"Developing Bioenergy Crops to Optimize Marginal Land Productivity through Mutation Breeding and Related Technique(RCA)"

Efficiency of Nitrogenous Fertilizer Application Timing in Sorghum

By

Nyo Nyo Mar

MYANMAR

"IAEA/RCA Coordination Meeting to Review the Progress of Field Trials"

3-7 July, 2017, Hanoi, Viet Nam

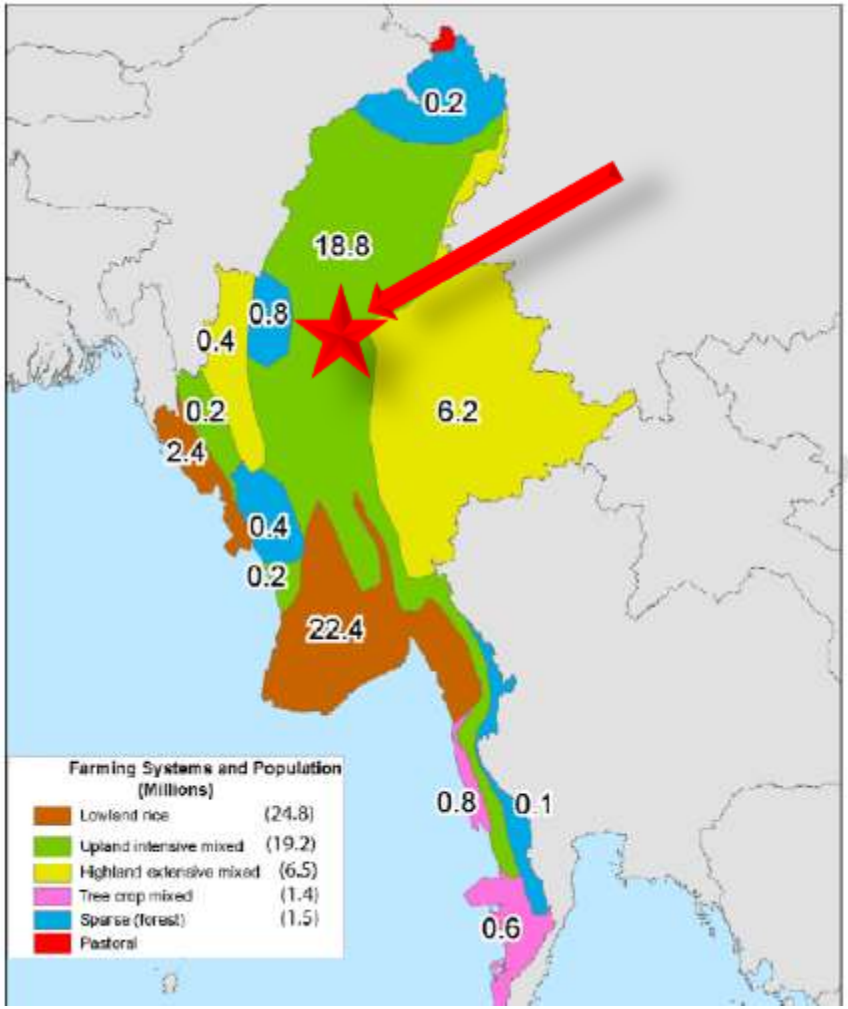
Basic Country Profile

- The second largest country in the South-east Asia borders with Bangladesh, India, China, Laos and Thailand.

- Land Area: 676,577 sq. km.
- Population: 59.78 million
- Main Exports: Agriculture, livestock and forestry products, natural gas
- Main Imports: Machinery, transportation & construction material, industrial raw materials, consumer goods

