**Original Research Article**

**Influence of Harvesting Age on Yield and Quality of Sugarcane Varieties (PMA-7, PMA-8, PMA-9) in Myanmar**

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ABSTRACT

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| This study aimed to determine the optimal harvesting age for three sugarcane varieties and to assess the changes in yield and quality at different harvesting ages. It was conducted at the Sugarcane Research Farm in Pyinmana and Nyaungpintha, Myanmar, from December 2023 to January 2025. The results indicated a similar number of millable canes across all varieties; however, significant differences were observed in single cane weight, cane yields, and sugar yields among the varieties. PMA-7 (92.56 t ha-1) achieved the highest yield in Pyinmana, whereas PMA-9 (89.90 t ha-1) performed best in Nyaungpintha. All varieties demonstrated comparable quality parameters at each location. Regarding harvesting ages, the 13-month age (H3) tended to produce higher yields at both sites. Additionally, there were quality parameters improved consistently at 13 months. In conclusion, the sugarcane varieties showed differing cane and sugar yields, while harvesting ages had a notable impact on quality parameters in both Pyinmana and Nyaungpintha. PMA-7 consistently produced higher cane and sugar yields in Pyinmana, while PMA-9 showed superior performance in Nyaungpintha. All quality parameters improved when harvesting ages were extended from 11 to 13 months. It is suggested that the tested sugarcane varieties should be harvested at 13 months of age for optimal results. This manuscript provides valuable insights on how harvest timing influences sugarcane yield and quality. Its findings guide farmers and policymakers in improving productivity and sustainability in sugarcane production. |

***Keywords*:** *cane quality, cane yield, harvesting age, sugar yield, sugarcane, variety*

# 1. INTRODUCTION

Sugarcane (*Saccharum* spp.) is a crucial industrial source for raw materials used in sugar and ethanol production, primarily cultivated in tropical and subtropical regions around the globe (Hoang, 2017). It serves as a key commercial crop in both developing and developed countries. Worldwide, sugarcane plays a significant role as a major sugar source and finds applications in various industries. It is the primary raw material for sugar production, essential for food processing and human consumption, and influential in sectors like beverages and pharmaceuticals (Khin Moh Moh Aung, 2024).

In Myanmar, sugarcane production is a vital part of the agricultural sector and the economy. The country cultivates sugarcane across 165000 hectares, producing 10.9 million tons with an average yield of 65.83 t ha-1 (Ministry of Agriculture, Livestock and Irrigation [MOALI], 2023). This yield is lower than that of Brazil, India, and China, which rank as the top sugarcane-producing countries in the world. Factors contributing to the low sugarcane yield include a lack of locally adapted sugarcane varieties, varying regional climates, pest infestations, and the need for improved infrastructure and technology.

Myanmar’s diverse climatic conditions and soil types provide a range of environments suitable for sugarcane cultivation. Various locally adapted sugarcane varieties are grown, and the Sugarcane Research Farm in Pyinmana has developed several hybrid varieties. These hybrids are bred for high sugar content, yield potential, and resistance to environmental stressors. Many hybrids are either imported or cross-bred within Myanmar to enhance their performance in the country's unique growing conditions. Notable characteristics of these hybrids include increased resistance to drought, pests, and diseases, along with higher yields of both sugarcane and sugar. Among these, varieties such as Pyinmana-7 (PMA-7), Pyinmana-8 (PMA-8), and Pyinmana-9 (PMA-9) have been selected for their suitability to the local water and soil types, as well as climatic conditions, making them favorites among farmers for their good yields.

Sugarcane varieties differ in their maturation times, impacting their quality, yield, and specific characteristics. These differences are significant for both cane growers and processors (Vajantha et al., 2019). Many researchers have emphasized the significant role that yield variations, components, and quality play among different sugarcane varieties (Abo El-Hamd, Ibrahim, Ahamed, & Kamel, 2019).

