Australian Journal of Science and Technology

ISSN Number (2208-6404)
Volume 5; Issue 3; September 2021

Original Article

Effect of coconut (*Cocos nucifera* L.) water on growth and yield of selected potato (*Solanum tuberosum* L.) varieties in Jos, Plateau State, Nigeria

Deshi K. E*, Oko M. O, Nanbol K. K, Satdom S. M

Department of Plant Science and Biotechnology, Faculty of Natural Sciences, University of Jos, Nigeria

ABSTRACT

This research was conducted at the Botanical Garden, Bauchi Road Main Campus, University of Jos, Jos, Plateau State, Nigeria, from November 2017 to February 2018, under irrigation to investigate the effects of naturally occurring phytohormones from coconut (*Cocos nucifera* L.) water on growth and yield of selected varieties of potato (*Solanum tuberosum* L.). Experiment was carried out in a completely randomized design, with three replicates. A 3 × 3 factorial arrangement was used, consisting of three potato varieties (Caruso, Jelly, and Marabel) and three concentrations of coconut water (0 – control, 50, and 100%). Percentage establishment count, number of leaves, plant height, stem number at harvest, total number/yield of tubers formed, number/yield of ware (marketable tubers) formed, and number/yield of seed tubers formed were evaluated. Variety had significant effect in all the parameters studied. The variety Caruso was significantly ($P < 0.05$) higher for all the growth and yield parameters, while variety Jelly was lowest, except for yield of seed tubers, where Jelly was highest. Different concentrations of coconut water used were significantly ($P < 0.05$) different in all parameters assessed. About 50% and 100% concentrations of coconut water were significantly ($P < 0.05$) higher than the control (without coconut water) in growth and yield parameters except for the yield of seed tubers where control was significantly ($P < 0.05$) higher. There was a significant ($P < 0.05$) interaction of variety × coconut water concentrations for all the parameters assessed. It is, therefore, recommended that local farmers should use variety Caruso because of its high performance and coconut water should also be used to enhance yield in potato.

Keywords: Coconut water, concentrations, growth, potato and yield

Submitted: 27-07-2021, **Accepted:** 02-08-2021, **Published:** 30-09-2021

INTRODUCTION

Potato (*Solanum tuberosum* L.) is a starchy and tuberous crop from the perennial nightshade family. It ranks as the world's fourth most important food crop, after maize, rice, and wheat.[1] It is cultivated worldwide in over 100 countries throughout Africa, Asia, Australia, Europe, and North and South America.[2] In the tropics, it is grown in cool highlands, typically at elevations over 1000 m above sea level, and in the subtropics, it is grown during cooler winter, autumn, and spring seasons at mid-elevations.[3] The potato grows best in cool climates, with higher temperatures favoring foliar development over tuberization.[4-6] Over two-thirds of the global production is eaten directly by human beings with the rest being fed to animals or used to produce starch.[7]

Coconut (*Cocos nucifera* L.) water, the colorless liquid endosperm, is one of the world's most versatile natural products.[8] This refreshing beverage is consumed worldwide as it is nutritious and beneficial for health. Coconut water is traditionally used as a growth booster in plant tissue culture/micro propagation. Coconut water is commonly used in orchid tissue culture.[9] The wide applications of coconut water can be justified by its unique chemical composition of sugars, vitamins, minerals, amino acids, and phytohormones.[8] Molnar *et al*.[10] reported that coconut water contains a great amount of amino acids, organic acids, nucleic acids, several vitamins, sugars and sugar alcohols, minerals, plant hormones (auxins and cytokinins), and other unidentified substances. None of which alone is totally responsible for growth-promoting qualities. Phytohormones in coconut water include auxins,

Address for correspondence: Deshi K. E, Department of Plant Science and Biotechnology, Faculty of Natural Sciences, University of Jos, Nigeria. Phone: +2348060997792. E-mail: kdeshi@yahoo.com

various cytokinins, Gas, and ABA. Coconut water contains indole-3-acetic acid (IAA), the primary auxin in plants. IAA is a weak acid that is synthesized in the meristematic regions located at the shoot apex and subsequently transported to the root tip in plants.[11]

