BIBLIOGRAPHY

BUSOY, GINA M. APRIL 2009. Morphological Characters and Forage Yield of Eleven Strains of Stargrass (*Cynodon nlemfuensis* V.) in Benguet Province. Benguet State University, La Trinidad, Benguet.

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ABSTRACT

Eleven strains of stargrass collected from different municipalities of Benguet were evaluated for their morphological character and forage yield under La Trinidad, Benguet condition. The eleven strains of stargrass exhibited prostrate growth habit, small leaves with medium green leaf color, medium leaf texture, and smooth stem texture.

Significant differences in morphological characters and forage yield were observed among the 11 strains of stargrass studied. The strains of stargrass from Tuba, La Trinidad and Itogon had the tallest plants among the 11 strains evaluated. The strains from La Trinidad and Kibungan had the biggest leaves. The highest stem diameter was noted in strains from La Trinidad, Itogon and Sablan. The strains of stargrass from La Trinidad and Itogon also produced the highest forage yield and dry matter content. As a result of this study, the stargrass from La Trinidad and Itogon are the best strains in terms of morphological characters and forage yield under La Trinidad, Benguet condition.

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INTRODUCTION

Forages are utilized as feeds for animals especially by ruminants, because they are usually regarded as one grown for edible plant parts other than the seed. They provide major part of nutrients required for dairy farming (Boone 1981). Production of high quality and large quantity of forage is very important in the animal production industry (Rosacia, 2007). Since there is fast rising demand and cost of animal meat and milk products, it is imperative to produce good quality of pasture and forage crops and utilize crop residues more efficiently. This becomes a practical option, since these natural feed resources will continue to be the most readily available and cheapest source of feeds for ruminants even in the distant future (PCARRD, 1981). Improving animal production requires improving the quality and quantity of forage (Miller, 1984).

Forage crops are not thought as a cash crop, but profit can and should be expected from raising them. It is thought that profit will be derived when it is consumed by an animal before they are generally considered usable for human beings (Miller, 1984). One of the keys to profitable livestock production is to minimize the costs of producing a marketable animal or animal product because feed costs are commonly 70-80 percent of the cost of growing or maintaining an animal (Huston and Pinchak, 2008).

The expansion and development of the livestock industry of the Philippines, particularly of carabao, cattle, and goats, will depend to a great extent on the production of good quality pasture and forage crops and the utilization of crop residues. This is because these materials are and will continue to be the cheapest sources of feed for ruminants.

In Cordillera region, forage production is not a major priority industry; in fact it is more on vegetable production. Ruminants particularly depends their animal feeds on the forages that occur on the mountains or occur naturally in their environment. Since almost all of the farmers depend on animal power in farming, farmers should realize the benefit of forage production.

Stargrass is considered as a serious weed in cultivated areas, however much benefited are derived from it such as good for providing erosion control, significant soil quality improvements such as: improved soil structure, better water infiltration rates and increased water holding capacity, result from the use of stargrass as permanent cover crops (CTAHR, 2007), fair quality forage for animal grazing systems in terms of production (nutritional quality and palatability). It helps reduce weeds by establishing quickly and out coming weeds (CTAHR, 2008), and as a cover crops in orchard.

The increased in stargrass usage in recent years has been due to high yields, persistence, good nutritive value, ease of establishment, drought tolerance, tolerance from most pest and diseases and extended forage production during short photoperiod (Mislevy and Rechcigl, 2003).

Stargrass mostly occurring as forage grass in pasture areas of Benguet are grazed by animals. It is most liked by animals because of its palatability and it contains nutrients needed for animal nutrition.

Forages improve human health when milk and meat products come from animals receiving adequate forage rich in nutrients and vitamins because forages provide a major part of nutrients required for animal nutrition (Rosacia, 2007).

Vegetable farming and raising of animals are the major source of income of farmers in Benguet. Some Benguet farmers especially in remote areas are adopting the old farming practices, which is the use of animal technology. During land preparation, they use animals in plowing and harrowing their field.

This study will help the researchers and farmers to have more information on stargrass as forage crop they feed on their animals since it grows widely in Benguet areas. It is important for them to know how to improve their management practices to produce quality grazing areas, also in non-grazing areas under cut and carry management system.

Aside from being a feed to ruminants, it can also be helpful in soil conservation. It can control soil erosion because of deep penetration of its roots, and it be used as a cover crops. It can make possible more economical use of wet, stony, stumpy or rough areas unsuited to grain production.

The objectives of the study were to evaluate the morphological characters and forage yield of 11 strains of stargrass collected from different municipalities of Benguet and to identify the best strain of stargrass in terms of morphology and forage yield under La Trinidad Benguet condition.

The study was conducted at Balili Experimental Station, Benguet State University from August 2008 to February 2009.

REVIEW OF LITERATURE

Importance of Forage

Forages are important in the sustainable agricultural systems. They are important sources of animal nutrition. Their inclusion in agro-ecosystems has also desirable environment benefits including improving water quality, preventing soil erosion, improving soil health and reclaiming contaminated soil and providing healthful nutrition to human (Tandang, 2007). It is the most important plant resource that can be converted to animal protein (Rosacia, 2007).

