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Andropogon gayanus: A Valuable Forage Grass for Tropical and Sub-tropical Arid Rangelands

Javed Ahmed

Andropogon gayanus Kunth, gamba grass, a native to east and west Africa, has been introduced for forage/fodder in South America, northern Australia, and tropical India. It is valued for its productivity, drought resistance, and palatability. In January 1977, a grass plant was found growing inside a thorny shrub, *Caoparis decidua*, at Taunsa, near Dera Ghazi Khan, Pakistan. Average annual rainfall in this area is about 80 mm, most of which occurs during July and August. Occurrence of the plant only under such protective cover and not elsewhere strongly indicates the palatable character of this taxon. Seed of this plant was collected and sown in a germplasm nursery in the Thal desert, near Bakkhar, Pakistan. In 1983, specimens were sent to Royal Botanic Gardens, Kew, for identification. The plant was identified as *Andropogon gayanus* var. *argyrophoeus* Stapf, a new record for Pakistan (Cope 1983, personal communication).

In the germplasm nursery, plants exceeded 1 m in diameter and height at the end of first growing season. (See photo.) The plants remained green and put on new growth until late winter, a value for animal nutrition. In order to test the palatability, harvested forage was fed to cattle and sheep, who relished the forage. However, no comparison was made with other taxa or forages to ascertain relative preference.

Some research and development has been done in Aus-



Andropogon gayanus var. *argyrophoeus* Stapf.

tralia and South America to develop this plant as a forage resource. The preliminary observations in Thal have prompted further investigations to highlight its potential for tropical and subtropical arid rangelands.

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Descriptions

Gamba grass is a tufted perennial grass reaching a diameter of 1-2 m and height of 1-4 m. Culms branch intravaginally, the leaves are 40-50 cm long and 5-10 mm wide, lamina glabrous or pubescent on both surfaces; ligule membranous. Inflorescence is a large panicle; the panicle has up to 6 groups of primary branches, with 2-18 branches in each group. The final branches are filiform and terminate in a pair of spikelets. The sessile spikelets, 7-9 mm long, are bisexual with a 1-4 cm long spirally twisted awn.

The root system has two types of roots: fibrous and vertical. The fibrous roots are close to the soil surface and absorb water from small rainfall events. This enable plants to produce vigorous green foliage early in the season. The vertical roots go deep into the soil and extract water from depth. This enables the plants to remain green well into the dry season. The rhizomes are thick and not only anchor the plant but also store the reserve food materials.

The species is drought resistant and well adapted to seasonally wet tropics with 750-1,500 mm rainfall. It can withstand 2-9 months of drought. It grows on a wide range of soil types from light sands to clay loams. It also occurs in seasonal swamps and tolerates deep seasonal flooding with water level reaching up to 2 m aboveground. In its native habitat, it occurs in areas where average minimum temperature does not drop below 4.4° C. However, it is known to tolerate frost.

Gamba grass has a number of well-marked varieties which are distributed as follows (Bodgan 1977):

var. <i>gayanus</i> Kunth	West Africa in seasonal swamps.
var. <i>squamulatus</i> Hochst	Tropical Africa, except very dry and humid areas, up to 2,300 m elevation.
var. <i>bisquamulatus</i> Hochst	West Africa, up to 2,000 m elevation, but more common below 1,000 m.
var. <i>tridentatus</i> Hock.	Semi-desert Sahel zone of West Africa.

The key for separation of varieties by Bor (1960) does not include var. *tridentatus* but includes var. *argyrophoeus* Stapf. The only reference to var. *argyrophoeus* was found in Chase, Index to Grass Names, but unfortunately the reference to Bull Soc. France 55:102 (1908) is quite wrong and correct citation could not be found (Cope 1988, personal communication).

Management

Gamba grass is highly palatable when green. The nutritional value is about medium. Average crude protein varies from 3.8 to 6.5%, the digestible crude protein from 1.5 to 3.4%, and crude fiber from 30-36%. The protein content is higher when gamba grass is grown in mixture with legumes.

Grazing management should aim at heavy utilization in early growing season to avoid rankness of growth. The young shoots are preferred, but cattle will eat it up to the time of flowering. It is resistant to burning and is usually burnt before the start of the rainy season and then grazed

continuously or rotationally. However, repeated early burnings and heavy grazing in dry season are detrimental to the plant's vigor and frequency.

Forage yields of 2.5-4 tons dry matter/ha have been reported from unfertilized grass. When grown in mixture with legumes, the dry matter production was similar to that of the grass given 50-100 kg N/ha (CIAT 1980). Fertilization with 112 kg N + 30 kg P₂O₅/ha almost doubled the yield (Haggard 1966).

Flowering usually begins 10-15 weeks after seedling emergence toward the end of the rainy season. Older plants also flower at about the same time. Tillers produced early in the season make up bulk of the floral stems. Therefore management for seed production should aim to stimulate early production of tillers through fertilization. Increases of 60-90 kg/ha in seed yield have been reported as a result of fertilization. Burning prior to start of growth with damp soil conditions may hasten start of growth and greater seed bearing culm production as in Kansas bluestem pastures (Owensby and Anderson 1967).

Gamba grass can be propagated both vegetatively and from seed. Yield of viable seed reaches maximum value after about 25-35 days of peak flowering and then declines rapidly when the shedding rate nears maximum. Viability and germination of pure seed reaches a maximum value of about 90% for 10 months after harvesting. The seeds germinate well for the first two years under open storage conditions. In the third year, germination percent varies 30-70% and soon thereafter drops almost to 0%.

Seed can be harvested by beaters or a conventional headers or combines. Traditional manual cutting and threshing results satisfactory seed yields. Re-threshing gives 10% more seed but of low germinative capacity. Collection from the ground is sometimes done after lodging or in absence of a standing crop.

Sowing seed in rows gives better results than broadcast sowing. Optimum planting depth varies from 1-3 cm depending on soil type and seed bed preparation. Seed rate as low as 1 kg/ha of clean de-awned viable seed or as high as 40 kg/ha of uncleaned seed have been used for stand establishment. If the initial stand density is low, it may improve the second year through lateral spread and self sowing. Field emergence usually occurs 5-10 days after it rains. Only one seminal root develops and penetrates to a depth of 10-20 cm in 10-20 days. Adventitious roots develop in another 10 days.

Rhizomes or plant "splits" may be planted 50 × 50 cm. Wider spacing has also been tried for pasture establishment or for seed production purposes. Rhizomes or splits planted at 3 × 3 m produced cover of 20-40% in 6 months (Spain et al. 1979).

Conclusions

A new record is reported for gamba grass in Pakistan. The site of its occurrence is more than 200 miles from India where it presumably was introduced for fodder. Its existence in Pakistan may be attributed to natural disper-

sal. Its establishment under natural conditions in an arid environment and survival under the protection of a thorny shrub strongly suggest its palatability and suitability for introduction into arid rangelands of Pakistan—and not only Pakistan but also other arid rangelands in tropics and semiarid rangelands of the tropics and sub-tropics. Because it tolerates seasonal flooding, it would be worth trying for erosion control along banks of rivers and hill torrents. The ability of gamba grass to remain green well into the dry season and its vigorous early growth are valuable nutritional and grazing use features which deserve special attention.

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