Phytohormones have been suggested to regulate potato growth and development as well as tuber formation.[12] Distinct hormones (auxins, cytokinins, abscisic acid [ABA], and jasmonic acid) stimulate some tuberization stages whereas GA_3 suppress them.[13,14] Gibberellins have been reported as potent inhibitors of tuber formation.[15-17] GA_3 stimulates haulm growth and delays tuber growth.[18] Some investigations report ABA stimulates tuberization while others report an adverse effect.[19] El-Antably *et al*.[20] observed stimulation of tuber formation by ABA applied to the leaves of potato plants. Furthermore, ABA was demonstrated to increase the number of tubers.[21] Adverse effects (reduction in number and yield of microtubers) of interaction of ABA and genotype have been reported.[22,23] The previous studies have shown that cytokinins and auxins can accelerate and enhance potato tuber formation.[24-26] Lomin *et al*.[27] suggested that tuber initiation can be associated with the local/temporary increase in cytokinins signaling in stolon tips. The level of endogenous cytokinins has been reported to be high during the later stage of tuber growth.[28] Kolachevskaya *et al*.[29] reported that auxin is of utmost importance for potato tuber initiation, growth and sprouting, as well as for stress resistance, particularly to biopathogens. Exogenous auxin definitely affects the rate of tuber formation, the average tuber weight, and, accordingly, the overall crop yield of potatoes of various genera, regardless of the degree of their dependence on photoperiod.

Foliar feeding is the application of nutrients, plant hormones, biostimulants, other beneficial substances, and pesticides to the leaves and stems of plants. The application of these substances during growth and development can improve the nutrient balance of crops, which, in turn, leads to increased yield and quality, greater resistance to diseases and insect pests, and improved drought tolerance.[30] To minimize the cost of crop production, the use of locally available inputs or other growth enhancing products such as coconut water should be given importance. Coconut water taken from mature coconut has potential as growth enhancer because it is rich with different nutrients, phytohormones, enzymes, and minerals.[31] Moreover, the availability of coconut water is not a problem because it can be accessed by the farmers easily. The water can be used directly on plants without any complicated and highly technical process or using a very expensive laboratory facility. Similarly, it is very easy to use by anyone even the marginal or poor and uneducated farmers. In addition, it is safe to the plants and to the consumer or the end-user. Hence, the study aims to evaluate the growth and yield of selected potato varieties treated with different concentrations of coconut water.

MATERIALS AND METHODS

Experiment Location and Plant Materials

This research work was conducted at the Botanical garden of the Department of Plant Science and Biotechnology, Bauchi Road Main Campus, University of Jos, Jos, Nigeria (latitude 09°5'N and longitude 08°53'E and altitude 1159 m above sea level), during November 2017 and February 2018, dry season. The potato varieties were obtained from National Root Crops Research Institute (NRCRI), Potato Programme, Kuru, Plateau State, Nigeria. Coconuts (*C. nucifera*) were bought from the market.

Experimental Design and Growing Conditions

The experiment was laid out in a completely randomized design, with three replicates. A 3 × 3 factorial arrangement used, consisting of three potato varieties (Caruso, Jelly, and Marabel) and three concentrations of coconut water (0 – control, 50, and 100%).

A mixture of top soil and cow dung manure in a ratio of 2:1 by volume was filled into polythene bags (7.433 cm^3), on November 6, 2017. One seed tuber (fully sprouted) was planted into each of the polythene pot containing the soil mixture, on November 8, 2017. Fertilizer (N_{15} P_{15} K_{15}) was applied in band to each plant at the rate of 100 $kgha^{-1}$ and weeding was carried out at 4 weeks after planting by hand to keep the experiment free from weeds. Plants were watered 3 times in a week initially (at 7 days after planting – [DAP]) and 4 times at the onset of flowering. In the treatments with concentrations of coconut water, these were applied as foliar sprays on plants. The control treatment was without coconut water. Plants were sprayed at 35 DAP using knapsack sprayer.

Parameters Evaluated

Along the experiment, at 42, 56, and 70 DAP, plant height and number of leaves per plant were determined. At harvest (84 days after planting), Number of stems (per plant), total number of tubers formed (per plant), total weight of tubers formed, number of ware tubers formed (saleable tubers), total weight of ware tubers formed, number of seed tubers formed, and total weight of seed tubers formed were determined.