The major goals in forage production are to maximize dry matter yield and to achieve a high level of forage quality, but ultimate goal is to produce a maximum yield of metabolizable energy which can be used by the animals (Humphreys, 2005). The optimum diet of animal depends on the product, such as beef or milk for cattle.

Forage Production in Relation to Ruminant Production

Forage production is a complex mechanism that takes the energy of sunlight and transforms it into plant proteins, carbohydrates and other compounds within the forage plant, and further involves the animal's conversion of these plant products into milk, meat or wool (Miller, 1984).

Van Soest as cited by Humphreys, 2005, concluded that ruminants have a much better capability to digest forage fibrous carbohydrates compared to monogastrics and to convert poor quality protein and non protein nitrogen sources. Animal performance, whether in terms of growth or milk production depends on the animal's potential for production, the amount dry matter (DM) the animal consumes, and the nutritive value of the DM consumed. Forage intake is affected by the amount of forage available; and the characteristics of the forage consumed. Intake is also affected by many characteristics of forages such as particle size of stored forages, amounts of fiber, protein, and minerals in the DM, and how fast undigested DM passes through the animal. Accumulations of dead forage or manure on pasture will decrease intake, while a dense, leafy canopy will increase intake. Animal performance fed on many stargrass has been excellent in producing live weight gains (LWG) per acre and average daily gain (ADG) per animal about that of bahiagrass.

Forage Quality

Forage quality is an inclusive expression used to encompass all nutritional attributes of forage in relation to its overall value to the consuming animal, including protein content, digestibility or simply palatability, energy, vitamins and minerals (Huston and Pinchak, 2008). It is a characteristics that make nutrients, the combination of chemical and biocharacteristics of forage that determines it's potential to produce meat, milk, and wool or with feeding value and nutritive value (MSU, 2007). Tandang, 2007 also added that feed quality of forages depends largely on the maturity of the plant and it can also be defined as animal performance because of the close relationship between animal performance and total digestible nutrient intake.

Total Digestible Nutrients (TDN) is the sum total of the digestibility of the organic components of plant materials (Tandang, 2007).it is simply the nutrients of the feeding stuff converted into carbohydrate equivalents. On an average, fat contains about two and one-fourth as much as energy as carbohydrates and protein contains about the same amount as carbohydrates.

The Acid Detergent Fiber (ADF) is the insoluble residue following extraction of herbage with acid detergent. This indicates that if the forage had fair, poor or reject ADF, the quality is not desirable level for feed production (Tandang, 2007).

Forage nutritive value is often described as crude protein concentration. Crude protein is the estimate of protein content based on a determination of total nitrogen content.

Relative Feed Value is another overall measure of forage quality used by National Forage Testing Association (NFTA). The relative feed value represents voluntary intake of digestible dry matter relative to standard forage, and it has been used to set hay prices by the NFTA. The RFV is determined by combining the digestibility and potential intake of forage into one number.

Relative Forage Quality (RFQ) is based on more accurate equations for estimating the energy value and voluntary intake of forages. Its value represents voluntary intake of total digestible nutrient (TDN) relative to standard forage.

Digestion maybe defined as the preparation of food for absorption into the body from the gastro-intestinal tract. However, in common usage, digestibility is taken to mean disappearance of food from the G.I tract. It is important to recognize that digestibility is variable. Thus, the digestibility data are used extensively in animal nutrition to evaluate feedstuffs or study nutrient utilization.

The word digestion is used to include all the processes necessary for the conversion of food into the soluble forms in which it is assimilable. However, not all the food can be converted into soluble forms so that it can be absorbed, digestion trials are run.

According to McDonald *et. al*. (2002), there are some associated terms derived from digestibility data, which are intended to provide a measure of the energy value of the food. One measure is the total digestible nutrients (TDN) constant of the food, which is calculated as the combined weight in 100 kilograms of the food of digestible crude protein and digestible ether extract. Another derived measure of the energy content of food is the concentration of digestible organic matter in the dry matter (DOMD).

Furthermore, intake and digestion by animals depends on forage properties such as its dry matter concentration, particle size, and the ensiling process (Humphreys, 2005).

Origin of Stargrass

Stargrass originates in East and Central Africa, from Ethiopia and Sudan throughout Zaire to Malawi and Angola. It has been introduced to other parts of the tropics as a fodder grass (Mannetje et al., 1992). It is a member of Bermuda grass family and sometimes it is called as giant stargrass or African stargrass, it is also called as a pioneer plant on disturbed lands (Mislevy, 2008).

