



## Floral Attributes And Toddy Yield Of Selected Dwarf Coconut Varieties As Affected By Tapping Season

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### ABSTRACT

The study was conducted to determine the floral attributes and toddy yield of selected dwarf varieties locally available in Capiz State University Burias Campus, Burias, Mambusao, Capiz, Philippines. The study was conducted using a Completely Randomized Design for a factorial experiment. Two factors were considered: Factor A- Varieties and Factor B – Season of Tapping. A total of four coconut varieties were used in the study. Varieties used were V1 – Aromatic (ARO), V2 – Equatorial Green Dwarf (EGD), V3 – San Isidro Green Dwarf (SGD), and V4 – Talisay (TAL). Season of Tapping included S1- Dry Season and S2 – Wet Season. Each treatment was replicated three times with six trees per treatment. The different varieties differ in terms of the length of the tappable portion of the spadix, length of the discarded tip of the spadix, tapping duration, and volume of toddy produced. The following results revealed that season significantly influences the length of the spadix, age of spadix at tapping, number of days from tagging to bending, number of days from bending to cutting, tapping duration, and volume of toddy produced. Among the coconut varieties, Aromatic gave the greatest volume of toddy when tapped during the wet season. Generally, more toddy is produced during the wet season than in the dry season. Season and variety interact in influencing the age of spadix at tapping, tapping duration, and volume of toddy produced.

**Keywords:** Capiz State University, Wet Season, Coconut Varieties, Dry Season, Aromatic (ARO), Equatorial Green Dwarf.

### INTRODUCTION

Previous studies on the sap flow, especially among various coconut varieties, remain perplexing. However, time, biotic, abiotic, and anthropogenic threats are some of its determining factors. The oyster-white fluid collected from the young coconut spadix (inflorescence) is known as coconut inflorescence sap (neera). It is a natural, healthy liquid that is high in sugar, protein, minerals, an

tioxidants, and vitamins (Sudha, R. et al., 2019). Inflorescence sap is the fluid produced by carefully slicing the distal end of an unopened inflorescence. Fermented drinks made from inflorescence sap are popular in most coconut-growing nations (Samsudeen K. et al., 2013a, p. 1). Choosing coconut varieties for tapping is something to be considered. Secretaria et al., (2002)

previously deduced that dwarf and tall varieties (MRD x BAYT, MRD x TAGT, CATD x LAGT) produced significantly higher toddy (495-699 li/tree/yr. When tapping, a process of extracting coconut toddy or "tuba", most tapped palm trees exude a sap that is packed with 10 to 20% sugar content (Dalibard, 1999). Throughout the island ecosystems of the tropics, several palm species have been tapped for generations to create fresh juice (sweet toddy), fermented beverages (toddy, wine, arak), syrup ("honey"), brown sugar (jaggery), or refined sugar. Vinegar from toddy is a healthier alternative to the synthetic commercially available vinegar. On the one hand, as is to be projected, tapping methods differ according to individuals and geographical roots. In a research interview survey conducted by Santiago & Virtudazo (1999a), respondents from a population of coconut tappers in Leyte, Samar, and Cebu provinces in Central Philippines selecting palm trees for tapping, Santiago and Virtudazo (1996b, p.2) pointed out that there are trees that are innately excellent toddy-yielders within the same cultivar. A good nut yielder is only sometimes a good toddy yielder, and alternately. Also, the study of Samsudeen K. et. al., (2013c, p4) indicated that, in general, tall and hybrid cultivars yielded better than dwarf cultivars.

Menon and Pandalai (1958), as discussed by Santiago & Virtudazo (1996c, p.4), implied that the time between the start of tapping and the actual juice flow is determined by the tappers' skill, the tapping method utilized, the prevailing seasonal conditions, and the nature of the tree. There have been indications that tapping has an effect on the palms. It is widely believed that after a period of tapping, palms produce much more nuts. The quantity of female flowers during inflorescence opening and fruits at the end of four months in tapped palms was found to be as high as three times the yield of high-yielding palms and double the yield of extremely high-yielding undeveloped palms (Mathes, 1984, as referenced by Samsudeen K. et al. 2013b). In the Philippine context, other significant issues facing coconut farming and industry include the degeneration of coconut trees, the widespread use of poor or low-yielding coconut varieties as a result of a lack of high-quality coconut seedlings, poor agronomic or farm management practices,

the unrestricted removal of coconut trees due to strong marketability, poor soil nutrition, the occurrence of pests and diseases, natural disasters, the conversion of coconut lands, and a lack of sustained and adequate resources for infrastructure (Arhin L. et al., 2023; Gurbuz & Manaros, 2019). Since there are several locally available dwarf varieties to choose from for potential tapping, the researchers find it best to identify their floral attributes and toddy yield as affected by tapping season. Hence, this study is initiated.

