EXPLORING THE AGRONOMIC YIELD POTENTIAL OF NEWLY INTRODUCED JUNCAO GRASS (*Pennisetum purpureum*) IN SHIKA, NIGERIA

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ABSRACT

Juncao grass, a multifunctional crop developed through innovative agricultural technology, has gained significant attention for its agronomic potential in addressing food security, environmental sustainability, and rural development. Juncao technology, pioneered by Professor Lin Zhanxi of Fujian Agriculture and Forestry University (FAFU), China, utilizes specific grass species for mushroom cultivation, livestock feed, soil conservation, and bioenergy production, the high nutritive value, adaptability, and ecological benefits of Juncao grass make it a promising crop for sustainable agriculture. A study was conducted at the Introduction Plot of feeds and nutrition research programme, National Animal Production Research Institute, Shika, Zaria, to explore a preliminary investigation on the nutritive potential of Juncao grass (Pennisetum purpureum). The grass was planted in a Randomize Complete Block Design with three replicates in 5m x 5m plots. Planting was done through stem cuts with 2 to 3 nodes at angle 45^0 into the ground. Data on plant height, leave length, leave with, tiller number, stem diameter and dry matter yield were taken from each plot before the first and second harvest. The plant height was significantly (P<0.05) higher (332.5cm) in second harvest. Similar trend was observed for stem diameter (7.03cm) and total dry matter yield of 12.21t/ha. The leave length (113.3cm), leave width (5.43cm), number of leaves (25) and tillers (23) were higher significantly (P<0.05) during the first harvest. The result revealed a serious concern to explore the potential yield of Juncao grass as feed for ruminants in Nigeria.

Keywords: Agronomic, Yield, Juncao grass, Shika

INTRODUCTION

Juncao technology, developed by Professor Lin Zhanxi of Fujian Agriculture and Forestry University (FAFU), China, is an innovative agricultural practice that utilizes specific grass species (Juncao) for cultivating edible and medicinal fungi, as well as for soil conservation and livestock feed. The term "Juncao" translates to "mushroom grass," highlighting its dual-purpose application in fungal cultivation and as a forage crop for livestock feeding. Juncao grasses are used as fodder for cattle, goats, and sheep, improving animal health and productivity. The high protein and fiber content of Juncao grass enhances milk production and weight gain in livestock (Lin *et al*., 2022). Federal Ministry of Agriculture and Food Security (FMAFS), through the Department of Animal Husbandry Services in collaboration with China government organizes a National Workshop on applications of Juncao technology and its contribution to the achievement of sustainable agriculture and the sustainable development goals in Nigeria. in line with the proposal by the presidential committee on the implementation of livestock reforms proposed that a combination of ranching and open grazing could offer the most viable solution to Nigeria's farmers- herder crises. In the quest to take proactiveness to resolve this crisis. The National Animal Production Research Institute, Shika, received a sample of Juncao grass in May, 2024 from FMAFS, Department of Animal Husbandry Services, Abuja., the grass is mainly used as feed for livestock in form of cut and carry feeding systems. It is a multipurpose forage crop that can be grazed directly, or made into silage or hay and as substrate for mushroom production. The varied uses provide an indication of the diversity of roles that Juncao grass could contribute to the reduction of poverty and nutrition. In Rwanda, Lin, 2022 reported that Juncao project created job for poor people and have trained more than 20,000 people, directly supported 50 cooperatives and companies. The Juncao grass sample (*Pennisetum purpureum*) introduced in Shika from China through FMAFS, was used in this preliminary study to explore its nutritive potential.

Description of the experimental site

The study was conducted during the rainy season in 2024 at the experimental farm of Feeds and Nutrition Research Programme, National Animal Production Research Institute (NAPRI), Shika, Zaria. Shika is located on Latitude 11^0 12'W. Longitude 07^0 33'E and altitude 660m above sea level, 22km North-West of Zaria in the Northern Guinea Savannah zone of Nigeria. The climate of the study area is characterized by a defined wet and dry season. Wet season starts from April to early May and ends in late September to early October while the dry season from October to April. Long-term annual rain fall (2014-2024) ranges from 1110 to 1160mm with a maximum temperature of 39^0C in May and minimum temperature of 10.5^0C recorded in December/January and relative humidity of approximately 75% (IAR, 2024).

Soil sampling and analyses

Soil samples was collected from the experimental site with the aid of soil auger at 4 corners and centers of the plots at 15 and 30cm depth and make a composite sample for soil analysis before the commencement of the experiment. The soil samples were analyzed for physical and chemical properties as described by (AES 1998), to determine texture, particle size, total nitrogen, total carbon, phosphorus, soil pH and Cations Exchange Capacity (CEC). The analysis was done at the Department of Soil Science, Faculty of Agriculture, Ahmadu Bello University, Zaria.

