The production of sugarcane (Saccharum officinarum L.) bud sett at the various ages of planting material and storage time

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Abstract. The best age and storage time of planting material sugar cane bud sett need to be known for sending of planting material bud sett that usually far from nurseries. This study aimed to determine the production of sugar cane (Saccharum officinarum L.) using bud sett planting materials at the various ages (6 months, 7 months, and 8 months) and storages (3 days, 6 days, 9 days, and 12 days). This research was carried out on the land of the Faculty of Agriculture, Universitas Sumatera Utara, Medan, starting in July 2018 - July 2019. The results showed that the best production was obtained from the use of bud sett aged 7 months and stored for 3 days. The use of bud sett aged 6 and 7 months can be stored up to 9 days, while the use of bud sett aged 8 months can be stored up to 6 days where the results were not significantly different with the use of 7 months planting material and storage for 3 days.

1. Introduction
Sugarcane is the main sugar-production plant which contains a lot of carbohydrates and the main source for domestic sugar consumption [1]. The causes of low domestic sugar production are the preparation of seedlings, low quality seedlings and the lack of available land area for breeding [2]. Seeds supply is still mostly done conventionally (sugar cane stems with 2-3 eye shoots) which require a lot of planting material and expensive. One of the efforts to overcome these problems is by using a bud sett (single eye segment) nursery technique.

Sugarcane planting material needs in a land are often met from outside the area. The problem is while on the storage time, seeds will decrease its water content that can decreased the germination. The fast process of storing planting material, the better percentage of growth [3].

Plant age is one of the important factors in cutting. Planting material for sugarcane is often used from 6th months plant because of adequate number of shoots, optimal growth power and meristematic. But technical obstacles in the field such as land in the field were not ready, transportation constraints and lack of manpower to plant the bud sett, so that considered to using seeds aged 6 months, 7 months and 8 months [4].

This study aimed to determine the production of bud sett seedlings in various ages of planting material and storage times.

2. Materials and methods
The experiment was carried out on July 2018 - July 2019 in the land of the Faculty of Agriculture, Universitas Sumatera Utara, Medan. This study used a randomized block design with two factors, the
first factor was the age of plant material (6 months, 7 months, and 8 months) and storage time (3 days, 6 days, 9 days, and 12 days). This research was carried out in two stages, the first stage of seeding in a polybag up to 4 months of age, the second stage was in the field until the plants are 11 months old, using sugar cane BZ 134 varieties. Storage of planting material was carried out by inserting sugar cane in a wooden box and stored in room according to treatment, then cut bud sett. The bud sett was soaked in the NAA with the concentration 0.2 ppm and IBA 0.15 ppm for 20 minutes then planted in a poly bag that contain the top soil for 4 months. Fertilizing at the nursery stage was carried out twice, at the age of 15 days after plant and 30 days after plant with N, P, K fertilizer (2; 2; 2 g / 10 plants). After 4 months, the seedlings were moved to the field with the distance 50 cm between seedlings in a juring and 100 cm between juring. In the planting hole was given compost 450g / hole. Fertilizer dose that used was 300 kg Urea / ha + 200 kg TSP / ha + 200 kg MOP / ha, when transplanted seedlings were given 1/3 dose of Urea + 1 dose of TSP; after 35 days the transplant were given 2/3 doses of Urea + 1 dose of MOP. Plant maintenance was carried out in field such weeding and removed the dried leaves. The parameters such as length of production stem, diameter of production stem, and weight of production stem per clump were collected at the harvest time which was 7 months after transplanting.

Data were analysed statistically by the F test and continued by the Duncan Multiple Range Test (DMRT) at α 5%.

3. Results and discussion

3.1. Production stem length

Table 1 shows that the longest production stems obtained on bud sett age 7 months and stored for 3 days (U_2L_1) which are not significantly different with 6 and 9 days storage treatment. At the age of 6 months planting material stored for 3 and 6 days also has a production stem length that is not significantly different from U_2L_1. At the age of 8 months planting material stored 3 days also has a production stem length that is not significantly different from U_2L_1. Storage time of 3 days give the higher results for production stem length compared to storage time of 6 days, 9 days and 12 days. This was because the food reserves contained in the 7-month-old planting material are sufficient and more when compared with the 6-month-old planting material and are more meristematic than the 8-month-old planting material, where at the age of 8 months the elongation phase of the stem is almost over [5]. The growth rate and the relative growth rate of bud sett seedling at 6-8 weeks after planting were obtain highest at the used of bud sett aged 7 months [6]. Storage time of 3 days gave the higher result for production stem weight per clump compared to storage time of 6 days, 9 days and 12 days. This was because the sugarcane seeds that were stored for 3 days have enough water content for the plant growth. In the previous research of the growth of sugar cane bud sett, also obtained the best length and diameter of the seedling is from 7 months planting material that stored for 72 hours [7].

