STUDY ON THE REPRODUCTIVE GROWTH AND YIELD EVALUATION OF VARIOUS CORN CULTIVARS (*ZEA MAYS* L.) IN AYEYARWADDY AND YANGON REGIONS

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Abstract

The field experiment with seed priming technique and organic fertilizer treatments was carried out at the Maubin University, Ayeyarwaddy Region from January 2022 to May 2022 using the seven various cultivars seeds of *Zea mays* L. (Corn). In this experiment, study on the total of seven cultivars of corn was collected from two different localities within Ayeyarwaddy and Yangon Regions. According to the experiment, the first germination percentage (Pan – pyaung) are the best in germination percentage, (A- Kaut gyi) and (Y- Sat kyar) are the lowest germination percentage although local varieties have a germination percentage of over 90%. In the second germination percentage, except Pan, the other varieties are more than 95% and Pan is the lowest. The experiment showed that the reproductive growth of (Y - Nga chaik) is the highest reproductive growth and (Pan - pyaung) plants is the lowest. (Y - Lay tan) and (Y- Sat kyar) are the medium reproductive growth. Among them, (Y- Nga chaik) is better than other varieties. (Y- Nga chaik) is weather resistant and has good yield for this region. So, it is a local variety that should be planted. Therefore, it is recommended that the (Y- Nga chaik) is strong and resistant local variety. Because it is economically beneficial of the farmers, it should be cultivated.

Keywords germination percentage, reproductive growth, varieties and yield evaluation

Introduction

Corn was originally domesticated in Mexico by native peoples about 9,000 year ago. Corn is also called maize, cereal plant of the grass family (Poaceae) and edible grain. Maize is the third most important cereal crop species, after wheat and rice, grown throughout a wide range of climates. Corn is cultivated mainly in the country's site of Shan, Chin states, Sagaing, Magway and Mandalay regions as a seasonal crop in monsoon and winter (Thandar Soe, 2019). It is among the ten most important world crops by value. Next to rice, maize stands as the second most important cereal crop in Myanmar, which is used as human consumption, animal feed for livestock farming and as one of the major agricultural products for export (Huang, *et al*., 2006). Hence more production of corn is needed through expansion of cultivable area and increased production per unit area (Thandar Soe, 2019). Therefore, corn becomes an important crop for growing population around the world. Corn is one of the most important crop around the world. Corn is generally a crop of warm climates with adequate moisture and annual crop (Denmead & Shaw 1960). Corn grows best in deep, well-aerated, warm, loam soils rich in organic matter, and with a high nitrogen, phosphorus and potassium content (Jugenheimar, 1992). Corn can be grown on soils with pH values ranging from 5.5 to 8.0 and does best at neutral pH (Garki, *et al*, 2004). Raising two to twenty feet high, corn stalks can have anywhere from eight to forty-eight leaves and multiple ears (Goldsworthy *et al*, 1974). Corn is a crop which is very sensitive to water stress (Pandey *et al*, 2000; Abdelgadir, 2002; Cakir, 2004; Kuscu & Demir, 2012).

The price of corn which was grown in dry season was higher than that of rainy season. In addition, growing maize during dry season increased annual production (Global Agricultural Information Network [GAIN], 2018). It will be needed to apply water using effective irrigation methods. Its importance as a major food in many parts of the world, corn is inferior to other cereals in nutritional value. It is usually planted at the end of winter and harvested during the

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summer, although in certain regions it is grown all year around (Usoh *et al*, 2017). The present study was conducted to investigate the collection of various local corn varieties in the Ayeyarwaddy and Yangon Regions. The objectives of this study were: the germination percentage of various varieties of corn, the growth and yield evaluation of various varieties of corn and to preserve the local corn cultivars.

Materials and Methods

Collection of corn cultivars

Three cultivars of *Zea mays* L. corn varieties were collected from Ayeyarwaddy Region are Nga chaik, Wat si and Kaut gyi. And then, four cultivars of corn varieties were collected from Yangon Region are Nga chaik, Lay-tan, Sat kyar and Pan. All the cultivars varieties were collected from locally grown for many decades using traditional methods.

