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Growth and yield performance of finger pepper (*Capsicum annuum* L.) Django F_1 variety as affected by the frequency of spraying with mature coconut *(Cocos nucifera* L.*)* water stored in various conditions

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Abstract

This experiment determined the effects of the storing conditions, frequency of spraying and interaction effects of the storing conditions and frequency of spraying with mature coconut water on the growth and yield of the finger pepper. The study was laid out in three blocks and analyzed using a 3 x 5 Factorial Randomized Complete Block Design. The treatments are as follows: Factor A) storing conditions (fresh, refrigerated and room stored), and Factor B) frequency of spraying (no spraying, weekly, every two weeks, every three weeks, monthly). The Tukey's (HSD) Test was used to test the significant difference between treatments. The result showed that plants sprayed with fresh mature coconut water were significantly the earliest to undergo flowering (32.03 DAT), highest yield (7.78tha^{-1}), highest net income (PhP293,960.00) and ROI (303.13%). Likewise, the plants sprayed every three weeks were significantly the tallest (44.45cm) and earliest to undergo fruiting (66.81 DAT), while the plants sprayed every two weeks have the highest yield (9.02tha^{-1}), net income (PhP361,410.00) and ROI (363.90%). Significant interaction effects have been observed in plants sprayed with fresh coconut water every two weeks resulting to highest fruit yield (9.74tha^{-1}), highest net income (PhP410,200.00) and ROI (403.11%). The results implies that spraying with fresh mature coconut water every two weeks will increase the yield, net income, and ROI of the finger pepper, even if the amount of inorganic fertilizer applied was minimal.

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Introduction

The Philippines is an agricultural country, and most of the people living in the countryside usually depend on agricultural production. Vegetable production is one of the major sources of income of the farmers after rice cropping season. Among those vegetables, finger pepper is commonly planted because it is a favorite ingredient for most of the local foods. Nowadays, the yield is declining due to depletion of nutrients as affected by intensive cropping. Most tropical countries that continuously cultivated their farms have suffered nutrient deficiency (Sailaja *et al.*, 2014).

The common practice of most farmers to increase their yield is the application of inorganic fertilizer alone, but such practice is insufficient to boost the growth and yield because it is possibly affected by several factors such as the soil pH, CEC, organic matter content, moisture content. Moreover, there is a possibility that the fertilizers applied might react or combined with other elements present in the soil into an unavailable form that could not be readily absorbed or utilized by the plants. The deficiency of the micronutrients has great effect to the growth and yield of the plants even in minute quantity.

The most efficient way of amending the micronutrients deficiency is by supplementing or spraying with foliar fertilizer (www.ecochem.com/t_ foliar.html). However, the small scale farmers are not keen to use foliar fertilizer because the synthetic foliar fertilizers and the commercially available organic foliar fertilizers are very expensive. The use of locally available inputs or waste products that have growth-enhancing properties was used to reduce the cost of production. Among the considered waste product that has the potential as growth enhancer is the mature coconut water. Besides it is readily available because the Philippines is one of the prime producers of coconut in the world and the water is being discarded by the coconut producing farmers, copra workers and even the vendors at public markets that eventually contribute pollution in the market place.

Coconut water is rich with phytohormones, enzymes, minerals and vitamins (Yong *et al.*, 2009), it is also used as medium in tissue culture (Verdeil *et al.*, 2002; Ang *et al.*, 2005; Arditti *et al.*, 2008). Further, aside of its nutritional value, coconut water has growth regulatory properties, such as cytokinin and other phytohormones (George and Sherrington, 1984; Kende *et al.*, 1997).

