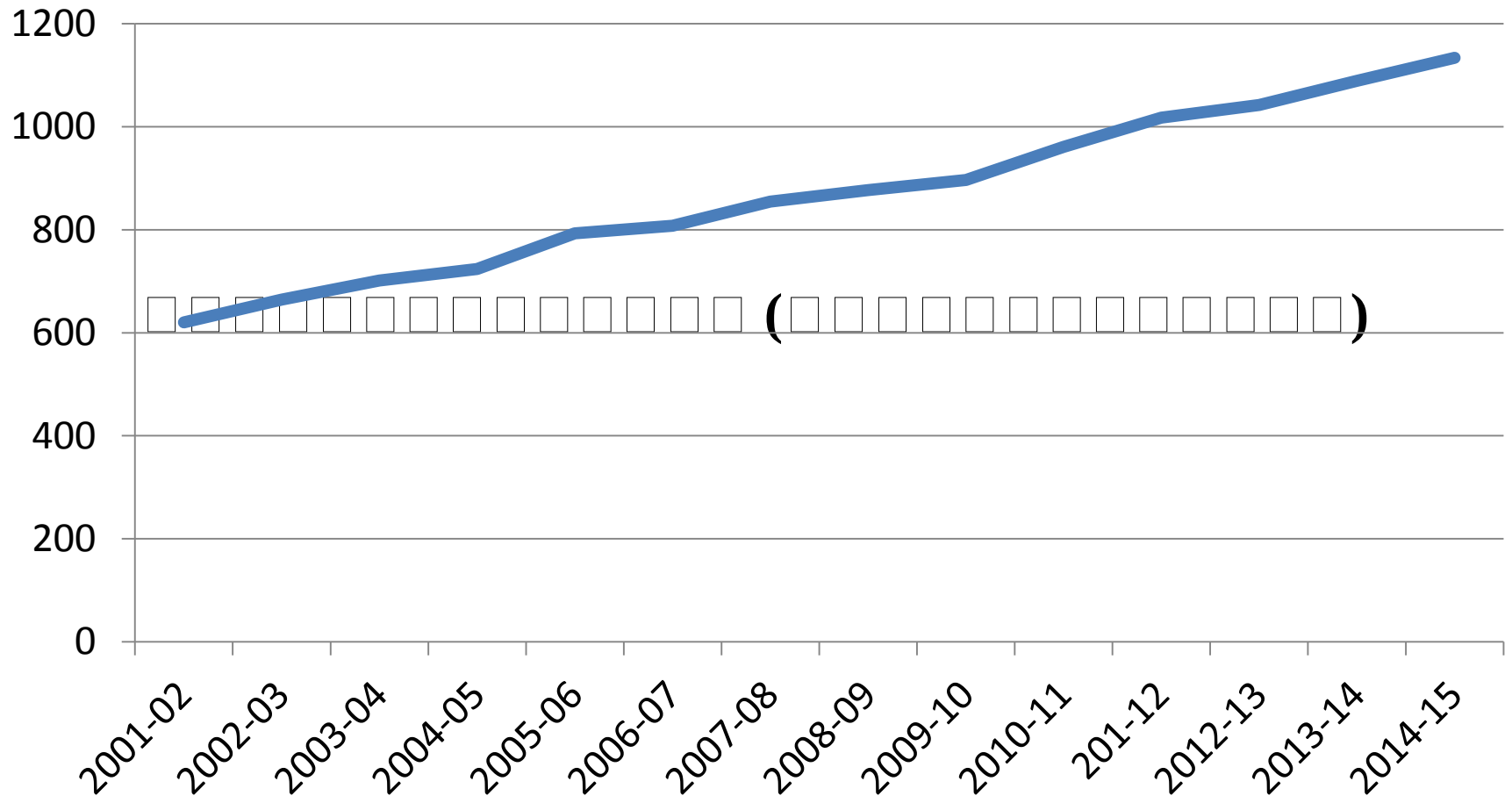
Maize Production and Maize Breedingin Myanmar

