YIELD AND YIELD COMPONENTS OF FIVE SELECTED VARIETIES OF *ZEA MAYS* L.

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Abstract

This study was conducted to investigate yield and yield components of five different maize varieties such as V1: Waxy corn (Sticky Big) indicated as ***Zea mays* L.var. *ceratina*** Kulesh., V2: Sweet corn (Angel 131) as ***Zea mays* L. var. *saccharata*** (Sturter) L. H. Bailey., V3: Flint corn (Padamyar) as ***Zea mays*. L. var. *indurata*** (Sturter) L.H. Bailey., V4: Peruvian maize (Nga Cheik) as ***Zea mays*. L. var. *microspermae*** (Sturter)L.H. Bailey., and V5: Flour corn (Meilan) as ***Zea mays.* L. var. *amylacea*** (Sturter) L.H. Bailey.was carried out at Vegetables, Fruits Research and Development Center (VFRDC), Yemon, Hlegu Township, Yangon Region from September to January, 2018. The experiment was laid out in randomized complete block design with four replications. The data recorded on various parameters were analyzed using computer software Statistics 8.0. The results showed that the plant height of Angel 131 (Sweet corn) (V2) (215.15cm) which was the tallest and the shortest (143.70) by Nga Cheik (V4) at 56 DAS (day after sowing). The maximum number of leaf (12.8) was found in Angel 131 (V2) and the minimum number of leaf (8.94) in Nga Cheik (V4). The maximum kernel weight (326.60 g) and the maximum grains yield (103.38 g) in Angel 131 (V2) and the minimum kernel weight (137.60 g) and the minimum grains yield (39.51g) in Nga Cheik (V4) were also recorded. It is concluded that among five varieties, Angel 131 (V2), Sticky Big (V1) and Meilan (V5) varieties were observed the highest value of yield and yield production.

Keywords – *Zea mays* L., five maize varieties, yield and yield components

Introduction

Maize (*Zea mays* L.) is a member of the grass family, Poaceae. It is believed that maize was originated in Mexico and introduced to West Africa in the early 1500s by the Portuguese traders (Salunkhe, D.K., and B.B. Desai. 2000).

Maize (*Zea mays* L.) is the world's widely grown highland cereal and primary staple food crop in many developing countries (Kandil, 2013). It was originated in America and first cultivated in the area of Mexico more than 7,000 years ago, and spread throughout North and South America (Hailare, 2000). Maize is the third most important cereal after wheat and rice all over the world serving as staple food for many countries (Frova *et al*., 1999). In 2014, the United States topped the list of ten maize producing countries which includes China, Brazil, EU-27, Ukraine, Argentina, India, Mexico, South Africa and Canada with an amount of about 351 million metric tons. It is the short duration crop, capable of producing large quantity of food grain. It can be grown twice a year, both for grain and fodder (AGBIOS, 2005 a).

In Myanmar, maize crop was produced regularly in Northern Shan State, Mandalay Region and Ayeyarwady Region. Nowadays, quality seeds have been changed in production. The cultivar of yield maize has been increased annually after the period of 2009, local maize production has been tried to have more year-round production. The harvest period of maize in Myanmar is commencing from August or September and in full swing during October or November (MPBSA, 2013).

Maize is tall, annual plant with an extensive fibrous root system. It is cross pollinating species with the female (ear) and male (tassel) flower in separate places on the plant and versatile

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crop and everything on acorn plant is useable. The female flowers are arranged in a spike on short branch and are characterized by long and feathery style, which emerge out of the cob. The grain is typically a single seeded dry fruit, caryopsis, having two kinds of endosperm, the outer yellow and hard while the inner white and soft (AGBIOS, 2005 a).

Seed germination is an essential process in any plant development in order to obtain an optimal number of seedling that results in higher seed yield (Yusuf. C.S., Makate N. and Jacob. R., 2014).Maize maintains its growing at high temperatures. Maize plant needs 10-11 ºC temperature to start germination. It needs a temperature parameter above 15 ºC (17-18 ºC) and 30 ºC for optimum and maximum temperature respectively.

