RESEARCH PROJECT – URALKALI and IPNI BRAZIL

RATES AND RESIDUAL EFFECT OF POTASSIUM FERTILIZATION IN A BRAZILIAN OXISOIL

RESULTS FOR SOYBEAN AND MAIZE SECOND CROP 2013-2014

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This Report

This report refers to the agronomic results for the soybean and maize 2nd crop of 2013-2014 (fourth year of the project). The research project is funded by Uralkali, coordinated in Brazil by IPNI, and has the field partner as Research Foundation MT.

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Introduction

The requirement for worldwide abundant food, feed, fiber, and more recently biofuel, leads to higher amounts of fertilizer utilized in agriculture in diverse parts of the globe. Potassium (K) is, most generally, the second nutrient in terms of plant demand (after nitrogen, N). Potassium is highly mobile in most soils and relatively mobile in the plants. This nutrient is responsible for several vital mechanisms for plant development and high yields (enzyme activation, translocation and stock of compounds, osmotic regulation, water maintenance, etc). Potassium fertilizers are very commonly a must in terms of plant nutrition in acid soils of the tropics, including Brazil. In many areas farmers are cutting back on fertilizer expenses, which could compromise good yields, profit and food safety in the future. Farmers expect that the soil supply will be sufficient to provide the ideal conditions for plant development and yield, even with lower or no supply of K fertilizers. Studying the impacts of K fertilizer cut back on Brazilian soils is essential as to demonstrate the effects in the medium to long run.

Objectives

The main objective of the study is to verify the effects of cutting back K fertilizer rates in some Brazilian soils. Also, it will be possible to study other important factors which may affect the K fertilizer effectiveness in tropical soils.

Material and Methods

A. General Information

The experiment took place having soybean as the main crop and is located in Mato Grosso at the experiment station of Research Foundation MT. The K fertilizer used is KCl. The study is initially planned to run for six years. During the 2013-2014 season, maize was grown as a second crop after the soybean,. The independent (input) variables studied apply for both crops: soybean (1st crop) and maize (2nd crop). The soil is an Oxisol with the chemical and granulometric properties described in Table 1 (medium in K bioavailability).

Table 1. Chemical and physical soil properties prior to the trial establishment in 2010 (0 - 20 cm).

Soil		P	K	S	Ca	Mg	Al	H	V	OM	Clay	Sand	Silt
H_2O	$CaCl_2$	mg dm^{-3}			$cmol_c$ dm^{-3}				%	g dm^{-3}	g kg^{-1}		
5.6	4.9	20.4	57	18.6	2.9	0.7	0.0	5.4	41.0	38.9	639	152	209

Zn	Cu	Fe	Mn	B
mg dm^{-3}				
4.4	1.3	91	26.3	0.46

B. Treatments

The treatments are shown on Table 2 and legends for the variables studied can be found in Table 3. In summary the experiment outline proposes: (1) 4 rates of K in interaction with suppression or not of K after third year, (2) 3 rates of base saturation (BS), (3) 3 rates of phosphogypsum application (PG), (4) suppression of P in different levels after third year, (5) two levels of time of application, and (6) two levels of locality effect. The experiment is designed mainly to study K rates and its residual effect after the third year. Secondarily, the experiment is designed to evaluate other important variables that affect K fertilization, having the regular rate of K (K3) as a standard. The experiment will study the residual effect of K fertilization in interaction with liming and phosphogypsum. Also, the outline will make possible to investigate the phosphorus (P) residual effect and the effect of KCl, regarding time of K application and locality effect. Table 4 summarizes the variables studied. The regular practices in terms of NPK rates, time of application, locality effect, liming and phosphogypsum application will be identified as N3, P3, K3, TA1, LE1, BS L2 and PG L2, respectively. Nitrogen is, of course, not a problem for soybean (due to N fixation when seeds are properly inoculated with *Rhizobium japonicum*) and will not be studied. Variations in rates and other variables will permit several important comparisons as outlined in Table 5.

