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Level of Technology Adoption in Groundnut (*Arachis hypogeae L.*) Production: A Case Study in Batticaloa District

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ABSTRACT

Groundnut is a major commercial crop cultivated in Sri Lanka, especially in the dry zone depending on the monsoon seasons. However, groundnut cultivation has been significantly affected by contemporary challenges, such as irrigation, climate change, methods of land preparation and selection of good seeds, which require adoption of new technologies. Especially, seed production aspects for groundnut cultivation requires a higher attention to maintain the sustainability and cost-efficiency of the process. Nevertheless, farmers are reluctant in utilizing new technology, considering their dependency on traditional methods passed through previous generations. Therefore, the current study was conducted to determine the knowledge level of farmers on technology adoption in groundnut production. A total of one hundred farmers from Eravur Pattu DS division in Batticaloa district were recruited for the current study, based on the stratified random sampling technique. An interviewer administrated pre-tested structured questionnaire was used for data collection. Descriptive analysis techniques were used to summarize the socio-demographic data and the cultivation practices among the farmers. The Chi-square test of association was used identify the significant driving factors on the level of technology adoption by farmers for groundnut seed production. It was noted that around 52% of the farmers were characterized with a moderate level of technology adoption, followed by 37% of farmers denoting a higher technology adoption level in groundnut production. According to the Chi-square statistics, the technology adoption level in groundnut seed production among the studied farmers denoted significant associations with age ($p=0.049$), education level ($p=0.015$), monthly income ($p=0.047$), farming experience ($p=0.005$), and farming extent ($p=0.006$). Provision of more training programmes on technology adoption for groundnut farming, extension services and insurance schemes are important to promote the technology adoption among farmers for groundnut seed production.

KEYWORDS: Groundnut, Technology adoption, Batticaloa

Introduction

The need for evolving transformation of the agricultural sector is driven by increasing agricultural productivity and has become decisive in the commercial-oriented sector, worldwide.

At present, many countries in the world have achieved higher agricultural production levels through technology adoption, leading to a transformative era of agriculture (Abay et al., 2018; Ugochukwu and Phillips, 2018). As per Loevinsohn et al. (2012), adoption is defined as the incorporation of innovative technologies into prevailing practices. Technology plays a key role as a tool to transform the structure of any sector. Growing concerns on the adoption and commercialization of existing and new agricultural technologies in countries all around the world to achieve self-sufficiency in food cannot be unnoticed (Ugochukwu and Phillips, 2018). Despite significant investments in agricultural technologies by governments and various development partners, technology adoption by farmers remains low in many countries. The situation with groundnut seed production in Sri Lanka also remains the same.

Groundnut (*Arachis hypogaea L.*), also known as peanut, earthnut, monkey nut or goober is a self-pollinating, indeterminate, annual herbaceous legume crop (Adinya et al., 2010). It is widely grown in the tropical and subtropical regions, being important to both smallholders and large commercial producers. It is classified as both grain legume and as an oil crop due to its high oil content. Groundnut is a major oil crop cultivated traditionally in Sri Lanka, under a system of subsistence farming mainly in highlands, dry and intermediate zones and it is one of the major oil crops grown in the Batticaloa district. Consumer preference for groundnut is also high in this district. The groundnut cultivation during the *'Maha*' season in 2016 reported an extent of 486 hectares, resulting in a total production of 464 Mt. During the *'Yala'* 2016, the extent of cultivation was only 480 hectares, and the production was 282 Mt. In the Batticaloa district, groundnut is grown mainly in Karadiyanaru, Marapalam and Mavaliyar areas (Central Bank, 2017).

Farmers prefer groundnut over other crops because of its market demand, easy cultivability, minimum fertilizer requirement, less requirement of irrigation and less or no impact of pest and diseases, except few diseases occurring during *Maha* season due to high rainfall and relative humidity. Groundnut production during *Maha* season always exceeds the *Yala* production, since groundnut cultivation is mainly carried out using rain-fed irrigation. Only a less number of farmers cultivate groundnut using artificial irrigation.

