INTRODUCTION
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The grass cultivated area devoted to fodder production in India is disproportionate and due to remote possibility of any significant increase in the acreage owing to priority for human food production, the livestock industry substantially depends on the natural grassland constituted by some range grasses including some indigenous species in particulars. Now, it has been well recognised that due to the past over use, continuous and close grazing as well as lack of scientific management of these vast national resources had deteriorated the vital economy of the country considerably. Although, the improvement and management of grasslands on scientific basis to maintain these natural resources in the highest of productivity had attracted the national attention in the early fifties of this country but the state of knowledge and the research in this field has not yet reached a stage at which a good overall picture can be drawn. Some amount of work on seed production, germination etc. has been carried out in Indian Grassland and Fodder Research Institute, Jhansi and elsewhere. A little is known about the presence of germination inhibitors, retention or loss of viability during storage and many other related ecophysiological aspects, which are of basic values to understand the germination of perennial grass species as reproduction from seed is very common in perennial grasslands (Lieth, 1960).

Inhibition of seed germination a commonly known allelopathic phenomenon is of wide occurrence in plant Kingdom (Evenari, 1961; del Moral and Cates, 1971; Lodhi, 1976;). Presence of germination inhibitors in the seeds of many desert plants is important
for their survival. It is a kind of germination control mechanisms, which help the plants to eliminate competition. By preventing germination under established plants, sufficient space as well as more moisture per plant is assured.

In poaceae (Bramineae), the dispersal unit (which is spikelet or a group of spikelets) consists of caryopses enclosed in glumes, lemmas, paleas etc. Removal of caryopsis from the enclosing glumes etc. (husk) has been reported to have an enhanced effect on percentage germination of seeds. Many workers viz. Alkamine, 1944; Elliot and Leopold, 1953; Lahiri and Kiarbanda, 1962; Mott, 1974; Martin, 1975; Hagon, 1976; Tothill, 1977; Pandeya and Jeyar, 1978; Parihar et al, 1984 a, b and many other have shown that seeds of various grasses germinate better when the glumes are removed.

Inhibition of germination by glumes extract/spikelet leachate of the grass seed (caryopsis) as well as of test species have been observed and identification of inhibitors have been done in a number of cases.

Most of the chemical inhibitors are compounds termed as 'secondary substances'.

Now, there are plenty of evidences indicating the secondary compounds in seed act as preservatives i.e. prevent the seeds from decaying (Swain, 1979; Rice, 1984; Tang and Zang, 1986) as most of the seeds that do not germinate rapidly after landing in the soil.

It is also evident that secondary compounds in seeds also act as a feeding deterrent for a variety of phytophagous insects and thus constitute the chemical defense against herbivore predators, which becomes essential during the course of evolution of a particular community (Janzer, 1977, 83; Seigler, 1977).

On the basis of a work carried out on germination inhibitors Kefeli and Dashak (1984) stated “Unfortunately these chemicals are still considered by many as inhibitors”. 

2
The study of seed germination emphasizing germination inhibitors present in the seeds are of practical importance for the formulation of proper management plans for the grazing lands in India and elsewhere. Therefore, studies on “allelopathic potentials of some range grass species belonging to *Sehima-Dichanthium* grass cover of India (Dabadghao and Shankarnarayan, 1973) were selected for the present study. The work has been carried out in the Research Laboratory of the Department of Botany, D.V. Post-Graduate College, Orai and Indian Grassland and Fodder Research Institute, Jhansi with the following objectives:

1. To assess the seed dormancy, germinability and viability including effects of scarification/chemical treatments on dormancy and seed germinability.

2. To obtain information on the effect of storage (seed age) and removal of glumes on germination so as to know the role of enclosing glumes etc. on seed (caryopsis) germinability and viability.

3. To isolate and characterize the germination inhibitors present in the dispersal unit by the combined use of chromatography, absorption spectroscopy and colour reaction.

4. To conduct bioassay studies on the compounds extracted from the dispersal unit and using these compounds on the respective grass seed (caryopsis) and two test species.