Time and Experimental Site

The experimental site was carried out using the seeds of corn in the farm of Maubin University, Ayeyarwaddy Region from January 2022 to May 2022.

Soil Analysis

Soil samples from 30 cm depth of soil surface were randomly taken from ten places of planting area. The collected soil samples were analyzed at laboratory of Land Use Division, Department of Land Use, Myanmar Agriculture Service (MAS), Insein Township, Yangon Region.

Seedling establishment

Seeds were germinated in small tray filled with soil, sand and rice husk. The seed of seven different cultivars were soaked in water for three days. One centimeter holes were made in the prepared medium. The germinating of corn seed was sown in the tray for one week. Then the seedlings of corn in the tray were transplanted to the prepared land.

Soil Preparation

The soil from cultivation field was thoroughly plowed by machine and cleaned to remove hard soil balls, stones and garbage's. The hole in the depth of 8 cm was dug and mixed with humus, fungicide and pesticide. Seven days after germination, the seedlings of corn were transplanted to the prepared field.

Transplanting Method

The germinating seedlings were sown directly in the prepared field plots. The seedling was sown in rows, the space between each row was three feet, space between each plant was one feet and space between each block was nine feet. The total cultivation area was 117 ft × 37 ft. There were seven blocks and each block containing three plots which represents one cultivars. Each plot has ten plants, the total of 210 plants were cultivated in the prepared soil.

Experimental layout design

T_1 = (Y- Pan-pyaung) (control)
T_2 = (A –Nga chaik)
T_3 = (A – Wat si)
T_4 = (A – Kaut gyi)
T_5 = (Y – Nga chaik)
T_6 = (Y – Lay tan)
T_7 = (Y – Sat kyar)

Cultural management practices

Weeding was done once in a week interval. Supplementary weeding was carried out in small scale when necessary. The whole plot was watered at ten days' intervals. Irrigation system is two times in one-week interval after brace root starts to emerge.

Data collection of reproductive characters

The data were collected weekly. A total of 15 plants from each cultivar were selected for evaluation. Reproductive characters such as ear number per plant, ear length, ear girth, kernel number per ear, kernel weight per ear, kernel row number per ear, kernel 100 weights per ear, husk number per ear and cob weight per ear were measured and recorded.

Germination percentage Test

Germination percentage was determined by using (Soupe, 2009). The calculation of percentage in Germination was as follows:

$$\text{Germination percentage (\%)} = \frac{\text{Number of Total Germinated Seeds}}{\text{Total Number of Seeds Tested}} \times 100$$

Results

Soil analysis

The soil analysis of the cultivation area was carried out to evaluate the production based on soil composition. The results of soil analysis showed that soil texture was loam, the pH (4.42) and extremely acid, moisture content (9.58 %) and low organic carbon content (1.90 %). Humus content was medium (3.27 %). However, the nitrogen (0.25 %) and potassium contents (0.45 meq/100gm) were medium phosphorous (0.22 ppm) was low and available nutrient potassium oxide content (21.23 mg/100gm) was high (Table 1).

Table 1 Analyzed result of the cultivate soil

Moisture (%)	pH	Texture				Organic carbon (%)	Humus (%)	Total N_2 (%)	K(meq /100gm)	Available P(ppm)	Available K_2O mg/100gm
		Sand	Silt	Clay	Total (%)						
9.58	4.42	37.58	19.38	43.04	100	1.90	3.27	0.25	0.45	0.22	21.23
	(extremely acid)		(loam)			(low)		(medium)	(medium)	(low)	(high)

Figure 1 Soil preparation of experimental area

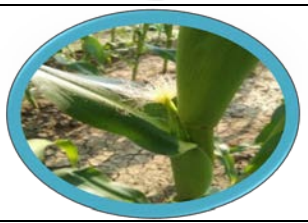
Figure 2 Seedlings were grown in the tray

