A Project Outline: Semi-commercial Scale Demo Area on Agrotiger Phils., Corporation's Technology – Hyfer Urea and Hyfer Foliar Fertilizers

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Background:

In all sugarcane growing regions in the Philippines, the fertilization of sugarcane had been traditionally on NPK fertilization program, 6-8 bags of Urea + 2-3 bags of DAP and 6-10 bags of Muriate of potash, which is equivalent to 156-257 kg N/ha, 46-69 kg P_2O_5/ha (average P = 25.1 kg/ha) and 180-300 kg K_2O/ha (average K = 199.2 kg/ha) for every cropping duration 11-12 months for plant crop and 10 months for ratooncrop. On an average, this is equivalent to a N:P:K ratio of 7:1:8.

Despite of the constant application of these elements, residual nutrients applied is low and these must have to be replenished every cropping due to nutrient losses. Unsuitable farm practice such as burning of trashes after harvest causes depletion of available nutrients in existing soil nutrient pool due to evaporation, weathering and volatilization losses. Dry conditions brought about by burning, can result into low soil moisture, rendering poor availability of nutrients in soil solution for plant absorption.

All over the years, agricultural chemical companies and research institutions have kept phase on solutions addressing efficient nitrogenous fertilizers for crop N utilization. At present, Agrotiger Phils. Corp is embarking on technologies, which would create economically viable and sustainable farm inputs that will improve yields of sugarcane and other crops. Agrotiger Phils. Corporation's products in its technology, namely, Hyfer N and Hyfer foliar (Growth enhance and Bloom booster) have succeeded in use crops like bananas, pineapple, rice and corn in Mindanao.

Agrotiger Phils. Corp.'s Hyfer Urea, an organically coated fertilizer offers several benefits on nitrogen availability, which prevents directly N losses by denitrification and volatilization of NH_3 (accounted at 28-37 %, Suarez et. al., 2012) from ground surface applied Urea. Coated with neem, Hyfer Urea prevents subterranean insect pests and diseases of sugarcane, assuring excellent root development for nutrient uptake, not alone for N, but for other essential nutrients.

Hyfer Urea has higher efficiency at 95 % than ordinary Urea at 63 %(Table 1). On bag basis, in 25-kg bag of Hyfer Urea, it has 23.75 kg for crop use, whereas 31.5 kg left equivalent weight from ordinary Urea for crop N use.

Table 1. Efficiency of Hyfer Urea vs. Ordinary Urea Fertilizer.

	Hyfer Urea	Ordinary Urea
	25 kg/bag	50 kg/bag
% Lost N	5%	37%
Kg N lost/bag	1.25	18.5
Efficiency %	95.0	63.0
Utilized by crop (kg) from a bag of fertilizer	23.75	31.5

In addition to the benefit of Hyfer Urea on N use and availability efficiency, it gives good control on subterranean pest destroying the roots of sugarcane. Hyfer Urea is coated with neem, which has pesticidal properties.

Other than Hyfer Urea, Agrotiger Phils., Corp. provides a two highly potential foliar nutrient fertilizer, Hyfer Foliar Fertilizer – Growth Enhancer and Bloom Booster. The Growth Enhancer contains 22 %N, 11 %P and 9 % K. Bloom Booster, on the hand contains 8 % N, 16 %P and 24 % K. Two of these products are applied based on timing on the vegetative and flowering stage of sugarcane.

Both Hyper Growth Enhancer and Bloom Booster contain Ca, Mg, S, B, Cu, Fe, Mn, Zn, vitamins, hormones, amino acids and humic acid. It acts as spreader-sticker, reducing surface tensions of solution and aid in spreading droplets to cover entire leaves. The benefits of each components are as follows:

a) N, P, K, Ca, Mg and S for plant growth, plant resistance and yield.
b) Micronutrients: B, Cu, Fe, Mn, Zn and Mo aids in photosynthesis, chlorophyll synthesis, cell wall development, germination and pollen tube elongation, metabolic process, sugar transport, carbohydrate metabolism, enzymes and synergism with other essential nutrient uptake, and hormone synthesis.
c) Vitamins: organic compounds that enhances plant growth and resistance to abiotic and biotic stresses.
d) Hormones: regulate plant growth.
e) Amino acids: supplemental providing building block for protein synthesis needed in plant growth development.
f) Humic acid: promotes plant health and growth.