Further, the crops treated with mature coconut water are very safe for human consumption, and very easy to adopt than any other source of nutrients generated from expensive laboratory facilities or through complex procedures which is beyond the reach or capability of the farmers. The utilization of mature coconut water has the potential to boost the growth and yield of the finger pepper at a lower cost of production. Hence, the objectives of the study are: 1) to evaluate the growth and yield of finger pepper as affected by the storage conditions of the mature coconut water; 2) to assess the growth and yield of the finger pepper as affected by the frequency of spraying with mature coconut water, and 3) to evaluate the interaction effects of the storing conditions and frequency of spraying with mature coconut water on the growth and yield of the finger pepper.

Materials and method

The study on finger pepper was conducted from 19 December 2016 to 3 May 2017 at DMMMSU Farm, Casiaman, Bacnotan, La Union, Philippines.

Procurement and sowing of seeds

The area for sowing the seeds was plowed and harrowed twice then a raised seedbed was prepared with one meter wide, five meters long and a height of 30 cm. The finger pepper (Django F1 variety) seeds were procured from a reliable Agricultural Supply in Bacnotan, La Union, Philippines. The seeds were sown on 15 November 2016. Cultural management was done uniformly to the seedlings until transplanting.

Land preparation, lay-outing, and statistical design

The experimental area was cleared from any debris and grasses then plowed and harrowed twice. It was laid-out in three blocks and the data were analyzed using the ANOVA of Factorial Randomized Complete

Block Design (Factorial RCBD). The Tukey's Honest Significant Difference (HSD) Test was also used to test the significant difference between the treatments. The treatments are as follows;

Factor A: Storage conditions of mature coconut water

C_1 – Fresh Mature Coconut Water

C_2 – Refrigerated Mature Coconut Water

C_3 – Room Stored Mature Coconut Water

Factor B: Frequency of spraying with mature coconut water

F_0 – No Spraying

F_1 – Weekly spraying

F_2 – Every two weeks spraying

F_3 – Every three weeks spraying

F_4 – Once a month spraying

Hardening and transplanting

Hardening of the seedlings was done by stopping watering three days before transplanting. Transplanting was done one month after sowing with only one seedling per hill. There were four rows in a plot with a 10 hills per row with a total of 40 seedlings. The distance of planting was 1.0m. x 0.50m. between rows and hills respectively.

Cultural management

The finger peppers were irrigated immediately after planting, then every week thereafter. The finger peppers were applied with 5g Urea per hill every three weeks from the vegetative stage until the fruiting period or until the required amount or dosage of fertilizer was wholly applied (75% of 90-0-0kgha^{-1} NPK). The finger pepper was alternately sprayed with different kinds of insecticides every two or three weeks during the vegetative stage and once a month during the fruiting period. Occasional Weeding was done to avoid competition with the plants.

Collection, storage and spraying with mature coconut water

The mature coconut water was collected from the public market of Bacnotan, La Union, Philippines with the first collection done seven days before spraying. An appropriate amount of the collected coconut water was stored at ambient room temperature within one week while the same amount was placed in plastic bottles and stored in a refrigerator within one week until they were sprayed to the finger pepper. The succeeding collection of mature coconut water was done every week thereafter.

Coconut water was sprayed based on the required frequency of the respective treatments- once a week, every two weeks, every three weeks, and once a month. The first spraying was done one week after transplanting and until the last week of fruit harvesting using the fresh, the room stored and the refrigerated mature coconut water. The coconut water was sprayed to the whole leaves of the finger pepper during the early vegetative stage but limited to 400L/ha during the late vegetative to fruiting period. The coconut water was diluted in a ratio of 1 part coconut water: 15 parts water.

Harvesting

The harvesting of fruits was conducted every three days to avoid over maturity of the fruits.

Data collection

The height of the plants was measured from the ground level to the tip of the tallest leaf. The number of days to flowering was recorded and counted from transplanting until 50% of the finger peppers in the plot have flowers, while the number of days to initial fruit harvesting was from transplanting until the first harvesting of fruits in the respective plots. The fruit yield of the finger pepper was computed in tons per hectare basis, the net income was computed by subtracting the gross income with the cost of production, while the ROI was calculated by dividing the net income to the cost of production then multiplied with 100.