Figure 3 Transplanting plant of seven corn field varieties

Figure 4 Growth of corn in cultivated Soil plot

Development stages of corn varieties

Development stages of corn were carried out by using organic fertilizers (cow dung). After the germination of corn put it in the tray for 7 days. After sowing on the ground: 5.5 cm after 14 days, 21.6 cm after 28 days, 37.2 cm after 42 days and 53.4 cm after 56 days. Early male tassel was observed in all treatments at 70 days after fertilizers treatments. Ear development continued and the mature was observed at 84 days after treatments. The female inflorescence, with young silk observed at 98 days after treatments. Stalks, ears and silk early fruit set was started at 112 days after treatments and female inflorescence, with young silk for harvest was resulted at 126 days after treatments. Therefore, it was noted that the mature maize ear on a stalk took 126 days after treatments (Figure 5).

Stage of vegetative growth	DAS	Stage of reproductive growth	DAS
	7 DAS		70 DAS
	14 DAS		84 DAS
	28 DAS		98 DAS
	42 DAS		112 DAS

Stage of vegetative growth	DAS	Stage of reproductive growth	DAS
	56 DAS		126 DAS

DAS = Days After Sowing

Figure 5 Development stages of corn varieties

Reproductive characters of seven corn varieties on ear length and ear girth

Reproductive characters of seven corn varieties on ear length and ear girth are shown that the reproductive characters of ear length and ear girth (Pan-pyaung) are the highest and (A - Kaut gyi) are the lowest (Table 2 and Figure 6).

Table 2 Reproductive characters of seven corn varieties on ear length and ear girth

No.	Reproductive Characters (cm)	Pan-pyaung	A - Nga chaik	A - Wat si	A – Kaut gyi	Y - Nga chaik	Y - Lay tan	Y - Sat kyar
1.	Ear length(cm)	19.6	18.6	17.4	16.2	19.4	18.1	16.7
2.	Ear girth(cm)	17.0	12.5	13.0	12.0	15.8	15.9	14.0

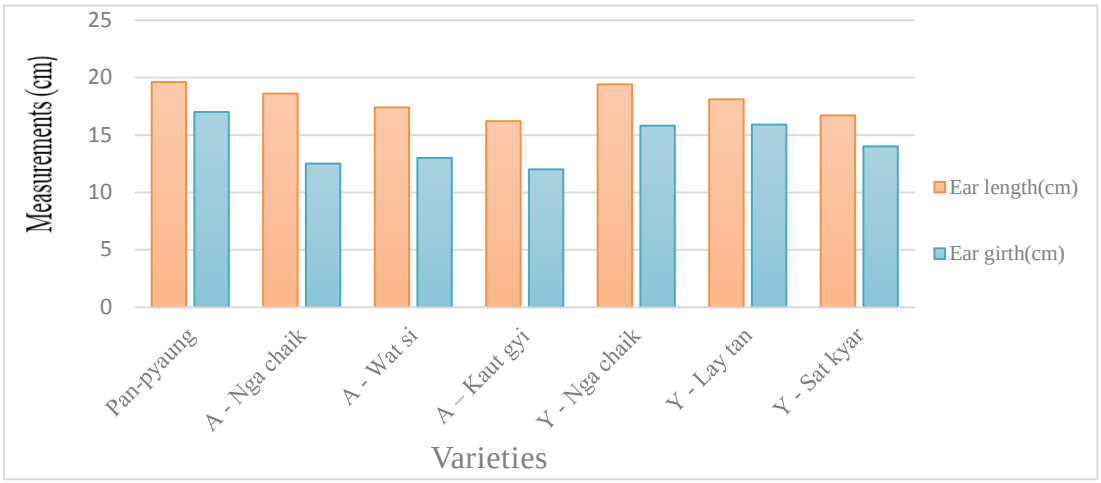


Figure 6 Reproductive character of seven corn varieties on ear length and ear girth

Reproductive characters of seven corn varieties on ear number, husk number, row number and seed number

Reproductive characters of seven corn varieties on ear number, husk number, row number and seed number are shown that the reproductive characters of ear number (A- Nga chaik), (A- Wat si), (A- Kaut gyi), (Y- Nga chaik), (Y- Lay tan) and (Y- Sat kyar) are the highest and (Pan- pyaung) is the lowest. Husk number (Y- Nga chaik) is the highest and (Pan- pyaung) is the lowest. Row number (Y- Nga chaik) is the highest and (Pan- pyaung) is the lowest. Seed number (Y- Nga chaik) is the highest and (A- Wat si) is the lowest (Table 3 and Figure 7).