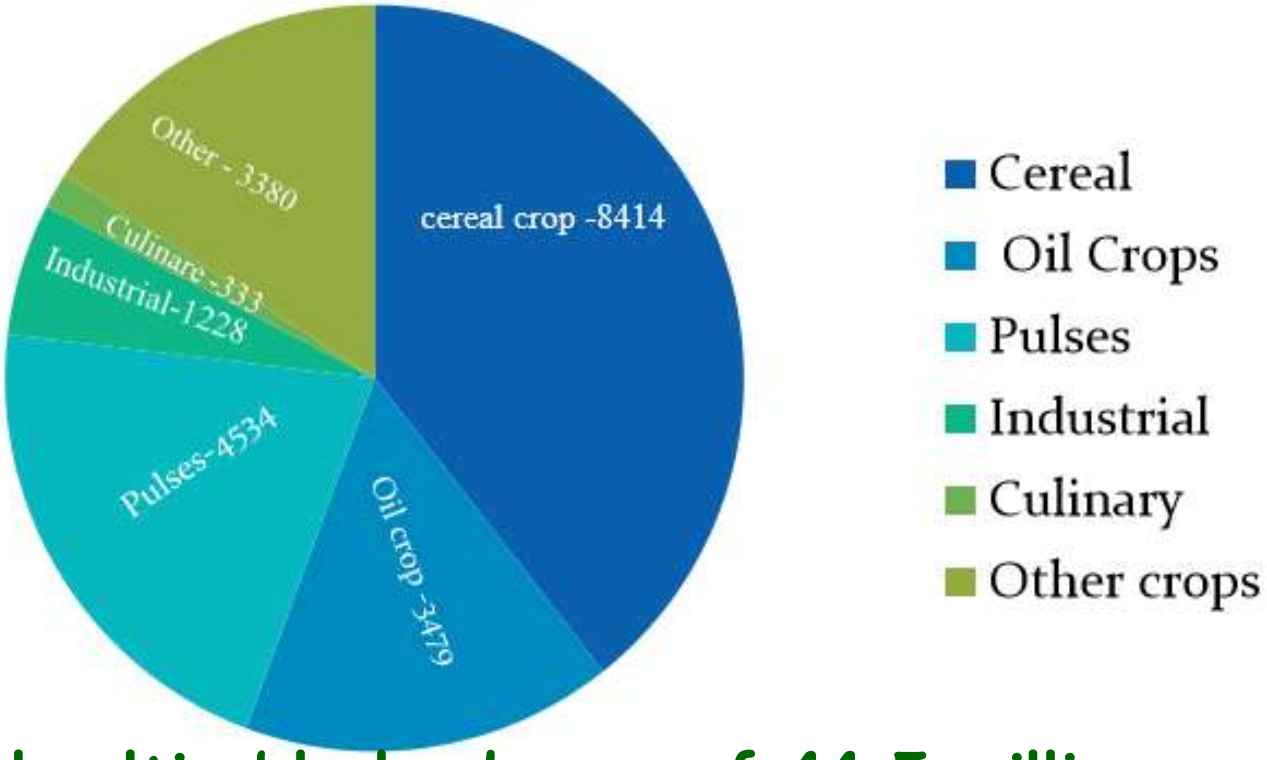
Agro-ecosystem of Myanmar

Total	**67.6 mha**
Alluvial and swampy soils	the delta and coastal zone, (405,000 hectares)
Vertisols (heavy clay soils)	the central dry zone.(Alluvial lowlands dominate agricultural production areas)
The hill zones and Shan plateau	Fruit and horticultural Crops
Virgin and fallow land" or "cultivable wasteland"	5.67 million hectares



*** Sorghum ; Area harvested = 228,000 ha (2016)

Sown Area of Crops in Myanmar ('000ha)



- Total cultivable land area of 44.5 million acres
- problem soils occupy an area of about 2.4 million acres, accounting for about 5.3%

Myanmar Agriculture at aGlance 2014

Objectives

- To study the response of sorghum variety to N fertilizers
- To estimate the efficiency of split dose of nitrogen fertilizer utilization
- To adopt nuclear and isotopic techniques for better soil, water and nutrient management practices

