The effect of fertilizer to production of neera dwarf coconut

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Abstract. This research was conducted at the Pandu Experimental Garden (KP) from April until June 2015, North Sulawesi. The research was conducted using a factorial randomized block design. The first factors were the kinds Dwarf coconut (A), Tebing Tinggi dwarf (GTT), Bali Yellow Dwarf (GKB), Nias Yellow Dwarf (GKN), Raja Dwarf (GRA), and Salak Dwarf (GSK). The second factors are the doses of fertilization (B), without fertilizer, urea 500 g + SP36 375 g + Potassium Chloride 750 g + Kieserite 100 g, urea 750 g + SP 36 562.5 g + Potassium Chloride 1125 g + Kieserite 150 g and organic fertilizer. Each experimental unit was replicated three times, so that total is sixty. Parameters observed are volume of neera, the number of bunches tapped and duration of tapping, brix, and rendement of neera. The results showed that among five Dwarf coconuts tested, coconut GTT, GKB, GKN, and GSK can be considered as a source of raw material for making sugar. The total of sap produced varies depending on the kinds of dwarf coconut and the dose of fertilizer.

Keywords: coconut, fertilizer, neera

1. Introduction
The main product of coconut is copra. Currently, fresh coconut meat at the industrial level is around Rp 2700-2800/kg. This condition is very promising for farmers. In addition to processing coconut fruit into fresh coconut meat, it can also be made copra, young coconut, coconut flour, fresh coconut milk, white copra, and other derivative products of the coconut fruit. In addition, coconuts can produce neera obtained from tapping bunches of flowers that have not been opened. Neera is a fresh liquid that comes out of tapping bunches of coconut flowers [1]. Coconut neera is a raw material for the industry of coconut sugar, both brown sugar and granulated sugar. A study[2] showed that the glycemic index (IG) of coconut neera was about 35 to 42. This value is very good for health so that it supports the product diversification program of coconut fruit that has a high added value, namely coconut sugar.

Neera from coconut bunches is so easily fermented that it cannot be used for sugar processing. Microbes in coconut neera cause this fermentation. Fermentation of neera can cause the neera to be cloudy so that neera can be convert into ethanol or alcohol[3]. Coconut neera that has been fermented is difficult or cannot be processed into brown sugar [4]. At the farmer level, the use of coconut neera preservatives such as lime is often utilized. The main point for making coconut sugar from neera coconut is the sugar content and the level of coconut neera (pH)[5].

Currently, the problem faced in sugar production is limited production caused by old and high coconut trees and lack of labor. Indonesia Palma Crops Research Institute (IPCRI) has produced superior dwarf coconuts that have coconut neera, including Bali Yellow Dwarf (GKB), Nias Yellow...
Dwarf (GKN), Salak Dwarf (GSK), Raja Dwarf (GRA), and Tebing Tinggi Dwarf (GTT). Dwarf Coconut has morphological characteristics such as a short stem and slow stem growth and fast fruiting production. These characters are very good to be utilized as a coconut tree that produces coconut neera. According to reports[6], GTT accession coconuts can produce 2172.38 ml/tree/day of fresh neera. This result is different from the study[7] that the Merah Waigapu Dwarf (GMW) is able to produce neera/day/bunch as much as 1006.57 ml and coconut Raja Dwarf (GRA) as much as 627.81 ml.

Coconut production could be increased by fertilizing. The combination of 50% inorganic fertilizers and 50% liquid organic fertilizers can produce good coconut growth[8]. The results of the study[9] reported that the use of liquid fertilizer increased the production of coconut neera by 15.32%. Based on the above issues, this research was carried out. This study aimed to find out the effect of Dwarf coconut accession and fertilization on coconut neera.

2. Material and methods
The research was conducted at Experimental Station Pandu, Agricultural Technology Assessment Center (BPTP), North Sulawesi. From April to June 2015. The factor tested was factor A = Accession of Dwarf coconut, which consists of
1. Tebing Tinggi Dwarf (GTT)
2. Kuning Bali Dwarf (GKB)
3. Kuning Nias Dwarf (GKN)
4. Raja Dwarf (GRA)
5. Salak Dwarf (GSK)
Factor B = Dose of Urea, SP-36, Potassium Chloride , and Kieserite fertilizers per tree, consisting of:
1. No fertilizer (control).
2. Urea 500 g + SP-36 375 g + Potassium Chloride 750 g + Kieserite 100 g.
3. Urea 750 g + SP-36 562.5 g + Potassium Chloride 1125 g + Kieserite 150 g.
4. Organic fertilizer/manure.
Each treatment was repeated three times, so the number of plants to be used in this study to 60 trees. The parameters observed were:
1. Volume of neera (ml).
2. Number of bunches tapped and length of wiretapping.
3. Neera sugar content (%).
4. Sugar yield (%).
All data obtained were tabulated and analyzed based on the average of each parameter