Proper timing of the harvest is essential; harvesting under-aged or over-aged cane can result in yield loss, poor juice quality leading to reduced yield and sugar content (Terauchi et al., 2012). Conversely, delaying the harvest can decrease cane yield, lower sugar recovery, compromise juice quality, and create milling challenges. According to Hagos et al. (2014), harvesting at the optimal age can maximize the weight of millable canes, minimize field losses, and significantly enhance the percentage of Brix, sucrose, and purity.

The Brix percentage is a critical factor in sugarcane production, as it indicates the sweetness of the plant. Typically, sugarcane is harvested at its physiological maturity, which usually occurs around 12 months, though this can vary among different varieties. The optimal harvesting age is determined based on crop cycles, particularly when the sugarcane stalks reach a Brix value of 16-20%. However, limited research has been conducted to identify the best harvesting age and appropriate sugarcane varieties for Myanmar’s farmers. Therefore, this study aims to establish the ideal harvesting age for the released sugarcane varieties and to evaluate how both yield and quality change at different harvesting ages.

# 2. MATERIAL AND METHODS

**2.1 Experimental Site**

Two field experiments were conducted from November 2023 to January 2025 at the Sugarcane Research Farm in Pyinmana, located at 19.00° N latitude, 96.00° E longitude, and at an elevation of 152.36 meters above sea level and Nyaungpintha, situated at 18.00° N latitude, 96.00° E longitude, and at an elevation of 175.00 meters above sea level. Both farms are operated under the Department of Agriculture (DOA) in Nay Pyi Taw, Myanmar.

**2.2. Experimental Design and Treatments**

The experiment was conducted by using a split-plot design with four replications for each treatment, testing a total of nine different treatments. Three sugarcane varieties developed and released by the Sugarcane Research Farm in Pyinmana were used in this experiment: V1 = PMA-7, V2 = PMA-8, and V3 = PMA-9, which were assigned to the main plots. The subplots were designated for three harvesting ages: H1 = Brix 16-20% (harvest when the sugarcane stalk reaches a Brix level of 16-20%), H2 = one month after H1, and H3 = two months after H1. Each plot measured 10 x 5.33 meters, resulting in a total experimental area of 1,918.8 square meters.

## **2.3 Crop Management**

In November 2023, the first tillage operation was conducted in the experimental fields at both locations. This process involved using a tractor equipped with two-disc ploughs to perform four rounds of harrowing. Following this, the fields were cleared of crop residues and any unwanted materials. A second tillage operation took place in December 2023, which included leveling the soil, harrowing with 16 discs, and plowing. Then, to achieve good soil tilth, three-disc deep plowing was employed, followed by the use of 16-disc harrows for finer tillage. Finally, ridges and furrows were prepared for planting sugarcane using a tractor.

Three sugarcane varieties: (PMA-7, PMA-8, and PMA-9) were used in this experiment. Each variety has a growth duration of 12 months. For planting, only the middle portion of the cane setts was utilized, while the top and bottom portions were discarded due to their lower germination rates. Healthy, disease-free cane setts with three eye buds were selected and soaked in water for 24 hours to enhance germination. Additionally, all cane setts were treated by dipping them in a 2% Topsin solution for 30 minutes to prevent seed-borne diseases

Cane setts were planted using a ridges and furrows system at a seed rate of 9.88 tons per hectare, with rows spaced 1.33 meters apart. The field was leveled with heavy planking to retain soil moisture and ensure uniform germination. After planting, the furrows were covered with 5 to 7 centimeters of soil. It is essential to ensure adequate moisture in the field at the time of planting.

One-third of the total nitrogen rate (247 kg N ha-1), in the form of urea and the total potassium rate (also 123 kg K2O ha-1), in the form of Muriate of Potash were applied at three different growth stages of sugarcane: at the basal stage, at tillering (90 days after planting), and at grand growth phase (125 DAP). A phosphorus rate of 123 kg P2O5 ha-1 was applied as a basal fertilizer using triple superphosphate. The remaining urea and potash fertilizers were applied as a side dressing, followed by earthing-up in each plot.