Statistical analysis

The data collected were subjected to analysis of variance (ANOVA) by F-test and the means were compared by LSD test at 5% level of probability.[32]

RESULTS AND DISCUSSION

Effects of the Treatments

There were significant effects ($P < 0.05$) of the isolated factors (potato varieties and concentrations of coconut water) on the

plant height, number of leaves, number of stems, total number of tubers formed, total weight of tubers formed, number of ware tubers formed, number of seed tubers formed, and total weight of seed tubers formed. As for the interactions, there were significant effects ($P < 0.05$) between potato varieties and concentrations of coconut water for all evaluated parameters except for number of stems. Therefore, follow-up test was conducted.

Plant Height (cm)

There was significant ($P < 0.05$) effect of variety on mean plant height at all the sampling dates [Table 1]. From 42 to 70 DAP, variety Caruso had the highest mean plant height which was followed by variety Marabel, while variety Jelly had the lowest mean plant height and the differences were significant at $P < 0.05$ except for 12 weeks after planting. Jelly was the highest at the 12th week [Table 1]. This agrees with the findings of Razzaque and Ali[33] and Otroshy and Sruik.[34] Razzaque and Ali[33] reported that varieties differ in length of longest stem; they found the stem length of variety Heera to be (60.18 cm), Dhera (55.47 cm), Diamant (58.93 cm), Chamak (57.12 cm), and Cardinal (56.87 cm). Otroshy and Sruik[34] showed that cultivar had a significant effect on length of longest stem; cultivar Marfona produced longer stems (23.50 cm) than Frieslander and Sante whose stem length is 15.40 cm and 17.20 cm, respectively. Differences between varieties may be due to differences in their genetic composition.

Table 1: Effect of variety as affected by coconut water mean plant height (cm) and number of leaves

	Age of plants (weeks after planting)			
	6	8	10	12
	Plant height (cm)			
Treatment				
Variety				
Marabel	30.70b	42.18a	44.60b	38.76c
Jelly	29.57c	35.87c	36.10c	71.07a
Caruso	41.76a	46.49a	47.87a	47.60b
LS	*	*	*	*
$LSD_{0.05}$	0.71	0.24	1.00	0.81
Coconut water conc.				
C_0 (control)	29.31c	38.49a	38.52b	34.31b
C_1 (100%)	35.57b	43.39a	43.63a	44.74a
C_2 (50%)	37.13a	42.66a	38.98b	42.68a
LS	*	*	*	*
$LSD_{0.05}$	0.01	0.60	1.00	0.01
	Number of leaves			
Treatment				
Variety				
Marabel	28.30c	71.17b	63.69b	54.54b
Jelly	32.29b	65.33c	46.56c	42.10c
Caruso	38.06a	97.71a	67.93a	59.46a
LS	*	*	*	*
$LSD_{0.05}$	0.85	0.30	0.12	0.13
Coconut water conc.				
C_0 (control)	24.88c	46.50c	63.62b	37.83c
C_1 (100%)	35.56b	71.67a	44.89c	64.16a
C_2 (50%)	38.18a	62.66b	69.61a	54.08b
LS	*	*	*	*
$LSD_{0.05}$	0.30	0.17	0.12	0.12

The different concentrations of coconut water resulted in significantly different ($P < 0.05$) mean plant height [Table 1]. The control (0% concentration) of coconut water resulted in significantly lower mean plant height than 50% and 100% which were similar ($P < 0.05$) [Table 1]. This may be due to the presence of minerals, vitamins, and phytohormones in the coconut water which enhanced growth. Molnar *et al*.[10] reported coconut water to contain a number of amino acids, organic acids, nucleic acids, several vitamins, sugars and sugar alcohols, minerals, plant hormones (auxins and cytokinins), and other unidentified substances. The phytohormones in coconut water include auxins, various cytokinins, Gas, and ABA. GA_3 has been reported to stimulate haulm growth and delays tuber growth, the timing of application, and the concentration depends a great deal on the stage of crop growth.[18]

The interaction between different varieties and concentrations of coconut water on mean plant height is presented in Table 2,

Table 2: Interaction of variety and coconut water on mean plant height and number of leaves

