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Adoption of production-led extension practices in paddy cultivation: An empirical study

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Abstract

The study was conducted to assess the level of adoption of production-led extension practices in paddy cultivation among rice growers. A structured interview schedule was administered to 120 respondents of Shivamogga district of Karnataka state. Data were analysed using percentages and frequency. The study results revealed that majority of the farmers adopted newly released varieties/hybrids of the paddy (84.17%), harvesting at the optimum time (91.67%), and application recommended quantity of the fertilizer (85.00%), timing (82.50%), and method (90.00%) of fertilizer application. However, adoption was low in the seed treatment (31.67%), use of bio-fertilizers (20.83%), micronutrient application (33.33–40.00%), and value-addition (8.33%). With respect to the Post-harvest practices such as cleaning and grading (60.83%), storage (60.83%), and transportation (60.83%) were moderately adopted, whereas collective storage (07.50%) and value-addition (08.33%) were adopted in meagre percentage. The study suggests that strengthening extension support, training, and input-subsidy schemes for seed treatment, micronutrients, and value-addition would enhance paddy productivity and farm income.

Keywords: Paddy, adoption, extension practices, production technology, post-harvest

Introduction

Agriculture plays a vital role in the growth of the Indian economy and overall national development. During the past six decades, the production-led extension system has significantly contributed to increasing agricultural productivity and improving farmers' livelihoods. Although India's achievements in the agricultural sector have been remarkable in certain regions and states, the overall performance remains below its full potential in several sectors. Therefore, agricultural development efforts need to be reoriented in response to changing socio-economic conditions, emerging challenges, and new opportunities. This requires a shift in perspective from viewing farming merely as a way of life to recognizing it as a viable entrepreneurial opportunity. Traditionally, many farmers sell their produce on an "as-is-where-is" basis without adequate knowledge of prevailing market conditions. Therefore, building farmers' capacity by equipping them with essential market information and decision-making skills has become increasingly important.

Production-led extension has emerged as an effective approach to bridging the gap between agricultural research and its practical application at the farm level. This approach focuses on enhancing agricultural productivity through the dissemination of improved technologies, scientific cultivation practices, and farm management techniques. Production-led extension practices include the promotion of high-yielding varieties, balanced nutrient management, integrated pest and disease management, efficient water-use practices, mechanization, and climate-resilient agricultural technologies. The successful adoption of these practices can substantially improve crop productivity, farm income, and agricultural sustainability. However, the extent of adoption varies considerably among farmers due to differences in socio-economic status, educational attainment, resource availability, farm size, access to extension services, and perceptions of new technologies. Understanding the level of adoption and the factors influencing farmers' decisions is essential for designing effective extension strategies and policy interventions. Paddy cultivation currently faces several challenges, including declining soil

fertility, water scarcity, rising production costs, pest and disease infestations, and the adverse effects of climate change. In this context, extension agencies play a crucial role in promoting scientifically validated practices that enhance productivity while ensuring environmental sustainability. Assessing farmers' adoption behavior provides valuable insights into the effectiveness of extension programs and helps identify areas requiring additional support and intervention. Therefore, the present study aims to examine the adoption of production-led extension practices in paddy cultivation and to analyze the factors influencing their adoption among farmers. The findings of the study are expected to contribute to the formulation of appropriate extension strategies, strengthen technology dissemination efforts, and support the sustainable growth of paddy production.

Materials and Methods

The present study was conducted to assess the adoption of production-led extension practices in paddy cultivation among farmers in Shivamogga district of Karnataka. An ex-post facto research design was employed, as the events under investigation had already occurred and the researcher had no control over the independent variables. A sample of 120 paddy-growing farmers was selected through simple random sampling from the major paddy cultivation belts of the district. The sample size was considered adequate to ensure reasonable representation of the study population and to facilitate the calculation of meaningful frequencies and percentages. A structured interview schedule was developed to collect information on the adoption of recommended practices related to pre-sowing, sowing, transplanting, nutrient management, crop protection, water management, and post-harvest operations. The major practice categories included the use of suitable varieties and hybrids, recommended sowing time and seed rate, seed treatment, spacing, nursery management, age and spacing of seedlings at transplanting, water management, application of chemical fertilizers, use of biofertilizers and micronutrients (ZnSO_4 and FeSO_4), plant protection measures against pests and diseases, weed management, harvesting, and post-harvest activities such as cleaning, grading, storage, transportation, and value addition. Data were collected through personal interviews conducted by trained investigators. The extent of adoption was assessed based on the frequency (f) and percentage (%) of respondents who followed each recommended practice. The collected data were coded, tabulated, and analyzed using appropriate statistical techniques to draw meaningful conclusions.