Groundnut cultivation is influenced by a variety of limiting factors such as land, labour and fertilizer availability, availability of good quality planting materials, pest and disease incidence, proper post-harvest techniques, availability of funds and appropriate storage facilities (Idoko and Sabo, 2014). However, wide use of low yielding, long-term local cultivars and non-availability of quality seeds of improved cultivars are the major constraints in Sri Lanka, and the Eastern Province is not an exception. In particular, due to erratic rainfall and frequent drought conditions experienced during the crop growth period, groundnut yields are generally low and unstable (John et al., 2011). Drought stress during reproductive stages like flowering and pod filling, is crucial for yield in groundnut and this reduction of crop yield depends on groundnut varieties (Shinde and Laware, 2010). Some tolerant genotypes are able to give better yields considerably, due to physiological and biochemical changes that were triggered during drought stress (Ratnakumar and Vadez, 2011).

There are significant genotypic variations in response to drought and their tolerance levels in groundnut (Azevedo Neto et al., 2010). Ultimately, farmers gain low yields due to the aforementioned factors.

Faced with the current threats in different areas, groundnut farmers have failed to increase their production, due to low levels of adoption of improved groundnut production technologies. In the case of increasing agricultural production while overcoming the negativities, technology adoption plays a major role. Groundnut cultivation has been significantly affected by contemporary challenges, such as irrigation, climate change, methods of land preparation and selection of quality seeds, which require adaptation of new technology. Today, the importance of introducing new agricultural techniques to groundnut farmers is of great interest to agronomists, sociologists and extensionists in the country. It is alleged that operative ways to enhance productivity are governed by the extensive use of novel agricultural technologies. Groundnut growers can increase yields by adopting new farming techniques. The introduction of improved agricultural technologies has positive effects on productivity, food security, nutritional status and household income etc. (Bozayeh et al., 2017; Konja et al., 2019; Kumar and Quisumbing, 2011). Therefore, the introduction and adoption of improved groundnut production technologies could be used as a mean of reducing poverty in Sri Lankan groundnut farmers.

Nevertheless, farmers are reluctant to adopt novel technologies in groundnut production. They still engage in conventional practices in groundnut production, which is a significant problem. Therefore, this study attempted to evaluate the level of technology adoption in groundnut production among farmers in Batticaloa District, along with the factors influencing the technology adoption for groundnut seed production in the study area.

Methodology

Study Area

This study was conducted within the Batticaloa District, which is situated in the Eastern province. The district has been divided into 14 Divisional Secretariat (DS), and 345 Grama Niladhari (GN) divisions for administrative purposes. The main professions of the people of the District are farming, agriculture and fisheries. The total population of Batticaloa District is approximately 587,684, out of which 34,027 are involved in agriculture. This study was conducted in the Eravur Pattu DS division located within the Karadiyanaru area of the Batticaloa district (Figure 1). The Eravur Pattu DS division is one of the major groundnuts cultivating regions in the Batticaloa District, covering a total area of 634.2 Km^2. It consists of 39 GN Divisions, and 203 villages. Concerning 2015/2016 census report, the population of the Eravur Pattu DS division was 74259 and the main livelihood is agriculture (Mahusoon et al., 2018).

Based on the highest number of groundnut farmers, respondents for the survey were selected from Karadiyanaru Agrarian Service Centre, which is under the Eravur Pattu DS Division. Karadiyanaru Agrarian Service Centre includes Karadiyanaru, Marapalam 185 C, Periyapullumali, Koppavelli, and Rugam GN Divisions.