Results and discussion

Plant height, cm

Effects of the storing conditions of mature coconut water on the height of the finger pepper.

In Table 1, the result revealed that the storing conditions of the mature coconut water used in spraying have no significant effects as the height of the finger peppers are comparable with each other at 0.05

levels Tukey's HSD Test ranging from 42.42cm to 42.66cm. The result implies that the quality and potency of the phytonutrients and phytohormones present in the mature coconut water stored in various conditions has retained; hence they are equally effective in promoting the growth of the finger pepper.

Effects of the frequency of spraying with mature coconut water on the height of the finger pepper.

The frequency of spraying mature coconut water has significant influence on the height of the finger pepper. The plants in F_3 were the tallest (44.92cm) but have no significant difference with the plants of F_2 (43.92cm), while the plants of F_1 and F_4 were the shortest with 40.73cm and 41.17cm, respectively (Table 1). The result implies that the nutrients supplemented every 3 weeks and once months are sufficient to promote the growth of the plant.

Table 1. The height of the finger pepper at 30 days after transplanting (DAT) as affected by the frequency of spraying with mature coconut water stored in various conditions.

Treatments	Height (cm)					
	Frequency of spraying with mature coconut water					
Storing conditions of mature coconut water	F_0–Not sprayed	F_1–Every week	F_2–Every two weeks	F_3–Every 3 weeks	F_4–Once a month	Mean, Storing conditions
C_1–Fresh	40.52^{d}	41.41^{cd}	43.50^{ab}	45.51^{a}	41.14^{d}	42.42
C_2–Refrigerated	40.70^{d}	41.47^{bcd}	44.50^{a}	44.43^{a}	41.22^{d}	42.46
C_3–Room stored	40.97^{d}	44.04^{a}	43.75^{a}	43.41^{abc}	41.15^{d}	42.66
Mean, Frequency of spraying	40.73^{c}	42.31^{b}	43.92^{a}	44.45^{a}	41.17^{c}	

Means followed by the same letter are not significantly different at 0.05 level Tukey's HSD Test.

On the other hand, the shorter height of the plants sprayed at closer interval (every week) was possibly the toxicity effects of the micronutrients or phytohormones due to excessive spraying. However, at a longer interval of spraying, the lack of micronutrients and phytohormones is possibly the leading cause of the stunted growth. Hussain *et al.* (2010) reported that the presence of hormones at higher dose will inhibit the growth or the elongation of the cell, shoot, apex, and the roots of the plants.

Interaction effects of the storing conditions and frequency of spraying with mature coconut water on the height of the finger pepper

The frequency of spraying with mature coconut water stored in various conditions has significant interaction effects on the height of the finger peppers. However, no significant interaction effects were observed on the plants sprayed every 2 and 3 weeks interval regardless of the storing condition of the mature coconut water in treatments C_1F_2, C_1F_3, C_2F_2, C_2F_3, C_3F_1, C_3F_2 and C_3F_3 ranging from 43.41cm to 45.51cm (Table 1).

The result implies that spraying the pepper every two and three weeks has sufficiently supplied the nutrients needed because the micronutrients and phytohormones from the mature coconut water is enough to boost the growth and development of the plants even at small quantity.

Number of days to flowering

Effects of the storing conditions of mature coconut water to flowering of the finger pepper.

The result in Table 2 revealed significant differences in the number of days to flowering of the finger pepper as affected by spraying with mature coconut water stored in various conditions. The plants of C_1 was the earliest to undergo flowering at 32.03 DAT while the plants of C_3 was the latest (33.10 DAT) but comparable to the flowering period of the plants in C_2 (32.82 DAT). The result is a manifestation that the nutrients and phytohormones in the fresh coconut water have no changes from its original conditions. According to Yashima *et al.* (2005) that the formation and abortion of reproductive organs are influenced by phytohormones.

