ABSTRACT

A Study of Changes in Dry Mass and Accompanying Changes in Anatomy in Pigeon Pea (Cajanus cajan) Following Treatment with Benzylaminopurine (BAP)

Devika Narine

Cajanus cajan L. Millsp. is unique among grain legumes for its relatively low canopy extinction coefficient and low harvest index. The low harvest index in this species results from prolific vegetative growth, particularly of the stems and a high rate of abscission of immature reproductive organs.

Previous reports on the effect of the cytokinin benzylaminopurine (BAP) on *C. cajan* and other crop legumes indicated the potential for increased yield and accompanying morphological and anatomical changes. In this thesis, an assessment of dry matter accumulation and changes in sink activity of vegetative and reproductive sinks following BAP application is presented. Changes in anatomy of vegetative and reproductive structures are assessed. Pedicel anatomy is also assessed as a possible limiting factor to yield.

Following BAP application as a foliar spray to field grown plants, stem and leaf dry mass significantly increased. Pod and seed number increased but seed

mass declined. Vegetative sinks seemed to eventually out-compete reproductive sinks, even in the presence of excess cytokinin. This increase in vegetative and reproductive sink activity may have resulted from increased photosynthetic activity, redistribution of photoassimilates from untreated regions to BAP treated regions, or increased availability of photoassimilates via larger vascular pathways.

Following BAP treatment, significant anatomical changes in stems, leaf laminas, petioles, pedicels and pericarps occurred. The presence of excess cytokinin may have affected endogenous cytokinin to auxin ratios, resulting in increased cell size and cell number in vascular and ground tissue. Investigations into the effect of BAP on endogenous auxin levels are recommended.

Following the application of BAP as a lanolin based paste, pedicel cross-sectional pedicels increased. The cross-sectional area of the vascular tissue within pedicels also increased but seed mass was unaffected. Pedicel vasculature does not appear to limit seed yield in *C. cajan* but pericarp and funicle vasculature may limit photoassimilate availability to seeds. Further anatomical investigations of the pericarp and funicles are recommended.

Keywords: Devika Narine; pigeon pea; yield improvement; harvest index; abscission; cytokinin; anatomy; vascular tissue; ground tissue; tissue cross-sectional area; cell diameter; cell number.

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