5. To explain the possible ecological significance of these chemical compounds present in the dispersal unit in the light of recent work carried out on this important field of allelopathy.
Ecological characteristics of grasses studied

*Bothriochloa intermedia* (R.Br.), *A. camus*; *Andropogon intermedium* R. Br.

**Common names**: Forest blue grass (Australia), lautoka grass (Feji), Australian blue-stem (United States).

**Natural habitat**: Open forest on heavier soils.

**Distribution**: Africa, India to Australia and the Pacific, introduced to United States.

**Description**: An erect to geniculately ascending branched perennial bunch grass (plate 1) to about 1 m height, the culms, often rooting at the lower nodes or, rarely, producing stolon bearing pale green to purplish raceme, simple or occasionally divided, arranged fairly densely about a central axis, the sessile pitted with a single tiny hole like a pinprick. Blade linear lanceolate and tapering gradually from the base to a fine hair like point. Ligule inconspicuous, short membranous and backed by sparse white hairs. Sheath glabrous and slightly compressed. Culms round, slender, glabrous. Roots coarse, aromatic.

**Season of growth**: Summer and rainy.

**Frost tolerance**: It survives seasonal frosts though the culms may be frosted. It is not tolerant as *D. sericeum*.

**Drought tolerance**: In Queensland, and Australia, it occurs in the 700-800 mm rainfall belt. It is fairly tolerant of drought conditions.

**Tolerance to flooding**: It will tolerate short term flooding.

**Soil requirements**: It occurs mainly on heavy clay loam to clay soils often derived from basalt in Queensland, and on heavier alluvial soils.
Plate-1. A STAND OF BOTHRIOCHELOA INTERMEDIA
Tolerance to salinity: Moderate.

Fertilizer requirements: It is not usually fertilized but will respond to nitrogen.

Ability to spread naturally: It will spread slowly by seed.

Land preparation for establishment: The land can be fully prepared for seedlings or roughly prepared for rooted slips.

Sowing methods: It is propagated by rooted slip in India.

Response to defoliation: It will stand heavy grazing up to one beast to 0.4 ha at Gayndah, Queensland (700 mm rainfall with summer dominance, Skerman and Riveros, 1990).

Grazing management: Under experimental conditions at Gayndah, Queensland, a stocking system of two weeks grazing, six weeks rest was adopted. In this environment it was shown that utilizing the native pasture (e.g. Bothriochloa intermedia, Heteropogon contortus dominant) for summer and autumn grazing and sown pasture (e.g. green panic and lucern) for winter and early summer grazing improved annual production without sown pasture, winter/spring grazing of 0.74, 1.24 or 2.47 animals per hectare increased the basal cover of B. intermedia and H. contortus at the expense of other species and improved the sward. Continuous summer grazing reduced the percentage of B. intermedia at the expense of Dichanthium spp. Rotational grazing resulted in an increase in B. intermedia.

Genetics and reproduction: 2n = 40, 50, 60, 80.

Suitability for hay and silage: It makes quite useful hay in Australia, the United Republic of Tanzania and India. In the Kangara district in Punjab, B. intermedia top dressed with 28 kgN/ha in June and harvested in early September gave the highest yields and the best
quality hay (Narayanan and Dabadghao, 1972).

**Palatability**: It is a palatable grass in Queensland and India. In Ghana it is regarded as unacceptable to livestock. At Richmond, New Southwales, dairy cattle refused to eat it both in the young stage and later. It is somewhat aromatic.

**Seed production and harvesting**: In Queensland it seeds from mid summer (December) to late autumn. No seed is harvested commercially. In India, mature seeds are harvested during October-November.

**Value for erosion control**: It is useful, but there are better grasses, e.g. *B. insculpta*, suited to similar soils.

**Diseases**: It is often attacked by smut.

**Economics**: It is very useful native grass for beef cattle in central and southern coastal Queensland, Australia.

**Main attributes**: A palatable native grass which will tolerate drought condition and survive annual burning. It utilizes heavy soils well.