Effects of the frequency of spraying with mature coconut water on the flowering of the finger pepper.

One of the factors that affect the flowering of finger pepper is the frequency of spraying with mature coconut water, as shown in Table 2. The plant of F_4 was the earliest to undergo flowering (29.70 DAT) but comparable to the plants of F_3 at 30.32 DAT, while the plants of F_0 was the latest for five days. The result shows that the exogenous introduction of micronutrients and phytohormones even in minimal amount is enough to induce the flowering of the finger pepper.

Table 2. The number of days from transplanting to flowering of the finger pepper as affected by the frequency of spraying with mature coconut water stored in various conditions.

Treatments	No. of days to flowering					
	Frequency of spraying with mature coconut water					
Storing conditions of mature coconut water	F_0–Not sprayed	F_1- Every week	F_2– Every two weeks	F_3– Every three weeks	F_4– Once a month	Mean, Storing conditions
C_1–Fresh	35.32	33.71	33.23	29.10	28.78	32.03[b]
C_2–Refrigerated	35.36	34.07	33.79	31.13	29.75	32.82[a]
C_3–Room stored	35.17	34.91	34.11	30.72	30.58	33.10[a]
Mean, Frequency of spraying	35.28[a]	34.23[b]	33.71[b]	30.32[c]	29.70[c]	

Means followed by the same letter are not significantly different at 0.05 level Tukey's HSD Test.

The early flowering was due to the presence of different phytohormones in the mature coconut water sprayed to the finger peppers. The flowering of plants can be manipulated or induced by the exogenous application of growth-promoting chemicals such as phytohormones (Darnel *et al.*, 2003; Weidman & Stang, 1983).

The interaction effects of the storing conditions and frequency of spraying with mature coconut water.

No significant interaction effect was observed on the number of days to flowering as affected by the frequency of spraying with mature coconut water stored in various conditions ranging from 28.78 to 35.36 DAT.

Number of days to initial fruit harvesting

Effects of the storing conditions of mature coconut water on the initial fruit harvesting of the finger pepper

The number of days to initial fruit harvesting as affected by the storing conditions of mature coconut water has no significant difference among the treatments ranging from 69.30 to 69.71 DAT (Table 3).

The effects of the frequency of spraying with mature coconut water

The number of days from transplanting to initial fruit harvesting was significantly affected by the frequency of spraying with coconut water because the mature coconut water contains several micronutrients and phytohormones at a considerable amount that promotes growth, flowering, and fruit development. The plants of F_3 were the earliest to have harvestable fruits on the 66.19 DAT, but comparable to the plants of F_4 at 67.81 DAT while the plants of F_0 were the latest on the 72.28 DAT.

Table 3. The number of days from transplanting to initial fruit harvesting of the finger pepper as affected by the frequency of spraying with mature coconut water stored in various conditions.

Treatments	No. of days to initial fruit harvesting					
	Frequency of spraying with mature coconut water					
Storing conditions of mature coconut water	F_0–Not sprayed	F_1– Every week	F_2– Every two weeks	F_3– Every three weeks	F_4– Once a month	Mean, Storing conditions
C_1–Fresh	72.54	71.06	70.25	66.35	68.34	69.71
C_2– Refrigerated	72.17	71.00	70.11	66.26	67.85	69.48
C_3–Room stored	72.12	71.26	69.92	65.97	67.25	69.30
Mean, Frequency of spraying	72.28[a]	71.11[b]	70.09[b]	66.19[c]	67.81[c]	

Means followed by the same letter are not significantly different at 0.05 level Tukey's (HSD) Test.

The result implies that a closer interval of spraying delayed the fruit formation of the finger pepper for four days; this is possibly due to over dosage of either with micronutrients or phytohormones. The excess amounts of either micronutrients or phytohormones have antagonistic effects that it will not only affect their growth but including the other physiological development such as the fruiting of the plants (Richards D 1985).

