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Minimum tillage technologies for the establishment of *Brachiaria decumbens* on the northwestern costal plains of Puerto Rico

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ABSTRACT

Three minimum soil tillage techniques for *Brachiaria decumbens* establishment were studied in comparison with the conventional way of establishing pastures in Puerto Rico. The minimum tillage establishment technique using one superficial harrow disk pass, without any previous glyphosate application (Treatment 2), showed an extremely poor pasture germination and coverage. This finding clearly proved that the app1ication of minimum tillage technologies, without the previous use of glyphosate, produced an increment of weed population above that of grasses. Conventional planting without glyphosate (Treatment 1), non tillage with previous application of glyphosate (Treatment 3), and one superficial harrow disking with previous application of glyphosate (Treatment 4) showed no significant ($P<0.05$) differences in soil coverture at four months after the establishment. Similarly, the average available dry matter yield during the three consecutive grazings after establishment showed no significant ($P<0.05$) differences among the three above mentioned treatments. From the agronomic perspective the three treatments were similar; minimum tillage technologies did not show any advantage over the conventional planting system. In terms of the projected costs for pasture establishment associated with these treatments, no significant differences ($P<0.05$) were observed among the three. Total cost for treatment 1 was $577.5/ha, followed by treatment 3 with $478/ha, and treatment four with $435.7/ha.

Key words: Minimum tillage, establishment and costs

INTRODUCTION

Rapid grassland deterioration is one of the world's greatest ecological problems (Xiao, 2005; Kemp and Michalk, 2005). At present in Puerto Rico, few cattlemen use improved pastures for grazing cattle and most of the grassland areas are in an advanced stage of deterioration. One crucial factor discouraging cattlemen from improving pastures is the high cost involved in establishing new stands through the recommended method of planting that requires vegetative materials (stems sections) and intensive soil preparation (Vicente et al., 1993).

Introducing improved forage species in highly deteriorated pastures is one of the most important aspects of pasture management. One of the most successful recent alternatives for the restoration of deteriorated grasslands is the introduction of *Brachiaria* grasses in Central America, Mexico and the Caribbean. Of all the pasture cultivars released in said countries, *Brachiaria* genus currently dominates the market.

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The adoption of *Brachiaria* significantly improved grass-planted areas and thus increased milk and beef production in the above mentioned countries (Holmann et al., 2005).

The objective of the present study was to test the possibility of restoring highly deteriorated pastures of a northwestern Puerto Rico beef farm, by using minimum tillage technologies for the plantation of *Brachiaria decumbens*.

MATERIALS AND METHODS

Four pasture establishment techniques (treatments) were evaluated in a completely randomized block design experiment with three replications. The treatments were evaluated at the Montaña Farm in Aguadilla during the period between 6 August 2002, and 19 March 2003.

Plot size for each replication was 0.20 ha for a total experimental area of 2.4 ha. The four evaluated treatments were established as follows:

Treatment 1 – Conventional planting, two disc plow passes followed by two harrow discs and application of a 1.5:1 ratio of rice straw to seed mixture using a seed spreader all over the field and a seed roller to favor soil seed contact.

Treatment 2 – Minimum tillage establishment, using one superficial harrow disc pass applied seven days after mowing, with no glyphosate application; then application of the same seed ratio and above mentioned roller.

Treatment 3 – Non - tillage, one application of glyphosate all over the plot (3.2 gal/ha) followed by seven days of moving. Then application of the same seed ratio and above mentioned roller.

Treatment 4 – Minimum tillage establishment, using one application of glyphosate all over the plot (3.2 gal/ha) followed by seven days of mowing plus one superficial harrow disc all over the plot. Then application of the same seed ratio and above mentioned roller.

Measurements of coverage and plants per m^2 before and after the first uniformity grazing period (between 24 September 2002, and 6 November 2002) were selected for discussion purposes. Grass coverage was estimated with 1 m^2 quadrants divided in 25 equal squares. The quadrants were cast on ten randomly selected areas of each plot for a total of 20 determinations per plot.

Three consecutive grazings took place during the period between 12 November 2004, and 19 March 2003. Each plot was grazed by beef animals (Mob Grazing) an average of 5.7 days per plot area, with a similar grazing pressure until lowering pasture height to approximately 10 cm. To measure vegetation harvested, a 1.3 m^2 quadrant was used to evaluate dry matter yield (DMY).

Offered, refused and consumed amounts of dry forage were determined by using 10 quadrants of 1 m^2 before and after grazing each plot.

All labor costs of the first three weeks of the establishment period and those until month four of the establishment were considered to evaluate the economic impact of establishing each treatment. Because of the high cost of using glyphosate at the rate of 3.2 gal/ha in treatments 3 and 4, a cost projection was also included using 1.73 gal/ha to have an idea of the possible costs associated with lower glyphosate

application. The projection was performed by using data from the same experiment at another location and with the same treatment dimensions as in this experiment.