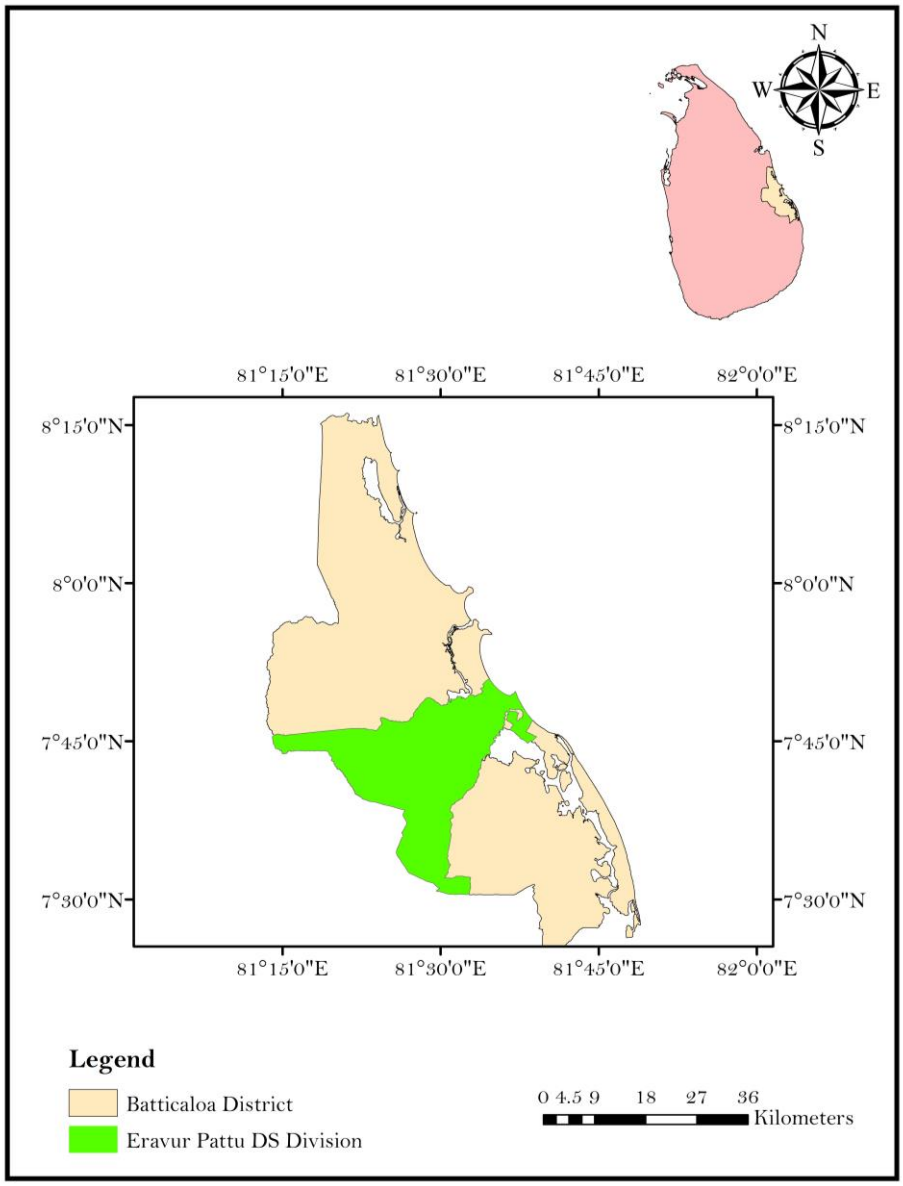

Figure 1: Location of Eravur Pattu DS Division

Data Collection

This study was conducted using both primary and secondary data. Primary data were collected from 100 groundnut farmers in the Karadiyanaru, Eravur Pattu DS division. A stratified random sampling technique was used for selection of farmers. Table 1 shows the number of GN divisions and the relevant number of groundnut farmers recruited for the study from each division.

Table 1: Distribution of Respondents by Groundnut production Area

Area	Frequency	Percentage
1. Karadiyanaru	25	25%
2. Mavadichenai	17	17%
3. Mavadiyodai	34	34%
4. Rajapuram	10	10%
5. Sinnapullumalai	06	06%
6. Vadichal	05	05%
7. Tharapilaveli	02	02%
8. Sarvodayanagar	01	01%
Total	100	100

Source: Field Survey Data, 2021

A Structured Questionnaire-based face-to-face interviews were conducted to collect the required data from groundnut farmers in the Eravur Pattu DS division. Prior to the original data collection, the survey instrument was pre-tested using a pilot survey in Karadiyanaru Area, Eravur Pattu DS division to assess the suitability of the prepared questionnaires. Alterations were made to enable easy recording of responses from farmers. The questionnaire aimed to collect data regarding the farmers' demographic information, the extent of cultivation (land used), type of groundnut cultivated and cultivation practices such as irrigation methods, fertilizer usage and weed controls etc. Personal Interviews were carried out with the farmers from September 2020 to January 2021 to obtain the required data about groundnut cultivation in *Yala* and *Maha* seasons.