After planting, irrigation was provided due to dry conditions during the dry season. During the rainy season, when the field was flooded, drainage was implemented. The first weeding was carried out using draft animals one week after irrigation. The second weeding was completed by hand one month later. After the first weeding, the final application of remaining fertilizers was made, and the earthing-up process was completed.

## **2.4 Data Collection**

**2.4.1 Yield and yield components**

During harvest time, we recorded the number of millable canes from each plot. The cane yield was calculated based on these counts. Before harvesting each plot, we randomly selected ten cane stalks from the two central rows and harvested them by hand. We then weighed the ten sampled cane stalks using a hanging scale to determine the weight of a single cane stalk. The following formula was used to calculate the cane yield:

**2.4.2 Quality parameters**

A Brix refractometer was used to evaluate the total sugar content (Brix) in the juice samples. Brix measurements were taken from the standing stalks located in the middle row of each plot. At one-third of the ground level, three sample plants were tested with a hand refractometer in the field. A higher Brix value indicates a greater amount of sucrose. After harvesting, cane juice was extracted using a three-roller sugar mill, and the Brix level was determined with a Brix hydrometer.

Cane juice was clarified using lead acetate, and polar readings were noted with a polarimeter. The quality of the cane, including brix percentage and pol percentage, was tested. Purity percentage was computed from brix and pol using the following equation.

(Meade & Chen, 1977)

Fiber content was determined from the cross-section of the stalk, taken from the base, middle, and top portions of each sample cane stalk. Fiber was extracted from the cane stalk using a cane shredder, followed by a standard washing method.

Commercial cane sugar (CCS%) is calculated using the following formula:

Where, P = Pol% in cane juice, B = Brix% in cane juice, F = Fibre% in cane

(Yadav & Sharma, 1980)

Sugar yield was computed using the following formula:

(Mathur, 1997)

**2.5 Statistical Analysis**

The data were subjected to analysis of variance by using Statistix (8.0) software. The treatment means were compared by Least Significant Difference (LSD) at a 5% level of significance.

**3. RESULTS AND DISCUSSION**

## **3.1 Yield and Yield Components**

### **3.1.1 Single cane weight**

In Pyinmana and Nyuangpintha, the weight of individual sugarcanes was significantly influenced by the sugarcane varieties (Table 1). However, no significant differences were observed among the harvesting ages (Table 1). Additionally, there was no interaction effect between the sugarcane varieties and harvesting ages (Table 1). The maximum cane weight recorded was 1.76 kg for the PMA-7 variety at the Pyinmana site, while 1.81 kg was observed for the PMA-9 variety at Nyuangpintha. The differences in cane weight among varieties may be attributed to variations in stalk diameter and height. This finding aligns with the results of Yousif, Ibrahim, and Ahamed (2015), who also noted that differences in stalk weight among varieties could be linked to differences in stalk height and diameter.

The harvesting age of H3 (approximately 13 months) yielded the highest single cane weight of 1.71 kg in Pyinmana and 1.72 kg in Nyuangpintha. This indicates that single cane weight gradually increases as the harvesting age is extended. These results are consistent with the findings of Ahmed, El-Bakry, and Abazied (2016), who reported that stalk cane weight significantly increased when the plant age was extended from 11 to 14 months.

### **3.1.2 Millable cane per hectare**

The number of millable canes was not significantly influenced by the various sugarcane varieties and harvesting ages at both sites (Table 1). Numerically, the maximum number of millable cane, 52701 ha⁻¹ was achieved by the PMA-7 variety at Pyinmana, while the PMA-9 variety yielded 49762 ha¹ at Nyuangpintha. The increased population of cane and the utilization of growth factors such as space, sunlight, water, and nutrients may have contributed to the rise in the number of millable canes (Ali, Gadallah & Hussien, 2022).