Some important local decisions related to the input variables for the treatments were made. They are:

1. *Rates of K_2O*: K3 was defined as 90 kg/ha. K_2O was applied in all treatments, except 23 and 24, by splitting the proper rate in two applications: half at seeding and half in top dressing right after plant emergency. In the 2013-2014 season, suppression of K was initiated according to treatments.
2. *Rate of N*: not applicable to soybean (inoculation).
3. *Rate of P_2O_5*: P3 was defined as 45 kg/ha P_2O_5. In the 2013-2014 season, suppression of K was initiated according to treatments.
4. *Lime rates*: Due to soil properties (pH H_2O 5.6) the decision was to start up the experiment by varying the rate only for treatments 14 and 15 (BS L3). These two treatments received 4.5 t/ha of dolomitic lime in 2010. All other treatments received no lime at any time. In 2013, after maize harvest and the 2012-2013 season was finished, 2 t/ha of dolomitic lime were applied to every treatment with exception of treatment 12 and 13.
5. *Phosphogypsum rates (PG)*: Similarly to the lime rates the decision was to start the experiment by varying the PG rates only for treatments 18 and 19 (PG L3). These two treatments received 2 t/ha of phosphogypsum in 2010. All other treatments received no phosphogypsum at any time. In 2013, after maize harvest and the 2012-2013 season was finished, 2 t/ha of dolomitic lime were applied to every treatment with exception of treatment 16 and 17.
6. *Time of application (TA)*: Regular TA was to regularly split the K_2O rates in two applications (half at seeding and half right after plant emergency). The alternative (treatment 23) was to split in three applications (1/3 at seeding, 1/3 at emergency and 1/3 fifteen days after emergency).
7. *Locality effect (LE)*: Regular LE was to apply half of the K_2O rate at seeding (5 cm besides and 5 cm bellow the seeds) and half in top dressing right after plant emergency. The alternative (treatment 24) was to apply all K_2O rate at the soil surface right after plant

emergency.

The above mentioned decisions were based on soil, crop and regional knowledge at the region (previous agronomic experimentation). Soybean variety used in 2013-2014 was TMG1176 and maize hybrid was 2B587 HX.

C. Plots, replicates and statistics

The plot size (6.3 m x 9.5 m; 59.85 m^2) was planned to allow future subdivisions in case of need. This will allow new variables to be studied in case of interest. The numbers of replicates are four per treatment. The statistics will follow proper procedures to allow the conclusions necessary for the study. For this season (2013-2014), statistics are for the main output variables studied, i.e., **grain yield, K leaf content, soil K availability, weight of seeds, and plant height**.

D. Evaluations (Output variables)

(1) Soil K status with time. (2) Plant K status with time. (3) Weight of 1000 seeds, (4) Grain yield, (5) Plant height.

For soil test, samples were collected in number of 12 subsamples per plot (8 between plant lines and 4 on the plant line) from the first 8 inches of depth.

For grain yield, all soybean plants or maize ears were harvested out of a 3.6 m^2 area in two points of each plot.

For plant nutrient status, twenty random leaves of soybean or maize were collected at each plot.

For plant height, ten plants of soybean or maize of each plot were measured before harvest.

For seeds weight, five subsamples with 100 seeds each were weighed per plot after harvest.

Table 2. Experiment Outline.