### **Materials and Methods or Methodology**

The study was conducted using a Completely Randomized Design (CRD) for a factorial experiment. All coconut varieties used were gathered from the Coconut Breeding Trial Unit (CBTU) of Capiz State University Burias Campus. Two factors were considered: Factor A- Varieties and Factor B – Season of Tapping. Varieties used were V1 – Aromatic (ARO), V2 – Equatorial Green Dwarf (EGD), V3 – San Isidro Green Dwarf (SGD), and V4 – Talisay (TAL). Season of Tapping included S1- Dry Season (January- August) and S2 – Wet Season (August-December). Each treatment was replicated thrice with four trees per treatment. Four dwarf coconut varieties were used for tapping (Aromatic, Equatorial Green, San Isidro Green Dwarf and Talisay). All data gathered were subjected to the Analysis of Variance Using the F-test and were interpreted at a 5% level of significance. T-test was used to determine significant differences for the season, while LSD was used for varieties and DMRT for the interaction effect.

### **Results and Discussion**

#### **Length of Spadix**

The analysis of variance for the length of spadix showed a highly significant result for the season but a not significant result for variety. This implies that spadix length is highly affected by season but not by variety. The mean difference test showed that spadices were longer during the dry season compared with those spadices during the wet season. This observation was found to be congruent with the findings of Legaspi (2006). She further reported that spadices tapped in the dry season were produced during the wet season, where water is abundant. While spadices

tapped in the wet season were formed during the dry season, where water is limiting the growth and development of the crop. There was no interaction effect of variety and season of tapping.

### **Length of Tappable Portion of the Spadix**

The analysis of variance for the length of the tappable portion of the spadix revealed a highly significant effect of variety and a not significant result on the effect of season. This can be interpreted as dwarf varieties utilized in this study having different lengths of tappable portion of the spadix regardless of the season of tapping. The mean comparison revealed that the TAL variety gave the longest tappable portion of the spadix and this was comparable to EGD. The shortest tappable portion of the spadix was recorded from ARO, which was found to be comparable with SGD. The SGD variety had a comparable tappable portion of the spadix with EGD.

Likewise, there was no interaction effect found between variety and season of tapping. This conforms with the study of Nathanael (1952), which states that despite the fact that the tall coconut palm produces more toddy than the dwarf species, there is significant variance in juice output from day to day, season to season, spadix to spadix, and tree to tree.

### **Length of Discarded Tip of the Spadix**

The analysis of variance for the length of the discarded tip of the spadix revealed a highly significant effect on variety but not a significant effect on the season of tapping. This means that the length of the discarded tip of the spadix during tapping is more of the inherent trait of the variety and not influenced by season at all.

The LSD revealed that ARO gave the shortest discarded tip of the tappable spadix while the longest discarded tip of the spadix was recorded from SGD, which was found comparable with the discarded tip of the tappable spadix of EGD and TAL. Likewise, there was no interaction effect of variety and season of tapping. This jives with the results of Menon, and Pandalai (1958), indicating that despite season and stage of tapping, although it has been proven that some trees have been toddy-yielders in nations such as the Philippines, Ceylon, and several Pacific Islands, the proper stage when the spadix is suited for tap-

ping is a matter of experience. The spadix becomes unrestrained when completely developed, as the spathe bursts open when training it for tapping. Even if the palm tree could be taught, the amount of juice it exudes is sure to be far lower.

### **Circumference of the spadix**

The analysis of variance for the circumference of the spadix revealed a not significant result for both the variety and the season of tapping. There was no interaction effect also on the two factors. The result showed that this parameter was not affected by season nor with variety. The means ranged from 17.58 cm to 21.28 cm for variety and 18.91 cm to 20.24 cm for season of tapping. The same results were evident in the study of Salvacion (2006) where the number of cut spikelets and circumference of the spadix were found to be superior among the morphological attributes of the Salambuyan and San Ramon varieties, indicating that it might be an aspect to consider for future breeding programs generating varieties for tapping purposes.