When compared to other varieties, the PMA-7 variety demonstrates a higher number of millable canes, which suggests it is better suited to well-distributed rainfall in the central zone of Myanmar. Conversely, the PMA-9 variety may thrive in regions with heavier rain and is more suited to wetter zones. The highest number of millable canes observed was 51929 ha⁻¹ at Pyinmana and 49837 ha⁻¹ at Nyuangpintha, noted at harvesting age H3.

Tillering capacity and tiller population are the main vital crop variables that are used to estimate the final millable cane and sucrose yield (D Legesse, Legesse & Geleta, 2016).

### **3.1.3 Cane yield**

A significant difference in cane yield was observed among various sugarcane varieties (Table 1) in Pyinmana and Nyuangpintha. However, no significant differences were found among the harvesting ages (Table 1). At Pyinmana, the highest cane yield of 92.56 t ha-1 was recorded for the PMA-7 variety, while the PMA-9 variety yielded 89.90 t ha-1 at Nyuangpintha. The variation in cane yields among the tested varieties may be attributed to their distinct characteristics. These findings support those reported by Abd El-Azez, Nagib, and Elwan (2018), who also found significant differences in cane yield among the studied varieties.

Additionally, the highest cane yields of 88.41 t ha-1 at Pyinmana and 85.72 t ha-1 at Nyuangpintha were observed at a harvesting age of H3. Gemechis and Ebisa (2021) reported that this may be due to the contribution of maximum cane yield at the harvest age and the increasing effect of quality parameters with extending age.

**Table 1 Yield and yield components of sugarcane as affected by varieties and harvesting ages**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Treatment** | **Pyinmana Site** | | | | | **Nyaungpintha Site** | | | | | | |
| **Single cane weight (kg)** | **Millable cane (ha-1)** | | **Cane yield ( t ha-1)** | | **Single cane weight (kg)** | | **Millable cane (ha-1)** | | **Cane yield ( t ha-1)** | |
| **Variety (A)** |  |  | |  | |  | |  | |  | |
| V1 (PMA-7) | 1.76 a | 52701 | | 92.56 a | | 1.64 b | | 48068 | | 79.09 b | |
| V2 (PMA-8) | 1.68 ab | 50310 | | 84.37 b | | 1.58 b | | 46898 | | 74.04 b | |
| V3 (PMA-9) | 1.64 b | 48068 | | 78.82 b | | 1.81 a | | 49762 | | 89.90 a | |
| LSD 0.05 | 0.08 | 4605.30 | | 7.37 | | 0.07 | | 4098.30 | | 8.21 | |
| **Harvesting (B)** | | |  | |  | |  | |  | |  | | |
| H1 | 1.67 | 50434 | | 84.53 | | 1.62 | | 46848 | | 76.28 | |
| H2 | 1.7 | 48716 | | 82.8 | | 1.69 | | 48044 | | 81.02 | |
| H3 | 1.71 | 51929 | | 88.41 | | 1.72 | | 49837 | | 85.72 | |
| LSD 0.05 | 0.04 | 3281.60 | | 5.65 | | 0.10 | | 3572.20 | | 8.68 | |
| **Pr > F** |  |  | |  | |  | |  | |  | |
| Variety (A) | \* | ns | | \*\* | | \*\* | | ns | | \* | |
| Harvesting (B) | ns | ns | | ns | | ns | | ns | | ns | |
| A x B | ns | ns | | ns | | ns | | ns | | ns | |
| CV % (a) | 4.63 | 9.15 | | 8.66 | | 4.22 | | 8.50 | | 10.14 | |
| CV % (b) | 2.83 | 7.60 | | 7.73 | | 6.68 | | 8.63 | | 12.49 | |
| \*\*= significant at 1 % level, \* = significant at 5% level, ns = non - significant  H1 = Brix 16% - 20% (about 11 months age), H2 = One month after H1(~ 12 months age), H3 = Two months after H1 (~ 13 months age) | | | | | | | | | | | | | |