Objective of Demonstration Trial:

1. To demonstrate the fertilization technology of Agrotiger Phils Corporation, using Hyfer N and Hyfer (Growth enhancer and Bloom booster) foliar as solution and alternatives to improve soil fertility and plant nutrition for a potential high production, higher sugarcane tonnage and sugar recovery.
2. To formulate suitable and specific fertilizer recommendation of Hyfer N and Hyfer foliar based from the results of this demonstration test.

Materials and Methods:

A. Experimental/Demo Design.

The setup will be in a commercial scale demo area. For each treatment, a 5.0 hectare shall be established as plot. This demo set up is not a replicated trial. By establishing a bigger observation area, it will be a reliable basis for differentiating a traditional practice and that of new technologies of Agrotiger Phils, Corp.

A.1. Establishing the plots. Before designating the area as treatment demo area, the following steps must be undertaken:

1. Select a 6.0 -hectare area with contiguous land topography, soil physical characteristics and production category. For each treatment, allocate 2.0 hectares. Stake out area, maintaining a buffer of 5.0 meters between treatments.
2. From identification and squaring-off the area, obtain a soil sample for chemical analysis. This will serve as initial as baseline on soil nutrients, pH and OM levels prior to introduction of treatment inputs. Obtain 1-2 kg composite sample of 10 borings taken at random (10 borings/5.0 hectares sampling grid; in case of 6.0 hectares of demo, 1 sample can be obtained).

   A detailed procedure of soil sampling as provided in SRA's Handbook on Sugarcane Growing (1986) shall be followed (Appendix A).

3. Analyze for pH, OM or N, P, K, Ca, Mg, S and micro-nutrients.
4. There will be three samples, corresponding to 3 treatments.

A.2. Treatment: Three major treatments will be compared, namely:

Code:		Treatment description:
X		Control or Without the technology: Traditional practice of the farm
T-1		With 50 % Agrotiger Phils., Corp Technologies: Hyfer Urea and Hyfer Foliar (Growth enhancer and Bloom booster).
T-2		With 100 % Agrotiger Phils., Corp Technologies: Hyfer Urea and Hyfer Foliar

A.3. Establishing the treatments:

<u>Treatment X - Control or Traditional practice</u>: Usual practice of fertilization will be carried out under this treatment.

TREATMENT - CONTROL (X) - FERTILIZER PROGRAM OF CURRENT PRACTICE:

DAYS AFTER PLANTING (DAP)	CROP AGE (MONTHS/STAGE)	TREATMENT - X (Control - Current Practice)			
		Fertilizer / Foliar	bags/ha & li foliar/ha	g/lin. Meter*	REMARKS
NEW PLANT					
Basal	At planting	Ordinary Urea (100 %) + DAP	4 bags Ordinary Urea + 1.5 bags DAP/ha	30 grams fertilizer mix/lin. Meter	Ordinary Urea + DAP can be mixed; mixing must be done outright in the field.
30-45 DAP	vegetative (early establishment)				
60-75	Tillering stage	Ordinary Urea (100 %) + DAP	4 bags Urea + 1.5 bags DAP/ha	23 grams fertilizer mix/ lin meter	Ordinary Urea + DAP can be mixed
90-120	Tillering stage				
120-150	Active vegetative	MOP	3 bags MOP/ha	23 g MOP/lin meter	
150-180	Active vegetative	MOP	4 bags MOP/ha	30 g MOP/lin meter	
180-210	Grand development				
210-240	Grand development				
240-270	Ripening				
270-300	Ripening				

***Linear meter/ha = 100 m, lenth of rows X (100 m, width / 1.5 m between rows) = 100 m x (66.66) = 6,666 lin. Meter/ha**

Treatment -1: 50 % of Agro-tiger's technology:

50 % AGROTIGER TECHNOLOGY - FERTILIZER PROGRAM:					
DAYS AFTER PLANTING (DAP)	CROP AGE (MONTHS/STAGE)	TREATMENT - A (50 % AgroTiger Technology)			
		Fertilizer / Foliar	bags/ha & li foliar/ha	g/lin. Meter*	REMARKS
NEW PLANT					
Basal	At planting	Urea Hyfer (50 %) + Ordinary Urea (50 %)+ DAP	2 bags Hyfer Urea + 2 bags Ordinary Urea + 1.5 bags DAP/ha	41 grams fertilizer mix/lin. Meter	Both Hyfer Urea + Ordinary Urea + DAP can be mixed; mixing must be done outright in the field.
30-45 DAP	vegetative (early establishment)	Hyfer foliar-Growth Enhancer	0.75 li/ha		Hyfer foliar must be diluted in 200 liters of water (covers 1 hectare).
60-75	Tillering stage	Urea Hyfer (50 %) + Ordinary Urea (50 %)+ DAP + Hyfer foliar - Growth Enhancer	2 bags Hyfer Urea + 2 bags Ordinary Urea + 1.5 bags DAP/ha + 0.75 li Hyfer foliar/ha	34 grams fertilizer mix/ lin meter	Both Hyfer Urea + Ordinary Urea + DAP can be mixed; Hyfer foliar must be diluted in 200 liters of water (covers 1 hectare).
90-120	Tillering stage	Hyfer foliar-Growth Enhancer	0.75 li/ha		
120-150	Active vegetative	MOP + Hyfer foliar - Growth Enhancer	3 bags MOP/ha + 0.75 ml Hyfer foliar/ha	23 g MOP/lin meter	
150-180	Active vegetative	MOP + Hyfer foliar - Growth Enhancer	4 bags MOP/ha + 0.75 ml Hyfer foliar/ha	30 g MOP/lin meter	
180-210	Grand development	MOP + Hyfer foliar - Bloom Booster	0.75 li Hyfer foliar/ha		
210-240	Grand development	Hyfer foliar - Bloom Booster	0.75 li Hyfer foliar/ha		
240-270	Ripening				
270-300	Ripening				
*Linear meter/ha = 100 m, lenth of rows X (100 m, width / 1.5 m between rows) = 100 m x (66.66) = 6,666 lin. Meter/ha					
** 200 li water covers 1 hectare.					

Treatment -2: 100 % of Agro-tiger's technology:

100 % AGROTIGER TECHNOLOGY - FERTILIZER PROGRAM:					
DAYS AFTER PLANTING (DAP)	CROP AGE (MONTHS/STAGE)	TREATMENT - B (100 % AgroTiger Technology)			
		Fertilizer / Foliar	bags/ha & li foliar/ha	g/lin. Meter*	REMARKS
NEW PLANT					
Basal	At planting	Urea Hyfer (100 %) + DAP	4 bags Hyfer Urea + 1.5 bags DAP/ha	30 grams fertilizer mix/lin. Meter	Both Hyfer Urea + DAP can be mixed; mixing must be done outright in the field.
30-45 DAP	vegetative (early establishment)	Hyfer foliar-Growth Enhancer	0.75 li/ha		Hyfer foliar must be diluted in 200 liters of water (covers 1 hectare).
60-75	Tillering stage	Hyfer foliar-Growth Enhancer	4 bags Hyfer Urea + 1.5 bags DAP/ha + 0.75 li Hyfer foliar/ha	23 grams fertilizer mix/ lin meter	Both Hyfer Urea can be mixed; Hyfer foliar must be diluted in 200 liters of water (covers 1 hectare).
90-120	Tillering stage	Hyfer foliar-Growth Enhancer	0.75 li/ha		
120-150	Active vegetative	MOP + Hyfer foliar - Growth Enhancer	3 bags MOP/ha + 0.75 ml Hyfer foliar/ha	23 g MOP/lin meter	
150-180	Active vegetative	MOP + Hyfer foliar - Growth Enhancer	4 bags MOP/ha + 0.75 ml Hyfer foliar/ha	30 g MOP/lin meter	
180-210	Grand development	MOP + Hyfer foliar - Bloom Booster	0.75 li Hyfer foliar/ha		
210-240	Grand development	Hyfer foliar - Bloom Booster	0.75 li Hyfer foliar/ha		
240-270	Ripening				
270-300	Ripening				
*Linear meter/ha = 100 m, lenth of rows X (100 m, width / 1.5 m between rows) = 100 m x (66.66) = 6,666 lin. Meter/ha					
** 200 li water covers 1 hectare.					