**Main deficiencies**: In Ghana it is unpalatable. It also invades lawns in the coastal savannahs.

*Chrysopogon fulvus* (Spreng) Chiov.

**Common names**: Dhawlu grass (India).

**Natural habitat**: It grows on rocky gravelly red soil.

**Distribution**: Burma, Ceylon, India, Pakistan especially in hilly area up to 1830 m.

**Description**: Perennial herbs: Culms tufted, 30-180 cm tall (plate 2), erect or ascending, simple or sparingly branched, leafy towards the base, slender to stout, nodes glabrous.
PLATE 2: A STAND OF CHRYSPOROGON FULVUS
Leaves: sheaths compressed, 6-20 cm long ligule a ciliated ring, blades flat, linear 7-28 x 0.4-0.9 cm, rigid, glabrous or sparsely hairy towards base, margins scaberulous, apex acute. Panicles: oblong-ovate to pyramidal 5-15 cm long, yellowish or purplish; rachis glabrous, scaberulous. Raceme: 1- noded, branched whorled, 3-7 cm long, erect or spreading, simple, flexuous, capillary with terminal traid of golden-brown spikelet of which 1-sessile and 2-pedicellated, callus bearded with fulvous hairs. Sessile spikelets 7.5-8 mm long, compressed, awned. Lower glumes chartaceous, laterally compressed, about 7.4 mm long 5-7 nervcd, scabrid on nerves, 1- keeled; keel hairy towards acute to short aristulate apex. Upper glume chartaceous, boat shaped, 6.9-7.2 mm long, 3- nervcd, 1-keeled; keel hairy towards acute to short aristulate apex. The lower 1/3 of the keel hispid with fulvous hairy, apically produced into 13-14 mm long, arista; apex 2- toothed. Lower lemma empty, hyaline, linear, 6.3-7.0 mm long, nerveless, acute, epaleate upper lemma reduced to a hyaline base of geniculate awn, 2.5-3.5 cm long. Palea hyaline, linear, 3-3.5 mm long. Lodicules: 2, cuneate. Stamen 3; 3 anthers 3.5-4.5 mm long. Grain linear. Pedicel of pedicellated spikelets 7-8 mm long (excluding the arista). Lower glume chartaceous, elliptic-lanceolate, 6.8-7.8 mm long, 7-nerved, narrowly 2-keeled; keels sparsely hairy, margins narrowly inflexed; apex acute or produced into 2-7 mm long arista. Upper glume similar, 3-nerved; margins ciliated, apex acute. Lower lemma empty, hyaline, lanceolate, 6.5-7 mm long, nerveless, acute, paleate or not. Upper lemma hyaline, lanceolate, 4.8-5 mm long, sub-acute at apex, paleate. Lodicules 2, cuneate. Stamens 3, anthers 4-4.5 mm long.

Soil requirement: It is grown in rocky, gravelly red soils where soil depth is shallow.
Drought resistance: It is very resistant to drought.

Palatability: It is a palatable grass.

Sowing time and rate: It is grown during rainy season for higher establishment with 4-6 kg seed/ha.

Sowing method: Sowing to be done either by broadcasting or in line at 50 cm spacing.

Tolerance to salinity: It has poor tolerance.

Fertilizer requirements: For higher forage production 120 kg N+30 kg P₂O₅/ha should be applied in monsoon season. Application of 120 kg N to be done in 4 split at 15 to 20 days intervals.

Forage production: The dry forage production ranged from 3-4 t/ha. However, the highest forage yield of 10 t/ha has been reported by Dwivedi et al. (1980) with application of 90 kg N+40 kg P₂O₅/ha in C. fulvus cv. Mhow. The crude protein contain reported by them was 4.8-5.7% while calcium and phosphorus content ranged from 0.40 to 0.59% and 0.09 to 0.11%.

**Dichanthium annulatum (forsk.) Stapf.**

**Synonym:** Andropogon annulatus (Forsk.)

**Common names:** Sheda grass (Australia), Lindi the Philippines, Kleberg blue-stem (United States), Pitilla (Cuba), Karad, Marvel grass in Maharashtra, Kail grass in Bundelkhand region of U.P. and Zinzwa grass in Gujarat.