Table 3 Reproductive characters of seven corn varieties on ear number, husk number, row number and seed number

No.	Reproductive Characters	Pan-pyaung	A - Nga chaik	A - Wat si	A – Kaut gyi	Y - Nga chaik	Y - Lay tan	Y - Sat kyar
1.	Ear number	1	2	2	2	2	2	2
2.	Husk number	10	18	17	21	22	20	20
3.	Row number	14	24	21	24	25	23	21
4.	Seed number	440	457	326	522	543	428	482

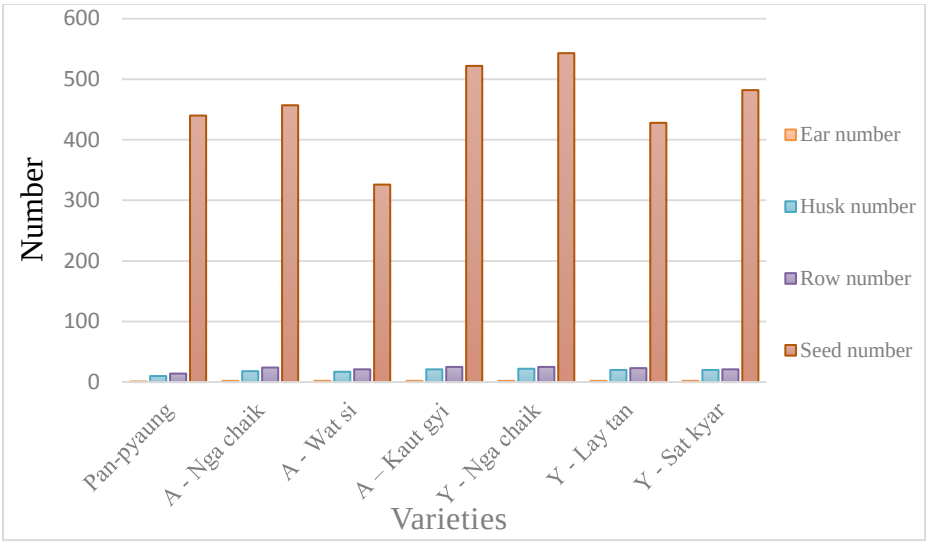


Figure 7 Reproductive character of seven corn varieties on ear number, husk number, row number and seed number

Reproductive characters of seven corn varieties on kernel weight, kernel 100 weight and cob weight

Reproductive characters of seven corn varieties on kernel weight, kernel 100 weight, and cob weight are shown that the reproductive characters of kernel weight (Y- Nga chaik) is the highest and (A- Wat si) is the lowest. Kernel 100 weight (Y- Nga chaik) is the highest and (Pan-pyaung) is the lowest and cob weight (Y- Lay tan) is the highest and (Pan-pyaung) is the lowest (Table 4 and Figure 8).