B. Procedures:

1. **During land prep**: apply lime. (Note: tons of lime will depend on the soil pH analysis).

2. **Leaf sampling** will be obtained after 12 WAP. The third youngest leaf at vegetative stage will be obtained for nutrient composition assessment and basis for formulating the foliar fertilization of the canes **(Appendix B**).

3. **New approach (Optional).** Sugarcane plant extract for nutrient analysis and brix will be obtained at full grand stage development of sugarcane (Figure 1). A minimum of five (5) canes will be sampled at random. Parameters: N, P, K, Ca, Mg, S, B, Zn, Fe, Mn and Cu. On plant extracts, the same nutrients and brix will be determined.

Figure 1. Cane sample for extract nutrient analysis.

4. **<u>Tonnage per hectare</u>**:
   a) Direct method – a yield plot of 10 m X 10 m, replicated 3 X will be squared-off. Weight of all harvestable canes from the area will be determined. Must exclude buffer rows. Compute of tonnage per hectare by multiplying (X) 100. Unit: tons cane (TC)/ha.
   b) Indirect Total tonnage: this can be obtained by properly monitoring and tagging loading trucks from the area to the mill.
5. **<u>Sugar content at harvest</u>**. In section 6.a., A composite sample of 5 fully developed or harvestable cane taken at random in the middle of the pile will be sampled. This will be replicated 3X. The samples must be submitted within the day for the °brix and sucrose content analysis.

C. Data / Observations to be gathered:

1. Initial soil chemical analysis of site of demonstration trial. Soil chemical analysis of reference high yielding area. Parameters: same as in section III.1.
2. Plant height and number of tillers at 12 WAP. (with photos taken to differentiate response to fertilizer application). Note: If weekly plant height measurements can be obtained, growth increment/week can be determined. This will give idea on the growth rate in response to treatment.
3. Leaf chemical analysis: determine nutrient composition or levels at 12 WAP.
4. Plant extract nutrient and brix determination at full grand stage and brix.\
5. Yield – average tons/ha
6. Sugar content: Average brix and sucrose content.
7. LSTC

APPENDIX A. Procedure in Soil Sampling in Sugarcane.

1. Use proper soil sampling tools (Figure 1). This procedure is cited originally in SRA's Handbook in Sugarcane (1988).

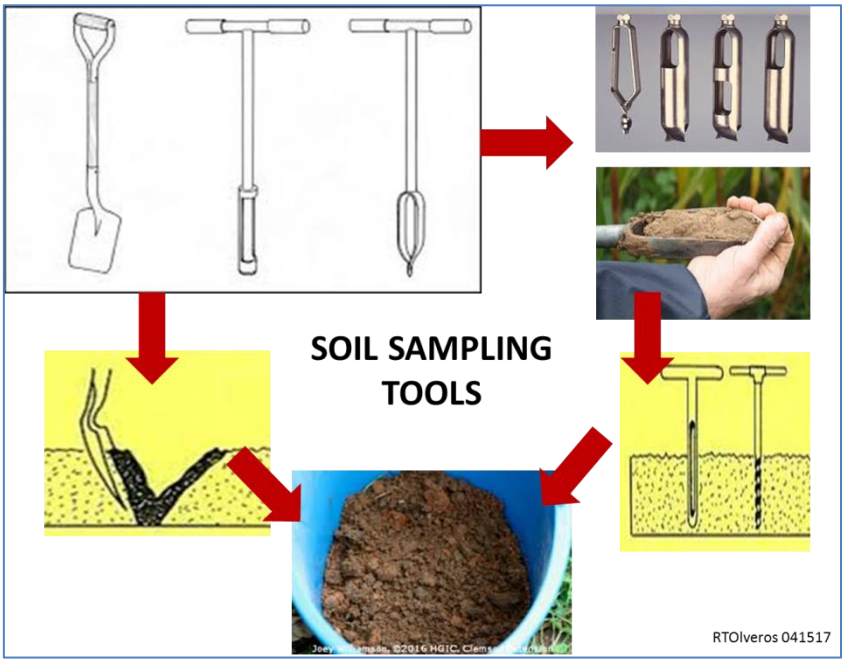


Figure 2. Tools in soil sampling.