Botanical Description of Stargrass

Stargrass is a warm-season perennial that grows vigorously and spreads rapidly after planting. Stargrass is a stoloniferous sward-forming without rhizomes. The stolons are stout, weedy and lie flat on the ground surface. The stems are 20-30 cm high and 1-3 mm at the base. The leaf blade is flat, linear-lanceolate, 5-16 cm long and 2-5 mm wide, thin and green or rather stiff and glaucous, scaberulous, with or without scattered hairs; ligule a scarious rim 0.3 mm long. Inflorescence of 4-13 digitate 1 sided spikes, usually in 1 or 2 whorls of 4-10 cm long spikes; spikelets measures 2-3 m long, green or purplish green (Mannetje, 1992).

Ecology of Stargrass

Productivity and persistence of stargrass are limited to lower elevations or where temperatures do not fall below -4 oC, as growth rapidly ceases with low temperatures. In its area of origin, it occurs up to 2300m altitude. It requires 20-80 inches of annual rainfall (Mannetje, 1992).

Stargrass are well adapted to a wide range of soil types ranging from sands to clays. It prefers moist, well-drained and fertile soils but cannot tolerate long period of flooding (Adesogan et. al., 2002). Soil pH of stargrass tolerates a broad pH range (5.0-8.0) but grows best when the pH is 5.5-6.0. It is not suitable for shaded conditions (CTAHR, 2007). Stargrass can be grown in areas with low growing legumes to improve forage quality and reduce the harmful effects of its prussic acid control. Small forms of *Cynodon nlemfuensis* can be mistaken for Bermuda grass (*Cynodon dactylon*).

Stargrass grows vigorously and roots at the internodes as it spread. Some genotypes have a bunch-habit type of growth even though they spread by stolons. It is deep rooted and it can be propagated by stolons or stem pieces.

Establishment of Stargrass

Stargrass are established vegetatively from mature (10- to 14-week-old) stem pieces. When placed in a moist, firm seedbed, nodes germinate in 5 to 10 days. These grasses are planted by distributing freshly cut planting material on clean (100% free of common Bermuda grass and all other vegetation), moist, cultivated soil, covered by discing 2 to 4 in. deep (allowing 40% of stem to be exposed) or crimping stem pieces 4 in. deep into the soil followed by an extremely firm packing.

Fresh planting material scattered on the soil surface must be covered with soil or crimped into the soil immediately after distribution (within 15 min) to prevent plant material from drying out. If plant material remains on the soil surface for 1.5 hrs, more than half of the vegetative stems die. Planting material must be uniformly distributed over the cultivated seedbed, with areas no larger than 3 ft^2 devoid of planting material. A solid stand of stargrass 24 inches high can be obtained in 90 days after planting under good condition.

Stargrass Feeding Value

Because of stargrass' palatability to livestock, stargrass can add to farms sustainability when used for rotational grazing, especially when interplant with low growing legumes (CTAHR, 2007).

Forage quality when harvested or grazed every 4-5 weeks is about the same for most star grasses. Under good management with about a 4-week rotation, CP values are mostly of the order of 11-16% and IVOMD, 55-60%. Quality can be improved to 18% CP and 68% IVOMD by reducing the rest period to 2 weeks, but persistence may suffer in some environments if the rest period is less than 3 weeks over an extended period. Alternatively, if the rest period is increased to 7 weeks or more, CP levels can fall to 7-8% and IVOMD to 42-53%. Stargrass is most nutritious when grazed every 4-5 weeks. Phosphorus levels in the DM of between 0.1-0.4% and calcium from 0.2-0.5% have been recorded.

Importance of Characterization

Characterization consists of recording those characters which are highly heritable, can be easily seen by the eye and are expressed in all environments. Such characters are rare in the out-crossing grasses, and quantitative characters of lower heritability have to be used which are also subject to genotype and environment interaction (IBPGR, 2007).

Characterization is based on agro-morphological characters of the plants. Standardized descriptions are used to characterize materials so that information exchange of genetic resources is more accessible to researchers and plant breeders (Borromeo et.al., 1994) and it is usually used as reference in exploiting new traits that is desirable and high yield performance (Miller, 1984).

MATERIALS AND METHODS

Eleven strains of stargrass were collected from different municipalities of Benguet. They were collected in non-grazing area where forage grasses are cut and carry (Plate 1). The stolons of stargrass were used as planting materials, and were cut one foot from the ground level.

An experimental area of 195 m^2 was prepared and divided into three blocks representing three replications. Each block was divided into 11 plots, each measuring 1m x 5 m (Figure 2).

The collected stolons of stargrass in each municipality were used as planting materials and seved as treatments. Stolons were planted in a seedbed for multiplication (Figure 1) and were grown at BSU – IPB Highland Crops Station for one month to produce sufficient planting materials for the study. Transplanting was done at the BSU experimental area in Balili at a planting distance of 20 cm between hills and 30 cm rows with 15 cm depth. There were two rows per plot. The experiment was laid out following Randomized Complete Block Design (RCBD) with three replications.

Characterization was based on agro-morphological characters of stargrass using the descriptor's list recommended for forages by USDA – ARS (2007).