Maize Production in Myanmar

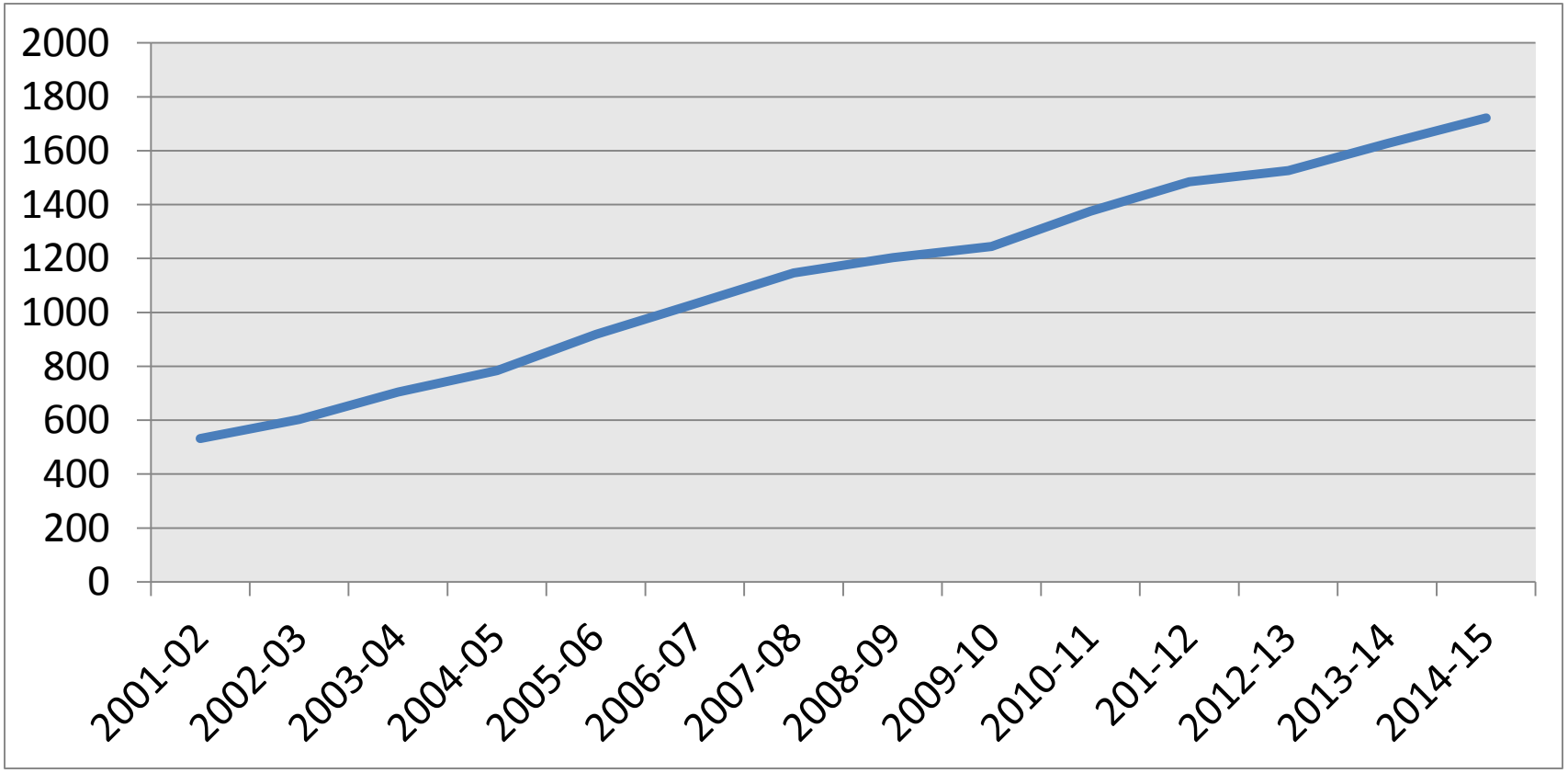
- Maize can be widely grown across different ecological zones in Myanmar : potential for horizontal & Vertical
  - Mainly grown in rainy season : in Shan, Kayar states and Magwe , Mandalay and Sagaing (Lower / South) Bago (upper /north)
  - In post monsoon season ; maize is grown across the country with supplementary irrigation (Ayeyarrawady Magwe , Mandalay and Sagaing Bago)
- High Market Demand in the world for various utilization (Bio-fuel, Animal Feeding, Value Added Products)