Secondary data were gathered from different sources namely; Agrarian Service Centre, Batticaloa, Department of Agriculture, Batticaloa, Seed and Planting Material Development Centre, Karadiyanaru and Seed Certification Service, Regional Office, Karadiyanaru.

Data Analysis

The collected data were analysed using the SPSS Statistical software package (version 23). Descriptive analysis techniques were used to summarize the socio-demographic data and the cultivation practices among the farmers. Chi-square test of association was used to evaluate the association between the level of technology adoption by farmers on groundnut seed production and the socio-demographic parameters of them.

Results and Discussion

Socio-Economic Characteristics of the Groundnut Farmers

The majority of the farmers were belonging to the age group of 20 to 35 years (32%), followed by the 36 to 45 years age group (31%). Meanwhile, only 11% of the groundnut farmers were belonging to the age group of >60 years.

The average age of the farmers was 47 years (Table 2). The majority of the groundnut farmers (90%) were males, while females accounted for only 10% of the population. In terms of family members, the majority (69%) were having 4 to 5 members in their families, followed by families with <3 members (21%). Farmers who had completed only their primary education, accounted for the majority (40%), followed by the Farmers who had passed GCE O/L (34%). Meanwhile, only 26% of farmers had passed GCE A/L (Table 2).

Table 2: Descriptive Statistics of the Sample

Parameter	Category	Percentage
Age	20-35	32
	36-45	31
	46-60	26
	>60	11
Gender	Male	90
	Female	10
Family Members	1-3	21
	4-5	69
	>5	10
Education Level	Primary Education	40
	Up to Ordinary Level	34
	Up to Advanced Level	26
Farming Experience (Years)	4 to 6	16
	7 to 10	34
	11 to 15	33
	> 15	17
Occupation	Farming	78
	Government	2
	Private	13
	Self/Business	7
Cultivated Land Extent (Acres)	1 to 3	9
	4 to 6	47
	7 to 10	39
	> 10	5

Most of the farmers involved in groundnut farming had more than 10 years of farming experience (50%). Meanwhile, farmers with <6 years of experience accounted only for 16% of the study population. For most of the farmers, farming was the basic source of income (78%), followed by private occupations (13%) and self-employment (7%) as shown in Table 2. For the extent of land used for seed production, around 47% of the farmers were cultivating 4 to 6 ac, followed by another 39% of farmers cultivating 7 to 10 ac. However, a limited fraction of farmers (5%) was cultivating more than 10 ac. In case of land ownership, a higher fraction of farmers was utilizing their own land for cultivation, while a minority of farmers used both their own, and leased land.

Groundnut Cultivation in Batticaloa District

Results of the survey revealed that, farmers cultivate groundnuts in both *Yala* and *Maha* seasons. It was denoted that an individual groundnut farmer averagely cultivates around 2.0 ac and 4.4 ac during *Mah*a and *Yala,* respectively. Further, the majority (97%) of the farmers were producing their own seeds that could be used as planting materials in the following season. In situations where farmers tend to buy seeds, they preferred to purchase quality seeds from both governments and private sellers.

Farmers in the surveyed sample revealed that they practice multiple methods to irrigate their cultivation. The majority of the farmers (38%) were using hand hose to irrigate the crops. Meanwhile, a notable percentage of farmers were using ridge and furrow systems (25%) and sprinkler methods (23%) as irrigation techniques. The least number of farmers were depending on rainfall (14%) to cater for irrigation requirements.

The average cost of groundnut production in the study area is depicted in Table 3. It was identified that groundnut farmers need to incur a cost of Rs. 75200.00 averagely per acre for groundnut cultivation in the study area. Results indicated that the highest proportion (44%) of the cost was allocated for hiring labour and as wages, which implies that groundnut is a labour extensive cultivation practice.

Table 3: Average Cost of Production

Cost Item	Average Cost per acre (LKR)	Relative Percentage (%)
Labour use and wages	33000.00	44
Planting materials	17200.00	23
Fertilizers	9000.00	12
Land Preparation	5000.00	7
Agrochemicals	3000.00	4
Transportation	3000.00	4
Gypsum	2500.00	3
Other costs	2500.00	3
Total	**75200.00**	**100**

The average cost spent on planting materials by farmers was Rs. 17200.00 per ac and the cost of planting materials accounted for 23% of the total cost of production (Table 3). On average, Rs. 9000.00 per ac was allocated for fertilizer as an input for the cultivation. It was identified that the average cost of land preparation was Rs. 5000.00 per ac, while the average costs of agrochemicals and Gypsum were reported as Rs. 3000.00 per ac and 2500.00 per ac, respectively.

