# Dry Matter Yield of Promising *Panicum maximum* Genotypes in Response to Phosphorus and Liming on Brazilian Savannah

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## Presenter Information

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# Dry matter yield of promising *Panicum maximum* genotypes in response to phosphorus and liming on Brazilian savannah

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## Introduction

Soil fertility of the Brazilian savannah Cerrado is naturally poor. Extensive areas of pastures located in the central part of territory are cultivated with *Brachiaria* grasses which are less demanding for soil nutrients and lime (Rao *et al.* 1998). On the other hand, Panicum maximum cultivars such as the high yielding Mombaça grass recommended to intensive beef and dairy cattle systems (Euclides *et al.* 2008), must be seeded with a higher amount of fertilizer, especially phosphorus (P). Consequently there is an effort for selection of P. maximum genotypes with low P demand and high responsiveness. The objective of this study was to evaluate dry matter yield of genotypes of *P. maximum* in response to doses of P and lime in the Brazilian Cerrado.

## Methods

The trial was conducted at Planaltina, Federal District, Brazil (15°35' S, 47°42' W, 1007 m) from January 2012 to March 2013. Local annual rainfall averages 1,230 mm/year, concentrated between October and March. The soil of the area is classified as Oxisol with pH 4.2; P (Melich) 0.33 $mg/dm^3$; Ca 0.96 $cmol_c/dm^3$; Mg 0.54 $cmol_c/dm^3$; K 0.28 $cmol_c/dm^3$; base saturation 21% and Al saturation 24%.

Promising *Panicum maximum* accessions PM32, PM34, PM39 and PM40 and Mombaça and Massai cultivars evaluated with three rates of P (0, 25 and 175 kg/ha) and two levels of lime. The experimental design was completely randomized in a split-plot arrangement with three replications, with P allocated in the plot and Genotypes in the subplot (2.5 × 3.5 m). The trial was replicated in two separate areas to evaluate two levels of dolomitic lime (1.6 ton/ha and 3.2 ton/ha), applied in 25 November 2011. Lime treatments were estimated to raise base saturation (BS) to 35% and 50%, respectively. Plots were fertilized with P (Triple superphosphate) and seeded after tillage on 13 January 2012 in spaced 0.5 m lines.

Dry matter yield (DMY) was evaluated by cutting forage at 20 cm from soil. Harvests were done on 20 March 2012 (just for 175 kg/ha P); 26 April 2012 (just for 25 and 175 kg/ha P), 11 July 2012; 03 December 2012; 30 January. 2013 and 25 March 2013. The first harvests were not done for 0 and 25 kg/ha P levels because sward height did not exceed 20 cm. A total of 100 kg of N and 83 kg of K were applied on 20 March 2012 and 03 December 2012. DMY data was analyzed separately for establishment (first three harvests) and maintenance (last three harvests) phases. Analysis of variance was performed using PROC GLM (SAS, 1996) and comparison of Genotype means using Tukey test ($P < 0.05$).

## Results

During the establishment period, DMY was affected by Genotype and P for both lime rates ($P<0.05$; Table 1), unlike Genotype × P effect ($P>0.05$). Mombaça, PM32, PM34 and PM40 were the most productive genotypes at establishment. The negative effect of non P addition on DMY was high, especially for the lower lime rate (BS 35%) which was also reported by Guedes *et al.* (2012). For the maintenance phase, there was a significant ($P<0.05$) Genotype × P effect on DMY for BS 35% (Table 2). In the control (*i.e.* no P applied) Massai and Mombaça were the most productive genotypes, confirming their lower demand for P. But for the 25 and 175 kg/ha P treatments, Massai was the most productive genotype indicating that it was highly responsiveness to P, where for Mombaça DMY was lower compared to more responsive genotypes like Massai and PM32. Only Genotype ($P<0.05$) and P ($P<0.05$) effect were detected on DMY for BS 50%, which is the target usually recommended for *P. maximum*. At this phase Massai cultivar produced approximately 1,000 kg of additional forage over others.