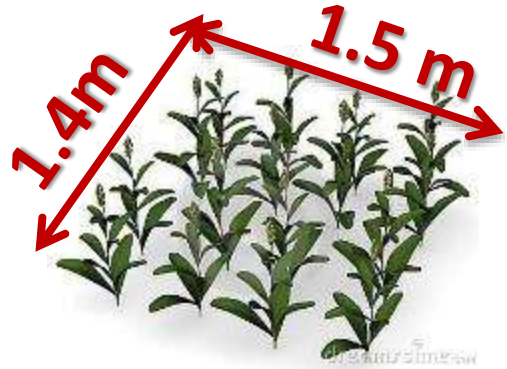
Research Plan

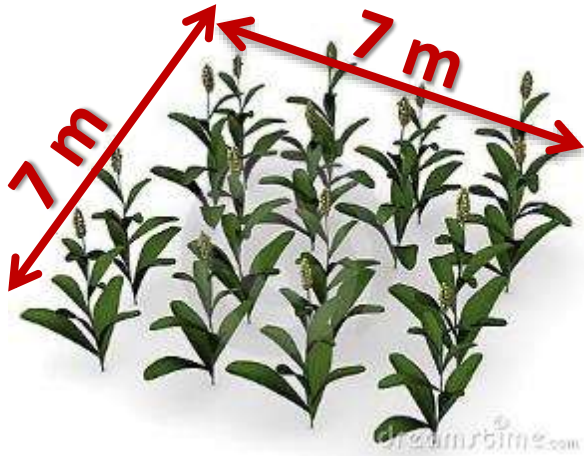
- After a training in Nepal in July, 2016 nutrient management practice was carried out

- ^{15}N tracer (Urea 5.18 a.e) was used from RAS5073

- Main plot size – 7m x 7m = 49 m^2
- Micro plot size – 1.4m x 1.5m = 2.1m^2

- Plant spacing – 15 cm plant x 45 cm rows
- 3 Replica





15N Labeled Fertilizer for Micro-plots

-Shared 15N tracer (Urea 5.18 a.e) from RAS5073

Experimental Design and Treatments

- ✓Treatment Crop - Sorghum (Shwe-Ni)
- ✓Life Period -120 days
- ✓Treatment Description (3 dosages)
  - -30kg/ha
  - -60kg/ha
  - -90kg/ha
- ✓Method of application - Split application
- ✓No. of replication - 3 replicates

Treatments Description

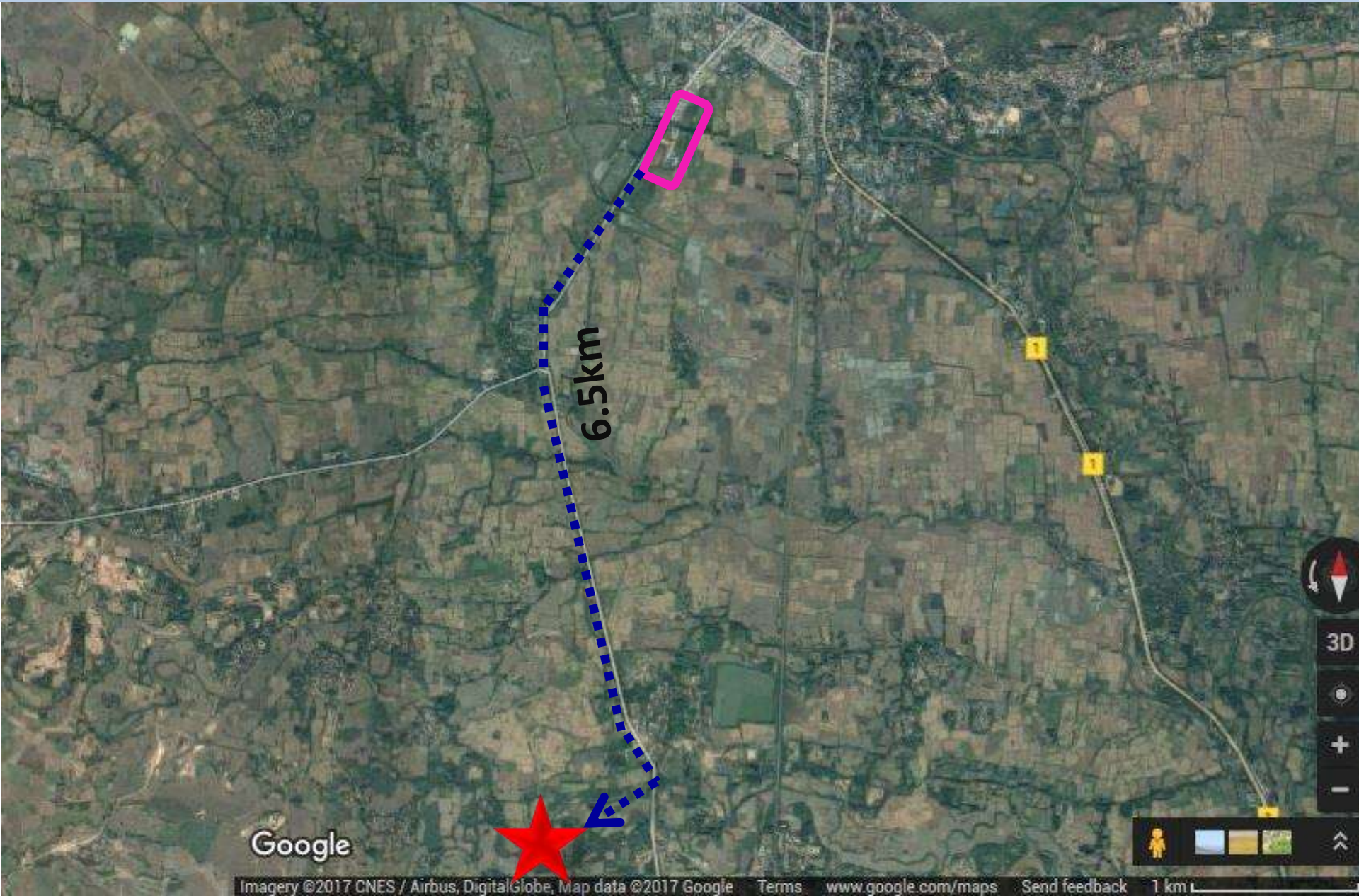
Split Application Management (Micro-plot)			
Dosages (kg/ha)	Vegetative Stage (g)	Booting Stage (g)	PI Stage (g)
30	6.85	6.85	-
60	9.13	18.26	-
90	13.69	13.69	13.69

