International Journal of Plant & Soil Science

34(23): 594-600, 2022; Article no.IJPSS.92815
ISSN: 2320-7035

Extent of Adoption of Recommended Potato Production Technologies in Meghalaya

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/IJPSS/2022/v34i232465

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/92815

Original Research Article

Received 05 August 2022
Accepted 10 October 2022
Published 12 October 2022

ABSTRACT

Improved crop technologies have a critical role in increasing crop yield and farmers' income. The present study was undertaken to analyze the adoption of recommended potato technologies in East Khasi Hills district of Meghalaya. The study revealed that majority of farmers adopted recommended technologies like improved varieties, seed preparation, maintenance of spacing, FYM application, earthing up, weeding, planting and harvesting times. However, there was poor adoption of technologies like land preparation, quality seeds, seed tuber treatment, seed replacement rate and nutrient management. Poor adoption of these technologies may be the reason for the low potato yield in the study areas. The study also revealed that majority of farmers had a medium level of adoption. Therefore, farmers should be encouraged to adopt these technologies and extension activities like training, demonstrations, etc. should be provided to enhance their knowledge and skills.

Keywords: Extent of adoption; production technologies; potato; Meghalaya.

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1. INTRODUCTION

Potato (*Solanum tuberosum* L.) is the world's and India's most important vegetable crop. It accounts for approximately a third of the total vegetable production in India [1]. It is the world's third most important crop overall, after rice and wheat [2]. In 2008, the FAO identified potato as the crop to address future global food security. In Meghalaya, it is the second most important crop after rice, and it is well integrated into the food patterns of the local people and in their cropping system [3]. During 2019-20, the potato production (Table 1) in the state was about 1.87 lakh tons from an area of about 19 thousand hectares, with the productivity of about 10 t/ha, which is far below the national average of about 23 t/ha, during the same period. The compound annual growth rate of area, production and productivity in the state was lower than the national average [4]. Thus, there is a great scope in increasing the potato productivity in the state. Scientists from ICAR-Central Potato Research Institute, India, estimated that at present level of farm management practices, India harvests just 42-45 percent of the achievable potato yield, which could be raised to 80 percent with recent advanced technologies [5].

Presently in Meghalaya, potatoes are imported from other states like West Bengal, Assam, Punjab and Uttar Pradesh during the months of October to May every year [6]. The demand is expected to increase in the future with the increase in the population in the state. Thus, it is needed to increase the productivity of potato in the state by the dissemination and adoption of the latest potato technologies. The low potato yield in the state could be attributed to many factors. However, there is a dearth of information regarding the adoption of improved potato technologies in the state. Moreover, adoption studies help determine research goals, improve agricultural research, extension services, and investment in new technology. Based on the aforementioned background, the present study attempted to analyse the extent of adoption of recommended practices by potato growers in Meghalaya. The findings of the study will be very helpful for the state government, the extension agencies, and the research institute to plan and implement the strategies for increasing and sustaining potato production in the state.

2. MATERIALS AND METHODS

A descriptive research design was used for the present study. The study was based on the data collected from 120 potato growers in the East Khasi Hills district, 60 each from Mylliem and Mawynrew C&RD blocks. The East Khasi Hills district was purposefully selected since it is the largest potato producing district in Meghalaya, which contributed about 67.00 percent of total production and about 63.50 percent of total potato area in the state. The data was collected by interviewing the respondents using a pre-structured interview schedule, which consisted of both open-ended and closed-ended questions, during 2022. For this study, twenty important potato technologies (Table 2) recommended for potato cultivation in the state were selected by discussions with the experts. The package of practices was obtained from the Central Potato Research Station, Shillong and the Department of Agriculture, Government of Meghalaya. To study the extent of adoption of these selected improved technologies, simple descriptive statistics like frequency

Table 1. District-wise potato area, production and yield in Meghalaya

Districts	Area (ha)	%	Production (t)	%	Yield (t/ha)
East Khasi Hills	11963	63.15	124902	66.67	10.44
West Khasi Hills	3797	20.04	27805	14.84	7.32
South West Khasi Hills	2069	10.92	26446	14.12	12.78
West Garo Hills	370	1.95	2798	1.49	7.56
South West Garo Hills	232	1.22	2144	1.14	9.24
West Jaintia Hills	196	1.03	974	0.52	4.97
East Garo Hills	87	0.46	688	0.37	7.91
South Garo Hills	72	0.38	521	0.28	7.24
North Garo Hills	62	0.33	500	0.27	8.06
East Jaintia Hills	57	0.30	332	0.18	5.82
Ri Bhoi	38	0.20	238	0.13	6.26
Total	**18943**	**100**	**187348**	**100.**	**9.89**