2. Collect soil sample at right moisture condition. The right soil moisture is when the soil is not too wet nor too dry to plow (Figure 2). By feel method, take a handful of soil taken at 15-18 cm depth and form a ball. If no moisture oozes out the ball or the soil does not break or crumbles, the soil is at right moisture condition.

Figure 3. Determination technique for soil moisture conditions.

3. Clear the surface of the soil from extraneous materials. Avoid contamination of tools and containers used for sampling. Soils must not be contaminated from any particle. Keep container closed and tools properly scraped of any particle.

4. Map out the farm into sample grids (Figure 3). Establish boundaries with differentiating factor such as topography, cropping system, cultural

practices, and/or yield classification. As a standard procedure, 10 borings are obtained per 5 hectare grid.

AREA MAPPING BASED ON SOIL, TOPOGRAPHY, AND/OR YIELD CLASSIFICATION.

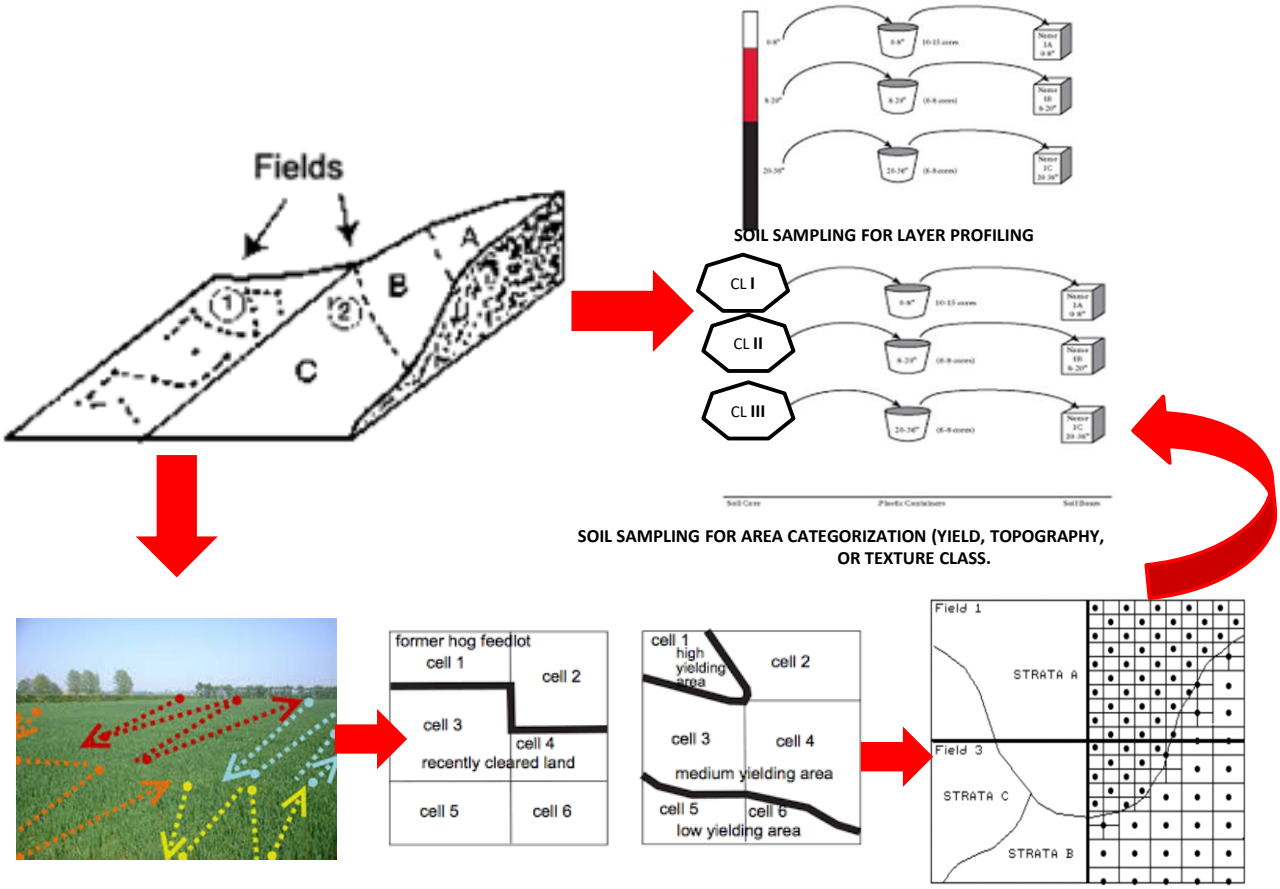
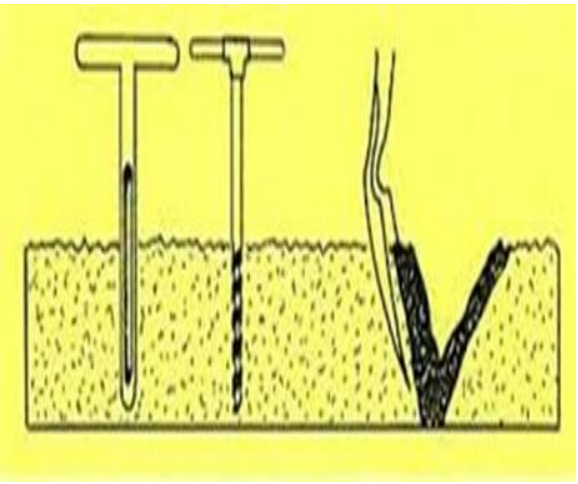
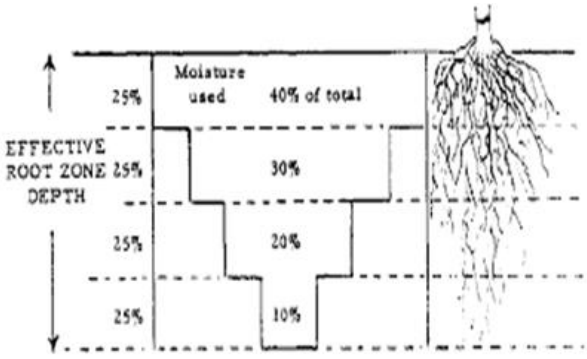
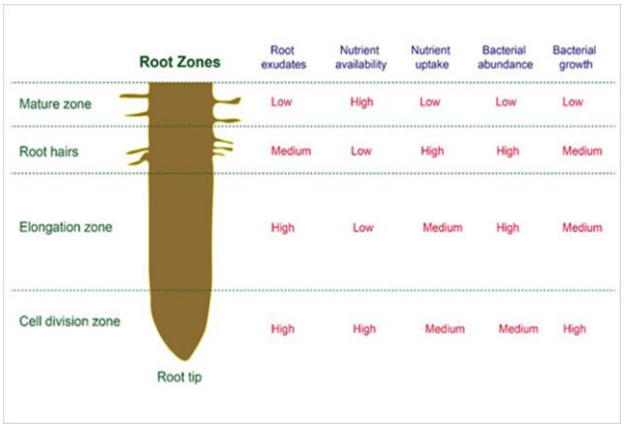


Figure 4. Soil mapping and area categorization for detailed soil sampling.

5. Collect sample at depth of 0-12", which will include top soil (15 cm) and a portion of subsoil (15 cm)(Figure 4). Ideally sampling must represent the effective root zone of the crop. For sugarcane, 0-12" will represent the root zone. Sampling can be done onwards at depth of 12-24" for established or ratoon crops.







Sugarcane:

60 - 90 cm – where roots are active in water and nutrient absorption.

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Figure 5. Depth of soil sampling.