RESULTS AND DISCUSSION

Table 1 presents the levels of weed invasion 78 days after the establishment. Treatment 2 failed because of the high levels of weed competition. This fact shows the importance of using glyphosate for the establishment of *Brachiaria* when using minimum or non tillage technologies. It was evident that if glyphosate is not used previous to seed broadcasting, weeds will overpower the efficient establishment of *Brachiaria decumbens*. In relation to treatments 1, 3 and 4, however, no significant ($P<0.01$) differences were observed among treatments in weed population.

Table 1. Average visual weed percentage estimates per treatment 78 days after the establishment.

Treatment number	Treatment description	Percentage weed invasion (%)
1	Conventional planting	4.67 a[*1]
2	Minimum tillage without glyphosate	100 b
3	Non tillage with glyphosate	7.33 a
4	Minimum tillage with glyphosate	4.87 a

[*1]Means on the same column followed by different letters differ ($P<0.01$).

The coverage potential of all treatments was best tested in the periods before and after the first uniformity grazing. Although no significant ($P<0.01$) differences were observed among treatments, before this grazing the conventional planting system (treatment 1) was 17.3% and 8.8% higher in coverage than treatment 3 and 4, respectively. However, after this first grazing the three above mentioned treatments were almost equal in their coverage potential. This fact showed that in terms of 78 days, almost 94% of all grazing areas was covered with *Brachiaria* in all treatments. The results showed that in terms of coverture establishment the three above mentioned treatments were the same (see Table 2).

Table 2. Average soil coverage percentage before (30 September 2002) and after (6 November 2002) the first uniformity grazing at 78 days of *Brachiaria decumbens* establishment.

Treatment number	Treatment description	Coverage (%)	
		Before 30 Sept. 2002	After 6 Nov. 2002
1	Conventional planting	72.5	97.2
2	Minimum tillage without glyphosate[*1]	None	None
3	Non tillage with glyphosate	55.2	96
4	Minimum tillage with glyphosate	63.7	94.4
Mean[*2]	-	63.8	95.7

[*1]Because of the high weed infestation of this treatment, no *Brachiaria decumbens* coverage was observed in field plots.

In relation to the mean dry matter yield of the three treatments, no significant ($P<0.01$) differences were observed among the three treatments in offered, refused and consumed forage. This fact corroborates that from the agronomic perspective, treatments 1, 3 and 4 were the same in terms of dry matter yield (see Table 3).

Table 3. Mean dry matter yield (kg/ha) of three pasture establishment techniques during three consecutive mob grazings after establishment (12 November 2002 to 19 March 2003).[*1]

Treatment num.	Treatment description	Offered	Refused	Consumed
1	Conventional planting	2,876	518	2,358
3	Non tillage with glyphosate	2,822	506	2,316
4	Minimum tillage with glyphosate	2,921	424	2,497
Mean	-	2,873	482	2,390

The average establishment costs at four months of the establishment are presented in Table 4. The results also showed no significant ($P<0.01$) differences in costs at the end of this period using the actual and projected cost evaluations. Again from the economic point of view, no differences were observed among the three mentioned treatments.

Table 4. Average establishment costs ($) at four months after the establishment.[*1]

Treatment num.	Treatment description	Four months after establishment	
		Total costs applying 3.2 gal/ha glyphosate $/ha	Total projected costs applying 1.73 gal/ha glyphosate $/ha
1	Conventional planting	577.5	577.5
3	Non tillage with glyphosate	606.1	477.7
4	Minimum tillage with glyphosate	564.1	435.7

[*1]Related establishment costs: 1 galon glyphosate = $40.00; 45.35 kg of a 15-5-10 fertilizer = $12.00; Seed costs = $6.6/kg; Labor = $5.5 man/hr considering the glyphosate costs.

CONCLUSION

The present study shows that from the agronomic and economic perspective, conventional planting, non tillage with glyphosate and minimum tillage with glyphosate did not differ. For the establishment of *Brachiaria decumbens* using minimum or no tillage technologies, the application of glyphosate before seed broadcasting is highly recommended to prevent weed contamination of the plots.

LITERATURE CITED

Holmann, F., P.J. Argel and C.E. Lascano, 2005. Adoption of Brachiaria grasses in Mexico and Central America: a successful story. Grassland a globlal resource. D.A. McGilloway (ed.). Wageningen Academic publishers. XX International Grassland Congress. Treland and United Kingdom. p. 343-346.

Kemp, D.R. and Michalk, 2005. Grassland for production and the environment. Grassland a global resource. D.A. McGilloway (ed.). Wageningen Academic Publishers. XX International Grassland Congress. Treland and United Kingdom. P-193-205.

Vicente-Chandler, J., R. Caro-Costas, F. Abruña and J.J. Silva, 1993. Producción y utilización de las forrajeras en Puerto Rico. Est. Exp. Agri. Univ. P.R. Bol. 271.