Plant height (cm)			
Treatment	**Variety**		
	Marabel	**Jelly**	**Caruso**
Coconut water			
C_0 (control)	20.68c	38.79a	51.49b
C_1 (100%)	33.36a	30.15c	52.74a
C_2 (50%)	28.21b	30.35b	43.19c
LS	*	*	*
$LSD_{0.05}$		0.03	
Number of leaves			
Treatment	**Variety**		
	Marabel	**Jelly**	**Caruso**
Coconut water conc.			
C_0 (control)	26.16c	23.10b	39.39b
C_1 (100%)	54.03a	37.53a	50.69a
C_2 (50%)	28.21b	38.68a	40.79a
LS	*	*	*
$LSD_{0.05}$		0.98	

with variety Marabel ×100% concentration of coconut water which resulted in significantly higher mean plant height (33.36 cm). The variety Jelly x control resulted in significantly higher mean plant height (38.79 cm), while variety Caruso x 100% of coconut water resulted in significantly ($P < 0.05$) higher mean plant height (52.74 cm) [Table 2]. The 100% concentration of coconut water gave the highest plant height. The present results are in agreement with those obtained by El-Areiny *et al*.[35] who reported that there is a direct proportionate relationship between the tested concentrations of cytokinin (CPPU) and the traits under study during 2016 and 2017 seasons. Foliar application of CPPU at the highest level (0.12 mM) recorded the highest average values of the tested traits. The tested traits include number of stems/plant, number of leaves/plant, plant height, plant fresh, and dry weights. Cytokinin (CPPU) has been reported to promote cell division, cell enlargement, and delay senescence.[36]

Number of Leaves

Varieties resulted in significantly different ($P < 0.05$) mean number of leaves at all the sampling dates [Table 1]. At 42 DAP, variety Caruso had a significantly higher mean number of leaves while variety Marabel was lowest. However, at 70 and 84 DAP, variety Caruso had the highest mean number of leaves, this was followed by variety Marabel, in contrast, variety Jelly had the lowest mean number of leaves and the differences were significant at $P < 0.05$ [Table 1]. Genetic differences may account for the differences in the number of leaves.

The different concentrations of coconut water resulted in a significantly different ($P < 0.05$) mean number of leaves at all the sampling dates [Table 1]. A 50% concentration of coconut water resulted in a significantly higher mean number of leaves at 42 and 70 DAP, this was followed by 100% concentration while the control had the least. However, at 56 and 84 DAP, 100% concentration was significantly higher than the other concentrations [Table 1]. The presence of phytohormones and other substances in coconut water may be responsible for the increased number of leaves. GA_3 has been reported to stimulate haulm growth.[18] Sillu *et al*.[37] attributed increase in vegetative characters to be due to enhanced cell division and quick cell multiplication.

Interaction between varieties and different concentrations of coconut water is presented in Table 2. Variety Marabel × 100% concentration of coconut water resulted in significantly higher mean number of leaves. While varieties Jelly and Caruso, 100% and 50% concentrations resulted in similar and significantly ($P < 0.05$) higher mean number of leaves than the control [Table 2]. This result agrees with those of El-Areiny *et al*.[35] who observed a proportionate increase in number of leaves with increased concentration of cytokinin. El-Shraiy and Hegazi[38] reported that foliar application of CPPU significantly improved most of plant growth parameters of potato plants. The highest values of plant height, leaf numbers, branches number, and fresh and dry weights were obtained by CPPU at 20 ppm. The major physiological feature of cytokinins is promoting cell division and elongation.[39] This explains the stimulation effect of coconut water at 50 and 100%.

Stem Number at Harvest

The effects of variety and coconut water concentrations on the mean stem number at harvest were significant ($P < 0.05$). Variety Caruso resulted in a significantly higher mean stem number at harvest while variety Marabel had the least. Main stems have been reported to be highly cultivar specific.[7,34] Regarding the concentrations of coconut water, 100% concentration resulted in a lower mean stem number compared to the 0% and 50% concentrations. This result does not agree with the findings of El-Areiny *et al*.[35] who found increased stem number with increased concentration of cytokinin. The reason for lower stem with higher concentration of coconut water is not quite clear.

Total Number of Tubers Formed/Plant

The varieties resulted in a significantly different ($P < 0.05$) mean total number of tubers formed [Table 3]. Variety Caruso had significantly higher total mean number of tubers formed (30.79) than varieties Jelly and Marabel which had a similar total mean number of tubers formed (12.48 and 12.15, respectively) [Table 3]. The variation may be due to the genetic composition of the varieties used. Werner and Peloquin[40] reported the number of tubers produced to be affected by stem population, variety, and environmental factors such as temperature, moisture, and nutrient supply.

