PASTURE SCIENCE MANUAL

Sejun Kikuchi

VIETNAM - 2006
Measuring height and length of pasture plant

Force to erect the stem or leaf by hand

Expectation:
I hope that (1) You will correct;
(2) Develop further the content of this manual;
(3) In order to develop the agriculture industry of your country.

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(1) How to plant

Planting method for Napier grass:

- 2 nodes under ground, 1 node upper ground
- Planting angle: $45^\circ$ to develop more root system by ethylene hormone
- Plant spacing is regular

Sugar cane planting method is unsuitable for Napier grass because some stems might not emergence then, plant spacing is irregular.

Cover solidly some nodes of stolon with soil: For example, Giant Star grass, Creeping Signal grass, Bermuda grass and Para grass, etc.
(2) How to prepare the vegetative propagation stem of Napier Grass

- When the later part of raining season come, in area, stop cutting (For example, in Ba Vi, September)
- Fertilize N.P.K.S: (For example, 15% : 15% : 15% : 10%).
- It’s recommended to use Superphosphate (P.S, for acid soil), Urea (N) and/or compound fertilizer (N.P.K). Quantity is from 500 - 1000 kg/ha. Please contact the regional extension officer for adequate quantity.
(3) How to cut the old (mature) stem (6 months or more) of Napier Grass for replanting

Stem is young and soft, so we use to feed for cattle after chopping.
(4) Ideal cutting time and height of Napier grass?

Further research needed for the cutting height by the Vietnamese researcher.

Cut the whole plant 15~20 cm from the ground level (basal stem part) for propagation, the ideal time for cutting is when the stem is hard and in brown color. Usually at the beginning of rainy season, we cut and divide stem for planting.

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(5) How to regrow after cutting

- Axial buds shooting
- Inside part of stubble gradually die (missing hill)

Advantage:
- High production
- Grow fast

Disadvantage:
- Low production
- Slow growth
- Cut a part of regrowth points

Regrowth point

Photosynthesize to produce CHO for new growth, the remaining is depended on Leaf Area Index (LAI)

20 cm

5 cm cut

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(6) Where to fertilize the grass?

If we do not use fertilizer and manure for pasture grass and legume, the soil will gradually degrade because the pasture grass use the natural soil fertility.

Main requirement for fertility:
- Grass: N. + P, K, S, Zn, Ca, etc.
- Legume: P$_2$O$_5$ + K, S, Mo, etc.

Basal fertilizer:
- Broadcasting fertilizer the land (N.P.K) and incorporate into soil by plow or harrow

Additional fertilization:
- After each time harvesting, we have to do additional fertilizer for the new growth.
- After every 3 - 5 years, we have to renovate the pasture.
(7) **Natural Nitrogen resource for fertilizer of pasture Grass and Legume**

**Natural N fertilizer resource**

- **Sky**
  - Thunder => fix Nitrogen from air, 100kgN/ha/year

**Irrigation and flooding supply N and minerals**
(8) Protein bank

Tropical forage legume tree (Leuceana spp., Glicichia spp., etc.) fix nitrogen from the air. Dry matter of the leaf and soft (edible) stem contain 20~25% of crude protein. This source is better than commercial concentrate.

- Fertilize at least 100kg super-phosphates/ha annually

Forage legume tree:
- Leuceana spp. (Grow bad under acid soil and low temperature)
- Glicidiea spp. (Grow well in acid soil but no resistance against draught and low temperature)
  
( It is more palatable if we feed the cattle with dried leaf)
(9) How to utilize the Napier Grass stem and leaf?

- It is not recommended if we feed the whole plant to cattle without chopping because cattle can only eat the leaf. Cutting frequency should be short to decrease the hard stem part. However, it is needed to fertilize the grass after each cutting time.
→ We have to cut or chop the part of soft (edible) stem part (by machine or manually) to 2~3 cm length ideally.

To increase the edible part (utilization ratio of plant's stem)
The farmer should chop it to small pieces, 2~3 cm length
(10) Rice straw utilization for feeding in the dry season

Volume is large $\Rightarrow$ transportation cost is very

Rice straw in paddy field

Rice straw transportation by simple riskshaw

Binding rice straw using simple binding machine
Made in Thailand and Ho Chi Minh city, etc.
(11) Rice straw treatment by urea (NH$_4^+$) and molasses (CHO) for feeding in dry season

Ideally give 1% urea - molasses treated rice straw + 1% concentrate + 1% dried grass, in total 3% of body weight of the cattle during dry season.
(12) Urea – molasses – mineral block for dry season
(Already experimented in NIAH)
It was introduced by Australian method but the Vietnamese farmers do not take advantage of this.

Why:
+ A lack of simple machine to produce block? (Mixer and block maker)
+ Labor cost? (Especially if added sulfur, it causes irritation to skin of worker)
+ Price?
+ Extension activities to introduce the feed?
+ Distribution and transportation cost?
(13) Breaking dormancy of tropical legume seed
- Before planting last year harvested seed, we have to treat to break the hard coat (dormancy) with using hot water treatment.
- If the seed was harvested 3~4 years before, the seed don’t need this treatment.

