-harvest handling methods. These low-cost, environmentally friendly, and locally adaptable practices are particularly valuable for resource-poor farmers. The integration of scientifically validated indigenous knowledge with modern agricultural technologies has gained increasing recognition as a sustainable approach to improving productivity, conserving natural resources, and enhancing climate resilience (Pavani *et al.*, 2025) [3].

Technology adoption among farmers is influenced by a combination of socio-economic, institutional, technological, and psychological factors, including education, farming experience, farm size, extension contact, access to credit, input availability, market opportunities, and perceived usefulness of innovations. Although considerable efforts have been made to promote improved chilli production technologies, several studies have reported persistent knowledge and adoption gaps. Farmers generally exhibit higher adoption of simple and observable practices such as recommended varieties and sowing time, whereas adoption of scientific seed treatment, micronutrient application, integrated nutrient management, and plant protection measures remains comparatively low due to inadequate technical knowledge, financial constraints, limited extension support, and poor market infrastructure (Naik *et al.*, 2019; Sunidhi *et al.*, 2022) [2, 5].

Although previous studies have independently examined knowledge, adoption, or indigenous farming practices, comprehensive research integrating these dimensions remains limited. Understanding farmers' knowledge of recommended technologies, their adoption behaviour, indigenous technical knowledge, and the constraints

encountered during cultivation is essential for developing evidence-based extension strategies. Such information can assist researchers, extension professionals, and policymakers in designing location-specific interventions, strengthening capacity-building programmes, promoting sustainable production practices, and improving farmers' livelihoods. Therefore, the present study was undertaken to assess the knowledge level of farmers regarding recommended chilli cultivation technologies, examine the extent of adoption of recommended and indigenous practices, and identify the major constraints affecting chilli cultivation, thereby providing valuable insights for strengthening agricultural extension services and promoting sustainable chilli production.

Methodology

The study was conducted in Ramanathapuram district of Tamil Nadu, India, by adopting an ex-post facto research design, as the variables under investigation had already occurred and the researcher had no control over their occurrence. The district was selected purposively due to its significant area under chilli cultivation, favourable agro-climatic conditions, and prevalence of traditional chilli-growing practices, particularly the cultivation of Ramnad Mundu chilli. The district is located between 9°05' and 9°50' North latitude and 78°10' and 79°27' East longitude, covering an area of approximately 4,123 km². It experiences a tropical semi-arid climate with an average annual rainfall of about 850–900 mm, mainly received through the Northeast Monsoon. The predominant red sandy loam soils, along with suitable climatic conditions, provide favourable conditions for chilli cultivation and other dryland crops. Among the nine taluks and eleven development blocks of Ramanathapuram district, Kamuthi, Mudukulathur, and Kadaladi blocks were purposively selected based on their larger area under chilli cultivation, higher concentration of chilli-growing farmers, and familiarity of the researcher with the local farming systems and dialects. A list of villages in the selected blocks was obtained from the office of the Joint Director of Agriculture, Ramanathapuram district, and six villages were selected based on the predominance of chilli cultivation and number of chilli-growing households. The selected villages included Peraiyur and Thimmanathapuram from Kamuthi block, Puseri and Thaliyarendal from Mudukulathur block, and Appanur and another major chilli-growing village from Kadaladi block. A sample size of 120 chilli growers was fixed considering the objectives, time, and available resources of the study. From the list of chilli-growing farmers in the selected villages, respondents were selected using a proportionate random sampling technique to ensure adequate representation from each village. Primary data were collected from the selected respondents using a pre-tested structured interview schedule by personal interview method. The collected data were analysed using appropriate statistical tools, including frequency and percentage analysis to interpret the findings and draw meaningful conclusions.