## **3.2 Cane Quality Parameters**

### **3.2.1 Brix %**

The response of sugarcane to brix percentage did not significantly differ among the various sugarcane varieties (Table 2). However, the effect of harvesting age on brix percentage showed significant differences (Table 2) in both locations. The highest brix percentage recorded was for the PMA-7 variety, which reached 20.23% in Pyinmana, while the PMA-9 variety achieved 20.30% in Nyaungpintha. Differences among varieties in brix% could be due to differences in their growth and response to the surrounding environmental conditions. Similar results were observed by Mehareb, Abou-Elwafa, and Galal (2016), who also found differences among the evaluated sugarcane varieties in terms of brix percentage.

Among the varying harvesting ages, the highest brix percentage was recorded for H3 at 20.80% in Pyinmana and 21.11% in Nyaungpintha. As the harvesting age increased from 11 to 13 months, the brix percentage gradually and significantly increased. This increase may be due to the continuous accumulation of soluble solids as the harvest date approaches the end of the growth period (between 11 to 14 months old). Similar findings were reported by Abu-Ellail, Gadallah, and El-Gamal (2020), who noted that the age at harvest significantly influences brix percentage.

### **3.2.2 Pol (sucrose) %**

The response of sugarcane to different polarization percentages did not show significant differences across the various sugarcane varieties (Table 2). However, a significant difference was observed between harvesting ages (Table 2) in both Pyinmana and Nyaungpintha. The highest polarization percentages recorded were 17.11% for the PMA-7 variety in Pyinmana and 17.24% for the PMA-9 variety in Nyaungpintha; these values were statistically similar with other in both sites. The interaction between varieties and environmental conditions during growth, sucrose formation, and storage periods leads to variations in sucrose percentages. According to the findings of Mehareb, Abou-Elwafa, and Galal (2016), there were changes among the evaluated sugarcane varieties concerning brix and sucrose percentages.

Furthermore, the highest polarization percentage 17.87% in Pyinmana and 17.93% in Nyaungpintha was observed at the harvesting age of H3. This phenomenon could be attributed to the dilution effect of enzymes, which alter the levels of reducing sugars and non-sucrose materials, thereby allowing for greater sucrose accumulation at the time of harvest. According to the findings of Shikanda, Jamoza and Kiplagat (2017), who reported that harvest age exhibited significant influence on brix, sucrose, and purity percentage.

### **3.2.3 Commercial cane sugar (CCS %)**

In both locations, there were no significant differences in the CCS percentage among the different sugarcane varieties (Table 2). However, the harvesting age showed a significant difference (Table 2). The highest CCS percentage recorded was 12.53% for the PMA-7 variety in Pyinmana, while the PMA-9 variety in Nyaungpintha showed a CCS percentage of 12.60%. These values were not significantly different from each other. The variation in reducing sugar content among the tested varieties may be attributed to their inherent varietal characteristics. Kamel, (2015) reported significant differences in reducing sugar percentages across various sugarcane varieties.

In terms of harvesting age, the maximum CCS percentage was achieved at the H3 harvesting age, at both sites. The data indicated that the sugar recovery percentage increased as the age of harvest progressed from 10 to 13 months. Similar findings were reported by Ahmed, El-Bakry and Abazied (2016) also disclosed that sugarcane harvesting age and variety varied significantly in sugar recovery percentage.

