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ORIGINAL ARTICLE

A Study on Extent of Adoption of Recommended Package of Practices in Cultivation and Marketing of Pineapple in Manipur State

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ABSTRACT
Manipur has an extensive and distinguished tradition of horticulture, as seen by the abundance of locally cultivated fruits and vegetables, as well as pineapple, orange, ginger, turmeric, and other produce, those are grown throughout the state. Pineapple is one of these crops that have been grown extensively throughout Manipur. Manipur has a lot of agricultural land dedicated to pineapple farming, but due to a lack of adoption of appropriate, suggested pineapple production technologies, productivity is comparatively low. Imphal East, Thoubal, and Kangpokpi are the three districts in the state of Manipur where this study was carried out. Using an ex-post facto research design and proportionate random sampling, a sample of 300 respondents was selected. The results showed that the majority of respondents fit into the medium level adoption category, which was followed by low- and high-level adoption groups. Cent per cent adoption was observed in practices 'such as use of sucker for propagation', 'hand weeding for weed control', 'using healthy planting materials to prevent from pests and diseases', 'using bamboo baskets, jute sacks for packaging' and using ordinary method for storage.
Keywords: *Adoption, Manipur state, pineapple growers and production.*

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INTRODUCTION

The pineapple, called the "Queen of the Tropics" for its exceptional flavor and taste, is one of the most significant commercial fruits in the world. It ranks third in importance among tropical fruits, after citrus and banana crops [3]. As a tropical fruit, pineapples may grow successfully in sub-topical environments that are free of frost up to 1100 meters above sea level [1], pineapples grow in a variety of environments, from sea level to alpine circumstances, and in moist to extremely dry situations. In India, pineapple cultivation was first established about six to seven decades ago. In 1548 AD, Portuguese settlers introduced pineapples to India. The fruit is naturally very tasty, has a great flavor and nutritional value, and improves indigestion. The North-Eastern region's unique agro-climatic are perfect for its expansion, and it can be cultivated in any kind of soil as long as it drains well and has a pH between 4.5 and 6.5. The summer and winter seasons have sunshine with an average temperature between 20 and 36°C. Since soil erosion increases significantly beyond that point during the rainy season and causes moisture scarcity in the winter, pineapples are only cultivated in hillocks with a slope of 30 to 40 percent. The Queen Variety fruit, which is most suited for hilly soils, is primarily produced in the Imphal East and Thoubal area [5]. In Imphal East, farmers in the hilly areas have shifted from cultivating paddy, which was their traditional habit, to producing pineapples. Presently, pineapple has emerged as one of the state's most significant commercial crops, primarily in the Imphal East district's Ngarian hills regions [2]. About 2,450 hectares of land are under pineapple cultivation in Manipur with the production of 52,825 tonnes of pineapple fruits. The average yield is 21.56 tonnes/ha as against 40-50 tonnes yield potentiality. The two most commonly grown varieties are Kew and Queen. In terms of economics, a sizable portion of farmers who have been growing them as their primary source of income have also come to depend primarily on the fruits. In

Manipur, pineapple growing could be an alternative business generating a significant amount of employment and income. In this study an attempt is made to analyse the extent of adoption of recommended cultivation and marketing practices pineapple in Manipur State.

MATERIAL AND METHODS

An exploratory study was carried out in the three districts of the state of Manipur, specifically Imphal East, Thoubal, and Kangpokpi. These districts were specifically chosen for the study because to their high concentration of pineapple growers. Using proportionate random sampling, a final sample of 300 respondents was selected. The pre-tested structured schedule and personal interview method were used to collect the data. Frequency and percentage analysis were used to study the extent of adoption of the pineapple growers. The levels of adoption of the respondents were classified into three categories viz, low, medium and high by using cumulative frequency method. The extent of adoption in recommended pineapple cultivation practices are categorized into 20 groups namely 'Improved variety', 'Method of prorogation', 'Treatment of sucker', 'Selection of suitable soil/site', 'Land preparation', 'Time of planting', 'Spacing, Fertilizers', 'Irrigation', 'Weeding and hoeing operation', 'Weed control', 'Pest and diseases management', 'Harvesting', 'Yield', 'After care of ratoon crop', 'Post harvest management', 'Grading', 'Packaging and transport', 'Storage' and 'Processing' of the pineapple.