Table 4 Reproductive characters of seven corn varieties on kernel weight, kernel 100 weight and cob weight

Weight (g)	Varieties						
	Pan-pyaung	A - Nga chaik	A - Wat si	A – Kaut gyi	Y - Nga chaik	Y - Lay tan	Y - Sat kyar
Kernel weight	479.7	321.3	232.7	286.5	482.3	370.3	420.7
Kernel 100 weight	38.0	55.1	72.1	64.9	78.7	70.8	63.6
Cob weight	41.0	61.9	85.0	56.3	76.6	95.0	66.3

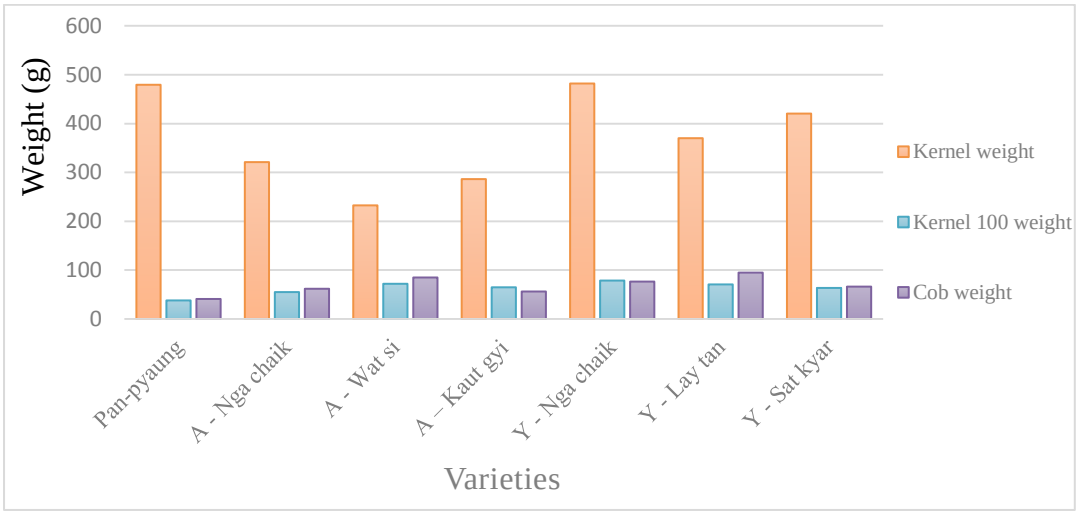


Figure 8 Reproductive character of seven corn varieties on kernel weight, kernel 100 weight and cob weight