**Distribution:** Tropical Africa to Southeast Asia, New Guinea and northern Australia.

**Description:** Tufted perennial and up to 80 cm (plate 3), the nodes bearded; leaves papillose pilose at least on the upper surface; first glume of the sessile spikelet not indurate,
PLATE 3: A STAND OF DICHANThIUM ANNULATUM
or slightly indurate. Two to six racemes, some times more. Lower glume of sessile spikele with tubercle based hairs towards the tip, oblong, obtuse or truncate, keel not winged. Median nerve present, sheaths terete, longish (Bor, 1960). It differs from D. caricosum in having the first glume keeled, not winged, a medial nerve, and large membranous ligule (Dabadghao and Shankarnarayan, 1973). Ninety six percent of its roots end within a depth of 1 m. It differs from Bothriochloa pertusa in having no pitting on the glumes (Narayanan and Dabadghao, 1972) and from Dichanthium sericeum by the spikelets having a naked appearance due to the hairs being few or almost absent. The spikelets are also very blunt at the top (white, personal communication). Roots penetrate to 100 cm in alluvial soil at Varanasi, India, with a yield of 11275 kg/ha of oven dried roots.

**Latitudinal limits**: 8°28’ N in India.

**Latitude range**: It has a range of 250-1,375 m in India.

**Rainfall requirements**: Tropical and subtropical rainfall patterns. It is found mostly in India in the 500-900 mm rainfall regime (Dabadghao and Shankarnarayan, 1973). It persisted poorly in arid zone trials at Alice springs, Australia.

**Drought tolerance**: It evades or endures drought well (Whyte, 1968).

**Tolerance of flooding**: It survives short term flooding.

**Soil requirements**: It tolerates a wide range of soils but prefers black cotton soils in India and will not thrive in acidic soils.

**Tolerance to salinity**: It tolerates saline soils well and occurs on such soils in India in association with *Sporobolus marginatus*.

**Fertilizer requirements**: In India, the application of 22.75 kg N/ha to a natural pasture of
predominantly *D. annulatum* increased the content of *D. annulatum* and decreased *Heteropogon contortus* and *Eremopogon*. Rai (1990 a), obtained maximum dry forage yield (5.23 t/ha) with application of 120 kg N+30 kg P_2O_5 ha. However, he found maximum net income of Rs. 271.9/ha at application of 30 kg N/ha.

**Ability to spread naturally**: Good.

**Land preparation for establishment**: A good seed bed is required for early establishment, but it will gradually colonize a rough seed bed.

**Sowing methods**: usually established from rooted slips in India, as seed collection is laborious and expensive. Rai (1987) reported that planting of seedling/rooted slips was found suitable material for better establishment of this grass as compared to seeds. It is sown in rows 60 cm apart with a similar distance between the plants, as they form large tussocks. However, Rai (1990 b) observed that there was no significant differences on establishment either seeds to be broadcasted or sown in line.

**Sowing time, depth and rate**: Sow at the commencement of the wet season. However, sowing in middle of July showed higher establishment and production as compared to middle of May and June (Rai, 1989). Sowing of seed at the rate of 4 kg/ha was found to be optimum for establishment and production of this grass (Rai, 1990 b). The optimum depth of sowing of this grass was found to be 0.4 to 0.8 cm as compared to surface (0 cm), 1.2, 1.6, 2.0 and 2.4 cm (Rai, 1990 c).

**Dormancy**: In India, Skerman and Riveros (1990) reported the filtrate of the rhizosphere fungus *Trichoderma viride* reduced the germination of *D. annulatum* seed from 90 to 77 percent.
Growth rhythm: It grows during the wet season from June to November in India and after harvest in November for hay. It provides spring growth from February to March, but this growth is stemy (Dabadghao and Shankarnarayan, 1973).