**Table 2 Brix % and CCS % of sugarcane as affected by varieties and harvesting ages**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Treatment** | **Pyinmana Site** | | **Nyaungpintha Site** | |
| **Brix %** | **CCS %** | **Brix %** | **CCS %** |
| **Variety (A)** |  |  |  |  |
| V1 (PMA-7) | 20.23 | 12.53 | 20.24 | 12.26 |
| V2 (PMA-8) | 20.22 | 12.31 | 19.96 | 12.25 |
| V3 (PMA-9 | 20.00 | 12.29 | 20.30 | 12.61 |
| LSD 0.05 | 1.04 | 0.85 | 1.24 | 1.29 |
| **Harvesting (B)** |  |  |  |  |
| H1 | 19.58 c | 11.65 c | 19.36 c | 11.91 b |
| H2 | 20.06 b | 12.21 b | 20.02 b | 11.99 b |
| H3 | 20.80 a | 13.28 a | 21.11 a | 13.22 a |
| LSD 0.05 | 0.36 | 0.52 | 0.43 | 0.60 |
| **Pr > F** |  |  |  |  |
| Variety (A) | ns | ns | ns | ns |
| Harvesting (B) | \*\* | \*\* | \*\* | \*\* |
| A x B | ns | ns | ns | ns |
| CV % (a) | 5.18 | 6.91 | 6.17 | 10.46 |
| CV % (b) | 2.10 | 4.92 | 2.46 | 5.61 |

\*\*= significant at 1 % level, \* = significant at 5% level, ns = non - significant

H1 = Brix 16% - 20% (about 11 months age), H2 = One month after H1(~ 12 months age), H3 = Two months after H1 (~ 13 months age)

### **3.2.4 Purity %**

Both sugarcane varieties and harvesting ages did not show significant differences in purity percentages at the Pyinmana and Nyaungpintha (Table 3). The highest purity percentage, 84.55%, was observed with the PMA-7 variety at Pyinmana, while the PMA-9 variety recorded a purity percentage of 84.95% in Nyaungpintha. The variations in purity percentages can be attributed to the genetic composition of the varieties and their interaction with environmental conditions. Previous studies by El-Geddawy, Makhlouf, Bekheet (2015), Mehareb, Abou-Elwafa, and Galal (2016) have reported on the differences in juice purity among sugarcane varieties.

Regarding different harvesting ages, the highest purity percentage of 85.90% was obtained from the H3 harvesting age at Pyinmana. At Nyaungpintha, the maximum purity percentage of 84.99% was achieved at the H1 harvesting age, with similar values observed for H3. This indicates that sugarcane varieties reach their optimum maturity at this harvesting age. Throughout all harvesting periods, all varieties demonstrated a purity percentage above 80%, which is considered acceptable for the sugar industry (Rhein et al., 2016; Rodolfo Junior et al., 2016). This suggests that the effect of the varieties on sugarcane purity percentage was not influenced by the different harvesting ages.

### **3.2.5 Fiber %**

At both locations, the impact of sugarcane varieties on the fiber percentage did not show significant differences (Table 3), while the effects of different harvesting ages were highly significant (Table 3). Among the varieties, the PMA-8 variety exhibited the highest fiber percentage, recording 13.49% at Pyinmana and 13.80% at Nyaungpintha. Furthermore, the highest fiber percentage was observed at the harvesting age of H1, reaching 14.07% at both Pyinmana and Nyaungpintha. As the harvesting age increases, sucrose materials may continue to accumulate. The fiber percentage in the sugarcane varieties decreased with a delayed harvest. The differences observed in quality among the varieties could be attributed to their genetic makeup. This finding aligns with the research by (Gadallah & Abd El-Aziz, 2019), who noted that the fiber content in sugarcane is primarily influenced by the variety and the maturation stage. Notably, sugarcane with a high fiber content tends to have lower sugar recovery rates.

