SOME ASPECTS OF COMPETITION BETWEEN A TROPICAL GRASS AND A TROPICAL LEGUME

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ABSTRACT

Verano stylo (Stylosanthes hamata c.v Verano) and Guinea grass (Panicum maximum c.v Coloniao) are two tropical pasture species reported to be superior in performance to many other species in the northeast of Thailand. A mixed pasture of these two species, therefore, has a potential to produce a high herbage yield in terms of both quantity and quality. Little is known, however, about the compatibility of these two species. A glasshouse experiment was set-up to establish competitive situations between these two species. The experimental design was based on the de Wit model (Replacement series principle).

Dry matter yield per plant of both species decreased markedly when the grass proportion increased. The reduction in dry matter yield was not proportional to the increase in grass proportion. Branch number in legume and tiller number in grass was the yield component most sensitive to plant competition. The results of relative replacement rate analysis indicated that during early stages of growth verano stylo was very sensitive to competition from grass. Verano stylo appeared to compete with the guinea grass more successfully after it had approximately 20 leaves.

An increasing grass proportion had no affect on the shoot/root ratio of the guinea grass but decreased the shoot/root ratio of legume plants

Plant height of guinea grass was decreased by increasing plant competition while legume height was not affected. In contrast, leaf area distribution of

legume was affected by increasing plant competition while that of guinea grass was not affected.

Increasing plant competition decreased herbage quality in both species as measured by the leaf/non-leaf ratio. In addition, under severe competition legume plants also showed a reduction in leaf nitrogen concentration.

Flowering time of verano stylo was markedly affected by competition from guinea grass. Flowering occurred after 7 weeks in the monoculture. In association with grasses flowering was delayed on average 11 weeks in two treatments while in the mixture containing the highest proportion of grass the legume plants remained vegetative throughout the trial.

The results demonstrated that there was no yield advantage from any of mixtures between these two species over the monoculture under the conditions of this study. One of the posssible reasons for this severe suppression of verano stylo from the guinea grass plants could have been associated with a consequent reduction in the legume capacity to fix nitrogen. The legume monoculture appeared to produce a higher yield than the other combinations in terms of protein content. Management strategies to help overcome legume suppression are discussed. Options such as reducing grass population relative to legume, establishing the legume before the grass, earlier defoliation, and/or the strategic application of fertilizers.

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CHAPTER 1

INTRODUCTION AND OBJECTIVE

1.1 Introduction

About half of the world's grazing animals are in the tropics, but output of animal products from this land is very much less than the rest of the world (Humphreys, 1980b). One of the reason is due to the grazing animal's heavy reliance on natural grassland resource, with its low productivity (Jones, 1972; Humphreys, 1980a; Shelton, 1983). The productivity of natural grassland is limited both in terms of quantity and quality. These limitations may be partly overcome by oversowing natural grassland with improved legume species, or by replacing the natural grass land species with selected high quality sown grass and legume species. The oversown legume species increases the natural grassland productivity by increasing the amount of forage grown, by its high nutitive value, and improving soil fertility (through its nitrogen fixation). For an intensively managed improved pasture, legume species also play an important role in pasture productivity ,maintaining soil fertility, and animal production. This can be seen in many temperate countries, for instance in New Zealand where pasture production is based on a mixed legume-grass sward. However, the question "What is the best proportion between grass and legume to get the highest yield in term of both quality and quantity?" remains unanswered. This is generally due to grasses having the potential to produce a higher yield than legumes but the nutritive value of legumes is considerably higher than that of grasses in terms of dry matter

digestibility and voluntary intake. For instance Playne and Haydock (1972) found that dry matter digestibility of Stylosanthes humilis was 58 percent while that of spear grass Heteropogon contortus at the same plant age (110 days) was 43 percent, and voluntary intake was 67 and 31 ($g/day/W^{0.75}$), respectively. When legumes and grasses are grown as a mixture their combined productivity is affected by competitive relationships between species in the community. Therefore, the quantity and quality of a mixed pasture is likely to be determined by the proportions of grass and legume.

In the northeast of Thailand, Panicum maximum and Stylosanthes hamata have been reported to be superior in performance to many other pasture species. Topark-ngarm et al (1977a) and Gutteridge (1979) showed that Stylosanthes hamata (cv. Verano) "verano stylo" produced a higher yield than Centrosema pascuorum (Commonwealth Plant Introduction (CPI) 40060), C. pubescens, Macroptilium atropurpureum cv. siratro, S. hamata (CPI 55831), S. guianensis (CPI 40294,cv. Endeavour), S. humilis (cv. Patterson, CPI 61674), Alysicarpus vaginalis. Verano stylo also grew more successfully than many other legume species including the species mentioned above when grown with pasture grass species such as "Sabi" grass (Urochloa mosambicensis) (Topark-ngarm et al 1977; Gutteridge, 1979; Torssel, et al., 1976).

Topark-ngarm et al (1979b) showed that "Guinea" grass (Panicum maximum) produced a consistantly higher yield than many other grass species including Cenchrus ciliaris (cv.Biloela), Melinis minutiflora, Chloris gayana, Setaria anceps (cv. Nandi), and Brachiaria decumbens (cv.Signal). The two pasture species (Guinea

grass and Verano stylo) were selected for this study as they appear to have the highest potential productivity in a mixed sward and also little is known about their compatibility.

1.2 Objective

This study has two objectives.

1. To investigate the effect of the different proportion of grass and legume on total dry matter yield.

2. To investigate the effects of plant competition on morphology, quality, growth and development of guinea grass and in particular verano stylo.

This study conducted over the establishment phase only.