Source: Directorate of Economics and Statistics (2022) [7]

and percentage were used. The extent of adoption in this study is the percentage of famers that adopted the selected recommended technologies. The level of adoption of each respondent was analysed using the Adoption Index (AI) based on the total number of recommended technologies adopted by each respondent farmer, which was calculated by the following formula:

$$\text{AI} = \frac{\text{Total number of technologies adopted}}{\text{Total number of selected technologies}} \text{X } 100$$

Subsequently, based on AI, all respondent farmers were categorized into three categories using sample mean ($\bar{x}$) and standard deviation (σ), *viz.*, low ($<\bar{x} - \sigma$), medium (between $\bar{x} \pm \sigma$) and high ($>\bar{x} + \sigma$) level of adoption.

3. RESULTS AND DISCUSSION

3.1 Extent of Adoption of Improved Potato Technologies in Meghalaya

Adoption of recommended technologies is very important to improve and sustain agricultural production. The extent of adoption of 20 recommended potato technologies by farmers in Meghalaya was analysed and presented in Table 2.

Table 2. Extent of adoption of recommended potato production technologies

Improved production technologies		Mylliem (n=60)		Mawkynrew (n=60)		Overall (N=120)	
		f	%	f	%	f	%
1.	Land preparation	36	60.00	7	11.67	43	35.83
2.	Use of optimum seed rate						
	• <25 q/ha	32	53.33	17	28.33	49	40.83
	• 25-35 q/ha (recommended)	25	41.67	39	65.00	64	53.33
	• >35 q/ha	3	5.00	4	6.67	7	5.83
3.	Use of improved varieties	53	88.33	55	91.67	108	90.00
4.	Use of quality seeds	6	10.00	7	11.67	13	10.83
5.	Seed preparation	47	78.33	52	86.67	99	82.50
6.	Use of potato seed tubers						
	• Whole	7	11.67	6	10.00	13	10.83
	• Cut + treated	24	40.00	20	33.33	44	36.67
	• Not followed	29	48.33	34	56.67	63	52.50
7.	Seed replacement (≤4 years)	7	11.67	5	8.33	12	10.00
8.	Maintenance of row-to-row distance						
	• <40 cm	10	16.67	14	23.33	24	20.00
	• 40-60 cm (recommended)	50	83.33	46	76.67	96	80.00
	• >60 cm	0	0.00	0	0.00	0	0.00
9.	Maintenance of plant-to-plant distance						
	• <15 cm	5	8.33	8	13.33	13	10.83
	• 15-25 cm (recommended)	55	91.67	52	86.67	107	89.17
	• >25 cm	0	0.00	0	0.00	0	0.00
10.	First dose of N fertilizer						
	• <60 kg/ha	2	3.33	5	8.33	7	5.83
	• 60-80 kg/ha (recommended)	9	15.00	8	13.33	17	14.17
	• >80 kg/ha	49	81.67	47	78.33	96	80.00
	• No application	0	0.00	0	0.00	0	0.00
11.	Second dose of N fertilizer						
	• <25 kg/ha	5	8.33	12	20.00	17	14.17
	• 25-40 kg/ha (recommended)	27	45.00	24	40.00	51	42.50
	• >40 kg/ha	14	23.33	9	15.00	23	19.17
	• No application	14	23.33	15	25.00	29	24.17

Improved production technologies		Mylliem (n=60)		Mawkynrew (n=60)		Overall (N=120)	
		f	%	f	%	f	%
12.	Phosphatic fertilizer						
	• <100 kg/ha	7	11.67	11	18.33	18	15.00
	• 100-120 kg/ha (recommended)	28	46.67	24	40.00	52	43.33
	• >120 kg P2O5/ha	17	28.33	15	25.00	32	26.67
	• No application	8	13.33	10	16.67	18	15.00
13.	Potash fertilizer						
	• <50 kg/ha	7	11.67	3	5.00	10	8.33
	• 50-60 kg/ha (recommended)	33	55.00	36	60.00	69	57.50
	• >60 kg K2O/ha	10	16.67	6	10.00	16	13.33
	• No application	10	16.67	15	25.00	25	20.83
14.	FYM application						
	• <10	16	26.67	13	21.67	29	24.17
	• 10-20t/ha (recommended)	44	73.33	43	71.67	87	72.50
	• >20	0	0.00	2	3.33	2	1.67
	• No Application	0	0	2	3.33	2	1.67
15.	Planting time	60	100.00	60	100.00	120	100.00
16.	Irrigation management	0	0.00	0	0.00	0	0.00
17.	Late blight management	54	90.00	52	86.67	106	88.33
18.	Earthing up	60	100.00	60	100.00	120	100.00
19.	Weeding	56	93.33	55	91.67	111	92.50
20.	Harvesting time	60	100.0	60	100.00	120	100.00

