

# The Effects of Seeding Rate on the Establishment of *Stylosanthes hamata* cv Verano and *Centrosema pubescens* cv Common Oversown into a *Brachiaria ruziziensis* Sward

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## ABSTRACT

*Stylosanthes hamata* and *Centrosema pubescens* were oversown in the *Brachiaria ruziziensis* sward at four seeding rates (0, 6, 12 and 24 kg PLS/ha). The results showed that there was a striking effect of seeding rate on legume establishment and early dry matter production. The increase in dry matter production of these legumes was due largely to better plant establishment. The minimum seeding rate of 12 kg/ha was recommended for the successful legume oversown in uncultivated pastures. *Centrosema pubescens* is more suitable than *Stylosanthes hamata* for improving the old *Brachiaria ruziziensis* sward by oversowing.

**Key words:** seeding rates, oversowing, *Brachiaria ruziziensis*, *Stylosanthes hamata*, *Centrosema pubescens*.

## INTRODUCTION

Oversowing legume seeds into an existing sward had been one of the more common techniques employed and the cheapest method for improving the quality and productivity of pasture. However, a major factor affecting successful establishment is the competition from the existing species. Several methods have been tested to reduce such competition, by chemical spraying, burning, cutting and heavy grazing prior to sowing (Tudsri and Whiteman 1977; Tudsri 1987). The persistence of these introduced legume species is often poor due to the vigorous recovery of the old established grasses and the cutting or grazing is often required to assist the continued growth and development of the newly established introduced species (Tudsri *et al.* 1990). However, the survival rate of oversown seed is still low (Middleton, 1973) and generally, the heavier the sowing rate the better the strike and the more rapid the sward improvement (Suckling 1965).

This experiment was initiated to determine the seeding rate for successful establishment of *Stylosanthes hamata* cv Verano and *Centrosema pubescens* cv Common, oversown into a *Brachiaria*

*ruziziensis* sward.

## MATERIALS AND METHODS

The experiment was conducted at the Dairy Farming Promotion Organisation of Thailand, Muaklek, Saraburi, on a low fertility soil (pH 6.5). The experimental area was established in 1989 as a pure ruzi grass pasture and had been cut on regular occasions.

The experiment was a randomised split plot with four replications. The main plots were: two pasture legumes, Verano stylo and Centro; while the sub plot treatments were: seeding rates at 0, 6, 12 and 24 kg pure live seed (PLS)/ha. Sub-plot size was 3 x 4 m.

The grass sward was cut to ground level immediately before the treatments were imposed on 10 June 1991 and forages removed. A basal fertiliser dressing of NPK (15-15-15) at 160 kg/ha was applied immediately prior to sowing. Seeds were surface sown according to treatment. After oversowing, the pasture was cut as required in an attempt to prevent the tall-growing ruzi from shading the legume seedlings.

Legume plant counts were taken on each plot 3,

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6, 12 and 46 weeks after sowing, from three samples per plot each 0.50 x 0.50 m. Dry matter yields was measured in the wet season (23rd July, 26th August and 2nd October) and dry season (8th November, 28th January and 4th April 1992) by cutting one quadrate (1 x 0.5 m.) down to 5 cm in each plot.

## RESULTS

### Seedling establishment and survival

The data presented in Table 1 shows that establishment of both Verano stylo and Centro was directly related to sowing rates. That is, the higher the seeding rate the higher the seedling establishment. The highest number of seedlings was recorded for both Verano stylo and centro three weeks after oversowing and thereafter the densities declined in all treatments. The seedling survival at the end of experiment was poorer for Verano stylo than for centro which was also reflected in legume yields (Table 2). However, The effect of seeding rate on plant density was still evident after 46 weeks from sowing.