Maize Cultivation in Myanmar



Maize Production of Myanmar

Metric tons in thousand



Source : Agriculture in Brie

Factors Needed to Improve Maize Production System in Myanmar

- Private participation and seed sectors
- Application Productive and Efficient & Sustainable Production Technologies (ie; Integrated Nutrient Mgt
- Post Harvest Technologies & Facilities (Harvesting, Drying, Threshing, Storage)
- Systematic Establishments of Various Stakeholders' Association
- Sustainable Markets by cooperation of Private-Private, Public-Private
- Policy development, regulation and supports for Maize & Value Chain

Maize Breeding in Myanmar

Background

- Maize breeding was initiated with the establishment of Central Agriculture Research Inistitute in 1974-75
- At begining , many open pollinated varieties were evaluated and selected ,and successfully released (OPVs varieties)
- Hybrid maize was initiated by introducing exotic inbreds from CIMMYT , but not adapted in Myanmar.
- The first Hybrid maize varieties (Yezin Hybrid Maize-1 and 2) were released in 1991-1992 by developing own inbred lines and Hybrid breeding research

Maior Pipe-Line for the Development of Hybrid Maize

Yezin, Myanmar

Introduction Trial

- International Maize and Wheat Improvement Center (CIMMYT)
- (ICF)

Development of Inbred Lines

- Standard Method
- Composite Line Selection Methods

Evaluation of Inbred Lines

- Banded Leaf and Sheath Blight Resistance
- Northern Corn Leaf Blight Resistance
- Drought Resistant Inbred Lines

Testing of Combining Ability of Inbred Lines

- Top-Cross Hybrid Yield Trial (CYT)
- Experimental Hybrid Yield Trial (EYT)
- Elite Experimental Hybrid Yield Trial (EEYT)
- Demonstration – n Trial (DCT)

Producing of Hybrid Seeds

- Parental Line Seed Increase
- Planting of Crossing Field (2male rows : 6 female rows) or (1 male row : 3 female rows)

Major Pipe-line for the Development of Hybrid Maize

1. Introduction Breeding
2. Development of Homozygous Inbred Lines
3. Inbred Line Evaluation
4. Testing of Combining Abiility of Inbred Lines
5. Producing of Hybrid Seeds

1. Introduction Breeding

- Genetically diversed high yielding OPVs and hybrids from local and exotic germplasms are used as source materials in the extraction of inbred lines
- Plants with good agronomic characters are selected and self-pollinated to obtain segregation generation - 1 (S_1)
- This step is carried out in Maize and other cereal crops Section, Yezin, Tatkone, Aung Ban and Naungmon Research Farm
- CIMMYT has been a main partner and source of germplasm since 1972.