Results and Discussion

Table 1 presents the distribution of respondents according to their personal, socio-economic, and psychological characteristics. The findings the study results revealed that a majority of the farmers (51.67%) belonged to the middle-age group (35–50 years), followed by 30.83 per cent young age (<35 years) and 17.50 per cent old age (>51 years) category. This indicates that farming activities are predominantly carried out by individuals in their economically productive age group, who possess adequate experience and willingness to adopt improved agricultural practices. With respect to education, the highest proportion of respondents (35.00%) had completed high school education, followed by primary school education (25.84%), PUC (20.83%), graduation and above (10.00%), and illiterate farmers (8.33%). The results suggest that most farmers possessed basic educational qualifications, which may facilitate access to agricultural information and technologies. Regarding

farming experience, more than half of the respondents (57.50%) had 5–10 years of farming experience, while 25.00 per cent had more than 10 years of experience and 17.50 per cent had less than 5 years. In relation to the mass media participation, 56.67 per cent of the farmers belonged to the medium category, followed by low (24.17%) and high (19.17%) categories of mass media participation. Similarly, extension contact was found to be medium among 61.67 per cent of the respondents, while 22.50 per cent and 15.83 per cent had low and high extension contact, respectively. These findings indicate that most farmers had moderate exposure to information sources and extension services. The analysis of innovative proneness showed that nearly half of the respondents (48.33%) belonged to the medium category, whereas 27.50 per cent and 24.17 per cent fell under low and high categories, respectively. Likewise, economic motivation was medium among 48.33 per cent of farmers, followed by low (29.17%) and high (22.50%) levels. These findings imply that the respondents exhibited a moderate tendency toward innovation and economic advancement. Regarding scientific orientation, 43.33 per cent of the farmers belonged to the medium category, followed by low (34.17%) and high (22.50%) categories. Similarly, risk orientation was medium among 44.17 per cent of respondents, while 32.50 per cent and 23.33 per cent exhibited low and high risk orientation, respectively. This suggests that most farmers maintained a balanced approach toward scientific farming practices and risk-taking behavior. The distribution of respondents based on access to e-tools revealed that a majority (51.66%) had low access, followed by medium (32.50%) and high (15.84%) access. This indicates that digital accessibility among farmers remains limited and may affect their utilization of information and communication technologies in agriculture. With respect to membership in farmers' organizations, 43.33 per cent of the respondents belonged to the low category, 39.17 per cent to the medium category, and only 17.50 per cent to the high category. This finding suggests relatively lower participation of farmers in formal organizations and collective activities. Finally, the results on cosmopolitanism indicated that 44.17 per cent of the respondents had a medium level of cosmopolitanism, followed by low (38.33%) and high (17.50%) levels. This implies that the majority of farmers maintained moderate interaction with external environments and information networks beyond their local communities.

Varieties and sowing-related practices

Table 2 shows the adoption of recently released suitable varieties/hybrids was reported by (84.17%) of the respondents, indicating that most farmers accepted varietal recommendations. Preferred hybrids and high-yielding varieties are known to increase productivity, pest & diseases and resistance to biotic and abiotic stresses. Sowing time (67.50%) and seed rate (74.17%) were also fairly well adopted, though about one-third of farmers still followed non-recommended timings or seeding rates, which can reduce yield and raise seed costs (Vasanthi C, 2020) [8].

Seed treatment and spacing

Seed treatment was adopted by only (31.67%) of farmers, indicating low awareness or poor extension follow-up on this practice. Seed treatment helps in controlling seed-borne diseases and improving seedling vigour, and low adoption may contribute to seedling mortality and disease incidence. Spacing at pre-transplanting stage was adopted by (64.17%) of farmers, suggesting moderate adherence to recommended plant

population.