The amount of labeled fertilizer used in this research = 246.48g/season

Fertilizer utilization and Soil type

- Fertilizer utilization : Top dressing (30Kg, 60 Kg , 90 Kg N ha^{-1} +40kg $P_2O_5 ha^{-1}$)
- Soil Type : Silty clay loam

-at evaluation of 268ft above mean sea level with 21°36’ N latitude and 96º08’E longitude.



Un- usual agriculture lands (not only because of low fertility but also cause of geographical condition, dry zone and low moisture holding capacity, high evapotranspiration)

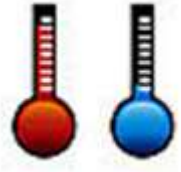
Meteorological Data for 2016

(Source: Mini-weather Station (IMETO) provided by IAEA)

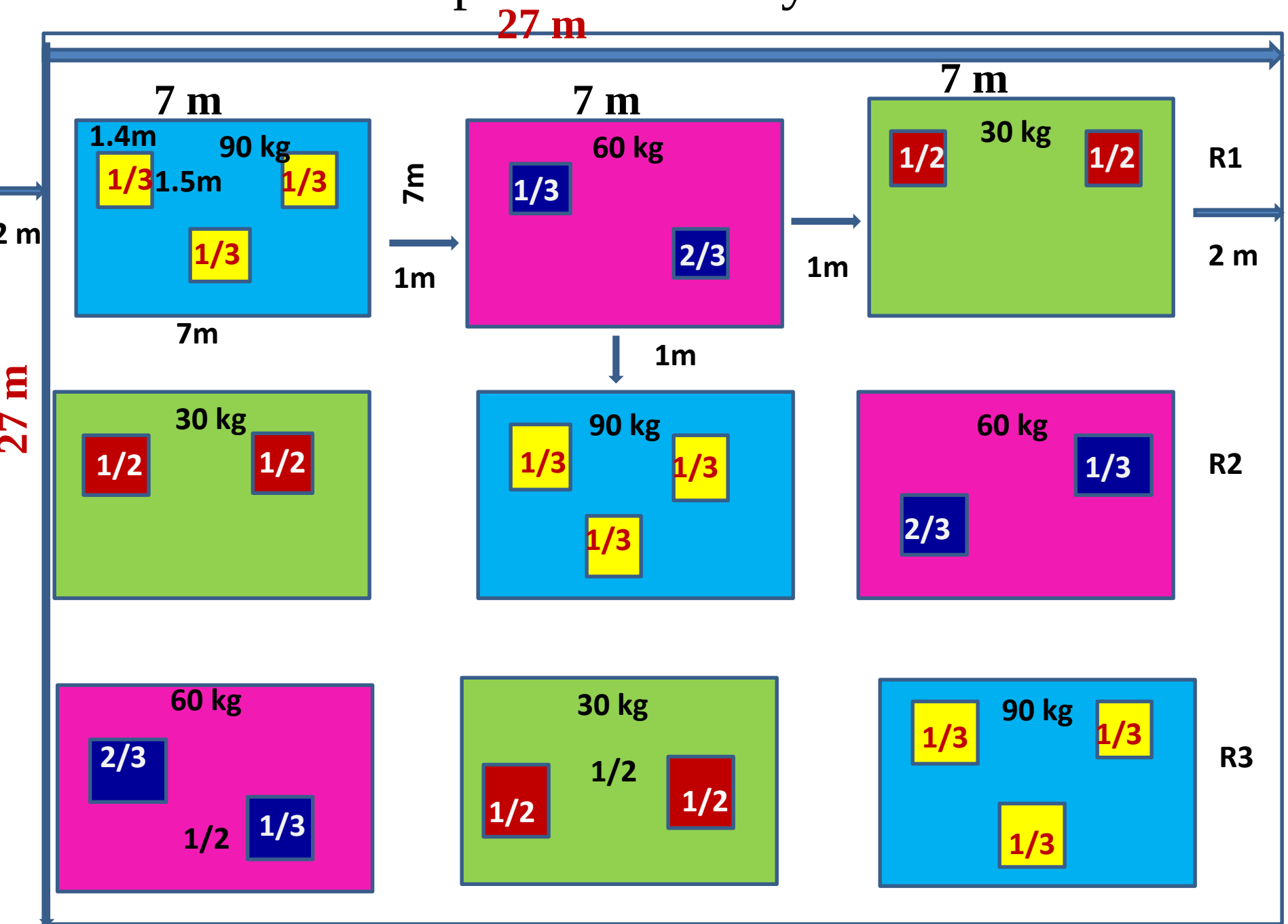
Month/ 2016	Solar Radiation Dgt [W/m2]	Precipitation [mm]	HC Air Temperature [°C]		HC Relative Humidity [%]		Dew Point [°C]
	aver	sum	aver	min	max	aver	aver
January	121.83	0.05	19.4	12.61	28.62	70.32	12.63
February	124.06	0	24.04	17.05	32.93	57.6	13.69
March	134.52	0	28.39	20.97	37.05	45.32	13.83
April	212.53	1.7	32.76	26.3	40.09	44.16	17.62
May	224.44	1.9	30.69	25.69	37.27	87.9	23.9
June	213.28	4	29.29	25.91	34.11	73.54	23.56
July	178.27	2.01	28.94	25.95	33.3	77.8	23.6
August	201.14	4.94	28.82	25.64	33.39	78	24.21