Compatibility with other grasses and legumes: It does not grow well in mixtures as it crowds out other grasses but it can be grown with various pasture legumes i.e. S. hamata, M. atropurpureum, M. lathyroides etc. (Rai, 1988 a,b, 1990 d, 1992).

Response to defoliation: It forms on open turf under grazing and stands very heavy grazing (Dabadghao and Shankarnarayan, 1973).

Grazing management: It is not usually managed, but if over grazed, a Dichanthium-Iseilema grassland in Bellary, Mysore, India deteriorates first to Bothriochloa sp., then Eremopogon sp. and Andropogon sp. and finally to an inferior Aristida sp./Andropogon sp./Fragroist sp. sward. Green matter production fell from 6000-10,000 kg/ha with Dichanthium-Iseilema to 200-1500 kg/ha with poor Aristida, Andropogon and Fragroist association.

Genetics and reproduction: 2n= 20, 40, 60. It is quite a variable species.

Dry and green matter yield: At Bellary, Mysore, India, on black cotton soils a mixture of D. annulatum and Iseilema antherphoroides yields 6,000-10,000 kg/ha of green herbage. An average hay production of 3300 kg/ha can be expected from a good D. annulatum stand (Dabadghao and Shankarnarayan, 1973). For higher dry forage yield and better animal production S. hamata to be grown in association with D. annulatum (Rai and Verma, 1995).
Suitability for hay and silage: It is widely used for hay in India (Narayanan and Dabadghao, 1972).

Palatability: Good. Preferred to Cenchrus ciliaris in India.

Seed production and harvesting: It seeds heavily and in India seeds are hand collected.

Value for erosion control: Numerous grasses tested for stabilizing the bunds in the ravine lands of Gujarat, India, D. annulatum proved one of the best because of its elaborate root system and excellent ground cover. It has also proved useful for erosion control on 20° slopes.

Economics: On the black cotton soils of Bellary, Mysore, India, it is a climax species with Iseilema antherphoroides and is a palatable and nutritious species. It is a climax species along with Sehima nervosum over practically the whole of peninsular India and one of the most important grasses in the Dichanthium/Cenchrus/Lasiurus cover in semi-arid northern India (Dabadghao and Shankarnarayan, 1973). It is widely used in the Philippines for pasture improvement.

Main attributes: It has got wide adaptability, tolerance of alkaline soils and effective erosion control.

Main deficiencies: Its variability and its dominance of other grasses.

Panicum maximum Jacq.

Common names: Guinea grass (Australia, United States), Zaina, Pasto Guinea (Peru), gramalote (Puerto Rico).

Natural habitat: Grassland and open woodland and shady places.
**Distribution**: From tropical Africa, but introduced in many countries.

**Description**: A tufted perennial, often with a shortly creeping rhizome, variable 60-200 cm high (plate 4), leaf blades up to 35 mm wide tapering to fine point; panicle 12-40 cm long, open spikelets 3-3.5 mm long, obtuse, mostly purple red, glumes unequal, the lower one being one-third to one-fourth as long as the spikelet, lower floret usually male. Upper floret (seed) distinctly transversely wrinkled.

**Season of growth**: Summer and Rainy.

**Optimum temperature for growth**: The mean range is 19.1-22.9°C.

**Minimum temperature for growth**: Mean temperature for the coldest month ranges from 5.4-14.2°C

**Frost tolerance**: It will not tolerate heavy frosts, but recovers from light frosts with the return of warm weather.

**Latitudinal limits**: 16.3-28.7° N and S.

**Altitude range**: Sea level to 2500 m.

**Rainfall requirements**: It requires a rainfall usually in excess of 1000 mm per year. With a summer dominance, cv. Gatton and Creeping Guinea do not tolerate very wet conditions. Range 780-1797 mm.

**Drought tolerance**: It does not tolerate severe drought.

**Tolerance to flooding**: It does not tolerate waterlogging.

**Soil requirements**: It will grow on a large range of soils, but produces poor stands on infertile types. It is well adapted to sloping. It will tolerate acid conditions if drainage is good.
PLATE 4: A STAND OF PANICUM MAXIMUM
Tolerance to salinity: It has little tolerance.

