1. INTRODUCTION

The light dependent development of plant is a complex process. It involves a signal transduction network wherein the environmental signal is perceived by the regulatory genes and in turn causes expression leading to development. The development of the plant has several unique features such as totipotency of cells, plastid development and, continuation of post embryonic development at sites called as meristem. The shoot meristem perpetuates itself and also give rise to new organ particularly leaf primordia. The leaf is an ideal model for studying the importance of cell lineage, local cell interactions and positional information. In grasses such as maize, the developing leaf is established by parallel files of cells originating at the leaf base, which matures in a tip-to-base fashion. Parallel veins running from base to tip, with structural and photosynthetic cells formed around it progressively subdivide the leaf primordia. These two developmental patterns of cell files from a basal meristem and the veins across the leaf appear to provide the specialization of cell types throughout the leaf. It suggests that in order to activate the cell specific expression of photosynthetic genes, bundle sheath (B) and mesophyll (M) cells must interpret positional information distributed locally around each vein. Recent molecular-genetic analysis have defined leaf development specific genes in the organization of leaf primordia, leaf shape, dorsiventral polarity, and the specification of distinct domains within a single leaf (e.g. leaf blade and leaf sheath), (Taylor, 1997).

In higher plants, greening of leaves involves a series of distinct morphological and biochemical processes leading to differentiation of cells and organelles such as chloroplasts. The differential action of light on chloroplast biogenesis in different cells highlights the general fact that tissue specific differentiation, as directed by the developmental program, determines light responsiveness. Chloroplast development requires a complex interaction between nuclear and plastid genomes which are triggered by light and a chloroplast derived signal. In addition, light is also required for photoreduction of protochlorophyllide to chlorophyll (Hoober, 1984).

The differentiation of cell types in plants depends on the continuous
interpretation of positional information. The developing young monocot leaf provides an excellent and highly reproducible tissue for investigating plastid development. Since cell age can be determined as a function of the cell position in the leaf, the appearance of cell constituents can be related directly to cell maturity. As a cell is displaced, it expands and differentiates, and thus the distance between a cell and its origin is a function of both cell age and leaf developmental stage (Schnyder et al., 1990). As cells develop in files, each leaf provides a linear gradient of cell development from base to its tip (Leech 1985). In C₄ plants, development is further accompanied by differentiation of two photosynthetic cell type viz., bundle sheath and mesophyll cells. The photosynthetic reactions are split between these two cell types with each cell type accumulating a specific complement of photosynthetic enzymes (Langdale and Nelson, 1991).

In this study, we used the pearl millet leaf as a model system to examine the effect of light on regulation of cytosolic and chloroplastic enzymes and levels of photosynthetic pigments in relation to the cellular position in developing leaves of pearl millet seedlings. We also used chloroplast developmental mutants of pearl millet to study the nuclear-plastidic interaction on photoresponse in developing pearl millet leaf. The study highlight that expression of photoresponse in pearl millet leaf is determined in hierarchical fashion by cell maturity, chloroplast development and the availability of light.