September	197.85	8.76	28.7	25.64	33.49	81.31	24.79
October	161.17	3.67	27.91	24.91	32.82	86.22	25
November	138.36	0.09	24.26	20.49	30.5	88.43	21.77







Preparation of Layout



Data To Be Recorded

- ✓Plant sample data (agronomic characters)

  Fertilizer Nitrogen Uptake ,Grain Yield, % Nitrogen Harvest Index, Physiological N-used Efficiency and % Harvest Index, NUE, Timing management

- ✓Yield data
- ✓ Climatic data (average monthly rainfall throughout the experimental time, minimum and maximum air and soil temperature, humidity, etc.)
- ✓Total soil analysis tests (both chemical and physical parameters) for initial soil status

Work Done

- Initial Soil sampling
- Agro-characteristics collection (plant height, panicle length, panicle width, number of leaves, stover fresh weight, grain weight, stalk weight)
- Soil sample collection, bulk density and sample preparation for 15N residue measurement

Soil Type and Chemical Properties of the Experimental Site

(LaMotte Soil Test Kit & SPAW)

Sand (%)	Loam (%)	Clay (%)	Nitrogen (%)	P ppm (olscm)	pH (1:2)	Soil Bulk Density (g/cm3)	Field Capacity (%)	Wilting Point (%)	Texture Class
16.67	40	43.33	0.33	4.92	8.5	1.35	39.9	25.8	Silty Clay