RESULT AND DISCUSSION

The data regarding the extent of the adoption are presented in Table 1

Improved variety: The data shown in Table 1 indicates that the majority of respondents (54.00 per cent) adopted the "Kew" variety, while (46.00 per cent) adopted the "Queen" variety.

Method of propagation: All the respondents were found adopting the 'suckers' as planting materials. The suckers need short duration to mature to the crop than others methods of propagation. Slips (6.30 per cent) and Ratoons is (4.30 per cent) were also used for propagation. This suggested that these methods are not well known, not preferred. However, cent per cent of respondents did not use crown as planting materials. As crown take more time are not adopted. The overall mean adoption percentage for all propagation methods is 27.65 per cent. This reflects a high reliance on a single method (suckers) and very limited adoption of other propagation techniques.

Treatment of sucker: It was found that Amritpani (2.00 per cent) and Panchagavya (3.00 per cent) were used by the respondents for sucker treatment. This indicates very low adoption. This may be due to lack of knowledge and awareness among the growers. The overall mean adoption percentage for sucker treatment practices is 2.50 per cent, reflecting a very limited use of these organic treatments.

Selection of suitable soil/site: The majority of respondents (83.00 per cent) adopted regions with moderate slopes, this suggests that moderate slopes are suitable for pineapple cultivation, likely due to benefits like better drainage and sunlight exposure followed by 62.70 per cent who choose hilly sites possibly for similar reasons such as drainage and microclimate benefits and only 5.70 per cent of the respondents select plain sites for pineapple cultivation. This indicates that plain sites are not considered ideal for pineapple cultivation in this region possible due to issues like poor drainage or less suitable soil conditions and they had enough experience choosing the appropriate types of soil and site. The overall mean adoption percentage for selecting suitable soil or site is 50.46%, reflecting a balanced but varied adoption of different site types among the growers.

Land preparation: Most of respondents (82.70 per cent) adopted trenches across the slope. This suggests that trenches are perceived as more beneficial or suitable for local conditions. While the remaining only (19.30 per cent) had used raised beds as a method of land preparation. Raising beds are not widely adopted in the region possibly due to factors like labour intensity, lack of awareness or perceived benefits. The overall mean adoption percentage for land preparation practices is 51.00 per cent, reflecting a moderate level of adoption when considering both methods together.

Time of planting: Majority of the respondents (76.00 per cent) prefer planting season as April to May, this indicates that growers recognize this period as optimal time for planting pineapples, likely due to favorable climate conditions, such as adequate rainfall and temperature, which support healthy plant establishment and growth and none of the farmers had done planting during June to August. The growers avoid this period possible reason due to unfavorable condition such as excessive rainfall, which can lead to water logging and disease issues, or other environmental factors that do not support plant growth during these months. The overall mean adoption percentage for planting times is 38.00 per cent, reflecting the high preference for the April to May as planting time.

Spacing: Majority (78.70 per cent) of the respondents adopted the single row system with spacing of 75 × 75 cm. This indicates a strong preference for this method, likely due to its simplicity and effectiveness in

ensuring adequate plant growth and maintenance space followed by 21.33 per cent who adopted the double row system with spacing of 60 × 90 × 60 cm. It may be possibly due to its benefits in optimising land use and facilitating better crop management. And no respondent was found to be adopting the high density planting method. This could be due to concerns about overcrowding, increased competition for resources, or higher susceptibility to pests and diseases and lack of knowledge. The overall mean adoption percentage for spacing methods is 33.33 per cent, reflecting a moderate level of adoption when considering all methods together, but heavily skewed towards the single-row system.

Fertilisers*:* The majority of responders (59.30 per cent) applied F.Y.M. as manure. This indicates a moderate adoption of organic fertilisers among growers, possibly due to their perceived benefits in improving soil health and fertility. 52.00 per cent of the respondents had applied urea. This synthetic nitrogen fertiliser is commonly used in agriculture to promote vegetative growth and enhance yield potential. And only 10.70 per cent applied S.S.P. This indicates relatively low adoption of phosphorus-based fertilisers, which are essential for root development, flowering, and fruiting in pineapples. There is no adoption of using chemical fertilizers such as M.O.P. and Micronutrient was not embraced by any of the farmers. A possible cause could be a lack of understanding of the advantages of fertilizer or a financial constraint restricting the purchase of manure and fertilizer. The overall mean adoption percentage for fertilisers is 24.40 per cent, reflecting a moderate level of adoption when considering all types together, but significantly lower than the adoption of individual fertilisers like F.Y.M and Urea.

