A STUDY OF THE EFFECTS OF WATER AND CUTTING ON SEED PRODUCTION OF VERANO STYLO (*Stylosanthes hamata*) AND SIRATRO (*Macroptilium atropurpureum*)

a thesis presented in partial fulfilment of the requirements for the degree of Doctor of Philosophy at Massey University, Palmerston North, New Zealand.

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DEDICATED TO MY FATHER

ABSTRACT

Tropical pasture legume seed production in the North-east of Thailand first began in the early 1970's. *Stylosanthes hamata* cv. Verano and *Macroptilium atropurpureum* cv. Siratro were two of the forage legumes proposed to fill the requirement for improved pastures in this region of Thailand. This study was initiated to provide information on the effects of water stress, stage of plant development at the time of cutting and cutting intensity on seed production of these two tropical forage legumes, in the field at Khon Kaen, Thailand.

A second and more intensive study on the reaction of Verano stylo to water stress, and stage and intensity of cutting was carried out to provide a better understanding of possible plant adaptation and the contribution of plant components to seed yield of this species under controlled environment conditions at the D.S.I.R., Palmerston North, New Zealand.

Initially, field experiments were carried out in two different seasons, (dry season and wet season). The dry season experiment studied the effects of irrigation, non-irrigation, and cutting on seed yield. In the wet season field experiment only the effect of cutting was studied in both Verano stylo and Siratro. The results from the dry season study showed that species are responsive to irrigation. Irrigated plants produced about 25% more seed yield than non-irrigated plants in Verano stylo but only about 10% more in Siratro. The response of the plants to cutting was variable depending on the stage and intensity of cutting. Light cutting at either the vegetative or floral initiation stages gave higher seed yields than uncut plants in Verano stylo, while in Siratro all cut plants gave higher seed yields than uncut plants. Planting Verano stylo or Siratro in the wet season resulted in plants taking longer to reach the reproductive stage than in the dry season. This protracted vegetative stage resulted in bigger plants and more sites for seedheads. In stylo both cut and uncut plants gave higher seed yields than those obtained in the dry season

planting, while in Siratro plants heavily cut at the vegetative stage gave the highest seed yield. Siratro plants grown in the wet season tended to produce strong vegetative growth and good inflorescence development. However, seed yield was lower because of poor pod development and low numbers of seeds per pod.

The second experiment on Verano stylo was carried out under controlled environment conditions designed to simulate as closely as possible the different growing seasons previously used in the field. The results confirmed that water plays an important role in increasing seed yield in both cut and uncut plants, and especially in cut plants provided they received high water levels throughout the growing period. Water stress appeared to change plant structure, both vegetative and reproductive growth being greatly reduced during the stress period. Water also had an effect on the number of sites for seedhead formation and the contribution to seed yield. In plants which were water stressed from about 30 days after sowing (vegetative stage) both cut and uncut plants remained small resulting in low branch numbers, shorter branches and fewer sites for seedhead development. Water stress applied following peak flowering (55 days after sowing) also reduced seed yield, compared with the yield from plants receiving water throughout the period of seed development. The maximum yield obtained varied from 1.2-9.3 grams per plant between the three water treatments.

Studies on the contribution to seed yield from each branch order and seedhead position indicated that in both cut and uncut plants most of the seed yield came from secondary branches (60-75%). The contribution to seed yield, however, was different between water treatments. In early stressed plants seed yield was apportioned almost equally between primary and secondary branches. However in plants which had been placed under water stress at peak flowering, the seed yield obtained from primary branches was only half that produced from secondary branches. In non-stressed plants 70% of total seed yield came from

seedheads produced on secondary branches and only 20% from primary branches. The position of seedhead formation on each branch was also important. The results showed that about 75-90% of total seed yield came from seedheads formed at nodal sites. The number of seedheads formed at terminal sites was low. In later stressed plants and in well watered plants the contribution of nodal sites to seed yield was higher than in early stressed plants.

The results of the field study on Verano stylo and Siratro, and the second experiment on stylo grown under controlled environment conditions were incorporated into practical recommendations which lead to conclusions on the most economically, socially and agriculturally acceptable management system for the seed production of Verano stylo and Siratro by Thai farmers.

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