The 11 strains of stargrass collected in the different municipalities of Benguet province are as follows:

Strain	Place of Collection
SG-AT1	Atok
SG-BK2	Bakun
SG-BU3	Buguias
SG-KP4	Kapangan
SG-KB5	Kibungan
SG-IT6	Itogon
SG-LT7	La Trinidad
SG-MK8	Mankayan
SG-SB9	Sablan
SG-TB10	Tuba
SG-TL11	Tublay

Data Gathered

A. Morphological Characters

1. Growth characters

a. Plant vigor. This was observed one month after transplanting using the following scale:

Scale	Description	Remarks
1	85-89% of the planting material had established and vigorous	low vigor
2	90-94% of the planting material had established and vigorous	moderate vigor
3	95-100% of the planting material had established and vigorous	high vigor

(a) Collection from Kibungan

(b) Collection from Kapangan

© Collection from Sablan

(d) Collection from Tuba

(e) Collection from Itogon

Figure 1. Collection of strains of stargrass in five municipalities of Benguet

(a) stolons of stargrass in seedbed for multiplication

(b) Stargrass after transplanting

(c) Stargrass at one week after Transplanting

(d) Three months after transplanting

(e) Stargrass at four months after transplanting

Figure 2. Overview of the eleven strains of stargrass at different stages

b. Growth habit. This was taken by describing the type of growth habit at the peak of its vegetative stage and was recorded as prostrate, medium or erect.

c. Plant height at harvest (cm). The height of the plants at 4 months after planting (MAT) was measured from the base of the plant up to the shoot of ten sample plants per plot using meter stick.

2. Leaf characters

a. Green color. This was observed as the intensity of leaves' green color at their maximum vegetative growth by visual observation and was be recorded as light, medium, or dark.

b. Texture. The texture was observed using the thumb and point finger and was recorded as fine, medium, or coarse.

c. Orientation. The leaf orientation of the leaves was recorded as erect, horizontal-erect, or horizontal.

d. Leaf size. The leaf size was observed based on the width and was classified based in the following scale:

Scale	Size	Remarks
1	Leaves has 0- 0.9mm width	Small
2	Leaves has 1-2 mm width	Medium
3	Leaves has 3-5 mm width	Large

e. Length (cm). The length of the leaf was measured at maximum vegetative stage using a ruler from the ligule to leaf tip of 10 sample plants per plot. The middle leaf was used as sample.

f. Width (cm). The width of the leaf sample used in gathering leaf length was gathered by measured from the broadest part of the leaf using a ruler at four months after transplanting.

g. Strength. The strength of the leaf was noted based on its ability to remain intact and not damaged when pulled and it was recorded as weak, moderate, or strong.

3. Stem characters

a. Stem diameter (mm). This was measured using vernier caliper at the middle portion of the stem from 10 sample plants per plot and recorded as round or flat.

b. Number of tillers. This was taken by counting the number of stem of 10 sample plants per plot.

c. Stem texture. The texture of the stem was recorded, using thumb and point finger and feeled it and was recorded as smooth, hairy, or coarse.

B. Forage Yield

a. Weight per plant. This was recorded as the average weight of the 10 sample plants per plot.

b. Yield per plot (kg/5m^2). This was obtained by weighing the forage yield in kg/5m^2 per plot.

c. Computed yield per hectare (t/ha). This was computed by converting the forage yield per plot in kg/5m^2 into tons per hectare using the following formula:

Yield (t/ha) = Yield (kg) 5m^2 x 2

Where 2 is a factor used to convert yield in kg/5m2 to t/ha assuming one hectare effective area.

d. Dry matter content (DMC). The dry matter content of 100 g fresh samples of each treatment was obtained using the following formula:

$$\text{Moisture content (MC)} = \frac{\text{Fresh weight} - \text{oven dry weight}}{\text{Fresh weight}} \times 100$$

$$\%DMC = 100 - \%MC$$

Data Analysis

Data gathered were analyzed following the analysis of variance for Randomized Complete Block Design (RCBD). The significance of differences among treatment means was determined using the Duncan's Multiple Range Test (DMRT) at 5% level of significance.

RESULTS AND DISCUSSION

Plant Vigor and Height

Table 1 shows the plant vigor of 11 strains of stargrass obtained from different municipalities of Benguet province. All strains were highly vigorous at one month after transplanting (MAT), except for the strains from Atok and Tublay which were noted to be moderately vigorous. All of the strains exhibited prostrate growth habit

The height of the stargrass was measured at four months MAT, just before cutting the forage yield 9 (Figure 3). The strains from Tuba, La Trinidad and Itogon exhibited the tallest plants, while the strain from Atok had the shortest plants (Table 1).

Leaf Characters

All the 11 strains of stargrass studied had small leaves with medium green color and medium texture. They also exhibited horizontal- erect leaf orientation (Plate 3). The strains from La Trinidad and Kibungan had the longest leaves while the strain from Atok produced the shortest leaves (Table 2). The strains from Bakun produced the narrowest leaves together with the stargrass from Tublay. On the other hand, the strain from La Trinidad had the widest leaves which were comparable to the width of leaves of the majority of strains studied (Table 2).

Longer and wider leaves may indicate higher forage yield than of shorter and narrower leaves. All of the strains were noted to have moderate leaf strength.