Table 1: Distribution of the respondents according to their practice-wise knowledge level (n=120)

I	Varieties	Frequency	Percent
1	Name the chilli varieties recommended for your area Ramnad Mundu and samba	120	100
II	Season of sowing		
2	Mention the recommended season of sowing Early adoption (August-December) Late adoption (April- May)	120	120
III	Seed rate		
3	Mention the recommended seed rate	84	70
IV	Field preparation		
4	Mention the recommended number of ploughings	91	75.83
V	Seed treatment		
5	Mention the recommended fungicide for seed treatment	76	63.33
6	Mention the recommended quantity of fungicide	68	56.66
7	Mention the recommended bio-fertilizer for seed treatment	97	80.83
8	Mention the recommended quantity of bio-fertilizer	76	63.33
VI	Method of sowing		
9	Sowing methods by using machine or manually	115	95.83
VII	Irrigation		
10	Optimum time of irrigation recommended for chilli	120	100
11	Optimum time of first irrigation recommended for chilli	80	66.66
12	Optimum interval between irrigation recommended for chilli	103	85.83
VIII	Manures and fertilizer application		
13	What is the quantity of FYM/acre recommended for chilli crop?	82	68.33
14	What is the quantity of NPK/acre recommended for chilli?	105	87.5
15	What is the quantity of super phosphate application/acre for chilli crop?	90	75
IX	Weed management		
16	Mention the recommended time of hand weeding?	110	91.66
17	How many days interval for hand weeding?	105	87.5
18	Name the recommended herbicide?	92	76.66
19	What is the quantity of herbicide application?	86	71.66
20	Which is the time of application?	78	65.00
X	Micro nutrient application		
21	Recommended micro nutrients for chilli crop	68	56.66
22	Quantity of micro-nutrients	58	48.33
23	Time of application	60	50
24	Method of application	54	45
XI	Plant protection measures		
25	Name of the pesticide recommended for Thrips, Whitefly and Fruit borer?	102	85
26	What is the quantity of pesticide to be applied?	93	77.5
27	What is the time of application?	88	73.33
28	Name of the fungicide recommended for control of leaf curl and Chilli wilt ?	58	48.83
29	What is the quantity of fungicide to be applied?	52	43.33
30	Time of application	55	45.83
XII	Harvesting		
31	How do you find out the harvesting stage of chilli crop?	112	93.33

Results and Discussion

Practice-wise knowledge level of the respondents

From the table 1 it revealed that considerable variation in the level of knowledge across different components of scientific and indigenous cultivation practices. Among the recommended chilli cultivation technologies, all the respondents (100.00%) correctly identified the recommended chilli varieties, namely Ramnad Mundu and Samba, as well as the recommended sowing season, indicating excellent awareness of these fundamental production practices. Similarly, a very high level of knowledge was observed regarding the optimum irrigation schedule (100.00%), method of sowing (95.83%), and harvesting stage (93.33%). High knowledge was also recorded for weed management practices, where 91.66 Percent of the respondents knew the recommended time for hand weeding and 87.50 Percent were

aware of the appropriate interval for hand weeding. Likewise, 87.50 Percent correctly identified the recommended NPK fertilizer dose, while 85.83 Percent were aware of the recommended irrigation interval and 85.00 Percent knew the recommended pesticides for controlling thrips, whitefly, and fruit borer. These findings indicate that farmers possessed better knowledge of routine and frequently practiced cultivation operations, possibly due to continuous interaction with extension personnel, personal farming experience, and repeated field application of these technologies. Knowledge regarding seed treatment practices was comparatively moderate. About 80.83 Percent of the respondents were aware of the recommended bio-fertilizer for seed treatment, whereas only 63.33 Percent knew the recommended fungicide and bio-fertilizer dosage. Similarly, 70.00 Percent of the respondents knew the recommended

seed rate, while 75.83 Percent correctly reported the recommended number of ploughings. Moderate knowledge was also observed with respect to fertilizer management, as 75.00 Percent of the respondents knew the recommended superphosphate application and 68.33 Percent were aware of the recommended farmyard manure (FYM) application. These results suggest that although farmers are familiar with major production practices, detailed technical recommendations requiring precise input application are not uniformly understood.