### **Age of Spadix at Tapping**

A highly significant result on the analysis of variance for the effect of season on the age of tapping was noted. This means that the age of tapping is influenced by the season. The mean difference test revealed that spadices tapped during the wet season require a longer time before tapping compared to those spadices in the dry season. Spadices tapped in the wet were developed during the dry season and vice versa. Water may play a vital role in spadix development. Likewise, a nonsignificant result in ANOVA was noted on variety, meaning that all the dwarf varieties utilized in the study had similar ages of spadix at tapping.

An interaction effect exists between seasons of tapping and variety. The DMRT revealed that a long time of waiting is required for the spadices of ARO, SGD, and EGD when tapped during the wet season, and this was found to be comparable with the age of spadix of SGD when tapped during the dry season. Shorter waiting time or younger spadix ages are noted among the varieties ARO and EGD during the dry season, and TAL for both dry and wet seasons were recorded. According to Jnanadevan (2013) as mentioned by Ghosh et al., (2018), the optimal moment to

begin tapping is before the inner bract splits and the spikes emerge from the spathe. He also indicated that sap output is much reduced if tapping begins after the spadices have burst open. A prematurely tapped spadix may burst open and become discolored at the sliced section. Menon & Pandalai (1958, p.293) also noted that there is no specific season for tapping the coconut since it produces inflorescence in consecutive leaf axils on a regular basis. It is astonishing, especially in the case of Filipino tappers, as noted by Santiago & Virtudazo (1996c, p3), how careful they are with the spadix or inflorescence, especially throughout the training, stimulating, and subsequent paring phases, to avoid straining it.

#### **Number of Days from Tagging to Bending**

The ANOVA for the number of days from tagging to bending revealed a highly significant result for the season and a not significant result for variety. There was no interaction effect for the two factors as well.

The mean difference test revealed that longer days was incurred during the dry season tapping compared to the wet season tapping. Salvacion (2006) emphasized that when the third spadix protruded from the sheath and female buttons began to flare noticeably at the base of the spadix, the spadix was regarded as ready for tapping. To ease bending, a slit was cut into the outer sheath. The spadix was progressively bent by connecting it to the peduncle of the coconut frond slightly below it.

#### **Number of Days from Bending to Cutting**

The ANOVA for the number of days from bending to cutting revealed a highly significant result for the season and a not significant result for variety. There was no interaction effect for the two factors as well.

In congruence with the result on the number of days from tagging to bending, the mean difference test revealed that longer days were incurred during the dry season tapping compared to the wet season tapping. This was being manifested in the findings of Chan and Elevitch (2016), which states that throughout the year, between 12 and 15 spadices are produced at generally regular intervals; however, drought conditions may cause the spadix to stagnate or

stop producing. Likewise, Salvacion elucidated that the length of the tying material could be modified daily until the spadix bent to the appropriate curve to facilitate toddy the collection. The tipmost section of the bended spadix was cut and pair to revitalize the wound is necessary.

#### **Tapping Duration**

A highly significant effect on both variety and season was noted on the tapping duration as reflected by the result of ANOVA. There was also an existing interaction effect between season and variety. The result implied that season and variety affected tapping duration. The two factors also interact in influencing the tapping duration. The DMRT revealed that ARO tapped during the dry season had the longest tapping duration, which was found to be comparable with the tapping duration of SGD and EGD during the dry season and ARO, EGD and SGD during the wet season tapping. The shortest tapping duration was recorded from TAL in both dry and wet seasons. Due to cultural practices, tapping duration varies from country to country. For instance, in Ceylon, the norm has been to continually tap palms for eight months, followed by a four-month rest period. This procedure appears to be suitable in terms of not impairing the palms' yielding potential or creating negative responses on their vigour and health (Nathanael,1952).

#### **Total Volume of Toddy Produced per Spadix**

The ANOVA for the total volume of spadix produced per spadix showed a highly significant result for variety and season. There was also a positive interaction effect between the season of tapping and variety. This means that the amount of toddy produced per spadix is both an interplay between season of tapping and variety.