(a) SG-AT1
(Strain from Atok)


(b) SG-BK2
(Strain from Bakun)


(c) SG-BU3
(Starin from Buguias)


(d) SG-KP4
(Strain from Kapangan)


(e) SG-KB5
(Strain from Kibungan)


(f) SG-IT6
(Strain from Itogon)


(g) SG-LT7
(Strain from La Trinidad)


(h) SG-MK8
(Strain from Mankayan)


(i) SG-SB9
(Strain from Sablan)


(j) SG-TB10
(Strain from Tuba)


(k) SG-TL11
(Strain from Tublay)

Figure 3. Overview of the eleven strains of stargrass

Table 1. Plant vigor at one MAT and height at 4 MAT of the eleven strains of stargrass

STRAIN	PLANT VIGOR[1]	PLANT HEIGHT (cm)
SG-AT1	2.33[b]	31.37[c]
SG-BK2	3.00[a]	43.98[c]
SG-BU3	3.00[a]	44.83[c]
SG-KP4	3.00[a]	43.27[c]
SG-KB5	3.00[a]	51.90[b]
SG-IT6	3.00[a]	58.46[a]
SG-LT7	3.00[a]	58.61[a]
SG-MK8	3.00[a]	40.63[d]
SG-SB9	3.00[a]	52.11[b]
SG-TB10	3.00[a]	59.10[a]
SG-TL11	2.66[ab]	38.46[d]
CV (%)	8.24	3.00

Means of the same letter are not significantly different at 5% level of significance using DMRT.

[1]Plant vigor: 1 – low vigor, 2 – moderate vigor, 3 – high vigor

Stem Characteristics

The eleven strains of stargrass collected had round stem and smooth texture. Significant differences in stem diameter were noted among the 11 strains of stargrass that were grown under La Trinidad condition (Table 3). The strains from Sablan and La Trinidad had the highest stem diameter while strain from Atok had the lowest.

Table 2. Leaf length and width of the eleven strains of stargrass

STRAIN	LEAF LENGTH (cm)	LEAF WIDTH (cm)
SG-AT1	4.52[cd]	0.26[ab]
SG-BT2	4.95[bcd]	0.03[c]
SG-BT3	5.12[bcd]	0.37[a]
SG-KT4	4.45[bcd]	0.37[a]
SG-KT5	5.77[a]	0.41[a]
SG-IT6	5.02[bcd]	0.39[a]
SG-LT7	5.95[a]	0.42[a]
SG-MT8	4.96[bcd]	0.36[a]
SG-ST9	5.38[ab]	0.40[a]
SG-T10	5.01[bcd]	0.27[a]
SG-T11	5.26[abc]	0.11[bc]
CV (%)	7.58	28.59

Means of the same letter are not significantly different at 5% level of significance using DMRT.

Statistical analysis revealed no significant differences on tiller number produced per plant among the 11 strains of stargrass that were grown under La Trinidad condition (Table 3). Strains produced 15 to 18 tillers per plant, with strains from La Trinidad, Buguias, and Kapangan having numerically more tillers per plant than the other strains.

Forage Yield

The forage yield of forage per plant is presented in Table 4. The strains from La Trinidad and Itogon gave the highest forage yield per plant recorded in strains from

Buguias, Mankayan, kapangan and Sablan. The strain from tublay had the lowest forage yield per plant.

The forage yield per plot and per hectare differed significantly among 11 strains of stargrass grown under La Trinidad condition as presented in table 4. The highest forage yields per 5m2 plot were recorded in strains from Itogon and La Trinidad while the lowest yield was obtained in strain from Atok

Table 3. Stem diameter and number of tillers per plant of the 11 strains of stargrass

STRAIN	DIAMETER (mm)	NUMBER OF TILLERS
SG-AT1	2.08[d]	17[a]
SG-BK2	2.71[abc]	15[a]
SG-BU3	2.98[abc]	18[a]
SG-KP4	2.97[abc]	18[a]
SG-KB5	2.85[abc]	16[a]
SG-IT6	3.20[ab]	17[a]
SG-LT7	3.61[a]	18[a]
SG-MK8	2.33[bcd]	17[a]
SG-SB9	3.34[a]	15[a]
SG-TB10	3.13[abc]	16[a]
SG-TL11	2.25[cd]	16[a]
C.V. (%)	16.92	11.27

Means of the same letter are not significantly different at 5% level of signicance using DMRT.

Consequently, the highest computed forage yield per hectare was noted in the strains from Itogon and La Trinidad and the lowest was obtained in strain from Atok. The highest forage yield recorded in strains from Itogon and La Trinidad could be due to their bigger and numerous tillers per plant that resulted in higher forage yield.