Treat #	Treat #	Year						Year						Year						Time App (TA)	Locality Effect (LE)	Liming BS Level	PG Level
		1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6				
		Rates of N						Rates of P_2O_5						Rates of K_2O									
1	1	N3	N3	N3	N3	N3	N3	P3	P3	P3	P3	P3	P3	0	0	0	0	0	0	TA1	LE1	BSL2	PGL2
2	2A	N3	N3	N3	N3	N3	N3	P3	P3	P3	P3	P3	P3	K1	K1	K1	K1	K1	K1	TA1	LE1	BSL2	PGL2
3	2B	N3	N3	N3	N3	N3	N3	P3	P3	P3	P3	P3	P3	K1	K1	K1	0	0	0	TA1	LE1	BSL2	PGL2
4	3A	N3	N3	N3	N3	N3	N3	P3	P3	P3	P3	P3	P3	K2	K2	K2	K2	K2	K2	TA1	LE1	BSL2	PGL2
5	3B	N3	N3	N3	N3	N3	N3	P3	P3	P3	P3	P3	P3	K2	K2	K2	0	0	0	TA1	LE1	BSL2	PGL2
6	4A	N3	N3	N3	N3	N3	N3	P3	P3	P3	P3	P3	P3	K3	K3	K3	K3	K3	K3	TA1	LE1	BSL2	PGL2
7	4B	N3	N3	N3	N3	N3	N3	P3	P3	P3	P3	P3	P3	K3	K3	K3	0	0	0	TA1	LE1	BSL2	PGL2
8	4C	N3	N3	N3	N3	N3	N3	P3	P3	P3	P3	P3	P3	K3	K3	K3	K1	K1	K1	TA1	LE1	BSL2	PGL2
9	4D	N3	N3	N3	N3	N3	N3	P3	P3	P3	P3	P3	P3	K3	K3	K3	K2	K2	K2	TA1	LE1	BSL2	PGL2
10	5A	N3	N3	N3	N3	N3	N3	P3	P3	P3	P3	P3	P3	K4	K4	K4	K4	K4	K4	TA1	LE1	BSL2	PGL2
11	5B	N3	N3	N3	N3	N3	N3	P3	P3	P3	P3	P3	P3	K4	K4	K4	0	0	0	TA1	LE1	BSL2	PGL2
12	6A	N3	N3	N3	N3	N3	N3	P3	P3	P3	P3	P3	P3	K3	K3	K3	K3	K3	K3	TA1	LE1	BSL1	PGL2
13	6B	N3	N3	N3	N3	N3	N3	P3	P3	P3	P3	P3	P3	K3	K3	K3	0	0	0	TA1	LE1	BSL1	PGL2
14	7A	N3	N3	N3	N3	N3	N3	P3	P3	P3	P3	P3	P3	K3	K3	K3	K3	K3	K3	TA1	LE1	BSL3	PGL2
15	7B	N3	N3	N3	N3	N3	N3	P3	P3	P3	P3	P3	P3	K3	K3	K3	0	0	0	TA1	LE1	BSL3	PGL2
16	8A	N3	N3	N3	N3	N3	N3	P3	P3	P3	P3	P3	P3	K3	K3	K3	K3	K3	K3	TA1	LE1	BSL2	PGL1
17	8B	N3	N3	N3	N3	N3	N3	P3	P3	P3	P3	P3	P3	K3	K3	K3	0	0	0	TA1	LE1	BSL2	PGL1
18	9A	N3	N3	N3	N3	N3	N3	P3	P3	P3	P3	P3	P3	K3	K3	K3	K3	K3	K3	TA1	LE1	BSL2	PGL3
19	9B	N3	N3	N3	N3	N3	N3	P3	P3	P3	P3	P3	P3	K3	K3	K3	0	0	0	TA1	LE1	BSL2	PGL3
20	11A	N3	N3	N3	N3	N3	N3	P3	P3	P3	0	0	0	K3	K3	K3	K3	K3	K3	TA1	LE1	BSL2	PGL2
21	11B	N3	N3	N3	N3	N3	N3	P3	P3	P3	P1	P1	P1	K3	K3	K3	K3	K3	K3	TA1	LE1	BSL2	PGL2
22	11C	N3	N3	N3	N3	N3	N3	P3	P3	P3	P2	P2	P2	K3	K3	K3	K3	K3	K3	TA1	LE1	BSL2	PGL2
23	12A	N3	N3	N3	N3	N3	N3	P3	P3	P3	P3	P3	P3	K3	K3	K3	K3	K3	K3	TA2	LE1	BSL2	PGL2
24	13A	N3	N3	N3	N3	N3	N3	P3	P3	P3	P3	P3	P3	K3	K3	K3	K3	K3	K3	TA1	LE2	BSL2	PGL2

Table 3. Legends for variables in Table 2.

Variable	Specification	Definitions/Observations
Treat	Treatment	
N	Nitrogen	N3 = ideal rate of N for specific crop and region.
P	Phosphorus	Rates of P_2O_5 = 0, P1, P2, P3, with P3 = ideal rate of P_2O_5 for specific crop and region. P1 = P3/4, P2 = P3/2.
K	Potassium	Rates of K_2O = 0, K1, K2, K3, K4, with K3 = ideal rate of K_2O for specific crop and region. K1 = K3/4, K2 = K3/2, K4 = 1.5*K3.
TA	Time of Applicaton	TA 1 = regular practice (ex.: ½ K3 at planting and ½ K3 in top dressing); TA 2 = variation for time of application (1/3 at planting and two top dressings of 1/3 K3 each).
Year		1 to 6
LE	Locality Effect = Placement of K as related to the seed	LE 1 = regular practice (ex.: ½ 5 cm besides and bellow the seeds at planting and ½ at plant emergency); LE 2 = variation for locality effect (all quantity at soil surface).
BS	Base Saturation	Levels of liming BS L1, BS L2, BS L3.
PG	Phosphogypsum	Levels of Phosphogypsum PG L1, PG L2, PG L3.

Table 4. Summary of variables studied at the present experiment outline.

Var #	Specification
1	K rate
2	K residual effect
3	K and base saturation/liming
4	K and phosphogypsum application
5	P rate and P residual effect
6	K time of application
7	K placement

Table 5. Possible comparisons with experiment outline suggested in Table 1.