Irrigation*:* All the respondents had adopted Rainfed irrigation for pineapple cultivation. This indicates a prevalent practice among growers, likely due to the sufficient rainfall in the region during the pineapple growing season, making additional irrigation methods unnecessary. Sprinkler irrigation and surface/sub-irrigation have low adoption rates, with 3.70 per cent and 5.70 per cent of respondents using these methods, respectively. This suggests that only a small proportion of growers employ supplemental irrigation techniques beyond natural rainfall. There is no adoption of the irrigated method among the respondents. This indicates that traditional irrigation methods involving artificial watering systems are not common among pineapple growers in the region. The overall mean adoption percentage for irrigation methods is 27.35 per cent, reflecting a low adoption rate primarily driven by rainfed practices.

Weeding and hoeing operation*:* Majority of the respondents (79.70 per cent) had down weeding and hoeing operation twice in a year. This suggests a prevalent practice among growers to maintain weed control and soil aeration regularly throughout the pineapple cultivation cycle. Whereas remaining 20.30 per cent of them had done weeding four times. This indicates that might be due to labour scarcity, high labour wages and not available in the needed season. The mean percentage of 50.00 per cent suggests a balanced distribution of respondents between the two frequencies. This indicates a relatively even split in adoption rates between yearly and quarterly weeding and hoeing operations among pineapple growers in the region.

Weed control*:* To control weeds, all respondents adopted hand weeding as their primary weed control methods, indicating a widespread practice among growers in the region. Mechanical weeding is used by only 5.30 per cent of respondents, while chemical weeding is adopted by 32.70 per cent. Both mechanical and chemical weeding methods have lower adoption rates compared to hand weeding, suggesting that they are shortage of weeding machines and insufficient information could be the cause of this. The mean percentage of 46.00 per cent indicates a moderate overall adoption rate for weed control methods. While hand weeding is universally adopted, the inclusion of mechanical and chemical weeding methods contributes to a higher mean percentage, indicating some diversification in weed control practices among growers.

Pest and diseases management*:* All the respondents priorities using healthy planting materials as a strategy for managing various diseases. Healthy planting materials are essential for disease prevention and overall crop health, indicating a widespread practice among growers. A portion of respondents (17.00 per cent) reported adopting good drainage practices as part of their disease management strategy. Good drainage helps prevent water logging and soil-borne diseases, contributing to improved plant health and disease resistance. To control diseases and pests on their pineapple farm, none of the respondents used any kind of pesticide or fungicide. They may want organic farming on their farms, which could be the cause. The overall mean percentage for pest and disease management practices is 29.25 per cent reflects a moderate overall adoption rate. While healthy planting materials are universally adopted, other recommended practices such as good drainage have lower adoption rates.

Harvesting*:* Majority of responders (80.00 per cent) harvest when the fruits are green but mature, specifically for local market, this suggests a focus on ensuring the fruit is harvested at an optimal stage for local consumption, where immediate freshness and readiness for sale are priorities. Only 18.70 per cent of respondents harvest pineapples at 75-80% maturity for distant markets. This practice is likely aimed at

ensuring the fruit remains in good condition during transportation, which takes longer compared to selling in local markets. A small proportion of respondents (6.00 per cent) harvest pineapples when they are 1/2 to 3/4 yellow for embankment purposes. This indicates that harvesting at this stage is not a common practice among the growers, possibly due to market demands or other logistical considerations. The mean percentage of 34.90 per cent indicates an overall low adoption rate of the diverse harvesting practices, heavily skewed by the predominant practice of harvesting green but mature fruits for the local market.

Yield: The data indicates that 30.30 per cent of respondents report achieving yields in the range of 50-80 tonnes per hectare. This suggests that a moderate proportion of pineapple growers have adopted practices that enable them to achieve relatively high yields. The data highlights the importance of promoting and supporting practices that lead to higher yields, with the goal of improving productivity and profitability for pineapple growers in the region.