The interaction effects of the storing conditions and frequency of spraying with mature coconut water on the initial fruit harvesting of the finger pepper

The storing conditions of the mature coconut water and the frequency of spraying has no significant interaction effects on the number of days from transplanting to initial fruit harvesting of the finger pepper ranging from 65.97 to 72.54 DAT.

Fruit yield, tha^{-1}

Effects of the storing conditions of mature coconut water on the fruit yield of the finger pepper

The storing conditions of the mature coconut water have significant effects as foliar fertilizer to the fruit yield of the finger pepper.

Table 4 revealed that the yield of finger pepper of C_1 significantly have the highest yield with 7.78tha^{-1}. The result shows that the nutrients and phytohormones in the fresh coconut water have not changed from its original conditions. The application of fertilizer through the leaves is the most efficient way to increase yield from 12% to 25% as compared to the conventional method of fertilization (www.ecochem.com/t_foliar.html).

Table 4. The fruit yield of the finger pepper as affected by the frequency of spraying with mature coconut water stored in various conditions.

Treatments	Fruit yield (t/ha)					
	Frequency of spraying with mature coconut water					
Storing conditions of mature coconut water	F_0–Not sprayed	F_1–Every week	F_2–Every two weeks	F_3–Every three weeks	F_4–once a month	Mean, Storing conditions
C_1–Fresh	5.41^{f}	7.33^{de}	9.74^{a}	9.06^{abc}	7.35^{dc}	7.78^{a}
C_2–Refrigerated	4.36^{f}	7.16^{de}	9.17^{abc}	7.98^{cde}	6.80^{e}	7.09^{b}
C_3–Room stored	4.21^{g}	9.34^{ab}	8.23^{bcd}	7.94^{cde}	6.87^{e}	7.32^{b}
Mean, Frequency of spraying	4.66^{d}	7.94^{b}	9.04^{a}	8.33^{b}	7.01^{c}	

Means followed by the same letter are not significantly different at 0.05 level Tukey's HSD Test.

The effects of the frequency of spraying with mature coconut water

The frequency of spraying with mature coconut water also have significant effects because the yield of the plants of F_2 was the highest (9.04tha^{-1}), while the plants of F_0 produced the lowest yield with 4.66tha^{-1}. The result confirmed that the optimum yield of the finger pepper was obtained even only 75% of the recommended rate of inorganic fertilizer was applied if supplemented with micronutrient and phytohormones through the spraying with mature coconut water every two weeks interval. It is a fact that foliar-applied nutrients are easily assimilated by the plant into its system within minutes just after application. The nutrients will be completely absorbed within a period of one to two days (http://aggie-horticulture. tamu.edu/ vegetable/ guides/ texas-vegetable-growers-handbook/chapter-iii-soils-fertilizers/).

Interaction effects of the storing conditions and frequency of spraying with mature coconut water on the fruit yield of the finger pepper

The storing conditions and frequency of spraying with mature coconut water have significant effects on the growth and fruit development of the finger pepper. The plants of C_1F_2 produced the highest yield with 9.74tha^{-1} but comparable to the plants of C_1F_3 with 9.06tha^{-1}, the plants of C_2F_2 with 9.17tha^{-1} and the plants of C_3F_1 with 9.34tha^{-1}, while the lowest yields of the plants were produced by the treatments C_1F_0, C_2F_0 and C_3F_0 with 5.41tha^{-1}, 4.36t/ha, 4.21tha^{-1} respectively.

The micronutrients and phytohormones in the fresh and refrigerated mature coconut water significantly boost the yield of the finger pepper by spraying every two to three weeks because the spraying at shorter interval have antagonistic effects due to over dosage as the amount assimilated by the plant was higher, but at longer interval or every four weeks, the dosage is insufficient. Moreover, there was a complementary effect of the combined application of organic and synthetic nutrients to supply essential nutrients at greater efficiency (Ahmad *et al*., 1996).