Maize is classified as sweet, pop, flour, silage or feed corn, depending on the type of carbohydrate stored in the ear. The average chemical composition of the grain is starch 68% - 70%, protein 5-11% and oil 3.5 - 5% respectively. Every part of the maize plant has economic value which the grain, leaves, stalk, tassel and cob can all be used to produce a large variety of food and non-food production. The husk of the maize is traditionally used in making tamales. The kernels are ground into food. The stalks become animal food and the silks are used for medicinal teas (Sleper, 2006).Therefore, aims and objectives of this study were to investigate the growth of five selected varieties and to evaluate the effect of yield and yield components of five selected varieties of *Zea mays* L.

Materials and Methods

Experimental site and plant materials

The field experiment was conducted at Vegetables and Fruits Research and Development Center (VFRDC), Hlegu Township, Yangon Region during September to December, 2018. In this experiment, a total of five maize varieties were collected from (VFRDC). These maize varieties were *Zea mays* L. var. Sticky Big (V1), *Zea mays* L. var. Angel 131 (V2), *Zea mays* L. var. Padamyar (V3), *Zea mays* L. var. NgaCheik (V4) and *Zea mays* L. var. Meilan (V5). Sticky Big (V1) is a commercial sticky maize and V5: Meilan is a glutinous maize. *Zea mays* L. var. Angel 131 (V2) is a commercial sweet maize and both V3 and V4 are local sticky maize varieties. Randomized complete block design (RCBD) with four replications were used in this experiment.

Soil Preparation and Fertilization

The soil was disk-ploughed thrice, leveled and harrowed. A basal dose of 15:15:15: (N:P:K) compound fertilizer and well-decomposed chicken manure were incorporated into the top soil at the rate of 50 kg ac^{-1} and 2 ton ac^{-1}, respectively shortly prior to planting. Lime at the rate of 100 kg ac^{-1} was incorporated into the soil during soil preparation. Seeds were treated with captan (3a,4,7,7a-tetrahydro-2- [(trichloromethyl)thio]- 1H-isoindole-1,3 (2H)-dione) at the rate of 5 g kg^{-1} seeds to protect from fungal diseases before planting. Plot size was 4 m x 4.5 m with 90 cm spacing of between rows and 30 cm between plants. Seeds were firstly germinated in the germination tray and the plantlets were transplanted into the field at 10 days after emergence. N:P:K compound fertilizer (15:15:15) was incorporated again into the soil twice at the rate of 50 kg ac^{-1} at one month and two months after transplanting. Irrigation was done daily until one month after transplanting and it continued with 2 days intervals. Hand weeding was done weekly until two weeks before harvest.

Data collection

The data for plant height, leaf number, leaf area and node length, stem girth, were collected at weekly intervals. The number of kernel row per ear, number of kernel per row, 100% grains weight, total dry matter per plant (dry weight, shoot weight and root weight) and grains yield were also collected for each variety.

Methods

Leaf Area (LA)

Leaf area was calculated according to (Montgomery, 1911).

Leaf area (LA) cm^2 = K x length (cm) x width (cm)

K value varies with the shape of the leaf which in turn is affected by cultivar, nutritional status, and growth stage of the leaf. K value for maize is (0.75).

Experimental Design and Statistical Analysis

The experiment was carried out using Randomized Completely Block Design (RCBD) in field. The totals of five maize varieties were carried out in the study. Each treatment consisted of four replications. Each replication included 5 samples plants. The data were subjected for analysis of variance according to a RCBD design and all calculation was performed using Statistic-8 package and Least Significance Differences (LSD) was used to compare treatment means (Gomez and Gomez, 1984).

Results

Plant height

Plant height had statistically significant differences ($P \leq 0.01$) among the maize varieties at 56 DAS (day after sowing). At 56 DAS, the tallest plant height was observed in Angel 131 (V2) 215.15 cm pt^{-1} followed by Meilan (V5) 191.60 cm pt^{-1} and Sticky big (V1) 188.75 cm pt^{-1} among the varieties. In contrast, the tallest means of plant height was found in Angel 131 (V2) 122.74 cm pt^{-1} and the shortest means in Nga Cheik (V4) 85.72 cm pt^{-1} among varieties throughout the growing period (Table 1. and Figure.1).

Number of leaves

The total number of maize leaves was gradually increased overtime among varieties. At 56DAS, the maximum number of leaves was observed in Angel 131 (V2) which was 12.80 pt^{-1} followed by Meilan (V5) which was 12.20 pt^{-1}, Sticky big (V1) which was 11.40 pt^{-1} and Padamyar (V3) which was 11.00 pt^{-1}. The minimum number of leaves was found in Nga Cheik (V4) which was 10.35 pt^{-1}. However, the mean differences in number of leaves were highly significant among the treatments during cultivation (Table 1. and Figure 1.).