After care of ratoon crop*:* About 70.70 per cent of the respondents' practices desuckering. This indicates that a significant majority of growers recognize the importance of this practice in managing ratoon crops effectively, Desuckering helps to improve the growth and yield of the subsequent crop by removing excess suckers that compete for nutrients. Only 8.70% of respondents engage in fertilization and earthing up after desuckering. This suggests that while desuckering is widely adopted, the subsequent steps to enhance soil fertility and plant stability are not as commonly practiced. A lack of understanding and education could be the cause. The mean adoption percentage of 39.70 per cent reflects a moderate overall adoption of aftercare practices. This is driven primarily by the high rate of desuckering, with much lower adoption of fertilization and earthing up practices.

Post-harvest management*:* Among the sample of respondents 28.00 per cent of them adopted cleaning by removing the leaves and stalk from both ends. This suggests that a notable portion of growers prioritize cleaning as an essential post-harvest practice to ensure the quality and safety of their produce. 6.00 per cent of them had adopted pre-cooling of the pineapples before sale. However, 5.00 per cent of the respondents are adopted the method keep for drying in dry and cool place under shade to enhance the shelf-life of the produce. The reason might by lack of knowledge and non-availability of labours timely. The overall mean adoption percentage of 13.00% indicates a generally low level of adoption for post-harvest management practices among the surveyed growers.

Grading*:* Results showed that 94.00 per cent of the respondents adopt grading practices based on their size, shape, and ripeness as well as their lack of defects and diseases. They suggest that to fetch better profit. This data highlights the success in the adoption of grading practices among pineapple growers, emphasising the importance of maintaining and supporting these practices to ensure continued quality and market competitiveness.

Packaging and transport*:* It was found that all respondents were actively following packaging methods such as jute sacks, bamboo baskets, crates, and lining with paddy straw. This suggests that all growers recognize the importance of proper packaging to protect pineapples during transport. Similarly, 100.0 per cent of respondents use transport methods including heat load, cartload, lorries, and tractors. This indicates that all growers have integrated appropriate transportation methods to ensure their produce reaches the market efficiently and in good condition. The mean adoption percentage of 100.0 per cent underscores the complete adherence to recommended packaging and transport practices among the surveyed growers.

Storage*:* All of the responders were found to be using ordinary storage methods. It suggests that all growers rely on traditional storage methods, likely due to ease of access and low cost. None of them used ethereal treatment or cold storage. This could be due to a lack of cold storage, insufficient storage facilities, and a lack of understanding regarding ethereal ripening techniques. The mean adoption percentage for storage methods is 33.33 per cent, but this is driven entirely by the universal use of ordinary storage.

Processing*:* Among the respondents 29.00 per cent engage in processing pineapple into products like syrup, juice, wine, jam and jelly etc. this suggests that a significant majority of growers do not add value to their produce through processing. The analysis highlights the importance of promoting processing practices among pineapple growers to enhance value addition, profitability, and economic resilience. From the Table 2 it is inferred that majority of the pineapple growers (45.00 per cent) had medium overall adoption level, indicating a moderate uptake of recommended cultivation practices and technologies. A significant portion of respondents (45.67 per cent) reported a low overall adoption level, suggesting potential barriers or challenges hindering the adoption of improved practices among this group. A smaller yet notable segment (17.33 per cent) exhibited a high overall adoption level, indicating proactive engagement and successful implementation of advanced cultivation techniques and

technologies. These, it could be concluded that there existed medium to low level of adoption among the pineapple growers. The growers cultivate pineapples using traditional methods, with little to no adoption of scientific techniques. The result is inconsistent with those of a research done by [4].

Table 1. Item analysis of extent of adoption of pineapple package of practices (n=300)

