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Studies on the Flowering, Seed Formation and Seed Viability of Kikuyu Grass (*Pennisetum clandestinum*. Hochst) *

by

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Synopsis: The flowering and seed characters of *kikuyu* grass, a very good fodder species of the Nilgiris are described in this article.

Introduction: Kikuyu grass *(Pennisetum clandestinum* Hochst) a perennial spreading species, introduced by about 1911 on the Nilgiris has now come to occupy the foremost place in the grassland area of the region, especially at elevations above 5000'. The grass is a native of East Central Africa. A very vigorous spreading species by means of underground runners and stolons, this was not recorded to have produced seeds in its native home. Stapf (1924), in his description of the species, Brown (1924), in his account of its collection in South Africa, introduction into India and its performance, and Bews (1929), in the discussion of grasses of the world, have referred to the lack of seed formation in this species. According to Gill (1938), "fertile seed is not set by kikuyu in South Africa so that propagation is by planting out runners". Watt (1925) however, attributes this general belief of non-seeding in kikuyu to the concealed and inconspicuous nature of the seeding spikelets. Under Indian conditions, Mudaliyar (1953) has cited kikuyu as an instance of an introduced grass, not setting viable seed in the Nilgiris, due to unfavourable environmental conditions. Bor (1960), referring to its performance in India, in general, has said that "it does not set seed in India". An account of the flowering and seeding habit of this species observed by the authors is presented below.

Observations: The history of the introduction of this species in India as well as in the Nilgiris reveals that it was first established by stolons and runners. On grazing grounds and open areas, this grass has formed a good matted turf, with short herbage and limited length of leaf blades whereas in areas adjoining sources of irrigation, on slopes etc., it has produced leaf in great quantities. Flowering has consistently been observed to occur only during the months of June to November, on short turfy growth in the form of a whitish tinge on the surface due to the exsertion of stigmas or anthers. Edwards (1937) has recorded similar observations indicating the flowering of this grass in Kenya. Regarding the frequency of flowering, it was observed that on the same shoots in a turfy growth in an undisturbed condition, flowering was noted to occur only once during the above period, but in areas subject to grazing or mowing, flowers began to appear in about a fortnight after this operation, from new shoots that appear as a result of these operations.

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The frequency of flowering, therefore seems to depend on the rate of production of new growth. Further observations on this aspect are in progress and will be reported separately.

The inflorescence, concealed in the short shoots of the turf and enclosed completely by the topmost leaf sheath, consists of a cluster of spikelets usually three in number. Of the three, one is pedicellate and the other two are sessile. Each spikelet is subtended by an involucre of bristles, 15 in number. All the three spikelets bear bisexual flowers. The floral structures, in general, agree with the description given by Stapf (1924).

Examination of a number of flowering shoots showed that in those spikelets in which the stigmas were exserted beyond the length of the spikelets, the anthers were short and immature, but in those in which the stamens were exserted, measuring about 25 mm. the ovary had already been fertilised and grains formed. Pollen were also found only after the complete exsertion of the stamens. Thus a remarkable degree of protogyny was found to be present, as in the case of other species of *Pennisetum*. In older herbage in which the spikelets and leaves had a dried up appearance, extended observation showed that grain formation had taken place in all the spikelets, both pedicellate and sessile, with one mature grain in each. In a number of instances, ripe grains were collected in the same area, showing that this is not a stray occurrence. The dry spikelets were separated from the shoots and it was found that the grains were tightly enclosed by the "valves" as described by Stapf. It was with some difficulty that the grain could be separated from enclosing structures. It was possible to collect 10–12 grams of 'seeds' from a small area of about 10 square yards. According to Watt (1925) seeds may be collected from three to twelve months from the first indication of flowering. Observations on this aspect are separately being made.

Grains (seeds) are dark brown in colour, oblong-elliptic in outline, dorsally compressed, with a distinct hilum. Measurements of 100 seeds at random showed an average length of 2·46 m.m. and width of 0·47 m.m. There were on an average 342 grains per gram. They usually had a certain short length of style persisting on them, in terminal position. The solitary stigmatic branch was characteristic as distinct from many other genera of Gramineae.

In view of the successful seed collection and earlier belief of their non-viability, the seeds were tested for germination both under laboratory and field conditions. Under field conditions, germination had not started even after 15 days and at the end of 30 days only 3% germination was recorded. In the laboratory where the seeds were tested on moist blotter in petri dishes under room temperature (14 to 18° C), germination could be detected only after a fortnight. Careful observation showed that seed coats had not cracked in most cases, indicating hard seed coat. In an attempt to germinate them, one batch of 4 petri dishes, each with 100 seeds on moist blotter, was kept in an incubator, and maintained at an alternating temperature of 30° C for 8 hours (9 a. m. to 5 p. m)

nd 20° C for 16 hours (5 p. m. to 9 a. m.) as recommended for certain grass seeds 1952). This was continued for a month. Observations recorded day by day howed that even on the third day, cracking of the seed coat could be noticed in few seeds. In a week, germination was in full swing and seedlings of 1·5 cm ength on an average were obtained. At the end of 30 days, an average germination f 25% was recorded. The remaining seeds were either hard or dead seeds.

Discussion: Kikuyu grass, though originally considered to have no seed etting has been shown to have produced seeds in its native habitat, in Kenya. Because of the ease of propagation by vegetative means, coupled with the fact hat the flowering and seeding is not open, but somewhat concealed from general iew, a tendency seems to have developed to assume that this does not produce eeds. However, observations of Watt have helped to focus attention on the node of flowering and seeding. Due to the very restricted area of its suitability nder Indian Conditions, much attention does not seem to have been paid to this spect of the growth of grass. However, in as much as the spikelets are tightly packed and concealed in the leaf sheath, it requires more than a passing glance o locate the flowering shoots and collect the seeds. Watt (1925) has observed that one person could collect about 300 seeds only by hand per day.

In regard to environmental conditions of growth in the Nilgiris, the period from April to November is the only time when active growth processes of life can take place, the period from December to March being very unfavourable on account of the severity of winter. Even in the period of active growth, on account of the rains and high humidity, it is probable that optimum temperature conditions are not available to the extent necessary for seed ripening on a large scale. Photoperiodic reasons may be responsible for the poor seed setting in this species.

Regarding viability, it seems evident that the prevailing environmental conditions are not optimum for germination under field conditions. Even in the laboratory, with controlled conditions of temperature, only 25% germination was recorded, with a high percentage of hard or dead seeds. This suggests that some pre-treatment may be necessary for obtaining higher germination. It is interesting to note that Cameron (1960) also has recorded germination in the seeds of kikuyu grass as 20%. But even this percentage of germination cannot be considered as low in as much as other important grasses of reputed economic value such as *Pennisetum polystachyum* and others have been noted by Chandrasekaran and Sundararaj (1950) to possess as low a viability.

It is recognised that, being easily propagated by vegetative means, seed setting might be of secondary importance from the agronomic point of view. However there is scope for use of this species in breeding with other species to produce forms with the desirable growth characteristics of kikuyu since the protogynous condition of the flowers offers an easy material for hybridisation work.

Summary: Kikuyu grass, a very good fodder species of the Nilgiris has been noted to flower and form seed for the first time. The flowering and seed characters are described. Viability of the seeds has been worked out.

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