Dip the seed in hot water container in 3 ~ 5 minutes for small seed, or 10 minutes for big seed (Leuceana)

Dry for 1~2 days in shade and windy place before planting
(14) Planting density of Napier Grass

Density: 50cmx50cm in fertile soil, good drainage, high temperature
75cmx75cm in normal soil
100cmx100cm infertile soil

(14) Stolon (Runner): African (Giant) Star grass
Creeping signal grass (*Brachiaria humidicola*, etc.)

Do not cover the whole stolon but every 30~60 cm over the nodes and then tap by foot
(15) Sampling method of soil for chemical and physical analysis

**Soil sampling depth**

<table>
<thead>
<tr>
<th>Vietnam (based on Russian method)</th>
<th>South America (CIAT method)</th>
<th>Japan</th>
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</thead>
<tbody>
<tr>
<td>20 cm</td>
<td>15 cm</td>
<td>5 cm</td>
</tr>
<tr>
<td>20 cm</td>
<td>15 cm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>30 cm</td>
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<tr>
<td></td>
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<td>1 sample</td>
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<tr>
<td></td>
<td>1 sample</td>
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</tbody>
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*Take out completely the remaining soil in the hole*

*Take sample beside the hole*
(16) Quarter method for soil sampling

- Eliminate root and stone by Ø 2 mm metal mesh
- Well mixed
- 1st soil sample (2 ~5 kg)

- Labeling to sample bag:
  - Location and farmer name
  - Date
  - Sample number
  - Name of collector
  - Organization name
  - Name of planted grass
(17) Sampling forage crop for approximate analysis

- Cutting height: 5 ~ 10 cm above the ground (fix the same cutting height for all species except tall type and creeping type)
- Chopping: The whole plant is cut by sharpened scissors into 2 ~ 5cm length pieces

**Popular method**

Whole plant → separate to
- leaf
- stem
- root
- seed

pieces (2 ~ 5cm) → Cut with sharpened scissors

**Research method in detail**

pieces (2 ~ 5cm) → mixing using quarter method

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final sample (2 samples) (500 – 1000 g)

final samples (2 separate samples) (500 – 1000 g/sample)

Dry

(In electric forced oven to eliminate water, at 100°C for 2 hours, and then 70°C for 24 hours)

Measure (weighing, 1st moisture %)

Crush the sample and pass the 1 mm diameter sieve (metal mesh)

Labeling:
- Date, grass or legume species and/or cultivar name, plant stage;
- Site name, farmer (field owner) name;
- Collector name and name of organization.

Send to lab.

Laboratory analysis (0.5 – 10g/analysis)
- Approximate analysis:
  + 2nd moisture (final) Crude ash (CA) after drying at 300~500°C
  + Crude protein (CP)
  + Crude fiber (CF): NDF, ADF, Lignin, etc.
  + Digestibility
  + Carbohydrate (WSC, NSC)
  + Crude fat (CF)
  + Minerals

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(18) Planting method

+ Seed:
  1- Line (streak)
  2- Spot (hill seeding, spaced planting)
  3- Broadcast
  4- Transplant (from nursery)

+ Vegetative parts (stem, root, nursery plant)
+ Transplant

2~3 seeds → Remove thinning → Transplant

- fertilizer
- water
- soil

Hole preparation for transplanting

+ Stem

Planting method of stem type

Planting method of stolon

Cover the node with soil
(19) Pelleted seed

1. Seed
2. Pellet fertilizer

+ 
+ 

Seed coated by fertilizer

- Dry

- Broadcast mainly to slope area by hand or airplane

Pasture in slope area
Usually creeping (stolon) type of grass and legume

Seed and adhesive
Pellet fertilizer
Fertilizer pelleted with seed
(20) Shot gun mixture

When we need to decide immediately local adapted species, we do as follow:

First, if we cannot get information of the soil in detail, we observe the soil color and indicator plant (Cassava – acid soil, Sugar cane – fertile soil, etc.).
We ask for information from the local farmer and technician about the natural condition, planted species and custom.
Based on limited information with expert experience, we can select what kind of species can be successfully grown in that area.

1- Mix - broadcasting

We mix 5 – 20 species together and broadcast to the seed bed. After germination, we observe the vigor of growth, diseases, palatability, etc. We can decide the most adaptable species.

2- Line (streak) planting

We examine 5 – 20 species in the field. Each species is planted in one or some line and put on the label with species name.
We observe the plant vigor, productivity, diseases, etc. to decide adapted species.
(21) Seed germination test

Germination test by ISTA (International Seed Testing Association (France) is common, but it is difficult for us to do in local area. We use simple method by Petri dish with paper filter (single or double method) or toilet paper. Firstly, we wet the paper by boiled water (or mineral water) or KCl solution.

Put 20 ~ 100 seeds into the dish (for legume seeds, we have to treated with hot water to break seed dormancy before putting into the petri dish), then keep the dish in dark place. Start counting germinated seed when they start germinating.

Remove germinated seed and record until no more seed can germinate.

Fungi may occur but it does not affect so much the germination test. Add water if necessary to keep the moisture inside the dish.

Germination % = Number of germinated seed ÷ Total number of the seed

Record:
- count the test seeds
- Count number of germinated seed
- Record normal, abnormal growth
- Date

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