Adaptability of Maize--Italian Ryegrass Cropping to Variable Sowing Dates by Life Cycle Assessment in Southern Kyushu, Japan

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Key words : life cycle assessment ,maize ,sowing date ,yield

Introduction In southern Kyushu , herbage production is achieved principally by annual forages , maize-Italian ryegrass cropping , and secondarily by perennial tropical pasture , such as bahiagrass and dwarf-late (DL) napiergrass . The objective of this study was to evaluate the adaptability of annual maize-Italian ryegrass cropping to variable sowing dates of maize in southern Kyushu .

Materials & Methods Maize (*Zea mays* L .) variety Snowdent Ohka" was sown at 6 .67 plants/m^2 (20 cm × 75 cm of spacing , 30 m^2/plot) to 12 plots by the combination of two sowing dates-early June (JN) and late July (JL) with two fertilizations-standard (S) and high (H) levels in Kobayashi City , southern Kyushu . As a perennial pasture , bahiagrass (*Paspalum notatum* Flügge) varieties , Nanou" and Pensacola" , were sown in late July at 2 .25 m^2/plot × 9 plots in Miyazaki . For maize and bahiagrass , herbage yield and growth characteristics were determined at 3 plants per plot at the maturity stage and pre-wintering stage , respectively , to calculate the production potential .

Results & Discussion In maize , although there was an elongated tendency in plant height in JL-sowing , dry matter yield (DMY) was obtained at 1 .5-1 .9 kg/m^2 (15-19 t/ha) and increased by 13% in JN-than in JL-sowing and by 15% in H-than in S-fertilization (Table 1) . In bahiagrass , DMY was less than 10% of maize yield even in the better coverage and more vigorous early-growth variety of Nanou than Pensacola (Figure 1) , while DL napiegrass achieved at 1 .36 kg/m^2 (13 . 6 t/ha) of DMY by the twice cutting in Kobayashi at the established year (Utamy et al . , unpublished) .

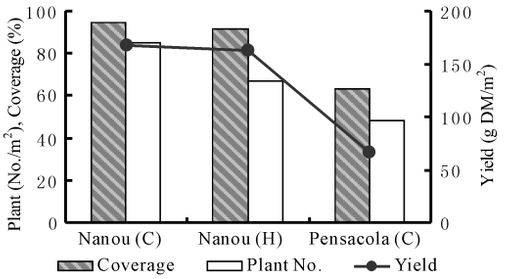

Figure 1 *Established plant number on Aug . 30 ., coverage and dry matter yield on Nov . 30 ,2007 in the combination of variety and pre-sowing treatment of control (C) and heat (H) in bahiagrass .*

Conclusions As a permanent tropical pasture , bahiagrass can produce enough herbage , ranging from-56 to 213 kg DM/ha/day (about 15 t/ha/yr) (Hirata et al . 2006) , and herbage consumption (HC) of DL napiergrass by breeding beef cows achieved at 15 t/ha/yr (Mukhtar et al . 2004) , both of which are comparable to annual maize crop yield . Italian ryegrass yielded at 15 and 1 .35 t/ha/yr of DMY in temporary leys and HC in the oversown pasture , respectively (Ishii et al . unpublished) . Although low input management in the permanent pasture has a positive effect on the environmental pressure , compared with the leys in LCA method , the early sowing of maize has the similar degree (13-15%) of benefit to increase DMY as well as CO_2 absorption to the system with the increase in nitrogen fertilization at the late sowing .

Table 1 *Plant height and yield under the treatments of sowing date and fertilization in 4 growing stages of maize .*

	Growing stage							
	3rd-4th leaf		7th-8th leaf		Heading		Matured	
Treatments*	Height (cm)	Yield (g DM/m^2)	Height (cm)	Yield (g DM/m^2)	Height (cm)	Yield (g DM/m^2)	Height (cm)	Yield (g DM/m^2)
JN—S	16 .1a#	1 .9a	42 .9b	20 .3c	235 .0b	817 .1b	188 .2b	1657 .9ab
JN—H	15 .2a	1 .4a	46 .6ab	27 .4bc	237 .1b	1038 .3a	191 .9b	1916 .1a
JL—S	14 .5a	1 .7a	51 .5a	38 .9ab	263 .1a	856 .4b	260 .9a	1468 .9b
JL—H	14 .5a	1 .6a	49 .5a	39 .2a	269 .4a	888 .0b	263 .2a	1686 .6ab

* Treatments (sowing date-fertilization) : Sowing in June (JN) or July (JL) , and fertilization in the standard level (S) or high level (H) .
# Values with the same letter within column were not significantly different at $P<0.05$.

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