Table 4. Forage yield per plant, per plot and per hectare of 11 strains of stargrass

STRAIN	FRESH FORAGE YIELD		
	PER PLANT (g)	PLOT (kg/ 5m^2)	HECTARE (t/ ha)
SG-AT1	26.19^{bcd}	3.13^{d}	6.27^{d}
SG-BK2	16.84^{cd}	4.27^{cd}	8.54^{cd}
SG-BU3	31.68^{ab}	5.55^{ab}	11.10^{ab}
SG-KP4	29.89^{abc}	4.29^{bcd}	8.58^{bcd}
SG-KB5	27.44^{bcd}	5.45^{bc}	10.90^{bc}
SG-IT6	31.56^{ab}	6.76^{a}	13.52^{a}
SG-LT7	33.07^{a}	6.32^{a}	12.64^{a}
SG-MK8	28.69^{abc}	5.26^{bc}	10.53^{bc}
SG-SB9	29.18^{abc}	5.13^{bcd}	10.26^{bcd}
SG-TB10	25.19^{cd}	5.55^{ab}	11.14^{ab}
SG-TL11	22.44^{d}	3.67^{cd}	7.34^{cd}
CV (%)	10.28	13.78	5.95

Means of the same letter are not significantly different at 5% level of significance using DMRT.

In addition, according to Paganas (2005) there is always a variation on the yield components with regard to different varieties in bush bean and this could be done due to interaction of varieties with the environmental condition.

Dry matter content (DMC)

The highest dry matter content was recorded in the strains from La Trinidad and Itogon while strain from Tublay and Atok had the lowest dry matter content. Weather and other environmental conditions, such as humidity and rainfall affect feed moisture

Table 13. Dry matter content of 11 strains of stargrass

STRAIN	DRY MATTER CONTENT (%)
SG-AT1	22.16[e]
SG-BK2	27.8b[bc]
SG-BU3	25.36[d]
SG-KP4	24.2[d]
SG-KB5	27.83[bc]
SG-IT6	30.33[a]
SG-LT7	30.70a[a]
SG-MK8	27.26[c]
SG-SB9	24.53[d]
SG-TB10	28.76[b]
SG-TL11	22.86[e]
CV(%)	11.32

Means of the same letter are not significantly different at 5% level of significance using DMRT.

content. Dry matter refers to material remaining after removal of water, and the moisture content reflects the amount of water present in the feed ingredient. The nutrients in feeds, required by the animal for maintenance, growth, pregnancy, and lactation, are part of the dry matter portion of the feed. The moisture content of a feed ingredient is important because the moisture content affects the weight of the feed, but does not provide nutrient value to the animal. Although animals do have a requirement for water, providing water through an actual water source, instead of through feed ingredients is necessary (USDA, 2008.)

SUMMARY, CONCLUSION AND RECOMMENDATION

Summary

The study was conducted to evaluate the morphological characters and forage yield of eleven strains of stargrass collected in different municipalities of Benguet and to identify the best strain of stargrass in terms of morphology and forage yield under La Trinidad Benguet condition.

All the strains were highly vigorous, except for the strains from Atok and Tublay which were moderately vigorous. All of the strains exhibited prostrate growth habit. The height of the stargrass at four months after transplanting showed that the strain from Tuba, Itogon and Sablan exhibited significantly the tallest plants, while the strain from Atok had the shortest plants.

All the 11 strains of stargrass that were studied had small leaves with medium green color and medium texture and moderate strength. The strains also exhibited horizontal- erect leaf orientation. The strains from La Trinidad and Kibungan had the longest leaves. On the other hand, the strain from La Trinidad had the widest leaves which were comparable to the width of leaves of majority of strains that were studied. The strains from La Trinidad and Itogon had the highest stem diameter.

The strains from La Trinidad and Itogon produced the highest forage yield per plant with more than 3 grams. The strains also produced the highest forage yield per $5m^2$ plot and per hectare. Consequently, the strains recorded also the highest DMC.

Conclusion

The 11 strains of stargrass differed significantly in morphological characters and forage yield. The strains from La Trinidad and Itogon are the best strains of stargrass in terms of morphological characters because they were highly vigorous, produced longer leaves, bigger stem diameter and highest forage yield per plant, per plot and per hectare and dry matter content.

Recommendation

Based on the results of this study, the strains of stargrass from La Trinidad and Itogon could be grown for forage production under La Trinidad condition. These strains could be suitable in the area and could give high forage yield.

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APPENDICES

Appendix Table 1. Plant vigor

TREATMENT	BLOCK			TOTAL	MEAN
	I	II	III		
S1	2	2	3	7	2.33
S2	3	3	3	9	3.00
S3	3	3	3	9	3.00
S4	3	3	3	9	3.00
S5	3	3	3	9	3.00
S6	3	3	3	9	3.00
S7	3	3	3	9	3.00
S8	3	3	3	9	3.00
S9	3	3	3	9	3.00
S10	3	3	3	9	3.00
S11	2	3	3	8	2.66
TOTAL	31	32	33	96	2.90

ANALYSIS OF VARIANCE

SOURCES OF VARIATION	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN SUM OF SQUARE	F COMPUTED	F TABULAR	
					0.05	0.01
Treatment	10	1.39	1.13	2.42**	2.35	3.37
Block	2	0.18	0.09			
Error	20	1.15	0.05			
TOTAL	32	2.72				