Leaf area

Among the varieties at 56 DAS, the maximum leaf area was observed in Angel 131 (V2) which was 688.48 cm^2 pt^{-1}followed by Meilan (V5) which was 664.33 cm^2 pt^{-1}, Sticky big (V1) which was 626.35 cm^2pt^{-1} and Padamyar (V3) which was 603.13 cm^2 pt^{-1}. The minimum leaf area was found in Nga Cheik (V4) which was 583.77 cm^2 pt^{-1}. However, the mean differences in leaf area were highly significant among the treatments during cultivation (Table 1. and Figure 1.).

Node length

Among the varieties, the maximum node length was observed in Angel 131 (V2) which was 18.8 cm pt^{-1} followed by Meilan (V5) which was 18.47 cm pt^{-1}, V1 (Sticky big) which was 18.45 cm $pt^{-1}$and V3 (Padamyar) which was 14.7 cm pt^{-1}. The minimum node length was found in V4 (Nga Cheik) which was 14.45 cm pt^{-1}. The mean differences in stem numbers were not significance among the treatments during cultivation (Table 1. and Figure 1.).

Stem girth

Among the varieties at 56 DAS, the maximum stem girth was observed in Angel 131 (V2) which was 8.35 cm pt^{-1} followed by Meilan (V5) which was 8.12 cm pt^{-1}, Sticky big (V1) which was 7.85 cm pt^{-1} and Padamyar (V3) which was 7.77 cm pt^{-1}. The minimum stem girth was found in Nga Cheik (V4) which was 7.4 cm pt^{-1}. However, the mean differences in stem numbers were not significance among the treatments during cultivation (Table 1. and Figure 1.).

Table 1 Selected maize varieties of plant height, leaf numbers, leaf area, node length, stem girth at 56 DAS

Maize Varieties	Plant height ($cmpt^{-1}$)	Leaf numbers (pt^{-1})	Leaf area (cm^2pt^{-1})	Node length (cm)	Stem girth (cm)
Sticky Big (V1)	188.75	11.40	626.35	18.45	7.85
Angel 131(V2)	215.15	12.80	688.48	18.8	8.35
Padamyar (V3)	182.10	11.00	603.13	14.7	7.77
Nga Cheik (V4)	143.70	10.35	583.77	14.45	7.4
Melian (V5)	191.60	12.20	664.33	18.47	8.12
F-test	**	**	**	ns	ns
5%LSD	8.92	0.71	35.87	1.80	0.63
CV%	6.85	8.70	8.06	15.14	11.39

ns = non significance, ** = 1% level of highly significance

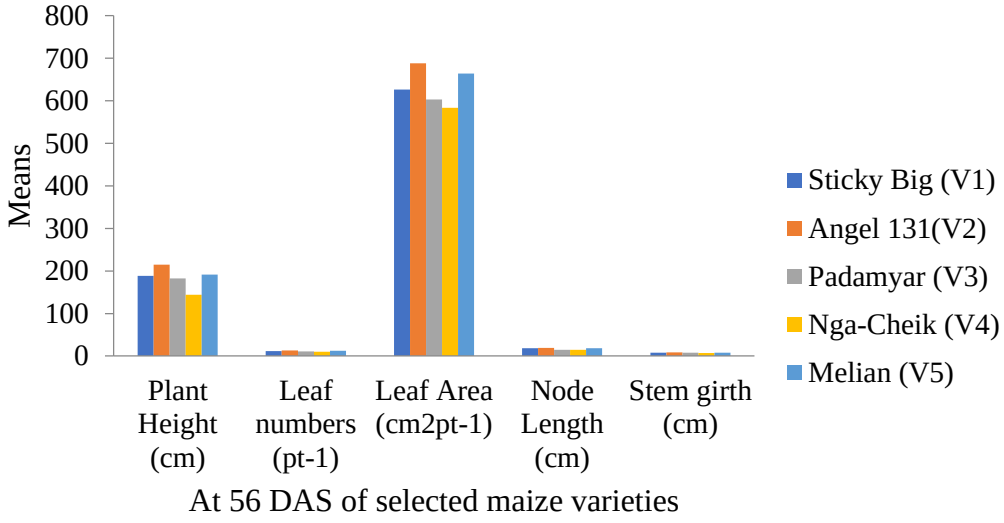

Figure1 Selected maize varieties of plant height, number of leaves, Leaf Area, Node length and Stem girth

Yield and Yield Components of selected maize varieties of *Zea mays* L.