Net income, Php

Effects of the storing conditions of mature coconut water on the net income of the finger pepper

The storing conditions of the mature coconut water sprayed on the finger pepper has significantly influenced on the net income of finger pepper wherein the plants of C_1 have the highest with PhP293,960.00. The net income could be correlated to the higher yield of the finger pepper, which means that more produced has been sold.

The effects of the frequency of spraying with mature coconut water on the net income of finger pepper

The finger pepper in F_2 has the highest net income with PhP361,420.00, while the plants of F_0 has the lowest with PHP135,790.00 (Table 5). The income is directly correlated on the higher yield of the finger pepper sprayed every two weeks because more fruits were produced and sold.

Table 5. The net income of the finger pepper as affected by the frequency of spraying with mature coconut water stored in various conditions.

Treatments	Net income (PHP) Frequency of spraying					
Storing conditions	F_0–Not sprayed	F_1–Every week	F_2–Every two weeks	F_3–Every three weeks	F_4–Once a month	Mean, Storing conditions
C_1–Fresh	162,070^{d}	264,330^{c}	410,200^{a}	359,000^{ab}	274,200^{c}	293,960^{a}
C_2–Refrigerated	126,230^{de}	253,500^{c}	359,530^{ab}	303,500^{bc}	245,970^{c}	257,746^{b}
C_3–Room stored	119,070^{e}	365,000^{ab}	314,530^{bc}	289,830^{bc}	250,470^{c}	257,780^{b}
Mean, Frequency of spraying	135,790^{d}	294,276^{bc}	361,420^{a}	317,443^{b}	256,880^{c}	

Means followed by the same letter are not significantly different at 0.05 level Tukey's HSD Test.

Interaction effects of the storing conditions and frequency of spraying with mature coconut water on the net income of the finger pepper

The spraying of the finger pepper with fresh mature coconut water every two weeks (C_1F_2) have a significant interaction effect on their net income amounting to PhP410,200.00 but comparable on the plants of C_1F_3, to the plants of C_2F_2, and to the plants of C_3F_1 with income ranging from PhP359,000.00 to PhP365,000.00. The result could be attributed to the yield of the finger pepper as affected by the storing conditions and frequency of spraying with mature coconut water.

Return on investment (ROI), %

Effects of the storing conditions of mature coconut water on the ROI of the finger pepper. The spraying with mature coconut water stored in various conditions has significant effects on the ROI of the finger pepper wherein the plants of C_1 has the highest with 303.13% (Table 6). The ROI was the direct effect of the volume of fruits produced and net income of the finger pepper.

Table 6. The ROI of the finger pepper as affected by the frequency of spraying with mature coconut water stored in various conditions.

Treatments	ROI (%) Frequency of spraying					
Storing conditions	F_0–Not sprayed	F_1–Every week	F_2–Every two weeks	F_3–Every three weeks	F_4–Once a month	Mean, Storing conditions
C_1–Fresh	176.94^{fg}	259.16^{de}	403.11^{a}	381.92^{ab}	294.50^{cde}	303.13^{a}
C_2–Refrigerated	137.81^{gh}	242.59^{ef}	363.65^{abc}	292.96^{cde}	261.12^{de}	259.63^{b}
C_3–Room stored	129.99^{h}	357.85^{abc}	324.94^{abcd}	308.17^{bcde}	268.75^{de}	277.94^{b}
Mean, Frequency of spraying	148.25^{d}	286.53^{bc}	363.90^{a}	327.68^{c}	274.79^{c}	

Means followed by the same letter are not significantly different at 0.05 level Tukey's HSD Test.

Effects of the frequency of spraying with mature coconut water on the ROI of the finger pepper

There was a significant effect of the frequency of spraying with mature coconut water wherein the plants of F_2 attained the highest ROI (363.90%), while the plants of F_0 was significantly the lowest with 148.25% (Table 6). The result could be due to the significant differences of the yield and net income of the finger pepper as affected by the frequency of spraying with mature coconut water.