Fertilizer requirements: The optimum content of phosphorus in the dry matter was determined as 0.185 percent. Inoculation with Spirillum lipoferum increased yield by 480 kg DM/ha without nitrogen and 1021, 1690 and 1930 kg/ha with 20, 40 and 80 kg/ha, respectively (Skerman and Riveros, 1990). Phosphorus at 24 kg/ha and nitrogen at 137 kg/ha are required in north Queensland, but soil fertilizer experiments are required to diagnose needs on various soils. Hendrick concluded that a nitrogen levels above 45 kg/ha, phosphorus and potassium may become limiting to P. maximum in western Nigeria. It tolerates high aluminum.

Ability to spread naturally: It spreads slowly by seed, but needs fertile soil.

Land preparation for establishment: Well seed bed preparation is generally required for Guinea grass establishment.

Sowing methods: Drilling on the contour is small drill furrows and pressing in with press wheels gives an excellent stand. Sowing seeds at intervals of 0.6 m in rows 1.25 m apart is successful but laborious. In Sri Lanka, it has been found that close planting of P. maximum cuttings (with a spacing of 15x45 cm) increased yield. Transplanting of P. maximum seedlings is more reliable than that of root cuttings, especially if they have recently started to show new growth after rain. In Puerto Rico it is also generally sown by clumps of roots. One hectare will provide material for five hectares of planting.

Sowing time and Rate: Sowing is done in rainy season or in spring or early summer, so the pasture is established before the extreme heat of summer, at 3-6 kg/ha (1-2 kg for 'Hamil', 3.5-4.5 for 'common').
Dormancy: The quality of the seed improves for some months after harvest.

Compatibility with other grasses and legumes: Guinea combines well with the legume centro (Centrosera pubescens) and this is a common pasture mixture for the wet tropics. In Brazil, 'Coloniao' Guinea centro and siratro are used successfully. Guinea and Stylosanthes guianensis is a successful mixture, Puero and glycine also combine well.

Response to defoliation: Guinea grass stands a good deal of defoliation but should not be grazed or cut below about 30 cm for permanence.

Grazing management: In the wet tropics it is necessary to let this pasture become well-established before grazing so that it can compete with weeds. Guinea usually seed in autumn; do not graze a new pasture until after this seedling period. Guinea can not be grazed below 35 cm, or it will recover slowly. Adjust the stocking rate to maintain this height. Rotational grazing will give better control of pasture growth. Mowing or slashing is useful to control excess growth and weeds, but do not mow below 35 cm, and not after mid-autumn, as it will give slow regrowth and encourage winter weeds. Do not graze under extremely wet conditions, as trampling damages pastures growing in boggy ground.

Genetics and reproduction: The somatic chromosome numbers are 2n=18, 32, 48. It is facultative apomict in which both apospory and pseudogamy occur. The amount of sexual reproduction varies from 1-5 percent depending on the variety.

Dry and green matter yields: At South John Stone, Queensland, cv. Makueni produced more than 60,000 kg DM/ha when 300 kg/ha of nitrogen was applied while in Puerto Rico 26,846 kg DM/ha was obtained with 440 kg N/ha, cut at 40 days intervals.
Suitability for hay and silage: It has been used successfully for silage at Mpwapwa, Tanzania, Brazil, Nigeria and Australia. It also makes useful hay in Thailand.

Palatability: It is very palatable.

Seed production and harvesting: Seed ripens unevenly, and is shed as it matures. In the Phillipines, highest seed yield (19 percent recovery) was obtained when the panicle had shed 40-60 percent of its spikelets, which occurred about 12 to 14 days from panicle emergence. Harvesting is usually done by direct heading.

Seed yield: Seed yield generally ranged from 48 to 156 kg/ha, however, 395 kg/ha from three cuts was obtained in Cuba.

Value for erosion control: Its great bulk aids in erosion control but its generally tussocky growth makes it less valuable than other species.

Main attributes: Its wide adaptation, quick growth and palatability, easy of establishment from seed and good response to fertilizers.