Comparatively lower knowledge was recorded for micronutrient application and disease management practices. Only 56.66 Percent of the respondents knew the

recommended micronutrients, while knowledge regarding the recommended quantity (48.33%), application time (50.00%), and method of application (45.00%) remained relatively poor. Likewise, less than half of the respondents correctly identified the recommended fungicide for the management of leaf curl and chilli wilt (48.33%), the recommended fungicide dosage (43.33%), and the appropriate time of application (45.83%). The relatively low level of knowledge in these components may be attributed to inadequate extension exposure, the technical complexity of these recommendations, and the limited emphasis placed on preventive crop management practices during farmer training programmes.

Table 2: Distribution of the respondents according to their Knowledge about ITK practices in Chilli (n=120)

I	Seed and Nursery Practices		
1	Do you use traditional seed selection methods?	117	97.5
2	How do you store chilli seed	88	77.33
3	Any indigenous seed treatment practices followed?	87	72.5
4	Materials used for nursery pest protection?	66	55
II	Soil and nutrient management		
5	Traditional manures used	75	62.50
6	Use of farmyard manure / cow dung /goat manure	68	56.66
7	Indigenous methods to improve soil fertility	95	79.16
8	Ash application practices	95	79.16
III	Pest and Diseases Management		
9	Traditional Methods used against Thrips / White fly	57	47.5
10	Use of neem extract /neem soap	54	45
11	Herbal spray used	88	73.33
12	Indigenous methods for wilt and leaf curl	120	100
IV	Water Management		
13	Traditional irrigation scheduling	98	81.66
14	Moisture conservation methods	84	70.00
15	Rainwater utilization practices	75	62.50
V	Harvest and Storage		
16	Traditional harvesting method	110	91.66
17	Indigenous drying method	115	95.83
18	Storage structure used for chilli	0	0

With respect to Indigenous Technical Knowledge (ITK), the respondents demonstrated substantial knowledge of several traditional cultivation practices. Nearly all respondents (97.50%) were aware of traditional seed selection methods, while 95.83 Percent possessed knowledge of indigenous drying methods and 91.66 Percent knew traditional harvesting practices. Complete knowledge (100.00%) was recorded for indigenous methods used in managing wilt and leaf curl diseases, highlighting the continued relevance of traditional disease management practices among chilli growers. Furthermore, a high proportion of respondents reported knowledge of traditional irrigation scheduling (81.66%), indigenous methods for improving soil fertility (79.16%), ash application (79.16%), traditional seed storage (77.33%), herbal sprays (73.33%), and indigenous seed treatment practices (72.50%). These findings indicate that indigenous knowledge continues to be preserved and transmitted across farming generations owing to its low cost,

ease of application, and compatibility with local agro-ecological conditions.

However, comparatively lower knowledge was observed regarding traditional pest management practices, particularly the use of neem extract or neem soap (45.00%) and traditional methods for controlling thrips and whitefly (47.50%). Similarly, only 55.00 Percent of the respondents were aware of materials used for nursery pest protection, while 56.66 Percent reported knowledge of farmyard manure, cow dung, and goat manure application. Notably, none of the respondents reported knowledge regarding traditional storage structures for chilli (0.00%), suggesting that conventional storage practices have largely been replaced by modern storage methods or commercial marketing systems. This transition may reflect changing production and marketing environments, where immediate sale of produce has reduced the dependence on traditional storage structures.

Table 3: Distribution of the respondents according to their extent of adoption of recommended technologies in chilli (n=120)