6. Follow the sampling pattern in the field appropriately made in the field. This refers to item No. 4, on delineation of areas.
7. From the bulk of soil collected in a bucket, mix and collect 1-2 kg sample.
8. Label bag of soil sample properly (Figure 5). Fill up the following: Name of area, Location, Date of sampling, Description of the Area, Soil type, Area size (in hectares), Cropping history, and Name of Collector / Head Crew in Sampling.

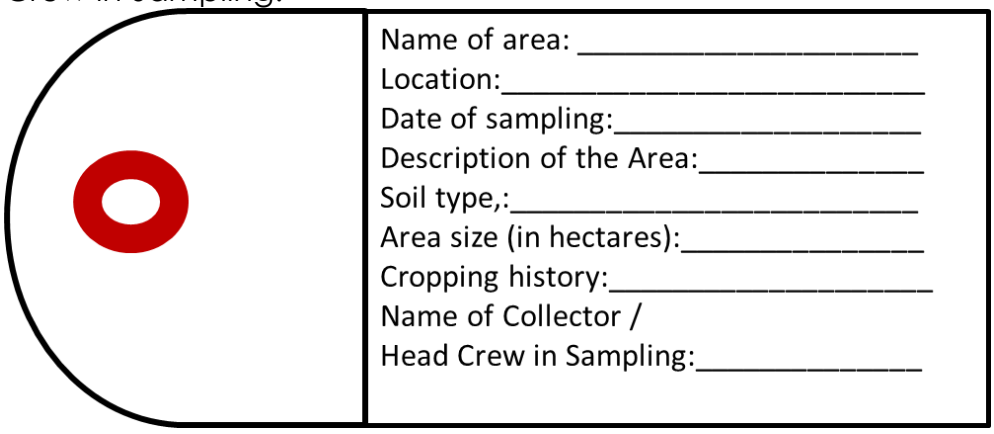


Figure 5. Labelling with details attached to the soil sample.

9. Submit samples to the lab. If it takes more than a day, open bags and allow the samples to be air dried, but be sure there is no contamination on the sample such as dust and other probable source of contamination.

APPENDIX B. Procedure in Leaf Sampling in Sugarcane.

1. Take leaf sample from 3rd open leaf (SRA, 1988). This leaf position resulted in the highest correlation in nutrient composition in relation to plant growth and yield.

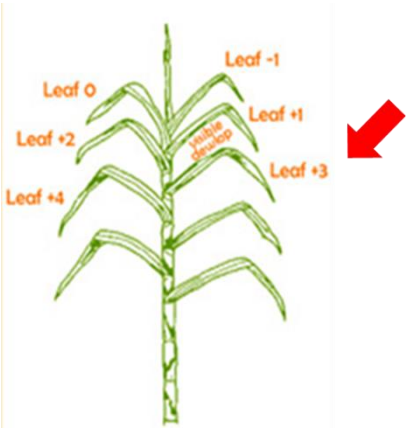
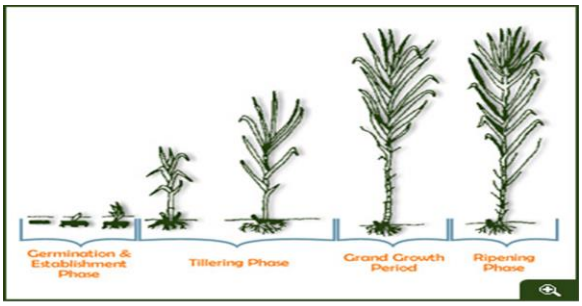
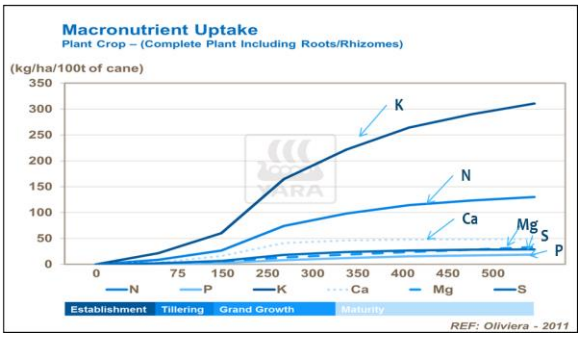
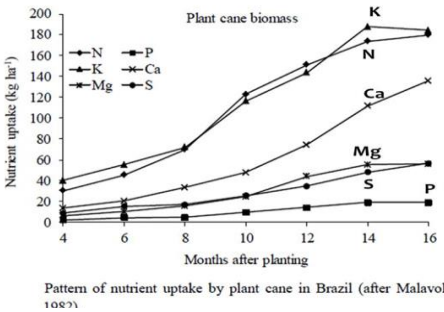