The different concentrations of coconut water resulted in significantly different ($P < 0.05$) mean total number of tubers formed [Table 3]. About 50% concentration of coconut water resulted in significantly higher mean total number of tubers formed (23.11) this was followed by 100% concentration (20.44) while the control (0%) had the least (13.51) [Table 3]. This may be due to the chemical composition of coconut water which includes the presence of phytohormones. Bai *et al*.[41] reported that cytokinins can promote potato tuberization and are considered to be tuber inducing factors. Peng *et al*.[42] found microtubers formed in treatments of 6-BA and CCC. It has been reported that GA_3 stimulates haulm growth and delays tuber growth, Alexopoulos *et al*.[43] found foliar application of GA_3 both at 30 and 60 days after transplanting caused a significant increase in the number of tubers per plant.

Interaction between varieties and different concentrations of coconut water on mean total number of tubers formed is presented on Table 4. With varieties Marabel and Jelly, 50% concentration of coconut water resulted in a significantly ($P < 0.05$) higher mean number of ware tubers, while the control had the least. However, with variety Caruso, 50% concentration

Table 3: Effect of variety as affected by coconut water on mean total number of tubers, total weight of tubers (g), number of ware tubers, weight of ware tubers (g), number of seed tubers, and weight of seed tubers formed (g)

Treatments	Stem number at harvest	Total no. of tubers formed/plant	Total weight of tubers formed/ plant (g)	No. of ware tubers formed/plant	Weight of ware tubers formed/ plant (g)	No. of seed tubers formed/plant	Weight of seed tubers formed/ plant (g)
Variety							
Marabel	1.86c	12.15b	125.29c	3.65c	57.12b	8.50b	68.17b
Jelly	1.93b	12.48b	139.59b	4.56b	35.86c	7.93c	63.73c
Caruso	2.40a	30.79a	170.49a	9.89a	94.48a	20.91a	76.01a
LS	*	*	*	*	*	*	*
$LSD_{0.05}$	0.01	1.77	1.01	0.76	0.98	1.78	0.75
Coconut water							
C_1 (100%)	1.77c	20.44b	125.78b	9.57c	44.24b	16.54a	81.54b
C_2 (50%)	2.10a	23.11a	136.73a	13.33a	66.70a	9.47 c	70.03c
C_0 (control)	2.10a	13.51c	123.94c	3.90b	16.94c	13.27b	107.00a
LS	*	*	*	*	*	*	*
$LSD_{0.05}$	0.11	1.77	1.01	0.76	0.75	1`.78	0.75
Interaction							
Variety × coconut water	*	*	*	*	*	*	*

was highest followed by the control while 100% was least and the difference was significant at $P < 0.05$ [Table 4].

Total Weight of Tubers Formed/Plant (g)

The varieties resulted in significantly different ($P < 0.05$) mean total weight of tubers formed [Table 3]. Variety Caruso had the highest mean total weight of tubers formed (170.49 g) followed by variety Jelly (139.59 g) while variety Marabel had the least mean total weight of tubers formed (125.29 g) [Table 3]. The genetic composition of the varieties may be responsible for the differences in weight.

The different concentration of coconut water resulted in significantly different ($P < 0.05$) mean total weight of tubers formed [Table 3]. About 50% concentration of coconut water resulted in significantly higher mean total weight of tubers formed (136.73 g) than 100% concentration (125.78 g) and the control (123.94 g) [Table 3]. Sillu *et al*.[37] found yield of tubers significantly affected by plant growth regulators; among different treatment of the plant growth regulators, treatment with IBA 200 ppm produced maximum yield of 8.26 kg per plot and it was at par with IBA 100 ppm, whereas, the control produced lower yield of 5.73 kg per plot. Corsini *et al*.[44] reported that tuber yields were not affected by exogenous application of BA or IAA, but were reduced by GA_3.