Selection Criteria in Line Development

- **Female Parent**

- Two ears per plant
- Good Shelling Percentage
- 2-3 days flowering than male parent
- Easy to Detassel
- Resistance to lodging

- **Male Parent**

- More pollen producing
- Long pollen producing time
- Plenty number of branches of tassel
- Higher plant height than female parent
- Later than female parent in flowering time

2. Development of Homozygous Inbred Lines

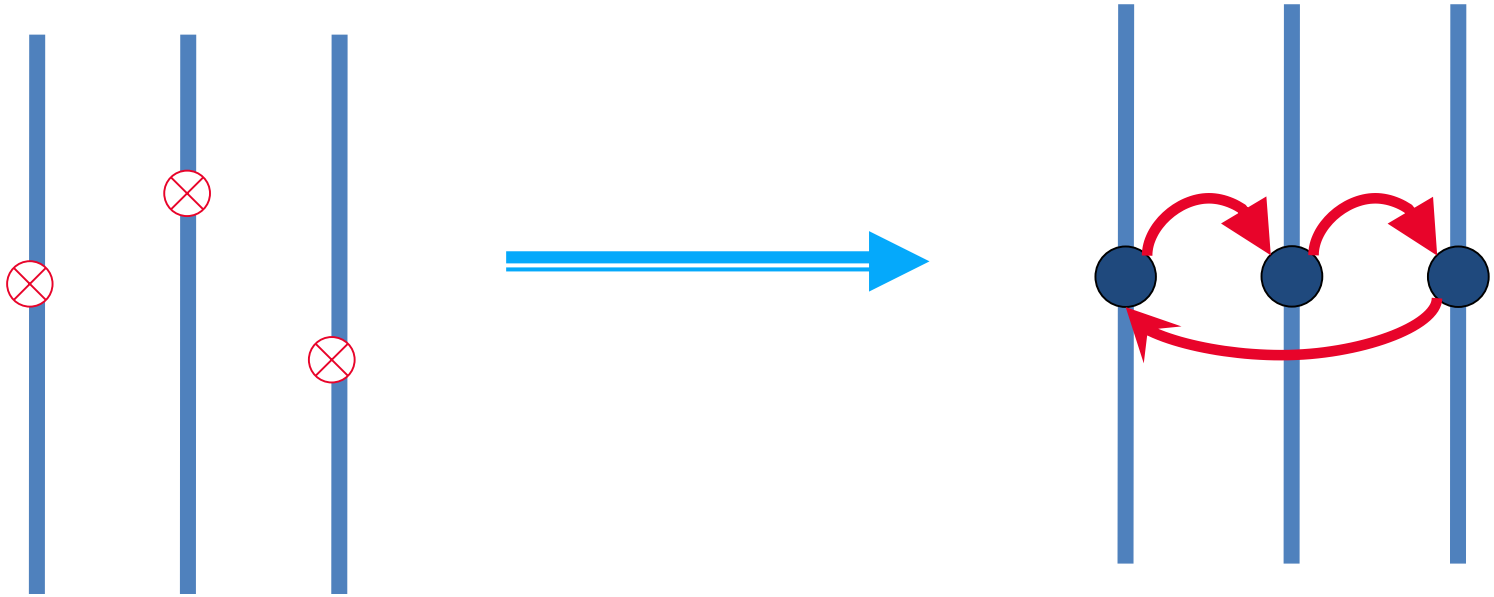
- Development of S1 to S6, S7 generation by Standard Method (Ear to Row)

- Development of inbred lines by Composite Line Selection Methods

Inbred Line Development by Standard Method

- ❖ Developing Stations – Yezin, Tatkone, AungBan, Naung Mon
- ❖ Inbred Line Coding System : YZSI-, TKSI-, ABSI-,NMSI-
- ❖ Used for F1 Varietal development with targeted traits : Age, Disease Resistant,Drought Tolerant
- ❖ Alternative Selfing & Half-sib in Matainance Breeding

Inbred Line Development by Composite Line Selection Method



Selfing

Full Sib

- Developing Stations – Yezin, Tatkone, AungBan, Naung Mon
- Inbred Line Coding System : YZCI-, TKCI-, ABCI-,NMCI-
- Used for F1 Varietal development for Superior Yield and Evaluate , Biotic & Abiotic Tolerance before release
- Alternative Selfing & Half-sib in Matainance Breeding