**f=Frequency of respondents*

Adoption of land preparation and management of spacing: For land preparation, it is recommended that the field should be thoroughly ploughed to obtain a good tilth. The ridge and furrow method is suitable for potato planting in hilly areas. It is important to make the furrows and ridges against the slope to avoid soil erosion, keeping 40-60 cm distances between the rows. The seed tubers should be placed in furrows, keeping 20-25 cm distance between tubers. It could be observed from the table that in the study areas, few farmers (35.83%) prepared their fields as recommended. The recommended practice was followed by the majority (60.00%) of farmers in Mylliem block but only by about 11.67% of farmers in Mawkynrew block. Overall, the majority of farmers followed the recommended row to row and plant to plant spacing. Umdor et al. [8] and Singh et al. [9] also found that the majority of potato growers followed the management of spacing.

Adoption of seed-related practices: Farmers are advised to acquire seeds of improved potato varieties from reputable sources. Due to the rapid degeneration of potato seed tubers, it is generally recommended that they be replaced every three to four years. In general, planting 25–35 q/ha of properly sprouted seed tubers is advised. It is recommended to use whole seeds, and if tubers are cut, they should be chemically treated. The study revealed that the majority of farmers in both blocks adopted the improved potato varieties. Overall, a large number of farmers (90.00%) adopted the improved potato varieties. However, only about 10.83% of farmers used quality/certified seeds. Seed preparation for good sprouting was followed by the majority of farmers (82.50%) in both blocks. In terms of seed rate, the findings revealed that 53.33 percent of farmers used the recommended seed rate of 25-35 q/ha. A significant number of farmers (~41.00%) used a seed rate lower than the recommended rate. This could be because many farmers still used cut potato seeds for planting. The findings found that, on an average, only 10.83 percent always used whole seed tubers, 36.67 percent treated the seeds cut, and the majority of farmers (52.50%) did not treat the seeds after cutting. Only 10.00 percent of respondents used the recommended seed replacement rate. The average seed

replacement rate in the study area was about 13 years. Many farmers reported that they had used the same seeds for several years, and some of them had not even changed the seeds of some varieties since they started planting them. Singh et al. [9] and Singh et al. [10] also conducted similar studies on the adoption of potato technologies and found similar results with respect to the adoption of seed-related practices.

Adoption of nutrient management practices: Based on the type of soil and purpose of production of potato (ware, processing and seed) in Meghalaya, it is recommended to apply 10-20 t/ha of FYM, 85-120 kg N/ha, 100-120 kg P2O5/ha and 50-60 kg K2O/ha. The study revealed that the extent of adoption of the recommended FYM application was high in both blocks. Overall, 72.50 percent of respondents adopted FYM application. There was poor adoption of the first dose of N fertilizer, as only 14.17 percent of the farmers adopted the recommended dose and 80 percent applied more than what was recommended. The average first N fertilizer dose was 109.44 kg N/Ha, as against the recommended dose of 60-80 kg N/ha. With regards to the second dose, about 42.50 farmers adopted the recommended dose. Many farmers (24.17%) did not apply the second dose of N fertilizer.

In terms of phosphatic fertilizer, 43.33 percent of farmers followed the recommended dose. About 27.00 percent of farmers applied more than the recommended dose. The average amount of phosphatic fertilizer was 98.64 kg/ha. There was good adoption of potash fertilizer, in which 57.50 percent of farmers adopted the recommended dose. However, a significant number of farmers (20.83%) did not apply the potash fertilizer. The poor adoption of balanced fertilizer dose is a serious issue in the study areas. Farmers need to be made aware of the environmental effects of inorganic chemicals and training should be imparted on nutrient management of potato. Multiple researchers, Singh et al. [11], Peer et al. [12] and Singh et al. [10] conducted similar studies and found that there was low adoption of the recommended fertilizer dose. In contrast with the finding, Singh et al. [9] found that majority of farmers adopted the recommended fertilizer dose.