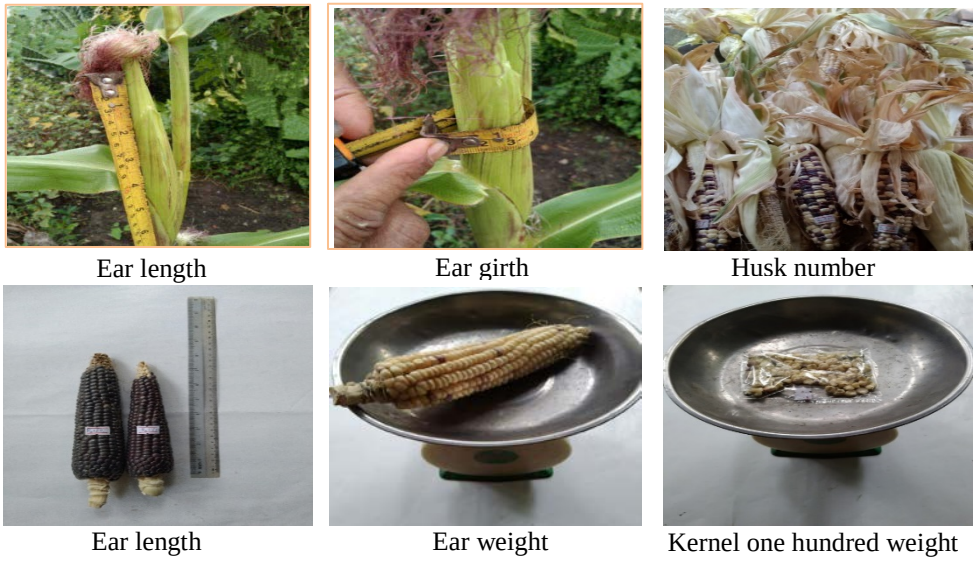


Figure 9 Data collection of reproductive characters corn varieties

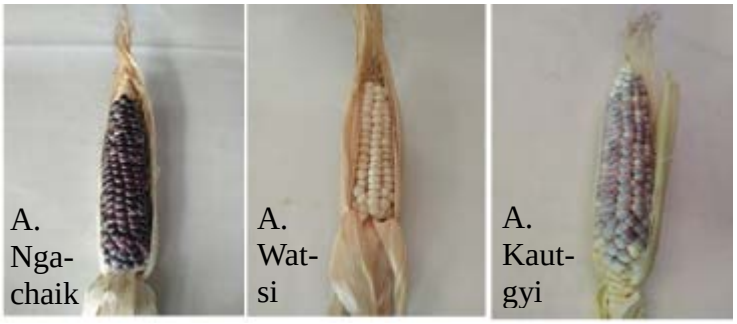


Figure 10 Harvested of seven corn varieties (Ayeyarwaddy Region)

Figure 11 Harvested of seven corn varieties (Yangon Region)

Comparison of the first and second germination percentage of seven corn varieties

Seeds of the seven cultivars were soaked in water and germination rates for individual cultivars were recorded at two different times. (Pan) variety germination in the first test was (98%) and (38%) germination in the second test. (A- Nga chaik) variety germination in the first test was (90%) and (97%) germination in the second test. (A- Wat si) variety germination in the first was (92%) and (98%) germination in the second test. (A- Kaut gyi) variety germination in the first was (64%) and (96%) germination in the second test. (Y- Nga chaik) variety germination in the first test was (94%) and (99%) germination in the second test. (Y- Lay tan) variety germination in the first was (96%) and (98%) germination in the second test. (Y- Sat kyar) variety germination in the first was (86%) and (97%) germination in the second test. Therefore, in the case of second germination, except for (Pan- pyaung), it is found that the other varieties are more than the first germination (Table 5 and Figure 12).

Table 5 Comparison of the first and second germination percentage of seven corn Varieties

No.	Varieties	Column-1	Column-2
		First germination percentage test	Second germination percentage test
1.	Y - Pan-pyaung	98%	38%
2.	A - Nga chaik	90%	97%
3.	A - Wat si	92%	98%
4.	A - Kaut gyi	64%	96%
5.	Y - Nga chaik	94%	99%
6.	Y - Lay tan	96%	98%
7.	Y - Sat kyar	86%	97%