Major constraints faced by groundnut farmers were the inability to obtain good quality planting materials and limitations in input subsidies provided by the Department of Agriculture. Among the study population, only 50% of farmers had obtained extension services. Interestingly, all the farmers had not obtained crop insurance for groundnut cultivation.

Level of Technology Adoption in Groundnut Production

The level of technology adoption by groundnut producing farmers is shown in Figure 2. It was noted that around 52% of the farmers were characterized with a moderate level of technology adoption, followed by 37% of farmers denoting a higher technology adoption level in groundnut production.

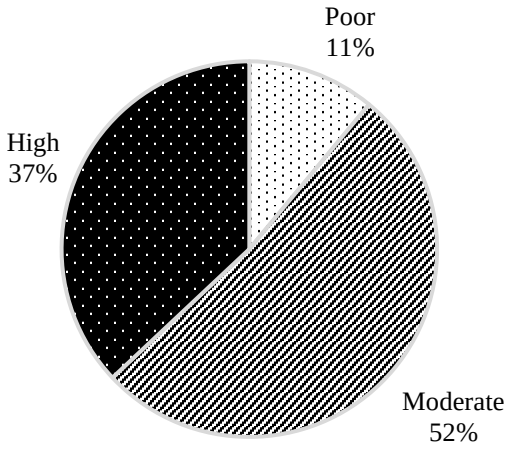

Figure 2: Technology Adoption Level among Farmers

In the case of the technology adoption, the majority of the farmers were maintaining their own seed production facilities (94%), and were using mechanical harvesting equipment (42%). Meanwhile, a notable fraction of the farmers was adopting climate-smart cultivation practices (42%), in terms of water conservation and land preparation. Further, 42% of the farmers were practising integrated approaches for weed control. However, the fraction of farmers using organic fertilizer (28%), soil and water conservation practices (28%) and proper storage facilities (25%) were relatively lower, as shown in Figure 3.

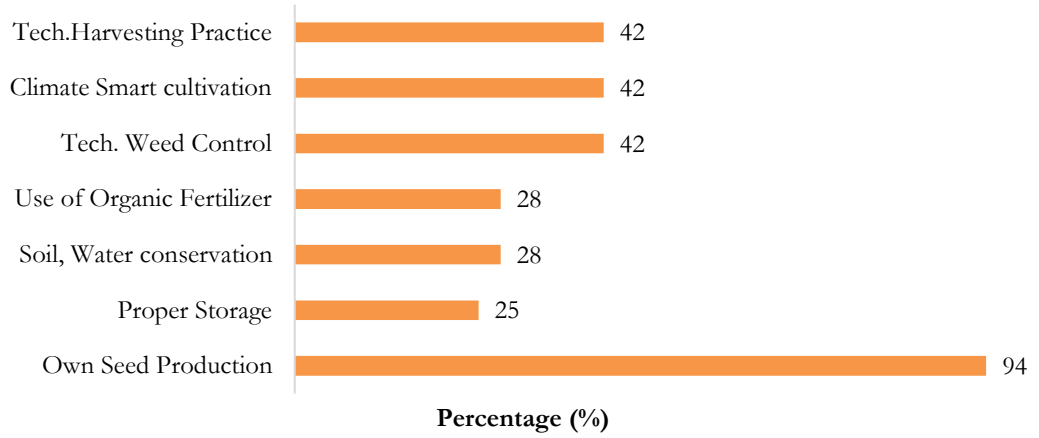

Figure 3: Percentage of Technology Distribution of Farmers

Socio-Economic Driving Factors Affecting the Technology Adoption in Groundnut Production

According to the Chi-square statistics, the technology adoption level in groundnut seed production among the studied farmers denoted significant associations with the age ($p=0.049$), whereby the young farmers were more willing to adopt the novel technologies than the old farmers. However, the gender, did not show any significant association among the technology adoption level of the studied groundnut farming community (Table 4). However, a recent study conducted in 20 districts of Uganda has reported a significant association between gender and the level of technology adoption, with emphasis on adopting improved groundnut varieties. According to the aforesaid study, female farmers have denoted a lesser level of improved variety adoption, compared to the male groundnut farmers (Tanellari et al., 2014).