Adoption of planting and harvesting time: In the study areas, potato is planted in two seasons in a year, i.e., the summer season and the autumn season. In summer season majority of farmers started planting during the first week of March, while harvesting was done during June-July. Autumn potatoes are planted from August to September and harvested in November and December. All the respondents followed the recommended planting and harvesting times. However, some farmers intentionally delayed harvesting the summer till September and October to get higher market prices. A similar finding was reported by Umdor et al. [8] while conducting a similar study in Meghalaya.

Adoption of management of late blight and irrigation: Late blight was the major disease in the study areas, especially in autumn crop. Farmers reported loss ranging from 10-50 percent from this disease alone. Late blight management was taken seriously by the farmers, with majority of them (88.33%) followed the recommended practices. During summer, farmers sprayed fungicides only two to three times, and for the autumn crop, farmers generally sprayed about 10–12 times using the recommended fungicides. Khalil et al. [13] and Singh et al. [10] also observed similar results in their studies. Irrigation is very important for increasing the yield of the crop, especially for autumn crops. However, none of the respondents applied irrigation, and they depended totally on rain for water. In contrast, Singh et al. [9] found that the majority of farmers adopted recommended irrigation practice in Uttar Pradesh.

Adoption of intercultural operations: Intercultural operations like weeding and earthing up are important to loosen the soil and destroy weeds to increase productivity. The earthing up operation was followed by all the respondents, and weeding was followed by 92.50 percent of the respondents. Earthing up and weeding were mostly done manually in the study areas.

3.2 Level of Adoption of Farmers

Fig. 1 shows the number of technologies adopted by farmers in the study areas. On an average, farmers adopted about 13 improved technologies out of 20 technologies. The studies revealed that none of the farmers adopted all the technologies. The minimum number of technologies adopted was 9 and the maximum was 17. About 24.17 percent used 13 technologies, 20.83 percent used 12, and 17.50 percent used 14. Based on the number of technologies adopted by farmers, an adoption index was calculated to categorise farmers (Table 3). The table revealed that the majority (62.50%) of farmers have medium level

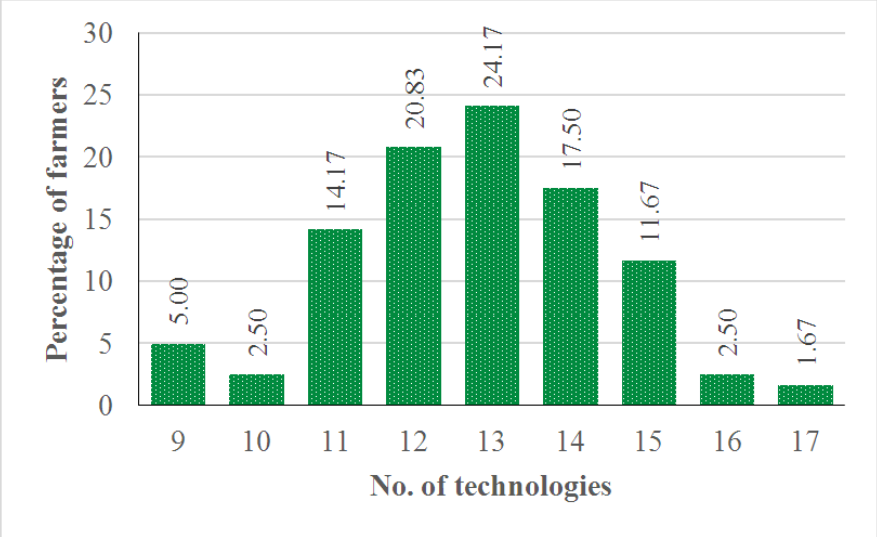

Fig. 1. Distribution of number of technologies adopted by farmers

of adoption, followed by low level (21.67%) and 15.83 percent have high level of adoption. Multiple researchers Patel et al. [14], Mishra et al. [15], Uikey et al. [16] and Mane et al. [17] found similar results in their studies on adoption level of potato technologies by growers.

Table 3. Distribution of farmers according to their level of adoption (N=120)

Adoption level	f	%
Low level	26	21.67
Medium level	75	62.50
High level	19	15.83

4. CONCLUSION

This study provides important insights on the extent of adoption of recommended potato technologies in Meghalaya. The results revealed that the majority of farmers had a medium level of adoption and the extent of adoption of some technologies like land preparation, quality seeds, seed tuber treatment, seed replacement rate, and nutrient management was poor. These technologies are important for increasing productivity and should be adopted by farmers. Therefore, it is needed to enhance the knowledge and skills of the farmers about these technologies to increase productivity and the farmer's income.'

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/92815