Interaction between varieties × coconut water concentrations on the total weight of tubers formed is presented in Table 5, with variety Marabel, 50% and 100% concentrations of coconut water resulted in a similar mean total weight of tubers which was significantly ($P < 0.05$) higher than the control. Variety Jelly ×100% concentration of coconut water resulted in significantly higher mean total weight of tubers (47.78 g) [Table 5]. While variety Caruso × 50% concentration of coconut water resulted in significantly higher mean total weight of tubers (49.90 g) [Table 5].

Number of Ware (Saleable) Tubers Formed/Plant

The varieties resulted in significantly different ($P < 0.05$) mean number of ware tubers formed/plant [Table 3]. Variety Caruso had the highest mean number of ware tubers formed/ plant (9.89). This was followed by variety Jelly (4.56) while variety Marabel had the least number of ware tubers formed/ plant (3.65) [Table 3]. This might be due to genetic variability among the varieties used. Rosen *et al*.[45] reported tuber number to be significantly influenced by variety.

The different concentrations of coconut water resulted in significantly different ($P < 0.05$) mean number of ware tuber formed/plant [Table 3]. About 50% concentration of coconut water resulted in significantly ($P < 0.05$) higher mean number of ware tubers formed/plant (13.33) followed by 100% (9.57), while the control was the least (3.90) [Table 3]. Harmoy *et al*.[46] observed that IAA treatment induced larger tubers at an earlier stage.

Interaction between varieties × coconut water concentrations on mean number of ware tubers/plant is presented in Table 4. With variety Marabel, the different concentrations of coconut water resulted in similar mean number of ware tubers formed/plant.

Table 4: Interaction of variety and coconut water on mean total number of tubers formed, number of ware tubers formed, and number of seed tubers formed

Total number of tubers formed/plant			
Treatment	**Variety**		
	Marabel	**Jelly**	**Caruso**
Coconut water conc.			
C_0 (control)	13.44c	10.11c	17.37b
C_1 (100%)	18.61b	11.07b	16.31c
C_2 (50%)	20.07a	12.70a	18.61a
LS	*	*	*
$LSD_{0.05}$		1.32	
Number of ware tubers formed/plant			
Treatment	**Variety**		
	Marabel	**Jelly**	**Caruso**
Coconut water conc.			
C_0 (control)	6.31a	7.81b	7.61b
C_1 (100%)	6.44a	7.96b	8.41a
C_2 (50%)	6.33a	8.44a	8.42a
LS	*	*	*
$LSD_{0.05}$		1.00	
Number of seed tubers formed/plant			
Treatment	**Variety**		
	Marabel	**Jelly**	**Caruso**
Coconut water conc.			
C_0 (control)	9.40	9.86	10.03
C_1 (100%)	9.81	9.78	10.44
C_2 (50%)	10.13	10.11	11.00
LS	*	*	*
$LSD_{0.05}$		1.32	

With variety Jelly, 50% concentration of coconut water resulted in significantly higher mean number of ware tubers formed/ plant (8.44) while with variety Caruso, 0 % (the control) had significantly lower number of ware tubers formed/ plant (7.61) than 50% and 100% concentrations [Table 4].

Weight of Ware (Saleable) Tubers Formed/Plant (g)

The effect of variety on mean weight of ware tubers was significant ($P < 0.05$) [Table 3]. Variety Caruso had the highest mean weight of ware tubers formed (94.48 g). This was followed by variety Marabel (57.12 g) while variety Jelly had the least mean weight of ware tubers formed (35.86 g) [Table 3]. Rosen *et al*.[45] reported tuber yield to be significantly influenced by variety for all size and quality categories.

About 50% concentration of coconut water had significantly higher mean of ware tubers (66.70 g) than 100% concentration (44.24 g), while the control had significantly lower mean weight of ware tubers (16.94 g) [Table 3]. Hormones have been suggested to play a prominent role in the control of tuberization.[47] Bai *et al*.[41] reported that cytokinins increased potato number and weight at the same time.