Maize Hybridization

Single Plant selection & Labeling

Bagging on Ears

Maize Hybridization

Pollination by Hands

Number of hybridization was done due to requirement of the program

3. Inbred Line Evaluation

- Evaluation for yield and adaptability
- Screening for Northern Corn Leaf Blight (NCLB)
- Screening for Banded Leaf and Sheath Blight of Corn (BlSB)
- Screening for drought tolerant Lines
- Genetic Diversity : Clustering by Phenotypic & Genotypic Characters

5. Evaluation of Promising Maize Hybrids

- Producing and testing of Experimental hybrids (EYT-Trails)
- Producing and testing of Promising hybrids (EEYT-Trails)
- Evaluation of Selected Promising F1 for Biotic and Abiotic Stress Tolerance
- (Demonstration-cum Trial) on Farmers' Field and Varietal Selection with Farmers' Participation

4. Testing of Combining Abiility of Inbred Lines

- Producing and testing of Top-cross or Test-cross Hybrids for GCA
- Producing and testing of Diallel-cross Hybrids for SCA
- Producing and testing of Elite Experimental Hybrids
- Producing and testing of Promising hybrids (Demonstration-cum Trial) on Farmers' Field
- High-yielding hybrids resistance to climate

Selection Criteria for Hybrid Maize

- Yield Superior : 20-30 % than Commercial Checks
- Age (<100 for Early, > for Moderate HYV)
- Better in Yield and Yield Component Characters
- Other desirable plant characters

  Profuse Brace Roots, Erect leaves with long Greeness, Srong Stalk diameter, Seed Color, Narrow ASI,

  Husk cover, Tolerance in Botic & Abiotic Stress

5. Producing of Hybrid Seeds

- Trial / (DUST)for TSC & NSC for New Hybrid Varieties Registration
- Parental Lines Seed Increase
- Planting of Crossing Field
  - ✓(female rows: male row: 4:2, 4:1, 6:2 due to nature of parents)
  - ✓ Synchronized flowering , Detasseling of Female Plants

Application of Biotechnology In Maize Breeding

- Genetic Diversity and Identification with molecular marker
- Marker Identification for Specific traits

Department of Agricultural Research

VISION

Food Security and Nutrition with the impact of innovative advanced crop variety and production technology research.

Department of Agricultural Research

MISSION

To systematically conduct research and development onrice and other cereal crops, oilseed crops and food legumes, industrial crops and horticultural crops,soil and water utilization,agricultural engineering, cropping systems and agricultural economics, biotechnology, seed bank and germplasm conservation
and plant protection.

Mission of Our Section

Maize

Sorghum

RESEARCH AND DEVELOPMENT OF MAIZE AND OTHERS CEREALS CROPS

Wheat

Millet

Staff of Maize and Other Cereal Crops Section

Sr. No	Qualification	No. of Staff
1	Ph.D	**1**
2	M.Sc	**6**
3	PGD.Ag	**2**
4	B.Ag	**10**
5	Dip.Ag	**4**
6	Other Staff	**4**
	Total	**27**

