

Leaf anatomy of a miracle C4 grass: *Vetiveria zizanioides* L. Nash.

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Vetiver grass (*Vetiveria zizanioides*) is a perennial C4 grass belonging to the family Poaceae (Gramineae). The leaves of C4 plants are characterized by Kranz-type anatomy. The Vetiver grass has many unique morpho-physiological characteristics as compared to other C4 grasses. Morphologically this plant has a strong, deep penetrating, aerenchymatous, fast growing root system while physiologically this grass is both a xerophyte and a hydrophyte, least affected by drought and floods. It has strong ecological adaptability and is highly tolerant to frost, heat, extreme acidity, alkalinity and metal toxicity. In possessing these characteristics, vetiver is highly suitable for treating contaminated and polluted wastewater from industries as well as domestic discharge. With the development of study and utilization, this grass is now regarded as a tool for environmental engineering and one of the most versatile crops of the millennium.

Keeping in view the deep importance of this plant for reclamation of polluted environment and its physiological characteristics we are reporting the leaf anatomy of vetiver grass for the first time from Pakistan. The aim of the present study is to visualize if the leaf anatomy helps this plant to become physiologically unique from other plants used for environmental engineering and to provide bench mark data on the anatomy of vetiver leaf so that other researchers may take benefit for further such studies.

The results of present study reveal that there is thick cuticle layer of 1.5 to 2 μ on the leaves while the upper epidermis has high stomatal density to that of lower epidermis. The distances between two large longitudinal veins, between large and intermediate longitudinal veins, between large and central small longitudinal veins, and between two transverse veins has been estimated as

744.32, 310.32, 124.27, 916 micron meter respectively. It is concluded that various anatomical characteristics such as large air spaces, type of stomata, nature of epidermis, arrangement of epidermal cells and efficient venation system crafts this plant very distinctive from the other C4 plants. This may be the reason that this plant can survive in various adverse conditions.