**Table 3 Pol %, Purity % and Fiber % of sugarcane as affected by varieties and harvesting ages**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Treatment** | **Pyinmana Site** | | | **Nyaungpintha Site** | | |
| **Pol %** | **Purity %** | **Fiber %** | **Pol %** | **Purity %** | **Fiber %** |
| **Variety (A)** |  |  |  |  |  |  |
| V1 (PMA-7) | 17.11 | 84.55 | 13.09 | 16.88 | 83.57 | 13.08 |
| V2 (PMA-8) | 17.01 | 84.17 | 13.80 | 16.87 | 84.73 | 13.80 |
| V3 (PMA-9 | 16.88 | 84.36 | 13.48 | 17.24 | 84.95 | 13.50 |
| LSD 0.05 | 0.86 | 3.39 | 0.61 | 0.84 | 7.47 | 0.59 |
| **Harvesting (B)** |  |  |  |  |  |  |
| H1 | 16.28 c | 83.19 | 14.07 a | 16.42 b | 84.99 | 14.07 a |
| H2 | 16.84 b | 83.98 | 13.53 b | 16.65 b | 83.33 | 13.54 b |
| H3 | 17.87 a | 85.90 | 12.77 c | 17.93 a | 84.95 | 12.78 c |
| LSD 0.05 | 0.46 | 2.34 | 0.35 | 0.46 | 3.10 | 0.35 |
| **Pr > F** |  |  |  |  |  |  |
| Variety (A) | ns | ns | ns | ns | ns | ns |
| Harvesting (B) | \*\* | ns | \*\* | \*\* | ns | \*\* |
| A x B | ns | ns | ns | ns | ns | ns |
| CV % (a) | 5.07 | 4.02 | 4.55 | 4.97 | 8.86 | 4.42 |
| CV % (b) | 3.18 | 3.22 | 3.04 | 3.14 | 4.28 | 3.02 |

\*\*= significant at 1 % level, \* = significant at 5% level, ns = non - significant

H1 = Brix 16% - 20% (about 11 months age), H2 = One month after H1(~ 12 months age), H3 = Two months after H1 (~ 13 months age)

### **3.2.6 Sugar Yield**

Significant differences in sugar yield were observed among various sugarcane varieties and harvesting ages at both sites (Figure 1). The highest sugar yield, recorded at 11.64 t ha-1, was for the PMA-7 variety in Pyinmana, while the PMA-9 variety yielded 11.35 t ha-1 in Nyaungpintha, followed by other varieties. The higher sugar yield of these varieties can be attributed to an increase in sugar recovery percentage and net cane yield. Differences among cane varieties may be attributed to the genetic structure. Mehareb, Abou-Elwafa, and Galal (2016) also found significant differences among cane varieties for sugar yield.

In terms of harvesting ages, the maximum sugar yield was noted for H3, with yields of 11.74 t ha-1 at Pyinmana and 11.33 t ha-1 at Nyaungpintha. Sugar yield increased gradually with a delay in harvesting. Several researchers reported a significant increase in sugar yield associated with older harvesting ages (Mehareb & Abazied, 2017, Ali, Gadallah, & Hussien, 2022).

V1 = PMA - 7, V2 = PMA - 8, V3 = PMA - 9

H1 = Brix 16% - 20% (about 11 months age), H2 = One month after H1(~ 12 months age), H3 = Two months after H1 (~ 13 months age)

**Figure 1. Sugar yield (ton ha-1) as affected by varieties and harvesting ages in Pyinmana and Nyaungpintha sites**

# 4. CONCLUSION

The results of this study indicate that the tested sugarcane varieties exhibited varying yield abilities, and harvesting at different ages influenced various quality parameters of sugarcane. The PMA-7 variety adapted well to the Pyinmana site, leading to higher cane yields, while the PMA-9 variety performed better at the Nyaungpintha site. Furthermore, extending the harvesting age resulted improved yield, yield components, and quality parameters, with optimal results observed at a harvesting age of 13 months. Based on these findings, it is recommended that the PMA-7, PMA-8, and PMA-9 sugarcane varieties should be harvested at 13 months of age at both sites. Extending the harvesting age from 11 months to 13 months resulted in increased single cane weight, cane yield, sugar yield, and overall quality parameters of the sugarcane. For future research, it would be beneficial to test different sugarcane varieties and various harvesting ages across different locations.

**DISCLAIMER (ARTIFICIAL INTELLIGENCE)**

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

**COMPETING INTERESTS**

Authors have declared that no competing interests exist.

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