Figure 6. Third open leaf.

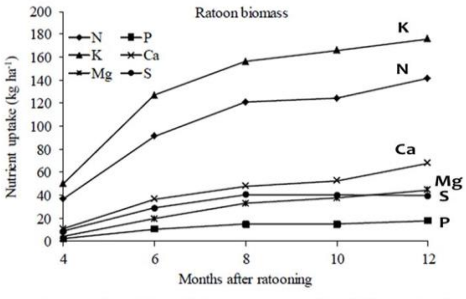
2. The best age of sample is at 3 to 4 months age of sugarcane crop. If only one sample is obtained, plant canes must be at 4 ½ to 5 months. For ratoon, leaf sample must be taken at 4 months.







Pattern of nutrient uptake by plant cane in Brazil (after Malavolta, 1982).



Pattern of nutrient uptake by ratoon cane in Brazil (after Malavolta, 1982).

Figure 7. Growth stage of sugarcane and the active nutrient utilization and dry matter production.

3. Collect leaf sample during the day, 8 AM giving the least fluctuation in moisture content in the plant.

4. Steps of gathering samples:

a) Select canes which would generally represent the status of crop. Samples must come from plants of similar sizes.
b) Select permanent sampling pattern, cutting diagonally and taking from no less than 50 plants (50-80 leaves).
c) Do not damage plants sampled. Collect only the 3rd leaf.
d) Fold the collected samples to 20 cm subsection. Remove the midrib.
e) Place in plastic bag and label properly.

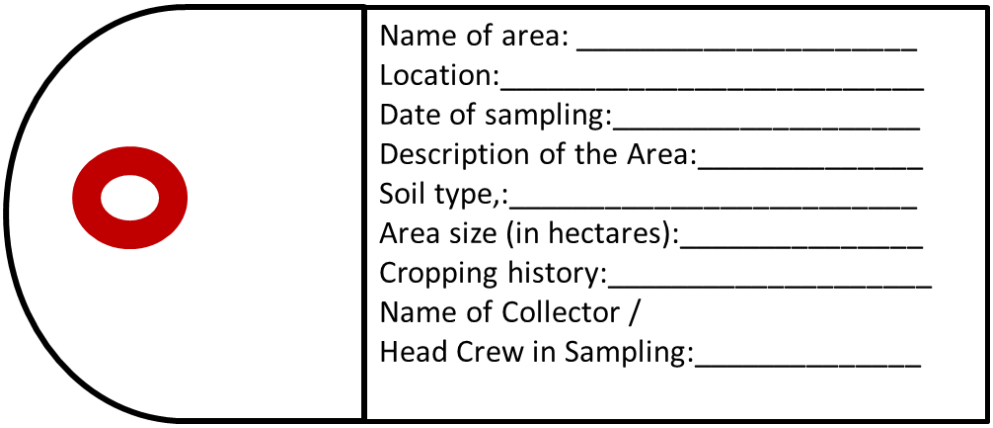


Figure 8. Suggested tags on samples for identification.

f) In case laboratory is far from site, sun-dry or air-dry the leaf samples.

Precautions in leaf sampling:

a) Do not sample when there is drought or excessive rain. Obtain samples after 4 weeks of rain, when plants would have normal moisture status.
b) The mid-section of the leaf provides the very significant and reliable nutrient analysis.
c) To obtain a good representation of the nutrient status of the crop, at least 2 to 3 samples must be obtained.
d) Most often the growth rate is considered as considered in leaf nutrient analysis rather than the chronological age of the plants.