Nursery raising and transplanting

Nursery-raising practices were followed by (58.33%) of farmers, while (85.00%) kept seedlings for the recommended duration in the nursery. This high adherence to seedling-age norms ensures robust seedlings and better transplanting. Transplanting age (80.83%) and transplanting spacing (65.00%) were also widely adopted, though spacing prescription was followed by only about two-thirds of farmers, which may lead to sub-optimal tiller production and poor light interception.

Water and nutrient management

Level of water at transplanting was adopted by (40.00%) farmers, whereas irrigation at critical stages such as panicle initiation and grain-filling was adopted by (81.67%). This indicates that most farmers recognize the importance of water at key growth stages but often neglect the initial water-depth norm. Application of chemical fertilizers was highly adopted: quantity (85.00%) timing (82.50%) and method (90.00%) of application. Timely and balanced fertilizer application is crucial for high yield and nutrient-use efficiency. However, application of farmyard manure (FYM) was adopted by only (37.50%) of farmers, reflecting limited integration of organic sources in nutrient management.

Bio-fertilizers and micronutrients

Adoption of bio-fertilizers was very low (20.83%), indicating that microbial inoculants such as Azospirillum or Azotobacter are still underutilized. Bio-fertilizers can reduce chemical-N requirement and improve soil health, but their adoption is limited by awareness, availability, and perceived reliability. Micronutrient application—Zinc sulphate (40.00%,) and ferrous sulphate (33.33%,) was practiced by less than half of the respondents, suggesting that soil micronutrient deficiencies may remain unaddressed, leading to hidden hunger and yield

constraints.

Plant-protection and weed control

Adoption of disease-management measures was reported by (55.83%) of farmers, whereas pest-management practices were adopted by (62.50%) Integrated pest and disease management, including scouting and judicious pesticide use, remains to be strengthened. Weed control through manual weeding (70.00%) and chemical herbicides (85.00%) was well adopted, indicating that farmers are increasingly relying on herbicides, which calls for wise-use messages to avoid resistance and environmental problems.

Harvesting

Optimum time of harvesting was adopted by (91.67%) of farmers, the highest among all practices. Harvesting at the correct physiological maturity (25–30% grain moisture) minimizes shattering and grain damage, which is critical for grain quality and yield realization.

Post-harvest activities

Table 2 (your post-harvest table) shows adoption of post-harvest activities among the same 120 farmers. Cleaning and grading (60.83%) and transportation (60.83%) were moderately adopted, ensuring that grain is reasonably cleaned and moved to market or storage. Storage practices were followed by (60.83%) of farmers, but almost all opted for local household/individual storage; only (07.50%) used collective storage, which limits economies of scale and risk-sharing. Value-addition activities (e.g., parboiling, milling, snack-making, branded packaging) were almost negligible (08.33%), indicating that farmers largely sell raw grain without capturing value-added margins. Strengthening cooperatives and small-scale processing units is essential for enhancing post-harvest income.

Results Tables

Table 1: Personal characters of the farmers

Sl. No	Category	Frequency (f)	Percentage (%)
1	Age		
1	Young (<35 Years)	36	30.83
2	Middle (35-50 Years)	60	51.67
3	Old (>51 Years)	24	17.50
2	Education		
1	Illiterate	10	8.33
2	Primary school	34	25.84
3	High school	42	35.00
4	PUC	29	20.83
5	Graduation and above	12	10.00
3	Farming experience		
1	Less than 5 Years	21	17.50
2	5 to 10 Years	69	57.50
3	More than 10 Years	30	25.00
4	Mass media participation		
1	Low (Mean – 0.425 SD)	29	24.17
2	Medium (Mean ± 0.425 SD)	68	56.67
3	High (Mean + 0.425 SD)	23	19.17
	Mean:16.10 SD: 4.24		
5	Extension contact		
1	Low (Mean – 0.425 SD)	27	22.50
2	Medium (Mean ± 0.425 SD)	74	61.67
3	High (Mean + 0.425 SD)	19	15.83
	Mean: 12. 45 SD: 3.78		
6	Innovative proneness		
1	Low (Mean – 0.425 SD)	33	27.50

