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Leaf arrangement in *Ragi* (*Eleusine coracana* Gaertn.) and its significance

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Unlike other millets and the cereal crops, the *Ragi* plant, though typically grass-like, has a peculiar build and appearance. The plant is often compared to a chandelier in general outline. A study of the plant was made to resolve the reason for this and it was found to be due to the packing of a large number of leaves that have conspicuous leaf bases on short slender culms. The total number of leaves including that of tillers (at an average of two tillers per plant - more may be found depending upon spacing and other cultural practices) may be 63 - 72, a single tiller having as much as 24 leaves. But the plant grows to a height of 90 to 120 cm. only. The culm of *ragi* is slender and has an average thickness of 0·69 cm. at the base and 0·23 cm., just below the earhead (peduncle). It may be quite probable that the slender culm derives support from the ensheathing leaf bases, to bear the burden of the leaves and the earhead. The leaf bases are longer than the internodes, especially the lower internodes. The several layers of bases that arise successively from the nodes that are close together, render the necessary support as well as protection to the slender culm. It was also observed that the support derived from the leaf bases, do not sustain throughout, but fails at a time when most needed.

The method of arrangement of leaves on the stem, can be clearly seen only after the plant has fully grown and the leaves with their bases are carefully removed. In the accompanying table, the measurements of the leaf blades and sheaths are presented. The leaves are arranged alternately, on either side of a compressed elliptical culm. The internodes are not of equal length, nor are the nodes uniformly distributed. Along the stem, especially at the base, the nodes are often crowded with the internodes being almost absent. The short internodes, ensheathing leaf bases and the cluster of leaves from regions of crowded nodes, give the impression of whorled leaf arrangement and of lesser number of nodes than that of leaves. Actually, there are as many nodes as leaves and their arrangement as already described, is distichuous and alternate. One plant having twenty leaves, showing the disposition of the leaves, as also the congestion of nodes, along the culm is presented in the accompanying figure. (Figure 1). All the varieties of *ragi*, irrespective of duration,