| Age of Planting material (month) | Storage times (day) | Mean |
|---------------------------------|--------------------|------|
|                                 | L_1 (3)           | L_2 (6) | L_3 (9) | L_4 (12) |
| U_1 (6)                         | 2.22 ab           | 2.27 a  | 2.03 bc | 1.98 c  | 2.13   |
| U_2 (7)                         | 2.28 a            | 2.23 a  | 2.11 abc| 1.91 e  | 2.14   |
| U_3 (8)                         | 2.24 a            | 1.95 c  | 2.01 c  | 1.65 d  | 1.96   |
| Mean                            | 2.25              | 2.15    | 2.05    | 1.85    |

Note: Numbers followed by the same letters show no significant differences in Duncan's Multiple Range Test at α = 5%.
3.2. Production stem diameter

Table 2 shows that the largest diameter of the production stems obtained on bud set material aged 8 months and stored for 12 days ($U_3L_4$) which is not significantly different with storage 3 and 6 days. At the planting material age 6 months that stored for 3, 9 and 12 days also has a production stem diameter that is not significantly different from $U_3L_4$. At the age of 7 months planting material stored up to 12 days also has a production stem diameter that is not significantly different from $U_3L_4$. This was supported by the data in Table 1 which shows that the length of planting material with the age 8 month and storage until 12 days produce the shortest stems. The older age of planting material, the lower its meristematic ability, this causes the ability to grow up lower while the diameter is getting bigger. This result accordance to the previous research of Ambarini which stated that the lowest seedling length is obtained at the use of 8 month planting material and storage for 12 days [8].

**Table 2.** The diameter of 11th months sugarcane production stem at the various ages of planting material and storage times

| Age of Planting material (month) | Storage times (day) | Mean |
|----------------------------------|---------------------|------|
|                                  | L$_1$ (3)           | L$_2$ (6) | L$_3$ (9) | L$_4$ (12) |      |
| U$_1$ (6)                        | 2.78 abc            | 2.68 bc   | 2.85 abc   | 2.87 abc   | 2.79 |
| U$_2$ (7)                        | 2.79 abc            | 2.87 abc  | 2.89 abc   | 2.75 abc   | 2.82 |
| U$_3$ (8)                        | 2.75 abc            | 2.92 ab   | 2.62 c     | 3.01 a     | 2.82 |
| Mean                             | 2.77                | 2.82      | 2.78       | 2.87       |      |

Note: Numbers followed by the same letters show no significant differences in Duncan’s Multiple Range Test at $\alpha = 5\%$.

3.3. Production stem weight

Table 3 shows that the best production stem weight obtained at bud set age 7 months and stored for 3 days ($U_2L_1$) which are not significantly different with 9 days storage treatment. At the age of 6 months planting material stored up to 9 days also has a production stem weight that is not significantly different from $U_3L_1$. At the planting material age 8 months that stored up to 6 days also has a production stem weight that is not significantly different from $U_3L_1$. The 8 months planting material stored for up to 6 days also has a weight of production stem that are not significantly different from $U_3L_1$. This explained that the 7 months planting material that storage until 3 days was a prime condition which allow the planting material to actively divide so it can produce the best stem length that in line to the production stem weight. Storage must be minimized to ensure the survival [9].

**Table 3.** The weight of 11th months sugarcane production stem at the various ages of planting material and storage times

| Age of Planting material (month) | Storage times (day) | Mean |
|----------------------------------|---------------------|------|
|                                  | L$_1$ (3)           | L$_2$ (6) | L$_3$ (9) | L$_4$ (12) |      |
| U$_1$ (6)                        | 8.91 abc            | 8.70 abc  | 9.16 ab    | 7.70 bcd   | 8.62 |
| U$_2$ (7)                        | 9.90 a              | 7.32 de   | 9.43 ab    | 8.61 bc    | 8.82 |
| U$_3$ (8)                        | 9.18 ab             | 8.92 abc  | 6.16 e     | 7.87 cd    | 8.03 |
| Mean                             | 9.33                | 8.32      | 8.25       | 8.06       |      |

Note: Numbers followed by the same letters show no significant differences in Duncan’s Multiple Range Test at $\alpha = 5\%$. 
4. Conclusion

The results showed that the best production was obtained from the use of bud sett aged 7 months and stored for 3 days. The use of bud sett aged 6 and 7 months can be stored up to 9 days, while the use of bud sett aged 8 months can be stored up to 6 days where the results were not significantly different with the use of 7 months planting material and storage for 3 days.

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