Interaction effects of the storing conditions and frequency of spraying with mature coconut water on the ROI of the finger pepper

The frequency of spraying with mature coconut water stored in various conditions has significant interaction effects to the ROI of the finger pepper. The plants of C_1F_2 attained the highest ROI (403. 11) but comparable on the plants of C_1F_3, C_2F_2, C_3F_1 and C_3F_2 with 381.92%, 363.65%, 324.94% respectively (Table 6). The ROI could be associated to the yield and net income of the finger pepper due to the interaction effects of spraying with mature coconut water stored in various conditions.

Conflict of interest statement

The authors declare that there is no conflict of interest.

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References

Ahmad N, Rashid M, Vaes AG. 1996. Fertilizers and their uses in Pakistan. National Fertilizer Development Centre. p. 142-149, and p. 172-175.

Ang SL, Yong JWH. 2005. A protocol for in vitro germination and sustainable growth of two tropical mistletoes. Plant Cell, Tissue and Organ Culture **80,** 221-228.

Arditti J. 2008. Micropropagation of Orchids, 2nd ed.; Blackwell Publishing: Oxford, UK. Volume II.

Darnell RL, Cantliffe DJ, Kirschbaum DS, Chandler CK. 2003. The physiology of flowering in strawberry. Horticultural Review **28,** 352-349.

George EF, Sherrington PD. 1984. Plant Propagation by Tissue Culture-Handbook and Directory of Commercial Laboratories; Exegetics Ltd: Edington, UK.

Haby VA, Baker ML, Feagley S. 2009. Texas Vegetable Growers Handbook Chapter III-Soils and Fertilizers. Accessed at https://aggie-horticulture. tamu.edu/vegetable/guides/texas-vegetable-growers-handbook/chapter-iii-soils-fertilizers/ on 12/2017.

Hussain K, Hussain M, Majeed A, Nawaz K, Nisar MF, Afghan S. 2010. Morphological response of scurf pea (*Psoralea corylifolia* L.) to indole acetic acid (IAA) and nitrogen (N). World Applied Sciences Journal **8,** 1220-1225.

Kende H, Zeevaart J. 1997. The five classical plant hormones. Plant Cell **9,** 1197-1210.

Richards D. 1985. Effect of cytokinin application and environment on growth and flowering of *Boronia heterophylla* F. Von Meuller. Scientia Horticulturae **27(3-4),** Pages 325-334.

Sailaja V, Ragini NN, Kumar KD, Reddy BR, Satyanarayana SV. 2014. Effect of Foliar Application of Panchagavya on Growth and Development of Leafy Vegetable. International Journal of Agricultural and Food Science **4(4),** 119-122.

Van Overbeek J, Conklin ME, Blakeslee AF. 1941. Factors in coconut milk essential for growth and development of very young Datura embryos. Science **94,** 350-351.

Verdeil JL, Hocher V. 2002. Digestion and absorption of food in plants: A plant stomach. Trends in Plant Science **7,** 280-281.

Weidman RW, Stang EJ. 1983. Effects of Gibberellins, 6-benzyladenine and promaline plant growth regulators on plant growth, branch, crown and flower development in 'Scott and Raritan' strawberries. Advances in Strawberry Production **2,** 15-17.

Yashima Y, Kaihatsu A, Nakajima T, Kokubun M. 2005. Effects of Source/Sink Ratio and Cytokinin Application on Pod Set in Soybean. Plant Production Science **8(2),** 139 - 144.

Yong JW, Ge HL, Ng YF, Tan SN. 2009**.** The Chemical Composition and Biological Properties of Coconut (*Cocos nucifera* L.) Water Molecules **14,** 5144-5164; DOI: 10.3390/molecules14125144.

Websites:

www.ecochem.com/t_foliar.html. Date Retrieved: December 2017.