Planting of Juncao grass

The Juncao grass was planted on 4th May in 2024. Seeding method was double to triple nodes horizontally buried in soil at 45^0 and covered with soil. The area of each plot is 5m x 5m and plant spacing, inter and intra rows are 0.5m x 1m respectively. The chemical fertilizer used in the experiment was N-P-K = 20:10:10, the application quantity was 250 kg/ha. The 60% fertilizer was used as a base fertilizer, 20% fertilizer was applied in tillering stage and 20% fertilizer was used during elongation stage. Weeding was done manually with hoes at 4 and 8 weeks after sowing. The experiment was laid in a Randomized Complete Block Design with three replicates. Data was collected from five (5) plants randomly sampled per plot and tagged for the measurements of various agronomic parameters using the Standard Procedure of Tarawali et al. (1995). Number of tillers was estimated by counting the number of tillers within 5 randomly selected Juncao grass stand at each harvesting period using a 0.5m x 0.5m quadrat. The plant height of Juncao was determined by measuring from the base of the plant to the flag leave with the aid of a tape rule on 5 randomly selected stands per plot. Leaf length of Juncao grass was estimated by measuring from the tip of the leaf to the base of the ligule with the aid of tape rule from 5 randomly selected plant stands per plot. The leaf width was determined by measuring the width at midpoint of the leaf on 5 randomly selected plants stands per plot. The first harvest was done on the 10th November, 2024 while the second harvest was done on the 5th of January, 2025. The Kjeldahl method (AOAC, 2005) was used to measure the total nitrogen in Juncao samples collected from the total two harvests. Data collected were analyzed using SAS, (2021) package. Means were compared using Duncan Multiple Range Test.

RESULTS AND DISCUSSION

The mean plant height at first harvest was 313.8 cm, which was significantly lower (P<0.05) compared to the mean height of 332.5 cm at second. This indicates that Juncao grass continues to grow taller with extended harvest periods. The mean leaf length at first harvest was 113.3 cm, significantly higher than the 108.8 cm observed at second harvest. Conversely, the mean leaf width was slightly higher at first harvest (5.43 cm) compared to second harvest (4.88 cm). These differences suggest that leaf growth may stabilize or decrease slightly as the plant matures. The mean stem diameter increased from 6.28 cm at first harvest to 7.03 cm at second harvest, indicating that the stems thicken as the plant ages. The mean tiller number decreased from 23 tillers at first harvest to 13 tillers at second harvest. This reduction could be due to the plant allocating more resources to height and stem growth rather than producing new tillers (Islam et. al., 2023). The dry matter yield significantly increased from 8.69 t/ha at first harvest to 12.21 t/ha at second harvest. This suggests that Juncao grass accumulates more biomass over time, making it a valuable crop for biomass production. The variation in plant height may be associated with soil fertility or nutrient absorption rate by individual crop. There was slight decrease in leave width compared to a study conducted in china. (Lin et al. 2022) which suggested that leave width may vary with environment condition. Juncao grass tends to produce more tillers at earlier age than when fully matured and tend to allocated more resources to height and stem growth. Mengistu et al., (2024) reported yields tend to be higher in tropical environment than in cooler climates. Juncao grass can produce dry matter from 10 to 40 tons per ha per year depending on management and environmental condition (Mwendia et al., 2017).

Table 1: Growth parameters of Juncao grass (cm) in Shika

Harvest	replication	Plant height	Leave length	Leave width	Leave number	Stem diameter	Tiller number	Dry matter yield (t/ha)
First	1	306.6	115	5.88	23	6.46	24	8.04
	2	321.0	111.60	4.98	27	6.10	22	9.34
	mean	313.8[b]	113.3[a]	5.43[a]	25[a]	6.28[b]	23[a]	8.69[b]
Second	1	292.0	104.6	4.58	19	6.8	14	11.67
	2	373.0	113.0	5.18	22	7.26	12	12.75
	mean	332.5[a]	108.8[b]	4.88[b]	21[b]	7.03[a]	13[b]	12.21[a]
	SEM	21..66	2.73	0.32	1.87	0.46	0.07	1.70
	LOS	*	*	*	*	*	*	*

Means*[ab] with different alphabets are significantly (P<0.05) different, SEM=standard error of mean, LOS= level of significance.

CONCLUSION AND RECOMMENDATION

Juncao grass is a highly versatile and valuable plant species with numerous agronomic, environmental, and economic benefits. Its rapid growth, high biomass production, and adaptability to marginal soils make it an excellent candidate for sustainable agriculture and environmental conservation. From the result of this investigation one can take the advantage of exploring the full potential of Juncao grass, with the aim of optimizing its cultivation and expanding its applications in various sectors. The yield obtained was very encouraging in the second harvest 12.21t/ha and plant height of 332.5cm. Mass production of Juncao grass (*Pennisetum sp.*) will enhance animal feed availability in both dry and wet seasons.

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