**Pennisetum pedicellatum trin.**

Common names: Annual kyasuwa grass (Nigeria), Bara (Mauritania), Deenanath grass (India).

Natural habitat: A secondary weedy invader of disturbed sites, road edges and fallows.

Distribution: Native of north tropical Africa and India.

Description: A tall, annual, bunch grass, up to 1 m high (Plate 5) branches from the base and above, leafy. Leaves 15-25 cm long by 4-10 mm wide, flat glabrous. Racemes cylindrical, 5-12 cm long, dense-flowered, rachis glabrous, notched, outer bristles few, slender, short (about 3 mm long); inner bristles numerous (longest 9 mm) densely villous
PLATE 5: A STAND OF *Pennisetum pedicellatum*
below the middle. Spikelets 4 mm long, usually solitary. It differs from *P. setosum* in having the inner bristles of the involucre densely villous while in *P. setosum* the inner bristles are laxly ciliate with long silky hairs.

**Season of growth**: Summer and rainy.

**Optimum temperature for growth**: 30-35°C.

**Frost tolerance**: It has little frost tolerance.

**Latitudinal limits**: 20° N and S.

**Rainfall requirements**: In Bihar, India, it grows on a rainfall of 1270 mm between June to September, from which it can produce seeds. The usual rainfall range is 500-650 mm.

**Drought tolerance**: It has good drought tolerance. It persists well in northern Nigeria with a dry season of seven months.

**Soil requirement**: It does best on fertile, loamy soils but with manuring, can grow in sandy soils. It can tolerate both acidic and alkaline soils (Narayanan and Dabadghao, 1972).

**Fertilizer requirement**: It responds well to added nitrogen.

**Ability to spread naturally**: It spreads rapidly by self sown seed.

**Land preparation for establishment**: It needs a well prepared moist seedbed.

**Sowing methods**: The seed is broadcasted or drilled in rows at 45 cm apart in India.

**Sowing depth and cover**: It is either surface sown or drilled at 1 cm.

**Sowing time and rate**: Just before the rainy season (May-July in India) at 1-2.2 kg/ha.

**Compatibility with other grasses and legumes**: It grows well in mixtures with *Stylos*, *Phaseolus mungo* and *Melilotus alba* in India.

**Response of defoliation**: It can stands several cuts a year for green fodder.
**Grazing management**: It is generally used as a cut and carry green forage in India at ear emergence (80-90 days).

**Genetics and reproduction**: $2n = 36, 48, 54$. There is a wide range of growth forms. It is strongly aporistic (Whyte, 1964).

**Dry and green matter yields**: At the Punjab Agricultural University, Ludhiana, India, four cultivars of *P. pedicellatum* yielded from 9.6 to 11.0 t/ha green matter compared with 5.7 t/ha from sweet Sudan grass and 3.6 t/ha from Sorghum. It is cut two or three times a season, first 80 days after germination and subsequently at 60 days intervals. It has also yielded good hay in Nigeria and Sierra Leone (Whyte, 1964). The dry forage yield of this grass can be enhanced up to 9.2 t/ha with improved variety like IGFRI-S-2808 as well as introduction of legumes (Dwivedi, et al., 1982).

**Suitability for hay and silage**: It has been made into silage in Nigeria, Sierra Leone and India and also into hay.

**Palatability**: It is very palatable to cattle in India. It has a high leaf/stem ratio.

**Seed production and harvesting**: It seeds abundantly and matures very quickly in India.

**Seed yields**: Up to 2 t/ha (Whyte, 1964).

**Value for erosion control**: It is a valuable soil stabilizer in India.

**Economics**: In India it is a valuable grazing grass for sheep, goat and cattle (Bor, 1960). It is also good as a short term hay and soil stabilizer. In northern Australia it is a weed.

**Main attributes**: Its early flowering, high tiller number, high leaf/stem ratio, low oxalic acid content, and palatability.

**Main deficiencies**: Being an annual it provides only short term grazing, can become a weed of cultivation.