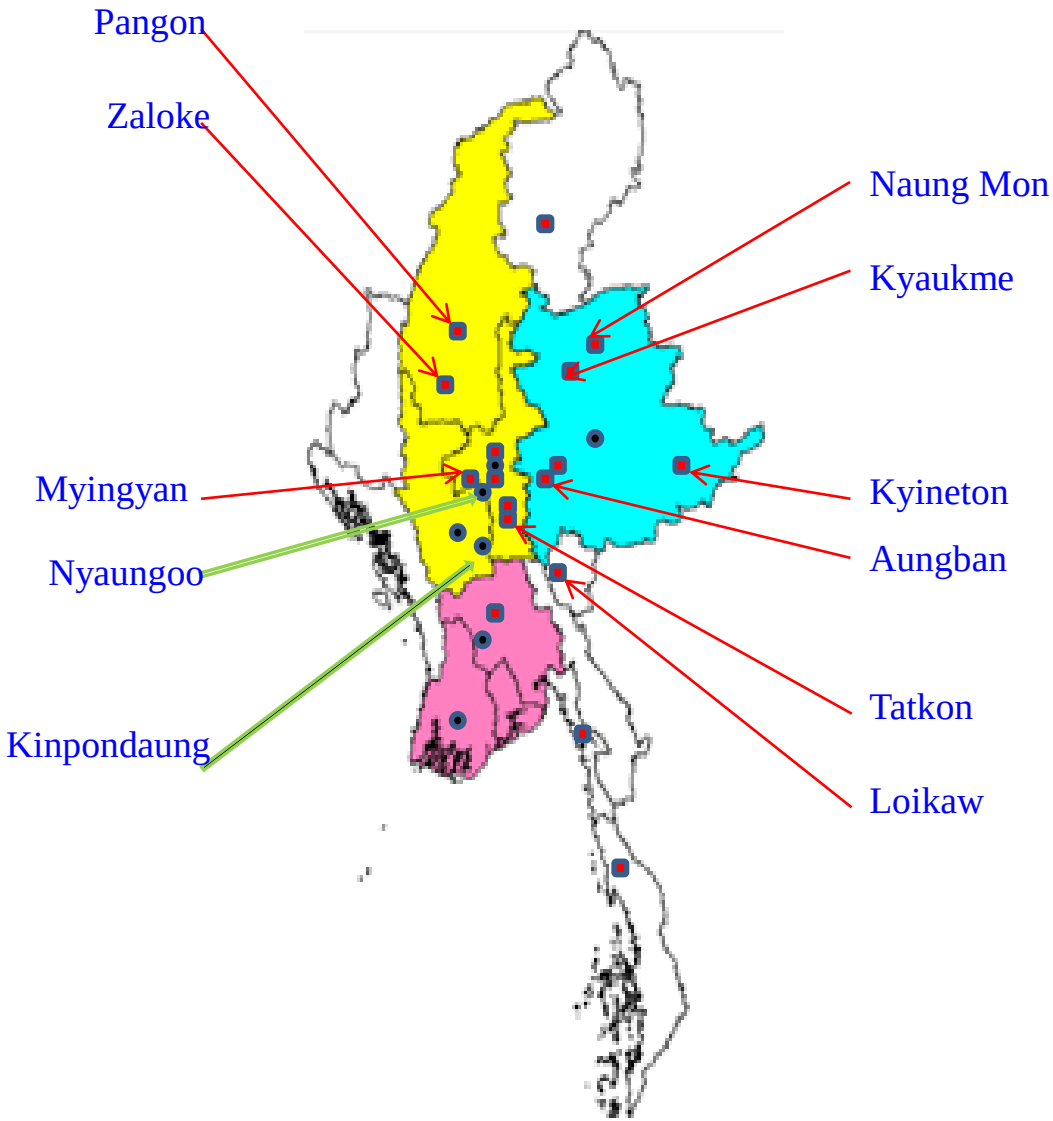
On going research

Sr. No	Research Title	Research Team
1.	Development of sweet corn and waxy corn varieties with better eating quality	Daw Ye Ye Nwe, Daw Mi Mi Khaing, Daw Aye Sandar Win, Daw War War Khaing Soe
2.	Development of locally adapted High-yielding hybrid maize varieties	Daw Khin Nyein Chan, Daw May Thet Naing, U Nay Aung, Daw Poe Nandar Myo Twin, Daw Moe Moe Soe
3.	Development of Early hybrid maize varieties	Daw Khin Marlar, Daw Aye Thidar, Daw Pyi Thu Zin
4.	Development of disease resistant varieties	Daw Phyu Thi Thi Nyein, Daw Shwe Sin Oo
5.	Development of drought resistant varieties	Daw Kyu Kyu Hlaing, U Nay Aung