Comp #	Comparison	Treatments Involved
1	Response curve to K_2O with continuous application of K and regular practices for N, P, K time of application, K locality effect, liming and PG level.	T1, T2, T4, T6 and T10 (A).
2	Response curve to K_2O with K application up to 3rd year and regular practices for N, P, K time of application, K locality effect, liming and PG level (B)	T1, T3, T5, T7 and T11 (B).
3	A vs B = Effect of suspension of K application after 3rd year at regular practices	
4	Effect of different rates of K in residual effect as related to ideal rate (K3)	T6, T7, T8 and T9 (C).
5	Effect of liming on K fertilization with continuous application of K and regular practices	T12, T6 and T14 (D).
6	Effect of liming on K fertilization with application of K up to 3rd year and regular practices	T13, T7 and T15 (E).
7	D vs E = Effect of liming on suspension of K application after 3rd year at regular practices	
8	Effect of phosphogypsum on K fertilization with continuous application of K at regular practices	T16, T6 and T18 (F).
9	Effect of phosphogypsum on K fertilization with application of K up to 3rd year at regular practices	T17, T7 and T19 (G).
10	F vs G = Effect of phosphogypsum on suspension of K application after 3rd year at regular practices.	
11	Response curve to P with full P only up to 3rd year and regular practices	T20, T21, T22 and T6.
12	Effect of timing of K application at regular practices	T6 and T23.
13	Placement effect of K application at regular practices	T6 and T24.

Regular practices = N3, P3, K3, TA1, LE1, BS L2 and PG L2

Results and discussion

Tables 6 to 14 show, data obtained for 2013-2014 soybean yield, soybean seeds weight, soybean plant height, soybean K leaf content, maize 2nd crop yield, maize 2nd crop seeds weight, maize 2nd crop plant height, maize 2nd crop K leaf content, and soil K availability, respectively. Tables 6 to 14 also provide mean comparisons, $p<0.10$, where applicable (comparisons 4, 5, 6, 8, 9, 11, 12, and 13 of Table 5).

From all other possible comparisons (lime application, phosphogypsum application, time and locality of K application, residual K rates, and residual P rates effect; comparisons 4, 5, 6, 8, 9, 11, 12, and 13 of Table 5), these were identified with statistical difference:

(i) effect of phosphogypsum application (comparison 8) on soybean seed weight leading to higher seed weight: PG L3 > PG L2 = PG L1 (Table 7).
(ii) effect of residual K rates (comparison 4) on soybean plant height leading to lower plant height with higher K rates (Table 8).
(iii) effect of time of K application (comparison 12) on soybean K leaf content where all rate of K_2O applied at seeding time lead to higher K leaf content as related to 1/3 of K application at 15 days after emergence (treatment 23) (Table 9).
(iv) effect of liming application (comparison 5) on maize 2nd crop yield leading to higher yield: BS L3 > BS L2 ≥ BS L1 (Table 10).
(v) effect of liming application with residual K rates (comparison 6) on maize 2nd crop yield and K leaf content leading to higher yield (BS L3 > BS L2 = BS L1, Table 10) and higher K leaf content (BS L3 = BS L2 > BS L1, Table 13).
(vi) effect of phosphogypsum application with residual K rates (comparison 9) on maize 2nd crop K leaf content leading to higher K leaf content as related to no application: PG L3 = PG L2 > PG L1 (Table 13).

Figures 1 and 2 show the soybean yield response curves to K_2O rates with uninterrupted and interrupted application, respectively (comparisons 1 and 2, according to Table 5). Response is observed to K application for soybean yield, for example, from 3314 kg/ha when no K_2O was applied to approx. 3865 kg/ha when 90 kg/ha of K_2O was uninterrupted used or to approx. 3862 kg/ha when K_2O application was suppressed. In terms of data analysis, an exponential model was adjusted to the data due to the statistical significant rate effect for K_2O application for soybean yield.

Figure 3 shows, respectively, the soybean seed weight, plant height, and K leaf content response curves to K_2O rates with uninterrupted or interrupted application (comparisons 1 and 2). Models were adjusted to the data (exponential, for K leaf content, and linear, for plant height) for the statistical significant rate effect for K_2O application. Figure 4 shows the soybean plant height response curve to residual effect of K_2O rates (comparison 4) where statistical significance was observed. Therefore, a polynomial model was adjusted to the data.

Figures 5 and 6 show maize 2nd crop yield response curves to K_2O rates with uninterrupted or interrupted application, respectively (comparisons 1 and 2, according to Table 5). Response is also observed to K application for maize 2nd crop yield, for example, from 8187 kg/ha when no K_2O was applied to approx. 9267 kg/ha when 90 kg/ha of K_2O

was uninterrupted applied or to approx. 9152 kg/ha when K_2O application was suppressed. In terms of data analysis, models were adjusted to the data due to the statistical significant rate effect for K_2O application for soybean yield: polynomial for K uninterrupted application and exponential for K interrupted application.