S. No	Technology	Frequency	Percent
I	Varieties Recommended chilli variety Ramnad mundu and samba	120	100
II	Season of sowing (August-November)	120	100
III	Seed rate Recommended seed rate Open pollinated seeds: 70-80g/ac Hybrid seeds: 35-40g/ac	88	73.33
IV	Field preparation Recommended quantity of FYM 25 t/ha tones Ploughing 2-3times with country plough	92	76.66
V	Seed treatment Seed treatment with fungicide (captan or thiram) Recommended quantity of the fungicide (captan @2-3g/kg.or thiram @2-3g/kg) Seed treatment with bio fertilizer Seed treatment with bio control agent	43	35.83
VI	Irrigation Optimum time for life irrigation (Immediately after transplanting) Optimum time for first irrigation (3 days after the life irrigation) Optimum interval between irrigation (Maturity phase-200 days)	103	85.83
VII	Manures and fertilizer application FYM (enriched FYM@25t/ha) NPK application @ (30:60:30Kg/ha) Super phosphate@375kg/ha	95	79.16
VIII	Weed management Hand weeding (Use first hand weeding) Intervals for weeding (35-40 days on one hand weeding) Recommended herbicide application (fluchloralin) Quantity of herbicide @at.1.0 l/ha Time for application Pre-sowing and pre-emergence	110	91.66
IX	Micro nutrient application Name of the micro nutrient Quantity of micro nutrient Time of application Method of application	65	54.16
X	A) Plant protection measures		
	fruit borer & white fly Pesticide recommended to control white fly and fruit borer Quantity of pesticide Time of application	82	68.33
	b) Leaf curl and Chilli wilt Recommended fungicide Quantity of fungicide per acre Time of application	76	63.33
XI	Harvesting		
	Finding out the harvest stage	110	91.66

Extent of adoption (Recommended technologies)

The extent of adoption of recommended chilli cultivation technologies among the respondents revealed considerable variation across different production practices, indicating that while farmers readily adopted basic and well-established technologies, the adoption of technically complex and preventive practices remained comparatively low. The study revealed that all the respondents (100.00%) adopted the recommended chilli varieties, namely Ramnad Mundu and Samba, as well as the recommended sowing season (August–November). This complete adoption reflects farmers' confidence in the recommended varieties and their awareness of the importance of timely sowing for achieving higher productivity. The widespread adoption of these practices may be attributed to their visible economic benefits, easy

availability of quality seed, and continuous dissemination through agricultural extension agencies and fellow farmers. A high level of adoption was observed for weed management and harvesting practices, with 91.66 Percent of the respondents following the recommended hand weeding schedule, herbicide application, and harvesting practices. Likewise, 85.83 Percent of the respondents adopted the recommended irrigation schedule, including life irrigation, first irrigation, and irrigation intervals. The adoption of balanced manure and fertilizer application was also relatively high (79.16%), while 76.66 Percent of the respondents followed the recommended field preparation practices, including farmyard manure application and appropriate ploughing operations. These findings indicate that farmers tend to adopt cultivation practices that are directly associated

with crop establishment, growth, and yield enhancement. The high adoption of these practices may also be attributed to repeated field demonstrations, extension advisory services, and farmers' practical experience gained over years of cultivation.

The adoption of recommended seed rate was moderate, with 73.33 Percent of the respondents following the prescribed seed rate for both open-pollinated and hybrid varieties. Similarly, 68.33 Percent of the respondents adopted the recommended plant protection measures for managing fruit borer and whitefly, while 63.33 Percent followed the recommended fungicide practices for managing leaf curl and chilli wilt diseases. Although these adoption levels are encouraging, they indicate that a considerable proportion of farmers continue to deviate from the recommended practices. This may be due to limited technical knowledge, dependence on local input dealers for pesticide recommendations, frequent changes in pesticide availability, or farmers' reliance

on their own field experience rather than scientific recommendations.

The adoption of micronutrient application was comparatively lower, with only 54.16 Percent of the respondents adopting the recommended micronutrient practices. Even lower adoption was observed for seed treatment practices, where only 35.83 Percent of the respondents treated seeds with the recommended fungicides, biofertilizers, or biocontrol agents before sowing. The poor adoption of seed treatment may be attributed to inadequate awareness regarding its long-term benefits, limited availability of recommended inputs, additional labour requirements, and the perception that seed treatment is an optional rather than essential cultivation practice. Likewise, the lower adoption of micronutrient application may be due to insufficient knowledge regarding deficiency symptoms, higher input costs, and limited extension emphasis on balanced nutrient management.