3. Result and discussion
3.1. Volume of neera
The results showed that the production of neera per tree per day differed by accession [Figure 1]. Neera production in May and June tends to be affected by the fertilizer dose applied and differs by accession. The highest production of neera/bunches/day on GTT (1,975.00 ml) was obtained on plants fertilized with Urea 500 g + SP-36 375 g + Potassium Chloride 750 g + Kieserite 100 g; GKB (1,950.67 ml and 1,708.62 ml) with fertilization of Urea 750 g + SP-36 562.5 g + Potassium Chloride 1125 g + Kieserite 150 g / tree and Urea 500 g + SP-36 375 g + Potassium Chloride 750 g + Kieserite 100 g / tree; GSK (1,975.00 ml and 1,948.56) with Urea 750 g + SP-36 562.5 g + KCl 1125 g + Kiesrite 150 g /tree; GKN (1,975.00 ml and 1,948.56) with Urea 500 g + SP-36 375 g + Potassium Chloride 750 g + Kieserite 100 g / tree; and Urea 750 g + SP-36 562.5 g + Potassium Chloride 1125 g + Kieserite 150 g / tree. The production of GRA coconut neera bunch day is generally low when compared to the other four varieties of Dwarf coconut. This is because there are no bunches that are eligible to be tapped. The results [10] reported that DwarfChawght Orange is only able to produce 104.20 ml day. Furthermore
the volume of coconut neera is affected by the coconut’s ability to absorb groundwater [11].

![Figure 1. Volume of neera on five accession of Dwarf Coconut](image)

The 5 accession of Dwarf coconuts studied, GRA is strongly influenced by the long dry season (El Nino) in 2015. The production of five varieties of 11-year-old Dwarf coconuts in KP. Pandu in May decreased. But in June, production of GTT and GSK coconut neera increased again, but still lower than in April. While the production of GKN, GKB and GRA is declined due to high rainfall in May and June. High rainfall causes low production because of the process of photosynthesis that produces neera does not take place optimally due to the low intensity of sunlight.

3.2. Number of bunches tapped and Duration of tapping

Neera tapping is carried out on bunches that is free from pest and disease attacks. The eligible bunches are tied with a rope, and before use as a binder, the raffia rope is opened so that it becomes wide. Bunches that had been tied up, ducked slowly. The submission of bunches is made in conjunction with the binding of bunches. These bunches that have been tied are left for 2-3 days then cut off the ends and cut each day. If the neera begins to drip, the container is placed at the end of the bunch that releases the neera. The process of tapping and storing affects the freshness of neera, as the sugars contained in neera are easily fermented [12]. To prevent the neera from becoming acidic, into the container is inserted a preservative solution. In this study, bunches released neera one week after the first cut.
The number of bunches tapped per tree differs according to the dwarf coconut accession and the season at the time of tapping. Based on figure 2, the results of the study indicated the duration of neera tapping in one bunch differs depending on the accession. GKB accession is the longest to be tapped, which was 23.5 days compared to the other four coconut accessions. In addition to the volume of neera, the number of bunches tapped/trees/day increased compared to the results of the 2013 study[6]. Wiretapping is done twice in the morning and evening. According [6], the longest bunch of GTT coconuts was tapped (19.00 days). The results illustrated the progress in terms of long-time tapping. This situation is presumably caused by differences in the skills of the tapper. In this study, the tappers are professional and experienced because they are coconut sugar artisans. [13] It is reported that the length of tapping of coconut flower bunches can reach six months, depending on the condition of the plant and the growing environment.