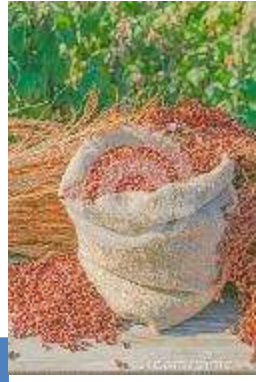
Soil Interpretation Results

Soil Interpretation of Results

Sr. no	Sample plot	pH soil: water 1:2.5	Texture	Organic carbon %	Total N %	Exchangeable Cations	Available Nutrient	
						K^+	P	K_2O
1	W-110	Extremely alkaline	Silty clay loam	Very low	Low	High	Low	High
2	W-220	Extremely alkaline	Silty clay loam	Very low	Low	High	Low	High
3	EM-110	Extremely alkaline	Silty clay loam	Very low	Low	Very high	Low	High
4	EM-220	Extremely alkaline	Silty clay loam	Very low	Low	High	Low	High
5	ES-110	Extremely alkaline	Silt loam	Very low	Low	Medium	Low	Medium
6	Es-120	Extremely alkaline	Silt loam	Very low	Low	Medium	Low	Medium

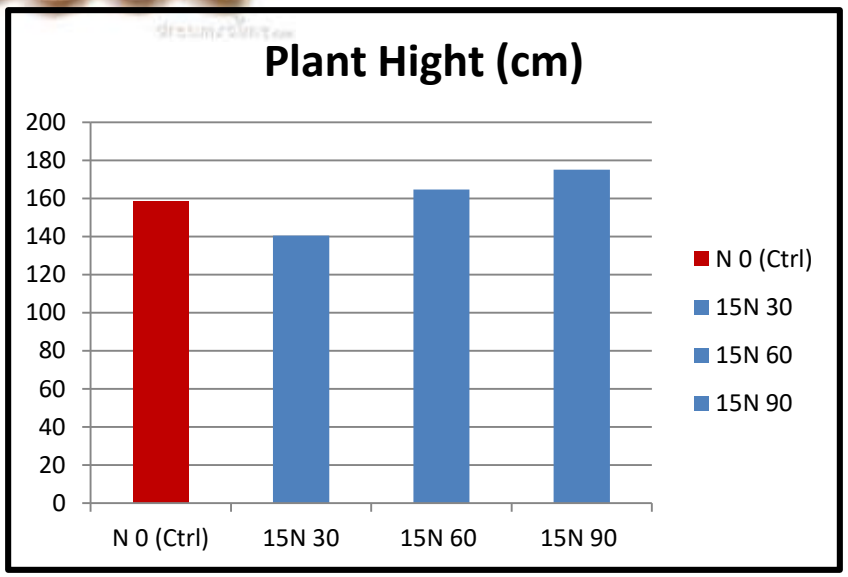
Department of Land Utilization (Ministry of Agriculture and Irrigation)