1. **Number of kernel rows ear^{-1}**
   Among the maize varieties, Angel 131 (V2) has obtained the highest value of (16.65 ear^{-1}) followed by (Meilan) V5 (15.10 ear^{-1}), V1 (Sticky big) which was (14.40 ear^{-1}), V3 (Padamyar) which was (12.50 ear^{-1}) and the lowest number of kernel rows ear^{-1} was found (11.75 ear^{-1}) in Nga Cheik (V4).

2. **Number of kernel per rows**
   The highest mean number of kernel per rows was found in Angel 131 (V2) (36.95 row^{-1}) followed by (Meilan) V5 (32.10 row^{-1}), V1 (Sticky big) which was (31.40 row^{-1}), V3 (Padamyar) which was (24.60 row^{-1}) and the lowest number of kernel per rows was found (24.42 row^{-1}) in Nga Cheik (V4).

3. **100 grains dry weight (g)**
   The maximum number of 100 grains dry weight was found in Angel 131 (V2) which was (21.80 g) followed by (Meilan) V5 (17.47 g), V1 (Sticky big) which was (13.90 g), V3 (Padamyar) which was (13.47 g) and the minimum number of 100 grains dry weight was found (13.07 g) in Nga Cheik (V4).

4. **Total dry matter (pt^{-1})**
   The highest mean total plant dry matter per plant was found in Angel 131 (V2) which was (124.34 g) followed by (Meilan) V5 (114.63 g), V1 (Sticky big) which was (105.22 g), V3 (Padamyar) which was (99.11g) and the lowest mean total dry matter per plant was found (86.06 g) in Nga Cheik (V4).

5. **Grains Yield (gpt^{-1})**
   It was observed that the maximum grains yield in Angel 131(V2) (103.38 gpt^{-1}), followed by (Meilan) V5 (70.13 gplant^{-1}), followed by V1 (Sticky big) (62.55 gpt^{-1}), followed by V3 (Padamyar) (41.42 gpt^{-1}) and the minimum grains yield was found (39.51 gpt^{-1}) in Nga Cheik (V4).

Table 2 Yield and Yield Components of selected maize varieties of *Zea mays* L.

Varieties	V1	V2	V3	V4	V5	F-test	LSD%	CV%
No.of kernel rows ear^{-1}	14.40	16.65	12.50	11.75	15.10	**	0.46	4.70
No. of kernel per rows	31.40	36.95	24.60	24.42	32.10	**	3.39	16.0
100 grains dry weight (g)	13.90	21.80	13.47	13.07	17.47	**	0.55	7.01
Total dry matter (pt^{-1})	105.22	124.34	99.11	86.06	114.63	**	1.65	2.21
Grain yield (gpt^{-1})	62.55	103.38	41.42	39.51	70.13	**	1.43	3.34

F-test = significance, LSD 0.05% = Least significant difference of 5% level, CV% = Coefficient variation

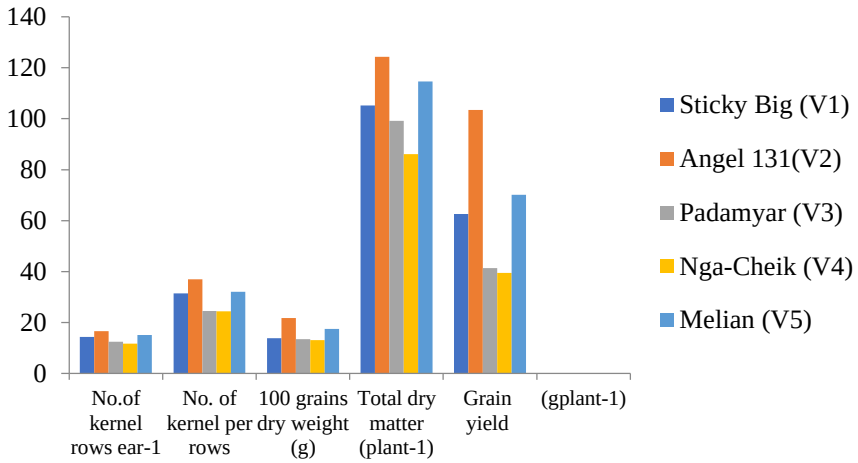

Figure 2 Yield and Yield Components of selected maize varieties of *Zea mays* L.