Table 4: Distribution of the respondents according to their extent of adoption of (ITK) in chilli (n=120)

S. No.	Technology	Frequency	Percent
I	Seed Selection and Storage Practices	105	87.50
	Selection of seeds from healthy and disease-free plant		
	Seed storage using ash		
	Seed storage using neem leaves		
II	Seed Treatment Practices	47	39.16
	Seed treatment with cow urine		
	Seed treatment with cow dung slurry		
	Seed treatment with neem leaf extract		
III	Soil Fertility and Nutrient Management Practices	77	64.16
	Application of FYM		
	Application of goat/sheep manure		
	Application of compost		
	Application of neem cake		
	Application of wood ash		
IV	Pest management practices	74	61.66
	Spraying neem seed kernel extract (NSKE)		
	Spraying chilli-garlic extract		
	Spraying neem leaf extract		
	Installation of bird perches		
V	Disease Management Practices	78	65.0
	Use of cow urine-based formulation		
	Use of herbal plant extracts for disease control		
	Field sanitation through traditional methods		
VI	Weed Management Practices	115	95.83
	Hand weeding		
VII	Water Management Practices	104	86.66
	Irrigation based on soil moisture		
	Mulching with crop residues/dry leaves		

Extent of adoption (ITK)

The distribution of farmers according to their adoption of indigenous technical knowledge revealed that weed management practices recorded the highest adoption level, with 95.83 Percent of the respondents adopting practices such as hand weeding and the use of traditional weeding tools and methods. This indicates that manual weed management continues to be widely preferred by farmers due to its simplicity, low cost, and compatibility with traditional farming systems. The findings further indicated that seed selection and storage practices were adopted by 87.50 Percent

of the respondents. Farmers mainly followed the selection of healthy and disease-free seeds, seed storage using ash and neem leaves, and the use of traditional storage containers. The high adoption level may be attributed to the long-standing indigenous knowledge associated with seed preservation and the effectiveness of these practices in maintaining seed quality without additional expenditure. Similarly, water management practices were adopted by 86.66 Percent of the respondents, particularly irrigation based on soil moisture and mulching with crop residues or dry leaves. The adoption of these practices reflects farmers'

awareness of moisture conservation techniques and efficient water utilization, especially under conditions of increasing water scarcity and climatic variability. Regarding soil fertility and nutrient management practices, 64.16 Percent of the respondents adopted practices such as the application of farmyard manure (FYM), goat/sheep manure, compost, neem cake, wood ash, and Panchagavya. The moderate level of adoption indicates the continued relevance of organic nutrient sources in maintaining soil health and improving crop productivity through sustainable nutrient management. In terms of disease management practices, 65.00 Percent of the farmers adopted traditional approaches, including cow urine-based formulations, herbal plant extracts, and field sanitation methods. The adoption of these practices suggests farmers' preference for eco-friendly disease management strategies that reduce dependence on synthetic chemicals.

The adoption of pest management practices was observed among 61.66 Percent of the respondents. Farmers followed practices such as spraying neem seed kernel extract (NSKE), chilli-garlic extract, neem leaf extract, installation of bird perches, and use of trap crops. The adoption of botanical-based pest management practices indicates growing interest among farmers towards environmentally sustainable pest control measures. The least adopted practice was seed treatment practices, with only 39.16 Percent of the respondents following methods such as seed treatment with cow urine, cow dung slurry, and neem leaf extract. The relatively lower adoption may be due to inadequate awareness regarding the benefits of seed treatment, lack of knowledge on preparation methods, and limited extension support for promoting indigenous seed treatment technologies.

Table 5: Distribution of the respondents according to their farmers constraints (n=120)

S. No.	Constraints	Frequency	Percent
1	High cost involved in adopting modern practices	95	79.16
2	High cost of inputs	120	100
3	Lack of knowledge about improved method of cultivation	43	35.83
4	Lack of credit facilities and non-availability of subsidies	82	68.33
5	Lack of proper marketing channel	80	66.66
6	High cost of labour	94	78.33
7	Problem of pest like fruit borer, white fly, Thrips	120	100
8	Problems of disease leaf curl, wilt	110	91.66
9	Non-availability of farm machineries in time	85	70.83

Constraints of chilli farmers

The findings from the table 5 revealed that the high cost of inputs and problems related to pest incidence were the major constraints reported by all the respondents (100.00 Percent). The high expenditure on seeds, fertilizers, pesticides, and other agricultural inputs may have restricted farmers, particularly small and marginal farmers, from adopting improved technologies. Similarly, the prevalence of insect pests such as fruit borer, white fly, and thrips was perceived as a serious production constraint, affecting crop growth, yield, and economic returns. The second major constraint reported by the respondents was disease incidence, particularly leaf curl and wilt diseases, which was experienced by 91.66 Percent of the farmers. Frequent occurrence of these diseases increases production risks and necessitates additional expenditure on plant protection measures, thereby influencing farmers' willingness to adopt new cultivation practices.