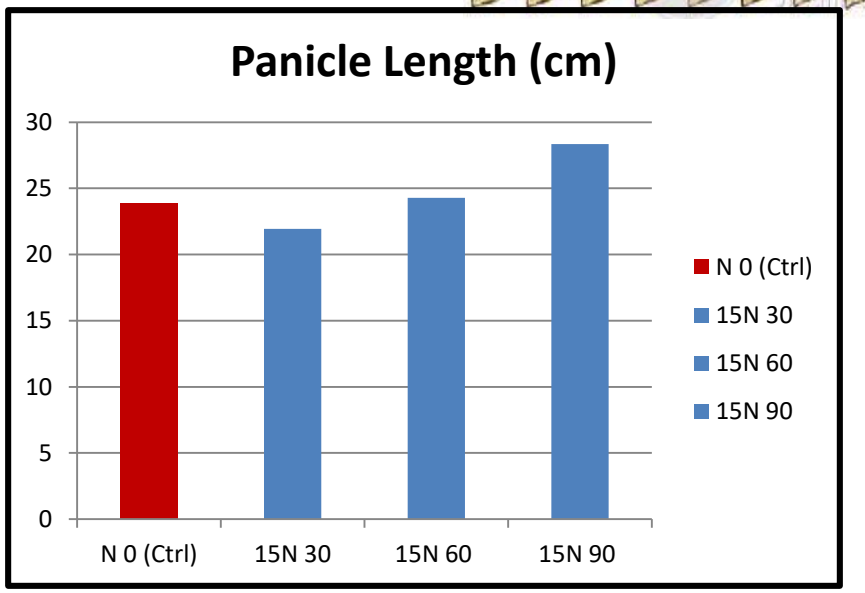
Harvest Index

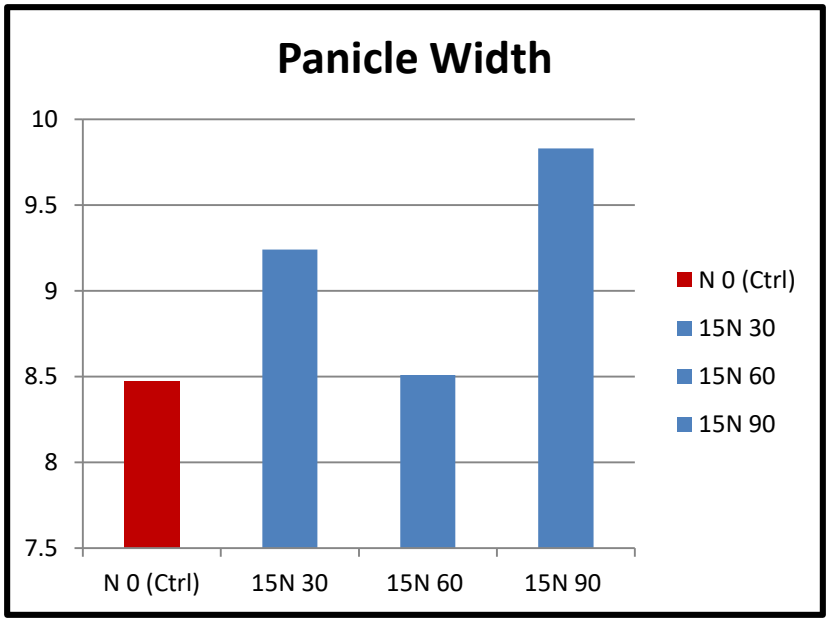


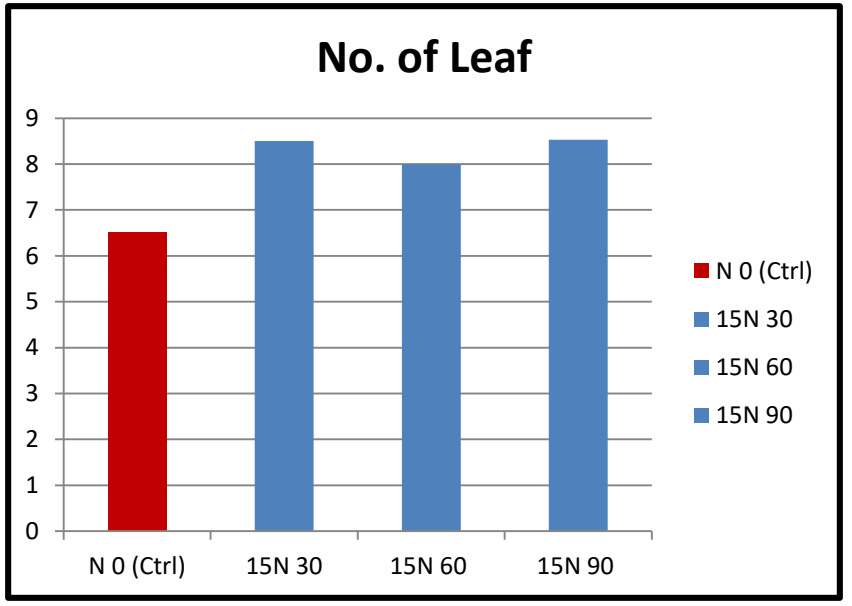
Treatments	Harvest Index (%)
N-0	13.75
N-30	17.42
N-60	16.22
N-90	20.86