### Dry matter yield

The dry matter yields for the wet and dry season are presented in Table 2 and show a striking effect of seeding rate on dry matter production. During the wet season legume yields of both Verano stylo and Centro showed a significant increase with every increase in seeding rate, but during the dry season the intermediate (12 kg/ha) and highest (24 kg/ha) seeding rate

**Table 1** Seedling density of Verano stylo and Centro oversown into a Ruzi sward at various seeding rates.

Legume Cultivar	Pure-live seed (PLS/ha)	Weeks after oversowing (plants/m <sup>2</sup> )			
		3	6	12	46
	Verano stylo				
	0	0	0	0	0
	6	25 <sup>a</sup>	26 <sup>a</sup>	20 <sup>a</sup>	5 <sup>a</sup>
	12	66 <sup>b</sup>	63 <sup>b</sup>	33 <sup>b</sup>	14 <sup>b</sup>
	24	92 <sup>c</sup>	84 <sup>c</sup>	37 <sup>b</sup>	16 <sup>b</sup>
Centro	0	0	0	3	2
	6	27 <sup>a</sup>	27 <sup>a</sup>	24 <sup>a</sup>	14 <sup>a</sup>
	12	59 <sup>b</sup>	57 <sup>b</sup>	49 <sup>b</sup>	36 <sup>b</sup>
	24	85 <sup>c</sup>	83 <sup>c</sup>	70 <sup>c</sup>	42 <sup>b</sup>

Note: Mean values in the same column with different letter are significantly different at 5 % levels.

treatments showed no significant difference in legume yield, although both these treatments produced significantly higher legume yields than the low (6 kg/ha) seeding rate treatment.

In terms of total yield, there was no significant effect due to the legume component-because of the major contribution coming from the grass component

**Table 2** Effect of seeding rate on oversown legume establishment and yield.

Treatment	DM Yield (kg/ha)						Total (G+L)	XL % Legume		
	Wet season(Jun-Oct.)		Dry season(Oct-April)		Total					
	Legume	Grass	Legume	Grass	Legume	Grass				
<b>Verano stylo</b> (kg PLS/ha)										
0	-	6,081 <sup>a</sup>	-	3,120 <sup>a</sup>	-	9,201 <sup>a</sup>	9,201 <sup>a</sup>	-		
6	88 <sup>a</sup>	6,938 <sup>a</sup>	256 <sup>a</sup>	2,856 <sup>a</sup>	344 <sup>a</sup>	9,784 <sup>a</sup>	10,131 <sup>a</sup>	3.40		
12	156 <sup>b</sup>	6,013 <sup>a</sup>	556 <sup>b</sup>	2,738 <sup>a</sup>	712 <sup>b</sup>	8,751 <sup>a</sup>	9,463 <sup>a</sup>	7.52		
24	394 <sup>c</sup>	5,331 <sup>a</sup>	588 <sup>b</sup>	3,656 <sup>a</sup>	982 <sup>b</sup>	8,987 <sup>a</sup>	9,969 <sup>a</sup>	9.85		
<b>Centro</b>										
0	-	5,831 <sup>A</sup>	-	2,594 <sup>A</sup>	-	8,425 <sup>A</sup>	8,425 <sup>A</sup>	-		
6	606 <sup>A</sup>	4,813 <sup>B</sup>	1,031 <sup>A</sup>	2,819 <sup>A</sup>	1,634 <sup>A</sup>	7,632 <sup>A</sup>	9,266 <sup>AB</sup>	17.63		
12	1,181 <sup>B</sup>	5,094 <sup>AB</sup>	1,775 <sup>B</sup>	2,438 <sup>A</sup>	2,956 <sup>B</sup>	7,531 <sup>A</sup>	10,487 <sup>BC</sup>	28.19		
24	1,469 <sup>C</sup>	5,475 <sup>A</sup>	1,900 <sup>B</sup>	2,813 <sup>A</sup>	3,369 <sup>B</sup>	8,306 <sup>A</sup>	11,675 <sup>C</sup>	28.86		

Note: Mean values in the same column with different letters are significantly different at 5 % levels.

(Ruzi) -except in the highest seeding rate treatment of Centro where the legume made a sizable contribution (29 %) to yield.