The high cost involved in adopting modern practices was expressed as a constraint by 79.16 Percent of the respondents. This indicates that although farmers may be aware of improved technologies, the initial investment required for adoption remains a major barrier. Similarly, high labour cost was reported by 78.33 Percent of the respondents, reflecting the increasing expenditure on agricultural operations due to labour scarcity and rising wage rates. Further, non-availability of farm machinery at the required time was reported by 70.83 Percent of the respondents. Timely access to machinery is essential for efficient farm operations; however, limited availability and high hiring charges may reduce the feasibility of mechanization among farmers.

The lack of credit facilities and non-availability of subsidies was perceived as a constraint by 68.33 Percent of the

respondents. Limited access to institutional finance and inadequate financial support mechanisms may restrict farmers' capacity to invest in improved production technologies. Likewise, lack of proper marketing channels was reported by 66.66 Percent of the respondents, indicating difficulties in accessing remunerative markets and obtaining better prices for their produce. The least reported constraint was lack of knowledge about improved methods of cultivation, expressed by 35.83 Percent of the respondents. This suggests that most farmers had a basic level of awareness regarding improved practices; however, economic and production-related issues were the predominant barriers affecting technology adoption.

Implications of the study

Although farmers exhibited a high level of knowledge and adoption of basic practices such as recommended varieties, sowing season, irrigation, weed management, and harvesting, comparatively lower knowledge and adoption were observed in technically complex practices such as seed treatment, micronutrient application, and disease management. Therefore, extension organizations should intensify farmer training programmes, demonstrations, and advisory services focusing on these areas. The study also highlights the continued relevance of Indigenous Technical Knowledge (ITK), particularly in seed selection, disease management, water conservation, and harvesting practices, emphasizing the need for scientific validation and integration of indigenous practices with modern technologies to ensure sustainable agriculture. Since high input costs, pest and disease incidence, labour shortages, inadequate credit facilities, and poor marketing infrastructure emerged as major constraints, policymakers should strengthen subsidy

schemes, institutional credit support, custom hiring centres, and market linkages to enhance farmers' access to resources and improve profitability. Furthermore, strengthening integrated pest and disease management programmes and ensuring timely availability of quality inputs and farm machinery can facilitate greater adoption of improved technologies. Overall, the study underscores the importance of enhancing farmers' technical knowledge, reducing economic barriers, and integrating scientific recommendations with indigenous knowledge systems to improve productivity, resilience, and sustainability in chilli cultivation.

Conclusion

The present study concludes that chilli farmers in Ramanathapuram district possess a satisfactory level of knowledge and adoption regarding major recommended cultivation practices, particularly those related to varieties, sowing season, irrigation management, weed control, and harvesting. However, considerable gaps persist in the adoption of technically complex practices such as seed treatment, micronutrient application, and scientific disease management. The findings further reveal that Indigenous Technical Knowledge continues to play a vital role in chilli cultivation, especially in seed selection, soil fertility management, water conservation, and disease control, reflecting its relevance and compatibility with local farming conditions. Despite the availability of improved technologies, farmers encounter several constraints, including high input costs, pest and disease incidence, labour shortages, limited access to credit and subsidies, inadequate marketing facilities, and the untimely availability of farm machinery. Therefore, enhancing extension support, promoting the integration of scientific recommendations with validated indigenous practices, and strengthening institutional and policy interventions are essential for improving technology adoption, increasing productivity, and ensuring the long-term sustainability and profitability of chilli cultivation.

Contributors

All authors contributed to and have approved the final manuscript.

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