In addition, the number of family members ($p=0.45$) and occupation ($p=0.23$) also did not show and significant associations among the technology adoption level of the groundnut farmers. On the other hand, the technology adoption level in groundnut production among the studied farmers denoted significant associations with education ($p=0.015$), monthly income ($p=0.047$), farming experience ($p=0.005$), and farming extent ($p=0.006$). The awareness of the groundnut farmers regarding the importance of adopting novel technologies for irrigation, pest and disease control and fertilizer application has been found to influence their level of technology adoption (Simtowe et al., 2010).

In this scenario, education is the most needed and important condition, which will motivate farmers to adopt new technologies in groundnut seed production. In case of the farming experience, more experienced farmers were willing to adopt new technologies and their acceptance levels were comparatively higher than the inexperienced farmers.

In addition, farmers with a higher monthly income were denoting relatively better levels of technology adoption, which is facilitated by their power of purchase. The negative impact of limited availability and accessibility to resources on the adoption of novel technologies has been emphasized in a recent study conducted by Tanellari et al. (2014). A similar study conducted in Malawi has highlighted that limited income of the farmers, limited accessibility to improved groundnut varieties and credit facilities, as major barriers behind the technology adoption for groundnut cultivation (Simtowe et al., 2010).

Table 4: Results of Chi-Square Test

Parameter	Category	Poor	Moderate	High	P Value
Age (in Years)	20-35	50	19	31	0.05
	36-45	41	22	38	
	46-60	59	23	18	
	>60	93	7	0	
Education	Primary	6	4	30	0.02
	O/L	12	10	12	
	A/L	8	5	13	
Family Members	1 to 3	9	5	7	0.45
	4 to 5	16	14	39	
	>5	1	0	9	
Occupation	Farming	21	12	45	0.24
	Government	1	1	0	
	Private	1	4	8	
	Self/Business	3	2	2	
Monthly Income (in Rs 1000.00)	25 - 35	6	4	29	0.05
	35 - 45	8	7	12	
	45 - 55	5	1	6	
Farming Experience (in Years)	4 to 6	2	2	12	0.01
	7 to 10	8	8	18	
	11 to 15	5	8	20	
	>15	11	1	5	
Extent (in Ac)	1 to 3	3	2	4	0.01
	4 to 6	7	11	29	
	7 to 10	11	6	22	
	>10	5	0	0	

Another study conducted in Negiria has identified lack of credit facilities, high cost of improved seed, limited technical know-how, lack of fertilizer marital status, source of information, primary occupation, age and land tenure status as significant factors that influence adoption of novel technologies and improved seeds in groundnut cultivation (Idoko & Sabo, 2014; Taru et al., 2008). The current study also agrees with the significant influence of some of the aforementioned factors such as, age, monthly income and farming extent. Therefore, enhancing the availability seeds of improved varieties, conducting more awareness and training programmes on novel technologies applicable for groundnut farming, enhancing the coverage and efficiency of extension services, provision of insurance schemes and soft loans are important to encourage the farmers towards adoption of novel technologies for groundnut seed production.

Conclusions

Findings of this study depicted that groundnut farmers incur a notably high cost, during groundnut seed production. Groundnut producers are not able to achieve the desired output, while effectively utilizing the cost they incur. In spite of considering the investments made by both government and local authorities on developing and disseminating novel agricultural production technologies, low performance indicates that the technology adoption is quite low in groundnut production. The findings of current study depicted that the majority of the groundnut farmers possess a medium level of technology adoption. Findings further emphasized that technology adoption for groundnut cultivation was significantly associated with age, education, monthly income, farming experience and cultivation extent.

At the ground level, farmers are more concerned about the economic and financial returns associated with moving into the adoption of such technologies. Therefore, dissemination of previous experience and benefits in technology adoption for groundnut seed production will act as a trigger to increase the technology adaption practices, among farmers. In addition, conducting more training programmes on technology adoption for groundnut farming, enhancing extension services and provision of insurance schemes and credit facilities for groundnut farmers are important to promote the technology adoption among farmers for groundnut seed production.

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