** - highly significant

Coefficient of Variation = 8.24

Appendix Table 2. Plant height (cm) at four months after planting

TREATMENT	BLOCK I	BLOCK II	BLOCK III	TOTAL	MEAN
S1	30.45	33.64	30.02	94.11	31.37
S2	41.73	45.92	44.31	131.96	43.98
S3	45.52	45.8	43.17	134.49	44.83
S4	43.35	43.88	42.60	129.83	43.27
S5	53.38	51.83	50.51	155.72	51.90
S6	59.43	57.27	58.68	175.38	58.46
S7	59.87	57.91	58.07	175.85	58.61
S8	42.51	38.95	40.44	121.9	40.63
S9	53.48	52.85	50.02	156.35	52.11
S10	60.42	58.29	58.60	177.31	59.10
S11	39.16	37.37	38.87	115.4	38.46
TOTAL	529.3	523.71	515.29	1568.21	47.52

ANALYSIS OF VARIANCE

SOURCES OF VARIATION	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN SUM OF SQUARE	F COMPUTED	F TABULAR 0.05	F TABULAR 0.01
Treatment	10	2546.96	254.69	125.14**	2.35	3.37
Block	2	11.16	5.58			
Error	20	40.70	2.03			
TOTAL	32	2598.84				

** - highly significant

Coefficient of Variation = 3.00

Appendix Table 3. Leaf length (cm)

TREATMENT	BLOCK I	II	III	TOTAL	MEAN
S1	4.48	4.51	4.58	13.57	4.52
S2	4.84	5.16	4.85	14.85	4.95
S3	5.39	4.69	5.29	15.37	5.12
S4	5.10	4.70	5.05	14.85	4.95
S5	6.10	5.75	5.46	17.31	5.77
S6	5.13	5.08	4.86	15.07	5.02
S7	6.11	5.87	5.88	17.86	5.95
S8	5.42	4.54	4.92	14.88	4.96
S9	5.51	5.64	5.01	16.16	5.38
S10	5.02	4.88	5.11	15.04	5.01
S11	5.26	5.36	5.17	15,79	5.26
TOTAL	58.39	56.18	56.18	170.75	5.17

ANALYSIS OF VARIANCE

SOURCES OF VARIATION	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN SUM OF SQUARE	F COMPUTED	F TABULAR 0.05	0.01
Treatment	10	6.18	0.61	4.12**	2.35	3.37
Block	2	0.003	0.001			
Error	20	3.00	0.15			
TOTAL	32	9.19				

** - highly significant   Coefficient of Variation = 7.58

Appendix Table 4. Leaf width (cm)

TREATMENT	BLOCK			TOTAL	MEAN
	I	II	III		
S1	0.04	0.35	0.40	0.79	0.26
S2	0.03	0.03	0.03	0.09	0.03
S3	0.42	0.36	0.35	1.13	0.37
S4	0.36	0.39	0.38	1.13	0.37
S5	0.41	0.42	0.41	1.23	0.41
S6	0.42	0.37	0.40	1.19	0.39
S7	0.43	0.42	0.43	1.28	0.42
S8	0.37	0.37	0.36	1.10	0.36
S9	0.42	0.39	0.40	1.21	0.40
S10	0.03	0.39	0.40	0.82	0.27
S11	0.10	0.20	0.04	0.34	0.11
TOTAL	3.03	3.84	3.6	10.31	0.31

ANALYSIS OF VARIANCE

SOURCES OF VARIATION	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN SUM OF SQUARE	F COMPUTED	F TABULAR	
					0.05	0.01
Treatment	10	0.51	0.05	6.49**	2.35	3.37
Block	2	0.02	0.01			
Error	20	0.15	0.007			
TOTAL	32	0.70				

** - highly significant

Coefficient of Variation = 28.59

Appendix Table 5. Stem diameter (mm)

TREATMENT	BLOCK			TOTAL	MEAN
	I	II	III		
S1	2.40	1.93	1.91	6.24	2.08
S2	2.90	3.14	2.10	8.14	2.71
S3	3.34	3.47	2.15	8.96	2.98
S4	3.32	3.31	2.30	8.93	2.97
S5	2.96	3.45	2.15	8.56	2.85
S6	3.90	3.83	2.39	10.12	3.37
S7	3.81	4.15	2.89	10.85	3.61
S8	2.37	2.25	2.37	6.99	2.33
S9	3.9	4.02	2.10	10.02	3.34
S10	3.40	3.55	2.45	9.40	3.13
S11	2.20	2.16	2.40	6.76	2.25
TOTAL	34.5	35.26	25.21	94.97	2.99

ANALYSIS OF VARIANCE

SOURCES OF VARIATION	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN SUM OF SQUARE	F COMPUTED	F TABULAR	
					0.05	0.01
Treatment	10	8.82	0.88	3.85**	2.35	3.37
Block	2	4.83	2.41			
Error	30	4.58	0.22			
TOTAL	32	18.25				