The effect of an absence of applied P in the maintenance phase was not so pronounced as in the establishment, but DMY was again higher BS 50%. Although Mombaça, PM32, PM34 and PM40 were considered to be less demanding for P compared to PM39 and Massai after seeding (establishment), all genotypes required P to achieve a fast regrowth. There was negligible DMY measured where no P was applied (Table 1). DMY at 0 kg/ha P increased during the maintenance phase, especially for Massai. Typically Massai was present as a high population of thin tillers at establishment that could have contributed to the late high performance. There were no accessions with higher DMY than Mombaça during establishment. However, PM32 was the only one that out performed Mombaça during the maintenance phase when 25 or 175 kg/ha P was combined with 1.6 t/ha (BS 35%), although it yielded similar to Massai.

**Table 1. Dry matter yield (DMY - kg/ha) of P. maximum genotypes at the establishment phase (three first harvests) for different doses of P and base saturation (BS) (Jan. 2012 to Jul. 2012).**

| | | | BS 35% (1.6 ton/ha lime) | | | | |
|---|---|---|---|---|---|---|---|
| P (kg/ha) | Mombaça | PM32 | PM34 | PM39 | PM40 | Massai | Mean |
| 0 | 37 | 17 | 4 | * | 7 | 5 | 14 |
| 25 | 2575 | 2306 | 2258 | 1025 | 1694 | 765 | 1919 |
| 175 | 4159 | 4262 | 3359 | 2283 | 3687 | 3436 | 3781 |
| Mean | 2257a | 2195ab | 1874ab | - | 1796ab | 1402b | |
| Coefficient of Variation = 7.3% | | | | | | | |
| | | | BS 50% (3.2 ton/ha lime) | | | | |
| 0 | 312 | 83 | 60 | 23 | 133 | 40 | 109 |
| 25 | 1976 | 2202 | 1567 | 777 | 1474 | 1124 | 1520 |
| 175 | 4050 | 3469 | 3120 | 2696 | 3685 | 3072 | 3349 |
| Mean | 2113a | 1918ab | 1582ab | 1165b | 1764ab | 1412b | |
| Coefficient of Variation = 15.5% | | | | | | | |

Means followed by the same letter did not differ by Tukey test ($P > 0.05$). * No forage above 20 cm (not analysed).

**Table 2. Dry matter yield (DMY- kg/ha) of *P. maximum* genotypes at the maintenance phase of regrowth (three last harvests) for different doses of P and base saturation (BS). (Jul. 2012 to Mar. 2013).**

| | | | BS 35% (1.6 ton/ha lime) | | | | |
|---|---|---|---|---|---|---|---|
| P (kg/ha) | Mombaça | PM32 | PM34 | PM39 | PM40 | Massai | Mean |
| 0 | 826ab | 597b | 691b | 218b | 693b | 1805a | 840 |
| 25 | 2877b | 3384ab | 3820ab | 3426ab | 3048b | 4382a | 3490 |
| 175 | 3073c | 4233ab | 3584bc | 4074abc | 3554bc | 4910a | 3905 |
| Mean | 2259 | 2738 | 2699 | 2867 | 2432 | 3699 | |
| Coefficient of Variation = 13.0% | | | | | | | |
| | | | BS 50% (3.2 ton/ha lime) | | | | |
| 0 | 1727 | 1637 | 1554 | 982 | 1525 | 2069 | 1582 |
| 25 | 2507 | 3413 | 3316 | 3379 | 2990 | 4494 | 3350 |
| 175 | 3225 | 3616 | 3706 | 4068 | 3499 | 5177 | 3882 |
| Mean | 2486b | 2889b | 2859b | 2810b | 2671b | 3913a | |
| Coefficient of Variation = 17.7% | | | | | | | |

Means followed by the same letter did not differ by Tukey test ($P > 0.05$).

## Conclusion

All genotypes evaluated require P fertilizer for establishment and to sustain reasonable yield. Massai could be considered both less demanding and more highly responsive to P after the establishment phase. PM32 was more P responsive than Mombaça during the maintenance phase, particularly for the lower lime rate.

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