Sl. No	Practices	No. of Respondents	Per cent
1	**Improved variety:**		
	i) Queen	138	46.00
	ii) Kew	162	54.00
	Mean Percentage	**50.00**	
2	**Method of propagation:**		
	i) Ratoons	13	4.30
	ii) Suckers	300	100.0
	iii) Slips	19	6.30
	iv) Crown	0	0
	Mean Percentage	**27.65**	
3	**Treatment of Sucker:**		
	i) Amritpani	6	2.00
	ii) Panchagavya	9	3.00
	Mean Percentage	**2.50**	
4	**Selection of Suitable Soil/Site**		
	i) Plain	17	5.70
	ii) Moderate slope	249	83.00
	iii) Hill	187	62.70
	Mean Percentage	**50.46**	
5	**Land preparation:**		
	i) Raised beds (20-30 cm high & 150 cm wide)	58	19.30
	ii) Trenches of 20 ×30 cm across the slope (Maybe dug above after every 3 rows)	248	82.70
	Mean Percentage	**51.00**	
6	**Times of Planting:**		
	i) April - May	228	76.00
	ii) June – August	0	0
	Mean Percentage	**38.00**	
7	**Spacing:**		
	i) Single row system 75 × 75 cm	236	78.70
	ii) Double row system 60 ×90 ×60 cm	64	21.30
	iii) High density planting 35 ×75 × 35 cm	0	0
	Mean Percentage	**33.33**	
8	**Fertilisers:**		
	i) F.Y.M: 25 tons/ha	178	59.30
	ii) Urea: 36 g/plant	156	52.00
	iii) S.S.P: 25 g/ plant	32	10.70
	iv) M.O.P: 75 g/plant	0	0
	v) Micro Nutrients	0	0
	Mean Percentage	**24.40**	
9	**Irrigation:**		
	i) Sprinkler irrigation	11	3.70
	ii) Surface and Sub-irrigation	17	5.70
	iii) Rainfed	300	100.0
	iv) Irrigated	0	0
	Mean Percentage	**27.35**	
10	**Weeding and hoeing operations:**		
	i) 2 times	239	79.70
	ii) 4times	61	20.30
	Mean Percentage	**50.00**	
11	**Weed control:**		
	i) Hand weeding	300	100.0
	ii) Mechanical weeding	16	5.30

	iii) Chemical weeding	98	32.70
	Mean Percentage	**46.00**	
12	**Pest and disease management:** a) Mealy bug wilt: (dipping of planting materials in 0.02 – 0.04% Ekatox before planting and Thimat 10 gm @ 17.5 kg/ha after planting)	0	0
	b) Leaf rot, Base rot, Fruit rot, Black rot or Soft rot, Heart rot, Steam rot and Leaf spot etc.		
	i) Good drainage	51	17.00
	ii) Healthy planting materials	300	100.0
	iii) Spray of Defoliation or Captain	0	0
	Mean Percentage	**29.25**	
13	**Harvesting:** i) Green but mature for the local market	240	80.00
	ii) 75-80% maturity for distant market	56	18.70
	iii) 1/2 – 3/4 yellow colour for embankment	18	6.00
	Mean Percentage	**34.90**	
14	**Yield:** i) 50-80 tonnes/hactare	91	30.30
15	**Aftercare of ratoon crop:** i) Desuckering	212	70.70
	ii) Fertilization and earthing up after desuckering	26	8.70
	Mean Percentage	**39.70**	
16	**Post-harvest management:** i) Cleaning	84	28.00
	ii) Pre-cooling	18	6.00
	iii) Drying	15	5.00
	Mean Percentage	**13.00**	
17	**Grading:** Size, Shape Maturity and free from diseases and blemishes	282	94.00
18	**Packaging and transport:** i) Jute sack/ bamboo basket/ crates/ line with paddy straw etc.	300	100.0
	ii) Transport by heat load/cart load/lorries/tractor	300	100.0
	Mean Percentage	**100.0**	
19	**Storage:** i) Ordinary	300	100.0
	ii) Cold Storage	0	0
	iii) Ethereal treatment of uniform ripening	0	0
	Mean Percentage	**33.33**	
20	**Processing:** **(**syrup, juice, jam**)**	87	29.00

Table 2. Over all extent of adoption pineapple cultivation practices

Sl No	Category	Frequency	Percentage
1	Low	90	37.00
2	Medium	184	45.67
3	High	26	17.33
	Total	**300**	**100.0**

CONCLUSION

From the findings, it could be concluded that majority of the respondents had medium level followed by low and high levels of adoption of recommended pineapple cultivation practices. The study suggests that government agencies, extension agencies, and other institutions provide more skill-oriented training and awareness programs specifically for pineapple growers in the area. This can help to boost the confidence of these growers and encourage them to adopt the practices, which could increase the current level of adoption.

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