On going research

Sr. No	Research Title	Research Team
6.	Development of quality protein hybrid maize varieties	Daw Thwe Thwe, Daw Sandar Myint, Daw Aye Thidar
7.	Hybrid Seed Production	U Si Thu Myint, U Myo Min Tun
8.	Development of sorghum and millet varieties with high yield of grain and fodder	Daw Lwin Lwin Myint, Daw Aye Thidar, Daw Shwe Sin Oo
9.	Development of wheat varieties with good quality	Daw Ye Ye Nwe, U Maung Maung Swe, Daw Mi Mi Khaing, Daw Chan Myae Thu

Crop Research Centers and Satellite Farms under DAR



State/ Division	Crop Research Center	Satellite Farm
Kayah State		1
Sagaing region		2
Mandalay region	1	1
Magway region	2	-
Shan State (South)		1
Shan State (North)		2
Shan State (East)		1
Total	3	8

International Collaboration

- International Maize and Wheat Improvement Center (CIMMYT)
- International Corn Foundation (ICF)
- International Crops Research Institute for Semi-Arid Tropic (ICRISAT).

Achievements

1. Open-pollinated Maize Varieties

No	Variety	Year Released
1	Akari	1979
2	Shwe War-13	2010

2. Hybrid Maize Varieties

No	Variety	Year Released
1	Yezin Hybrid No-6	2010
2	Yezin Hybrid No-10	2013
3	Yezin Hybrid No-11	2013

Yezin Hybrid -6

Yezin Hybrid -10

Yezin Hybrid -11

3. Fresh Corn Variety

No.	Variety	Year Released
1	Yezin Fresh Corn-1	2013

Yezin Fresh Corn-1

Salient Characteristics of Widely Grown Hybrid Maize Varieties

Yezin Hybrid –10

Variety Characteristics

Type of Hybrid	Single Cross Hybrid ($YZI\text{-}C_2$ x $YZI\text{-}C_7$)
Days to maturity	100 - 110 days
Ear per plant	1.5
Ear length	18 cm
Kernel color	Reddish Orange
1000 kernel weight	317 g
Shelling %	84%
Yield	7.4 - 7.7ton ha^{-1}
Location	Lowland region
Salient characters	Drought resistant, big ear, good husk cover, tip fill, good shelling %, moderately resistant to banded leaf and sheath blight of maize.

Yezin Hybrid –11

Variety Characteristics

Type of Hybrid	Single Cross Hybrid ($YZI\text{-}D_{15}$ x $YZI\text{-}C_{7}$)
Days to maturity	105 - 115 days
Ear per plant	1.5
Ear length	18 cm
Kernel color	Orange
1000 kernel weight	285 g
Shelling %	85 %
Yield	7.1 - 7.8 ton ha^{-1}
Location	Highland region
Salient characters	Semi-flint type with seed colour of orange. Grain filling to ear tip.

Drought resistant variety with good shelling percentage.

Yezin Fresh Corn – 1

Variety Characteristics

50% flowering	45 days
Ear length	18.9 cm
Row Length	16.3 cm
Ear diameter	4.3 cm
No. of rows per ear	12
Kernels per row	32
Seed colour	Milky
Fresh ear weight	250 g
Marketable ear	16500 (ear/ac)
Eating quality	Very Good
Location	All lowland maize growing regions
Salient characters	It can be harvested 20-25 days after flowering, good eating quality, sticky and sweet, open pollinated variety.