Table 5: Interaction of variety and coconut water on mean total weight of tubers formed, weight of ware tubers formed, and weight of seed tubers formed

Total weight of tubers formed			
Treatment	**Variety**		
	Marabel	**Jelly**	**Caruso**
Coconut water conc.			
C_0 (control)	41.76b	46.53b	23.50c
C_1 (100%)	45.92a	47.78a	48.32b
C_2 (50%)	45.38a	46.23b	49.90a
LS	*	*	*
Weight of ware tubers formed			
Treatment	**Variety**		
	Marabel	**Jelly**	**Caruso**
Coconut water conc.			
C_0 (control)	86.21c	122.64b	82.89b
C_1 (100%)	87.32b	124.48a	84.48a
C_2 (50%)	88.44a	122.72b	83.32b
LS	*	*	*
$LSD_{0.05}$		1.07	
Weight of seed tubers formed			
Treatment	**Variety**		
	Marabel	**Jelly**	**Caruso**
Coconut water conc.			
C_0 (control)	61.67c	78.78b	74.11b
C_1 (100%)	78.44a	81.00a	74.75b
C_2 (50%)	65.78b	78.99b	78.29a
LS	*	*	*
$LSD_{0.05}$		1.00	

Interaction between varieties × different concentrations of coconut water is presented in Table 5. With variety Marabel, 50% concentration of coconut water resulted in significantly higher mean weight of ware tubers (88.44 g). With variety Jelly and Caruso, 100% concentration of coconut water resulted in significantly higher mean weight of ware tubers [Table 5].

Number of Seed Tubers Formed/Plant

The varieties resulted in significantly different ($P < 0.05$) mean number of seed tubers formed/plant [Table 3]. Variety Caruso had the highest mean number of seed tubers formed/ plant (20.91) followed by variety Marabel (8.50) while variety Jelly had the least mean number of seed tubers (7.93) [Table 3]. Genetic variability may be responsible for the observed

differences between the varieties. Trehan *et al*.[48] found that cultivar Cardinal had 14.56 seed tubers per hill.

The different concentration of coconut water resulted in significantly different ($P < 0.05$) mean number of seed tubers formed/plant [Table 3]. About 100% concentration of coconut had the highest mean number of seed tubers (16.54), this was followed by the control (13.27) while 50% concentration had the least number of seed tubers (9.47) and the difference was significant at $P < 0.05$ [Table 3]. This may be because 50% concentration increased number of large sized tubers thus it had few seed tubers.

Interaction between varieties × different concentration of coconut water on mean number of seed tubers formed/plant is presented on Table 4. With variety Marabel, 50% and 100% concentration of coconut water resulted in similar and significantly ($P < 0.05$) higher mean number of seed tubers than the control. With variety Jelly, the different concentration of coconut water resulted in similar mean number of seed tubers. With variety Caruso, 50% concentration of coconut water resulted in significantly higher mean number of seed tubers [Table 4].

Weight of Seed Tubers Formed (g)

The varieties resulted in significantly different ($P < 0.05$) mean weight of seed tubers formed [Table 3]. Variety Caruso had the highest mean weight of seed tubers formed (76.01 g), this was followed by variety Marabel (68.17 g) while variety Jelly had the least mean number of seed tubers formed (63.73 g) [Table 3]. Mahmud *et al*.[49] found that seed tuber yield varied with variety.

The different concentrations of coconut water resulted in significantly different ($P < 0.05$) mean weight of seed tubers formed [Table 3]. The control (0% concentration) of coconut water resulted in significantly higher mean weight of seed tubers formed (107.00 g), this was followed by 100% concentration (81.54 g), while 50% concentration had the lowest weight of seed tubers [Table 3].

Interaction between varieties and different concentrations of coconut water on the mean weight of seed tubers is presented on Table 5. With variety Marabel, 100% concentration of coconut water resulted in significantly ($P < 0.05$) higher mean weight of seed tubers. With variety Jelly, 100% concentration of coconut water resulted in significantly ($P < 0.05$) higher mean weight of seed tubers than 50% concentration and the control which were similar. With variety Caruso, 50% concentration of coconut water resulted in significantly ($P < 0.05$) higher mean weight of seed tubers than 100% concentration and the control which was similar [Table 5].

CONCLUSION

Based on the results, the varieties resulted in a significantly different ($P < 0.05$) mean number of stem at harvest, plant height, total number, and weight of tubers formed. Variety Caruso was significantly higher in terms of growth and yield. Treatment with coconut water enhanced the growth and yield of potato.

In this study, foliar spray of coconut water was used. It is, therefore, recommended that dipping of seed tubers should be evaluated. Furthermore, the time of application of foliar spray can be evaluated in future research to determine the best time for application.

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