** - highly significant

Coefficient of Variation = 16.92

Appendix Table 6. Number of tillers per plot

TREATMENT	BLOCK I	BLOCK II	BLOCK III	TOTAL	MEAN
S1	16.5	18.1	15.8	50.4	16.8
S2	14.7	16.7	13.5	44.9	14.96
S3	19.1	20.5	14.5	54.1	18.03
S4	18.2	16.0	16.4	50.6	16.86
S5	12.9	18.7	15.7	47.3	15.76
S6	14.5	18.3	16.1	48.9	16.3
S7	15.8	16.4	18.0	50.2	16.73
S8	17.8	17.0	16.3	51.1	17.03
S9	16.3	15.7	13.2	45.2	15.06
S10	17.5	17.7	17.8	53.0	17.66
S11	20.8	15.2	16.5	52.5	15.06
TOTAL	184.1	190.3	173.8	548.2	16.61

ANALYSIS OF VARIANCE

SOURCES OF VARIATION	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN SUM OF SQUARE	F COMPUTED	F TABULAR 0.05	F TABULAR 0.01
Treatment	10	32.15	3.21	0.92^{ns}	2.35	3.37
Block	2	12.78	6.39			
Error	20	69.84	3.49			
TOTAL	32	114.78				

^{ns}- highly significant

Coefficient of Variation = 11.27

Appendix Table 7. Forage yield per plot ($5m^2$)

TREATMENT	BLOCK			TOTAL	MEAN
	I	II	III		
S1	3.26	2.99	3.16	9.41	3.13
S2	4.24	4.38	4.20	12.82	4.27
S3	5.43	5.55	5.68	16.66	5.55
S4	4.18	4.39	4.31	12.88	4.29
S5	5.43	5.58	5.34	16.35	5.45
S6	6.89	6.80	6.59	20.28	6.76
S7	6.25	6.42	6.30	18.97	6.32
S8	5.25	5.35	5.20	15.80	5.26
S9	4.95	5.25	5.20	15.4	5.13
S10	5.53	5.26	5.58	16.67	5.55
S11	3.46	3.59	3.97	11.02	3.67
TOTAL	54.87	55.86	55.53	166.26	5.03

ANALYSIS OF VARIANCE

SOURCES OF VARIATION	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN SUM OF SQUARE	F COMPUTED	F TABULAR	
					0.05	0.01
Treatment	10	36.01	3.60	180**	2.35	3.37
Block	2	0.05	0.02			
Error	20	0.36	0.02			
TOTAL	32	36.41				

** - highly significant

Coefficient of Variation = 16.92

Appendix Table 8. Forage yield (g) per plant

TREATMENT	BLOCK			TOTAL	MEAN
	I	II	III		
S1	23.44	27.92	27.23	83.95	27.98
S2	28.8	22.88	24.25	50.53	16.84
S3	31.94	30.09	33.02	95.05	31.68
S4	23.84	32.83	33.0	99.63	33.21
S5	33.8	22.68	25.84	72.36	24.12
S6	32.0	34.23	33.0	99.23	23.07
S7	28.62	27.46	30.01	86.09	28.69
S8	30.42	31.6	32.68	94.7	31.56
S9	28.43	30.81	28.31	87.55	29.18
S10	24.8	26.32	24.33	76.46	25.48
S11	22.32	21.62	23.40	67.34	22.44
TOTAL	309.48	308.44	315.07	912.89	27.66

ANALYSIS OF VARIANCE

SOURCES OF VARIATION	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN SUM OF SQUARE	F COMPUTED	F TABULAR	
					0.05	0.01
Treatment	10	311.75	31.17	3.68**	2.35	3.37
Block	2	2.24	1.12			
Error	20	169.30	8.46			
TOTAL	32	483.29				

** - highly significant

Coefficient of Variation = 10.28

Appendix Table 9. Dry matter content (%)

TREATMENT	BLOCK I	BLOCK II	BLOCK III	TOTAL	MEAN
S1	22.0	21.8	22.7	66.5	22.16
S2	28.6	26.2	28.6	83.4	27.8
S3	25.6	24.9	25.6	76.1	25.36
S4	24.0	24.7	23.9	72.66	24.22
S5	27.8	28.3	27.4	83.5	27.83
S6	29.2	30.0	31.8	91	30.33
S7	31.6	30.9	29.6	92.1	30.7
S8	27.0	26.9	27.9	81.8	27.26
S9	24.3	24.4	24.9	73.6	24.53
S10	29.0	28.9	28.4	86.3	28.76
S11	22.7	23.0	22.9	68.6	22.86
TOTAL	291.8	290.0	293.7	875.5	26.53

ANALYSIS OF VARIANCE

SOURCES OF VARIATION	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN SUM OF SQUARE	F COMPUTED	F TABULAR 0.05	F TABULAR 0.01
Treatment	10	251.8	25.18	43.98**	2.35	3.37
Block	2	10.62	0.31			
Error	20	11.45	0.57			
TOTAL	32	263.88				

** - highly significant

Coefficient of Variation = 0.17