It was also apparent that the legume contribution was considerably higher in the dry season than the wet season, probably reflecting the lower productivity and competitiveness of the grass component during the dry period. It was also clear that Centro was much more productive than Verano stylo.

## DISCUSSION

The results of this experiment clearly shows the importance of seeding rate on legume establishment and dry matter production when oversown into a grass sward. The increase in seeding rate of legume up to 24 kg PLS/ha resulted in a significant increase in the wet season production of both Verano stylo and Centro due largely to better plant establishment. This effect was still evident in the dry season with more legume yield under the highest and intermediate seeding rates than the lowest one. The results of this experiment also indicate that, for successful introduction of legume into an old established grass, the seeding rates should be two or three times of the normal rate (6 kg PLS/ha). However, in view of the high cost of legume seed, the establishment of these legumes by direct-drilling would enable successful establishment at lower seeding rates (McWilliam and Dowling, 1970; Sukpitaksakul *et al.*, 1992). However, oversowing cannot be dismissed in favour of direct-drilling because the former is easier and cheaper and the only method available on country too steep for machinery (Janson and White, 1971).

Centro produced considerable more yield than Verano stylo over the wet and dry season due to its larger seed size and hence greater seedling vigour and rate of radicle elongation, as reported by Campbell and Swains (1973) and Tudsri and Whiteman (1977). Furthermore, with the twining growth habit of this legume, it is able to avoid shading effect by climbing the associated grass. (Whiteman 1980). This is in contrast to the erect growing habit of Verano stylo which is sensitive to shading (Humphreys, 1981). Therefore, the contribution of Verano stylo was less than 10 % of total dry matter yield compared to 29 % for Centro at the highest seeding rate.

The increase in both legume yield and the percentage of contribution to total dry matter yields during the dry period over the wet season was due to a better adaptation of these legumes under low soil moisture conditions. No doubt, low temperature be-

tween October-February also inhibited the growth of Ruzi grass.

Although the introduction of the legume had a small but significant effect on total dry matter production of the pasture, particularly with Centro, one must not forget the potential importance and value of the high protein legume to pasture quality and hence to animal production.

## LITERATURE CITED

Campbell, M.H. and F.G. Swain. 1973. Factor causing losses during the establishment of surface sown pasture. *J. Range Mgmt.* 26:355-59.

Humphreys, L.R. 1981. *Environment Adaptation of Tropical Pasture Plants*, Macmillan, London. 432 p.

Janson, C.G. and J.G.H.C. White. 1971. Lucern establishment studies on uncultivated country. I. Germination and Seedling establishment. *NZ. J. Agric. Res.* 14:572-86.

Middleton, C.H. 1973. Oversowing legumes into grass swards. *Qd. Agric. J.* 99:217-20.

McWilliam, J.R. and P.M. Dowling. 1970. Factors influencing the germination and establishment of pasture seed on the soil surface. pp. 578-583 In Proc. ZI Int. Grassl. Congr.

Suckling, F.E.T. 1965. *Hill Pasture Improvement*. Newton king Group of Companies and the New Zealand, DSIR. 58 p.

Sukpitaksakul, P., N. Wongsuwan and B.R. Wathin. 1992. Tropical pasture and forage crop improvement in Thailand by direct drilling. Annual Report 1992. DPO, Thailand. p.20-25

Tudsri, S. 1987. Effects of seed-bed pretreatment on oversown legume establishment. *Kasetsart J. (Nat. Sci.)* 21:126-33.

Tudsri, S. and P.C. Whiteman. 1977. The effect of cultural treatments on establishment of *Macroptillium atropurpureum* cv. Siratro oversown in a *Setaria anceps* sward, Trop. Grasslands. 11:49-54.

Tudsri, S., S. Tongyam, S. Chantkam, U. Harnbanjok and P. Sornprasit. 1990. Productivity and Quality of Selected Grasses and Legumes on a Small Dairy Farm Conditions. NRCT Report. Ministry of Science and Technology, Bangkhen, Bangkok. 160 p.

Whiteman, P.C. 1980. *Tropical Pasture Science*. Oxford University Press. 392 p.