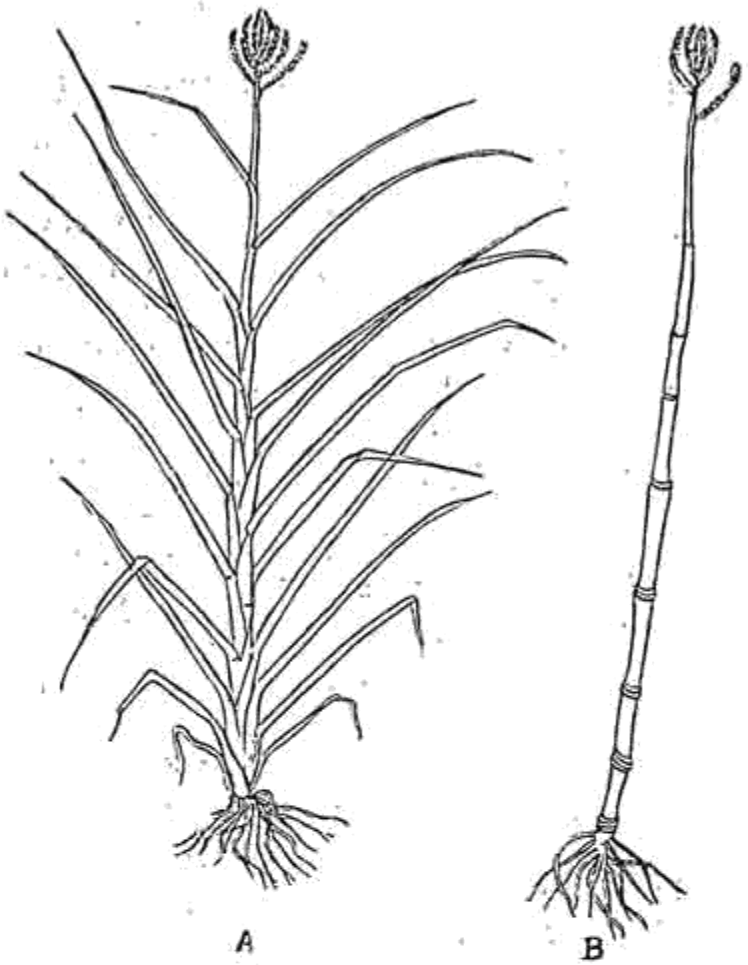

FIGURE 1
E. coracana, a tiller with leaves (A) and leaves removed (B)

etc., show this method of leaf disposition. The measurements of leaves, internodes and count of nodes and tillers of two varieties of *ragi* - 100 days and 120 days in duration - are presented in table I.

TABLE I

(a) *Leaf numbers at nodes*

Type of *ragi* and duration	Number of leaves at nodes								
	1	2	3	4	5	6	7	8	9
K. 1 - 120 days	3	4	4	4	3	2	2	1	1
NS. 390 - 100 days	3	4	4	3	2	1	1	...	...

Note : The parts where a cluster of leaves occur, with the internodes being absent, are accounted as one node in the table.

(b) *Length of internodes*

Type of *ragi* and duration	Length of internodes (cm.)							
	1	2	3	4	5	6	7	8
K. 1 - 120 days	4·2	11·9	15·4	13·3	14·3	11·5	11·6	29·7
NS. 390 - 100 days	9·8	13·2	12·3	10·4	9·5	26·5	...	...

Note : The internodes where the nodes cluster are too small to be measured, the elongated internodes only are measured.

(c) *Leaf measurements, number of nodes and internodes*

Type of *ragi* and duration	No. of leaves per plant	No. of nodes per plant	No. of internodes per plant	4th leaf measurement (cm.)			
				Length (Leaf blade)	Breadth (Leaf blade)	Length (Leaf base)	Breadth (Leaf base)
K. 1 - 120 days	24	9	8	52·8	1·7	12·0	2·1
NS. 390 - 100 days	18	7	6	41·9	1·5	10·5	1·5

Note : In the tables the average is struck from 50 observations at random in each case.

The length of internodes show gradual increase from the base and then records a fall and again elongates with the peduncle that has the earhead, being the longest. Short internodes and crowding of nodes is more towards the base and decrease in intensity towards the top, the last one or two, having one node and one leaf only. It was also observed that with increasing duration and height, there is a progressive increase in number and length of internodes. The prominent leaf bases that hold the leaves aloft and the earhead standing clear out of the leaves give the appearance of a chandelier to the plant.

The slender culms are safely ensconced in the ensheathing leaf bases, until after emergence of the earhead, when only the internodes elongate, particularly the top ones. As the plants mature, the lower leaves with their leaf bases wither and dry off. The remaining leaf bases that were closely adherent to the culm, become loose and flabby and render little support to the culm when it is most needed. The weakening of the culms at this crucial period. may be to a great extent, responsible for the lodging of the crop, when it is near

harvest. None of the economic types are completely free from this defect. Search from varieties with persistent leaf bases may help in the isolation of *ragi* free from damage by lodging.

The primary function of the leaves is carbon assimilation. The stem is intended to assist the leaves to this end by exposing them most efficiently to sunlight. In *ragi*, efficiency is achieved by the telescoping of internodes which enable the packing of a large number of leaves in a limited space. The small size of the plant is well compensated by the tillering habit and increase in the number of leaves. It is also quite probable that the culms, leaf bases and the leaves that are green assist in photosynthesis. The availability of a large area for carbon assimilation, may be one of the reasons for the high yield of *ragi*.

It is well known to millet growers that the rainfed as well as irrigated crops of *ragi*, give a high return among the cereals of this group. All the parts of the plant are ideally suited to its economic role which is further enhanced by the nutritive value of grain.

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