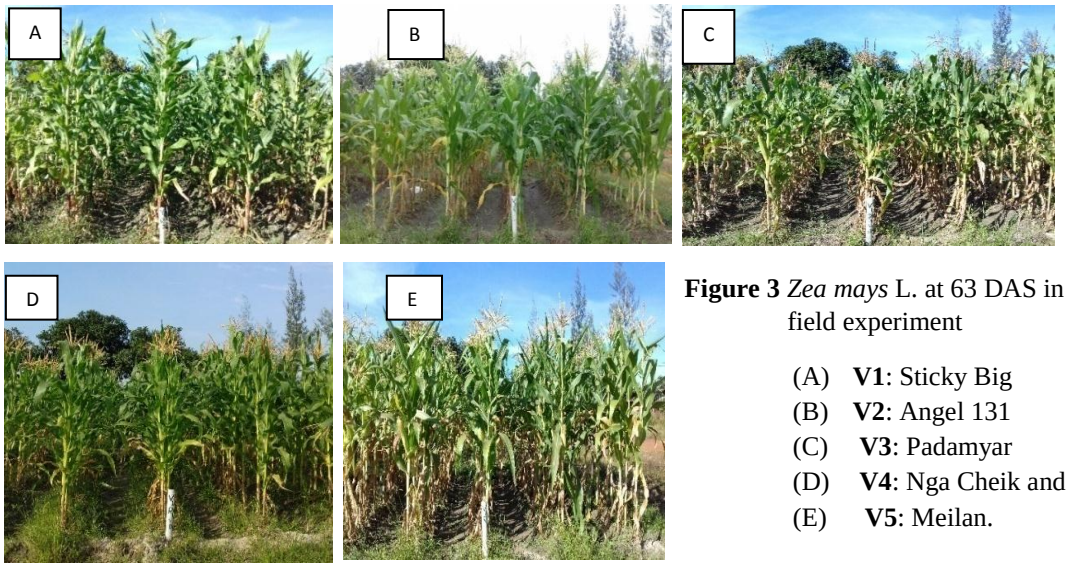

Figure 3 *Zea mays* L. at 63 DAS in the field experiment

(A) **V1**: Sticky Big
(B) **V2**: Angel 131
(C) **V3**: Padamyar
(D) **V4**: Nga Cheik and
(E) **V5**: Meilan.