The DMRT revealed that ARO tapped during the wet season produced the greatest volume of toddy. This was followed by EGD, and SGD tapped during the wet season and the least amount of toddy was produced by TAL during the dry and wet season which was comparable with the volume of toddy produced by the ARO, EGD and SGD during the dry season. In general, more toddy are produced during the wet season compared to the dry season. This might have something to do with the availability of water during

Variety	Number of days from tagging to bending		Length of spadix		Length of spadix tappable		Length of spadix discarded	
	Dry*	Wet*	Dry *	Wet*	Dry*	Wet*	Dry	Wet
ARO	18.23	14.33	51.23	40.42	41.85 <b>b</b>	43.65 <b>b</b>	10.08	11.1
EGD	22	13.9	59.35	49.4	53.21 <b>a</b>	47.94 <b>b</b>	11.3	12.95
SGD	22.11	15.1	57.81	48.64	52.11 <b>a</b>	44.74 <b>b</b>	12.06	11.49
TAL	20.89	16.43	61.91	48.93	53.03 <b>a</b>	58.88 <b>a</b>	12.31	12.61
Total	83.23	59.76	230.3	187.39	200.2	195.21	45.75	48.15
Mean	20.8075 <b>a</b>	14.94 <b>b</b>	57.575 <b>a</b>	46.84 <b>b</b>	50.05	48.8025	11.4375	12.0375

Variety	Number of days from tagging to cutting		Volume of toddy per spadix		Tapping duration per spadix		Circumference per spadix	
	Dry*	Wet*	Dry *	Wet*	Dry*	Wet*	Dry	Wet
ARO	8.29	4	1810.48 <b>c</b>	8821.33 <b>a</b>	40.34 <b>a</b>	28.21 <b>ab</b>	17.93	17.58
EGD	8.66	4	1839.45 <b>c</b>	4785.7 <b>b</b>	31.55 <b>ab</b>	28.62 <b>ab</b>	20.87	19.28
SGD	7.77	5.8	1584.05 <b>c</b>	6155.69 <b>b</b>	38.21 <b>a</b>	28.84 <b>ab</b>	21.28	18.13
TAL	8.36	5	1353 <b>c</b>	1664.22 <b>c</b>	12.78 <b>c</b>	20.88 <b>bc</b>	21.31	20.66
Total	33.08	18.8	6587.19	21426	122.88	106.55	81.39	75.65
Mean	8.27	4.7	1646.798	5356.735	30.72	26.6375	20.3475	18.91

Variety	Age of Spadix at tapping days	
	Dry*	Wet*
ARO	31.33 <b>b</b>	42.55 <b>a</b>
EGD	32.4 <b>b</b>	44.65 <b>a</b>
SGD	39.96 <b>a</b>	42.55 <b>a</b>
TAL	33.73 <b>b</b>	33.17 <b>b</b>
Total	137.42	162.92
Mean	34.355	40.73

**Table 1.**  
**Tapping attributes of the selected dwarf coconut varieties.**

the translocation process since toddy exudates; hence, the more water is available, the greater the sap or exudates. Consequently, the results of Chan & Elevitch (2016) explains that a coconut palm may generate 1.5-3 liters of neera per day on an average basis, and up to 4.5 liters per day depending on the health of the palm and garden management. Other contributory factor affecting toddy yield, as contended by Secretaria et al., (2002) is the varietal differences in terms of vegetative and floral characteristics of coconut palms.

**Conclusions and Recommendations**

Based on the result of the study, the following conclusions were drawn:

1. Among the population of the different dwarf varieties, each differs in terms of the length of the tappable portion of the spadix, length of the discarded tip of the spadix, tapping duration, and volume of toddy produced.
2. Season has a significant influence on the length of the spadix, age of spadix at tapping, number of days from tagging to bending, number of days from bending to cutting, tapping duration, and volume of toddy produced.
3. There was an interaction effect of season

and variety in influencing the age of spadix at tapping, tapping duration, and volume of toddy produced.

4. Generally, a great quantity of toddies are produced during the wet season as compared to the dry season.

5. Aromatic gave the greatest volume of toddy when tapped during the wet season.

The following recommendations are forwarded based on the results of the study:

1. Use aromatic variety for a greater volume of toddy production, especially during the rainy season.

2. Maximize tapping during the wet season and allow the spadix to bear fruit during the dry season to balance fruiting and toddy production.

3. Conduct studies on the response of the different dwarf varieties to the production of toddy and nuts in a single tree.

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