3.3. Brix of neera
Based on Figure 3, the sugar content of five varieties of dwarf coconuts, ranged from 14.20-14.70% in April, and fertilizer treatments did not affect the sugar levels of dwarf coconut neera until the end of the study (June 2016). Neera sugar levels in May (12.20-14.60%) and June (12.87-14.38%) were lower than those in April. The low content of sugar due to high rainfall in May and June. Rainwater enters the container of neera reservoir, causing lower sugar concentration.
The results of this study are similar to those reported by [6] that the sugar content of neera coconut dwarf is about 13.51-14.77. The same result was conducted by [14] that Malaysian yellow dwarf has a sweetness rate of 16%, coconut Hybrid PB 121, coconut Hybrid 113 consecutively 13.68 and 13.56 while coconut in which is West Africa Tall 13.03%. This indicates that each coconut accession is different in sugar content.

3.4 Rendement of Sugar (%)
Sugar yield of five accessions of dwarf coconut in April 2015 range 16.34-17.33%, May 15.75-16.91%, and June 13.00-16.67%. Based on varieties, GKN produces the highest neera/bunch/tree/day (1946.86 ml), followed by GKB (1770.69 ml), GSK (1766.83 ml), and GRA (1108.76 ml). But the number of bunches tapped / trees most GTT, which is 1.92 bunches, followed by GKB 1.62 bunches, GKN 1.49 bunches, GSK 1.31 bunches, and GRA 1.00 bunches, then the production of neera/tree/month is obtained in the coconut GTT, followed by GKB, GKN, GSK, and GRA. The results of this study showed that the position of GTT, GKB, GSK, and GRA as the results of the International Palm Crops Institute (IPCR) [6], despite the increase in the volume of neera produced.

![Figure 4. Rendement (%) fives accession of Dwarf Coconut](image)

The highest rendement among the five varieties of Dwarf coconuts tested was obtained on GKN, which is 17.29%, GKB (13.30%), GSK (14.08%), and GRA (13.96%), and GTT (15.62%). But when compared to Hybrid coconut and Deep coconut, Dwarf coconut rendement is lower than hybrid coconut (18.45%), and specifically GKN, The yield is almost the same as the Tall coconut (16.64%).

4. Conclusion
Fertilizing coconut plants has not served the quality of neera, namely the number of neera, the number of banchesand the length of tapping, the sugar content of neera, and the yield of coconut neera sugar for three months Volume neera from the five coconut Dwarf vary every day. Tebing Tinggi Dwarf(GTT) showed the highest production of neera/bunch / last day followed by Bali Yellow Dwarf (GKB), SalakDwarf(GSK), NiasYellow Dwarf(GKN), and Raja Dwarf(GRA). Bali Yellow Dwarf (GKB) is the longest tapped, which is 23-24 days. The sugar contents of five Dwarf coconuts are about 14.20-14.70%, 12.20-14.60%, and 12.87-14.38% in April, May, and June, respectively. The highest yield of coconut sugar is in Yellow Nias Dwarf (GKN) by 17.29%.
References

[1] Somawiharja, Y, Wonohadidjojo, D.M, Kartikawati, M, Suniati, F.R.T and Purnomo H 2018 Food Res.2 398–403
[2] Trinidad T P, Mallillin A C, Sagum R S and Encabo R R 2010 J. Funct. Foods2 271–4
[3] Karouw S and Lay A 2006 Bul. Palma 1 116–25
[4] Febriyanti R, Susanto W H and Nugrahini N I P 2015 J. Pangan dan Agroindustri 3 1026–31
[5] Muzaifa, M, Heru, Widayat M 2012 J. Teknol. dan Indutri Pertan. Indones.4 6–12
[6] Mashud N and Yulianus Matana 2014 Bul. Palma15 110–4
[7] Meity Tulalo dan Sukmawati 2018 J. Litri24 87–92
[8] Risandi F.H A M dan S M A 2020 J. Kultiv.19 1–7
[9] Purwanto P, Mujiono M and Tarjoko T 2017 Planta Trop. J. Agro Sci.5 2015–8
[10] Samsudeen K, Niral V, Jerard B A, Kumar M, Sugatha P and Hebbar K B 2013 J. Plant. Crop.41 57–61
[11] Haryanti P, Marseno D W and Santoso U 2018 Agritech,38 295–303
[12] Indahyanti E, Kamulyan B and Ismuyanto B 2014 J. Penelit. Saintek19 1–8
[13] D.K. Ghosh, A. Bandyopadhyay, S. Das K B H and B B 2018 Int.J.Curr.Microbiol.App.Sci7 1883–97
[14] Konan N’guessan Ysidor A R R and Konan Konan Jean-Louis, Okoma Djeya Muriel1, Alexia Prades A K and B G H M 2014 Int. J. Biochem. Res. Rev.4 116–27