2	Medium (Mean $\pm$ 0.425 SD)	58	48.33
3	High (Mean + 0.425 SD)	29	24.17
Mean= 24.88 SD= 4.39			
7	Economic motivation		
1	Low (Mean – 0.425 SD)	35	29.17
2	Medium (Mean $\pm$ 0.425 SD)	58	48.33
3	High (Mean + 0.425 SD)	27	22.50
Mean= 18.58 SD= 3.61			
8	Scientific orientation		
1	Low (Mean – 0.425 SD)	41	34.17
2	Medium (Mean $\pm$ 0.425 SD)	52	43.33
3	High (Mean + 0.425 SD)	27	22.50
Mean= 19.35 SD= 2.21			
9	Risk orientation		
1	Low (Mean – 0.425 SD)	39	32.50
2	Medium (Mean $\pm$ 0.425 SD)	53	44.17
3	High (Mean + 0.425 SD)	28	23.33
Mean= 21.15 SD= 2.39			
10	Access to e-tools		
1	Low (Mean – 0.425 SD)	62	51.66
2	Medium (Mean $\pm$ 0.425 SD)	39	32.50
3	High (Mean + 0.425 SD)	19	15.84
Mean= 11.14 SD= 3.38			
11	Membership in Farmer's organisation		
1	Low (Mean – 0.425 SD)	52	43.33
2	Medium (Mean $\pm$ 0.425 SD)	47	39.17
3	High (Mean + 0.425 SD)	21	17.50
Mean= 4.81 SD= 2.18			
12	Cosmopoliteness		
1	Low (Mean – 0.425 SD)	46	38.33
2	Medium (Mean $\pm$ 0.425 SD)	53	44.17
3	High (Mean + 0.425 SD)	21	17.50
Mean= 5.85 SD= 1.88			

Table 2: Production led extension practices in paddy

Sl. No	Practices	Frequency (f)	Percentage (%)
1	Suitable varieties/ Hybrid/ of paddy	101	84.17
2	Sowing time	81	67.50
3	Seed Rate	89	74.17
4	Seed Treatment	38	31.67
5	Spacing	77	64.17
6	Application of organic manures	41	34.17
7	Nursery raising	70	58.33
	Methods of making nursery seed bed	102	85.00
8	Days required for keeping seedlings in nursery before transplanting		
	Transplanting	97	80.83
	Age of the seedlings for transplanting	78	65.00
9	Spacing for transplanting		
	Water management	48	40.00
	Level of water at the time of transplanting	98	81.67
10	Irrigation at critical stages		
	Chemical fertilizer application (kg/acre)		
	Quantity of fertilizer	102	85.00
	Time of application of fertilizer	99	82.50
	Method of application of fertilizers	108	90.00
11	iv) Application of FYM and their quantity	45	37.50
	Application bio fertilizers	25	20.83
12	Micronutrient application		
	Zinc Sulphate	40	33.33
	Ferrous Sulphate		
13	Plant protection measures		
	Diseases	67	55.83
	Pest	75	62.50
14	Weed control		
	Manual weeding	84	70.00
	ii) Use of chemicals weedicide	102	85.00
15	Harvesting		
	Optimum time of harvesting	110	91.67

Conclusion and Recommendations

The study reveals that several core production-led extension practices such as use of suitable varieties/hybrids, timely sowing, appropriate seed rate, fertilizer quantity and timing, and harvesting at optimum time—are fairly well adopted by paddy growers. However, low adoption of seed treatment, FYM, bio-fertilizers, micronutrients and value-addition indicates important gaps in the current extension system. To enhance productivity and post-harvest income, the following measures are recommended: Conduct regular front-line demonstrations and training programmes on seed treatment, bio-fertilizers, and micronutrient application with special emphasis on Zn and Fe deficiencies. Promote integrated nutrient management by combining chemical fertilizers with FYM and bio-fertilizers through subsidies or package deals. Strengthen farmer-collective storage and cooperative-based value-addition units (e.g., parboiling, cleaning, branding) to improve shelf-life, quality, and market price realization. Intensify extension contacts through Krishi Vigyan Kendras (KVKs), farmer-field schools, and digital platforms to address knowledge gaps in water-management norms and integrated pest/disease-management. Such interventions will help in translating the existing knowledge base into widespread adoption and higher profitability for paddy-growing farmers.

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