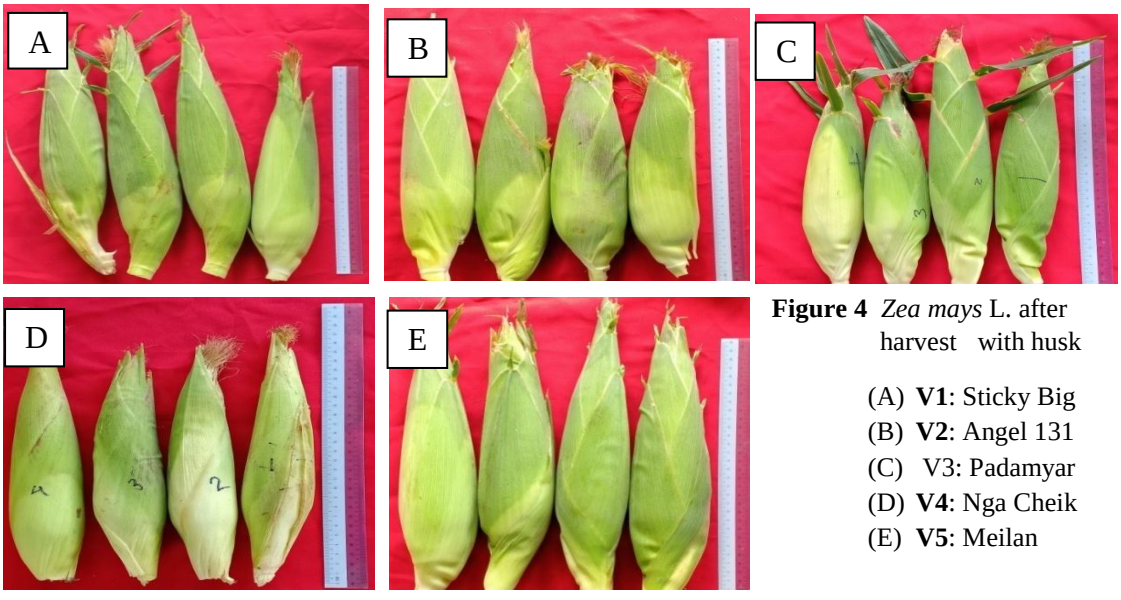

Figure 4 *Zea mays* L. after harvest with husk

(A) **V1**: Sticky Big
(B) **V2**: Angel 131
(C) V3: Padamyar
(D) **V4**: Nga Cheik
(E) **V5**: Meilan

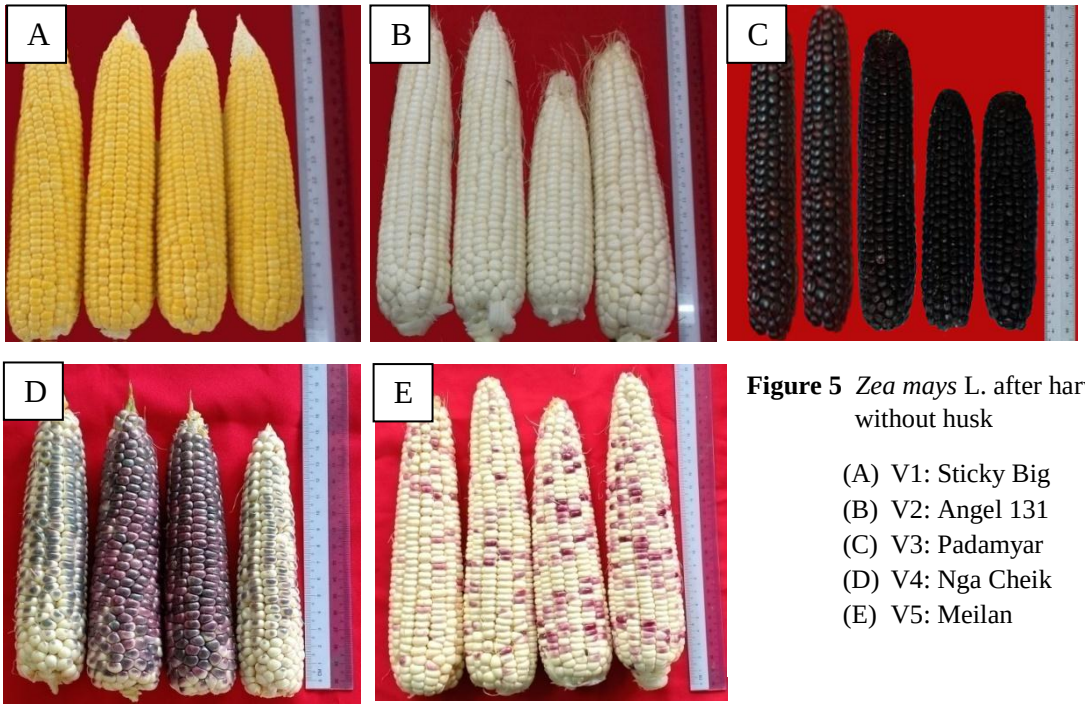

Figure 5 *Zea mays* L. after harvest without husk

(A) V1: Sticky Big
(B) V2: Angel 131
(C) V3: Padamyar
(D) V4: Nga Cheik
(E) V5: Meilan

Discussion and Conclusion

In this experiment, the soil of the cultivation area was the sandy loam, pH 6.74 and temperature of 27ċ. The plant height, leaf number, number of kernel row ear^{-1}, number of kernel row^{-1}, 100 grain weight and grain yield of the sweet corn was 215.15 cm plant^{-1}, 12.80 cm^2 plant^{-1}, 10 ear^{-1}, 16.65 row^{-1}, 21.80 g and 103.38 gplant^{-1}. However, the sweet corn grown in Iran was the temperature of 21ċ, pH of 7.8 and silty clay soil. The plant height, leaf number, number of kernel row ear^{-1}, number of kernel row^{-1}, 100 grain weight and grain yield of the Iran (sweet corn) was 142 cm plant^{-1}, 14.3 cm^2 plant^{-1}, 17.13 ear^{-1}, 37.07 row^{-1}, 40.5 g and 89.6 gplant^{-1}. The plant height, number of leaves, number of kernel row ear^{-1} and 100 grains weight of the plants in Iran (sweet corn) was higher than in this experiment (Milandan, 2015). However, the yield of Iran (sweet corn) was lesser. It may be due to the less cob number was produced in Iran (sweet corn).