Distribution of Hybrid Seed form 2011 to 2015

Sr. No	Name of Varieties	Distribution (kilo)				
		2011-12	2012-13	2013-14	2014-15	**2015-16**
1	Yezin Hybrid-6	3200	2250	3175	450	**450**
2	Yezin Hybrid-10	-	7500	19000	3600	**3600**
3	Yezin Hybrid-11	-	1250	-	375	**375**
4	Yezin Hybrid	-	31500	8800	2475	**2475**
	Total	3200	42500	30975	6900	**6900**

Distribution of Open-pollinated Varieties form 2011 to 2015

Sr. No	Name of Varieties	Distribution (kilo)				
		2011-12	2012-13	2013-14	2014-15	**2015-16**
1	Shwe War – 13	75	100	150	100	**75**
2	Akari	15	20	15	50	**25**
	Total	90	120	165	150	**100**

Distribution of Wheat Varieties from 2011 to 2015

Sr. No	Name of Varieties	Distribution (kilo)				
		2011-12	2012-13	2013-14	2014-15	**2015-16**
1	Zaloke White-1	82	72	82	20	**30**
2	Zaloke White-2	112	97	90	30	**30**
3	Zaloke White-4	10	-	-	-	**-**
	Total	204	169	172	50	**60**

Research Activities Related To New Plant Variety Protection for DUS Testing

Characterization of DUS Testing In 2016

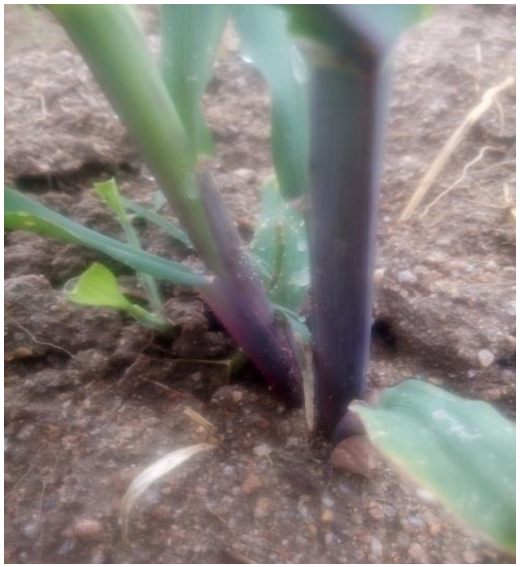
No. of tested varieties	→	**94 Inbred Lines**
Date of sowing		**19.6.2016**
Date of harvesting	→	**20.9.2016**
Plot size	→	**4 m x1.67m**
Spacing	→	**0.8 m x0.25m**
Data collection	→	**UPOV TG**

First leaf : anthocyanin coloration of sheath

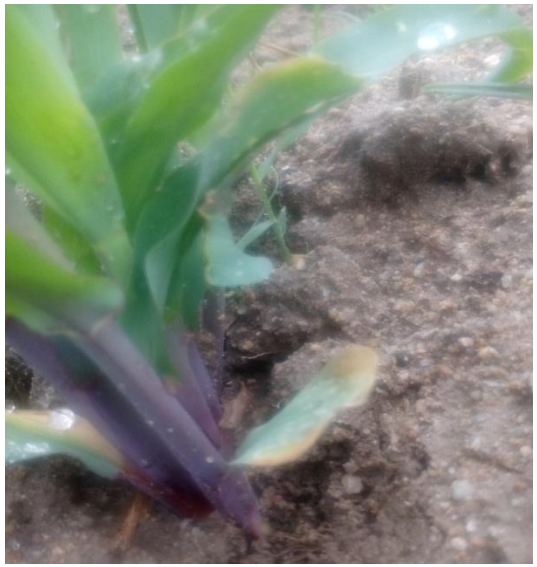
Absent

Weak

Medium



Strong



Very Strong

Ear : anthocyanin coloration of silks

Absent

Weak

Medium

Strong

Very Strong

Root: anthocyanin coloration of brace root

Absent

Weak

Medium

Strong

Very Strong

Ear . Shape

1. Conical

3. cylindrical

2. Conico-cylindrical

Characterization of DUS Testing In 2017

No. of tested varieties → **215**

Date of sowing → **8-11-2017**

Plot size **4 m x1.67m**

Spacing → **0.8 m x0.25m**

Data collection → **UPOV TG**

Thank You