Data from Collected Samples

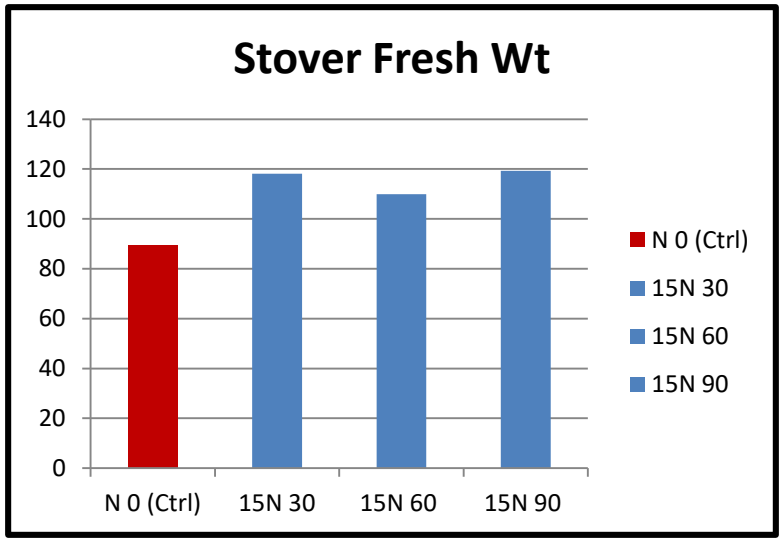


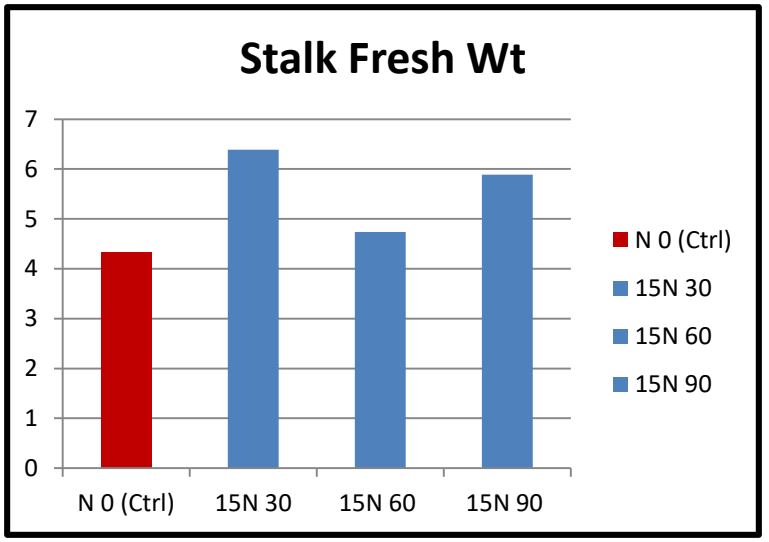


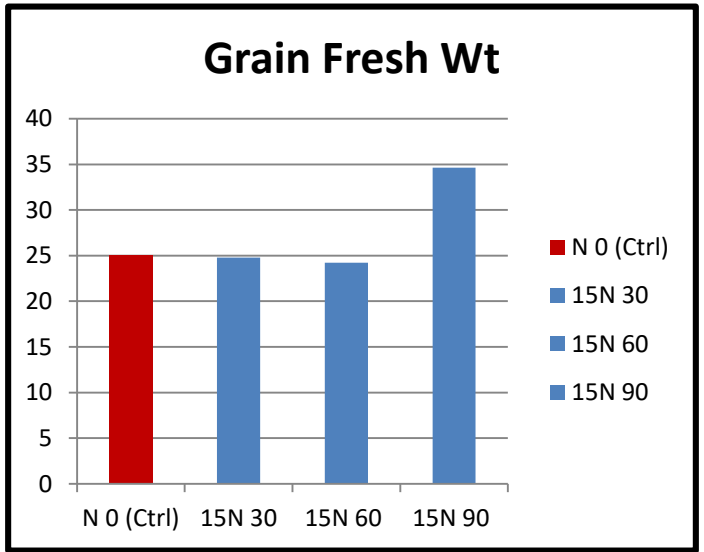




Data from Collected Samples







Collected Samples

Grain, Leave and Panicle

Collected Samples

Stover

Risks and Assumptions

- Climatic conditions will be favorable for the experiment (Specially on the areas where they depend on rain for cultivation)

- Inputs for the experiment like ^{15}N and other should be available in time.

Initial soil Sampling

Land Preparation


Thinning and Weeding after two weeks

1st Time Feeding

2nd Time Feeding

3rd Time Feeding

Preparation for Harvesting

Before Harvesting


Harvesting Time

Soil Sampling after harvesting

Future Plan

2016	2017	2018
- 15N management experiment was carried in sorghum field - Where to send sample for 15N residue analysis?	- Repetition of split plot management for confirmation of effective dosage of nitrogen fertilizer in August, 2017. - Data collection and sample preparation - Soil analysis	- To find out timing fertilizer application for most effective dosage in sorghum - Provide information for effective dose and right timing nitrogen fertilizer to be used for local famer - Farmer field extension in Eastern Part of Myanmar

Problems and Requirement

1. Don't have 15 N isotope for this research (shared from RAS5073)

2. Where to send soil and plants for 15 residue analysis??

3. Expert mission or fellowship training for better practices in the field of ^{15}N tracer application and effective sampling approaches


THANK YOU!!!