Moreover, the difference in yield may be due to the different in soil type, soil pH and temperature. The preferable soil pH of sweet corn was 5-7 and the temperature was 30 ċ (www. homeguide.sfgate.com).The soil pH and temperature of this experiment was in accordance with the preferable range of reference. Therefore, the plant in this experiment produced the higher yield than the plants in Iran (sweet corn).

In terms of waxy corns, four different varieties of waxy corn were grown in sandy-loam soil of this experiment under soil ph of 6.74, temperature of 27 ċ. The plant height, leaf number, number of kernel row ear^{-1}, number of kernel row^{-1}, 100 grains weight and grain yield of these waxy corn were 143.7-191.60 cm plant^{-1}, 10.35-12.20 cm^2 plant^{-1}, 11.75-15.10 ear^{-1}, 24.42-32.10 row^{-1}, 13.07-17.47 g and grain yield 39.51-70.13 g plant^{-1}. In Vietnam, the waxy corns were grown in silt-loam soil with the pH of 5-9 and the temperature of 16.56 ċ. The plant height, leaf number, number of kernel row ear^{-1}, number of kernel row^{-1}, 100 grains weight and grain yield of these waxy corn were 90-104.3 cm plant^{-1}, 16.3-16.6 cm^2 plant^{-1}, 10.13.6 ear^{-1}, 18.2-28 row^{-1}, 15.2-18.8 g and grain yield 40-72g plant^{-1} (Pham, 2018). It was found that the yield were not as

much different the plants in this experiment and the plants in Vietnam experiment, although the soil type, soil pH and temperature were different. It was also different in the plant height and the number of leaves. Therefore, it can be assumed that waxy corns are resistant to the different soil type, soil pH and temperature.

In conclusion, the sweet corn can be grown in Hlegu area to obtain the high yield. However, the waxy corns can be grown in any areas and it may be the resistant varieties.

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References

AGBIOS (2005) a.**Biology of Maize**. AGBIOS Canada, available online at hppt://www. Agbios.com? estudies. php? book = ESA &ev = MON810 & Chapter = Appdx 1&1 agn.

Frova C, Krajewski P, Fonzo ND, Villa M, Sari-Gorla M. (1999). Genetic analysis of drought tolerance in maize by molecular markers. I. Yield components. Theoretical and Applied Genetics, 99: 280-288.

Gomez, K.A., and A.A. Gomez. (1984). **Statistical Procedures for Agricultural Research 2nd Edition.** John Wiley & Sons, NY.

Hailare,L., (2000). **Corn: An American Native**. Spanning the Gap.The newsletter of Delaware Water Gap National Recreation Area Vol. 22 No. 1 Spring 2000. U.S. Dept. of the Interior National Park Service.

Kandil, E.E., (2013). **Response of Some Maize Hybrids (*Zea mays* L.) to Different Levels of Nitrogenous Fertilization.** Journal of Applied Sciences Research, 9(3): 1902-1908.

Milandan, J.J.; S.C.Mason, G.k;Kruger, T.DGalusha, Z. Kmail. (2015). **Waxy maize yield and components as influenced by environment, water regime, and hybrid.** Maydica electronic publication. www.researchgate.net.

Montgeomery E. G. (1911). **Correlation Studies in Corn.Nebraska Agronomy**.Exp. Sta. Annual Report.

MPBSA, (2013). **All Rights Reserved**. Powered by Trade Myanmar Co.Ltd.

Pham Q.T., Trung N.Q., and Anh N.T.N. (2018). **Evaluation selections of purple waxy corn lines for new hybrids variety development.**

Salunkhe, D.K., and B.B. Desai. (2000)**. Post-harvest biotechnology of vegetables. Vol II, CRC press, Inc. Boca Raton, Florida.**

Sleper DA, JM Poehlman (2006). **Breeding Field Crops.**The Blackwell Publishing Inc Ames Lowa, Columbus, USA.

Yusuf. C.S., Makate N. and Jacob. R., (2014). **Effect of seed size on germination and early growth of maize (*Zea mays* L.)**

www. homeguide sf.gate.com.