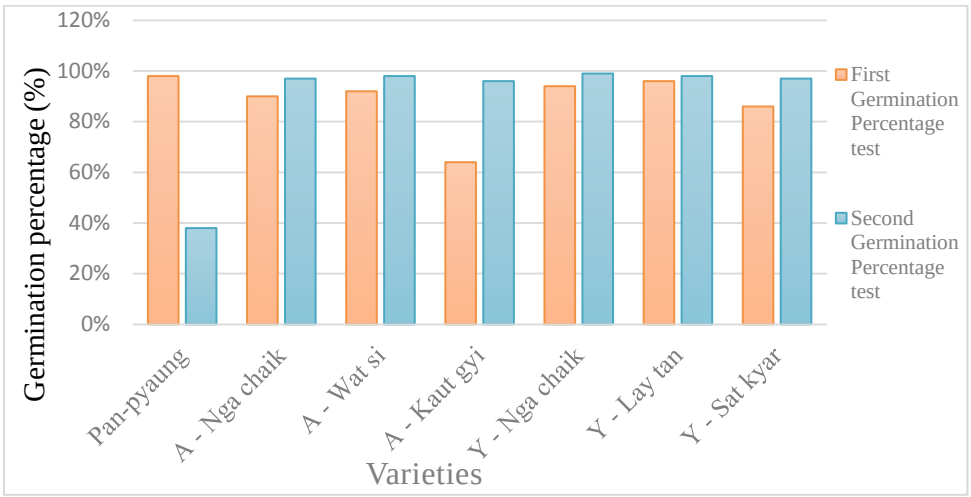


Figure 12 Germination percentage of seven corn varieties

Discussion and Conclusion

The experiment was conducted from January 2022 to May 2022, using cow dung fertilizer. According to soil analysis showed that soil texture was loam, the pH of 4.42 and extremely acid, moisture content of 9.58 % and low organic carbon content 1.90 %. Humus content was medium 3.27 %. However, the nitrogen (0.25 %), and potassium contents (0.45 meq/100gm) were medium, phosphorous (0.22 ppm) was low and available nutrient potassium oxide content (21.23 mg/100gm) was high. Denmead & Shaw (1960) reported that the optimum pH range for a corn is 5.0 to 6.2. Any soil pH below this level is considered low. Corn health may be visibly affected by low pH, but it is usually manifested as a nutrient deficiency. Now, the transplanted soil is more acidic than normal soil. Even though it is very acidic, it can be seen that these types of plants can grow in these areas. So, the local varieties can be grown on any kind of soil and are hardy. Although the soil in which the varieties are grown in these regions is very acidic, it is found that they can grow. Cultivated corn usually prefers full sun, most levels of moisture, and fertile loamy soil. It will be needed to apply water using effective irrigation methods. Maize is a crop which is very sensitive to water stress agreement with respective references, (Abdelgadir, 2002). Humus is better than the other fertilizer for fruit quality and yields are moderate. Therefore, it can be use suitable for business agricultural plantation. Reduce the cost by natural fertilizer application and these plants are strong and it is also resistant to diseases.

The result of the experiment showed that the first germination test, (Pan-pyaung) was highest percentage but (A - Kaut gyi) and (Y - Sat kyar) were lowest percentage in germination rate. In the second germination test, (Y -Nga chaik) was highest percentage but (Pan-pyaung) was lowest percentage in germination rate. In other varieties of germination rate is more than 95%. The authors reported that the kernel moisture content is an important determinant of differences in germination rate between freshly harvested. The percentage of germination required for certification is high in a crop like corn (90%), these results were in agreement with the findings of (Austin & Longden, 1967).

At the second germination rate, the Yangon Region has better germination rate and can be grown in any region. So, it saves the cost of purchasing the species. Farmers should focus on cultivating their own local varieties with suitable germination rates. (Abbas, *et al.*, 2005) reported that the irrigation water is available, corn can grow during dry season even in central dry zone. Most farmers used furrow irrigation method. In addition, growing corn during dry season increased annual production. The agronomic characters of (Y – Nga chaik) has the highest reproductive growth and (A- Kaut gyi) plants has the lowest. The yield was found to be almost identical except the Pan - pyaung. In the reproductive phase, seasonal changes such as high temperatures and heavy rains reduce the rate of nutrient uptake, affecting yields.

The results of the experiment showed that the seven husk numbers of corn varieties, (Y- Nga chaik) is the highest and (Pan - pyaung) is the lowest and the other is the moderate husk numbers. Tight husks have been shown to reduce earworm damage in corn husk trials (Archer *et al.*, 1994 and Wiseman *et al.*, 1977), presumably by acting as a physical barrier to entry into the developing ear. The purpose of counting the husk number was to increase the number of buds on a plant as the number of insects in a plant increased.

In conclusion, (Y- Nga chik) found that the reproductive part was the best in the husk number, row number, seed number, kernel weight and kernel 100 weight. Among them, (Y- Nga chaik) is better than other varieties. The ear number of (Y- Nga chaik) is high due to the high number of nodes. The reason for counting the number of nodes is that the output depends on the good or bad due to the ears coming out from between these nodes. Climate changes such as untimely rains; we experienced hypothermia and gusty winds two times. Therefore, the yield is

found to be lower than normal. Due to these conditions, the output rate is affected. So, (Y- Nga chaik), it also grows on highly acidic soil and is resistant to adverse weather conditions than other varieties.

As a follow up to this research, hybrids and local varieties will be hybridized to produce new varieties with good quality and yield in the future. The nutritional value of hybrid varieties and local varieties can also be compared through experimental work. A variety of yields can also be realized by growing in different soils and climates. The above points are intended for further study in the future.

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