Figure 7 shows, respectively, the maize 2nd crop seed weight, plant height, and K leaf content response curves to K_2O rates with uninterrupted or interrupted application (comparisons 1 and 2). Models were adjusted to the data for the statistical significant rate effect for K_2O application: polynomial, for plant height and seed weight under uninterrupted K application, and linear, for plant height, seed weight, and K leaf content under suppression of K application.

Figure 8 shows the soil K availability response curve for K application as a function of rates. In terms of data analysis, a linear model was adjusted to the data due to the significant rate effect for K_2O application for soil K availability. Figure 9 shows the soybean and maize 2nd crop yield response curve to residual P_2O_5 rates (comparison 11, Table 5) where no significance was observed.

Figures 10 and 11 present, respectively, the average soybean and maize 2nd crop yield response curve to K_2O rates with uninterrupted K application. Exponential models were adjusted to the data that shows significant difference between K_2O rates treatments and control. Figure 12 shows the yield gap between the recommended K rate (90 kg K_2O/ha) and control for soybean and maize 2nd crop along the four years of the project. This was the first season with K suppression and, for this clay soil, K residual supply was able to sustain grain yield. An important and pertinent question to be answered by this project is for how long residual K will supply high grain yields

Figures 13 and 14 show, respectively, soybean and maize 2nd crop yield as affected by the level of bases saturation in the soil and K_2O application, for the 2013/2014 crop season. Important observation may be drawn from Figure 14: K application increased maize 2nd crop yield in soil presenting higher levels of bases saturation.

Figures 15 and 16 present, respectively, soybean and maize 2nd crop yield as affected by the level of phosphogypsum and K_2O application, for the 2013/2014 crop season. Clearly, K application was required to increase maize 2nd crop yield under low use of phosphogypsum in the soil.

In 2013, after maize 2nd crop harvest, another application of lime (2 t/ha) and phosphogypsum (2 t/ha) was done in the trial. Lime was applied to all plots with exception of treatments 12 and 13. Phosphogypsum was applied to all plots with exception of treatments 16 and 17. With this, since the beginning of the project: (i) treatments BS L1 (12 and 13) have received no lime, (ii) treatments BS L2 have received, in 2013 2 t/ha of dolomitic lime applied on the soil surface, (iii) treatments BS L3 (14 and 15) have received 4,5 t/ha of dolomitic lime applied and incorporated in 2010 and in 2013 additional 2 t/ha of dolomitic lime applied on the soil surface, (iv) treatments of the PG L1 (16 and 17) have received no phosphogypsum, (v) treatments PG L2 have received, in 2013, 2 t/ha of phosphogypsum, and (vi) treatments PG L3 have received, in 2010, 2 t/ha of phosphogypsum and in 2013 additional 2 t/ha of phosphogypsum. Prior to any lime and phosphogypsum application in 2013, soil samples

were collected from different depths to investigate soil chemical conditions of the treatments related to BS and PG levels. Figures 17 and 18 summarize the results, respectively, of soil chemical properties for different soil depths as affected by liming or phosphogypsum application at the project start. Liming (BS L3) led to higher soil pH and bases saturation as well as increased Ca and Mg availability in the 0-20 cm layer of soil (Figure 17). Phosphogypsum application (PG L3) did not significantly impact any of the analyzed properties, but tended to increase S availability with depth (Figure 18).

Table 15 presents a summary of statistical analysis for all comparisons since the beginning of the project.

Some comments regarding maize 2nd crop yield and soil K availability are necessary:

(i) Maize 2nd crop yield observed in the 2013/2014 season was remarkably high due to the rainfall above average.
(ii) There might be an error associated with replicates of treatment #10 regarding maize 2nd crop yield that jeopardized partially the results. Therefore, the model adjusted to data in Figure 5 does not represent the expected behavior for this factor.
(iii) Soil K availability values presented in Table 14 are low because soil samples were collected after the maize 2nd crop harvest. As maize presents high uptake of K, a large amount of the nutrient was still hold in the crop residues. It would be returned to the soil only after the first spring rainfalls. A suggestion will be made to the field research coordinator to move soil sampling to a different time of the year.

Final Considerations

It will be interesting to find out what effects for the different treatments will occur with time, most especially those related to the comparison of treatments with uninterrupted K versus interrupted K application. Some of the questions we seek answers are:

(1) For how long will the suppression of K rates not influence crop yields?
(2) What will be the response curves to K previously applied, with suppression or not of K_2O application?
(3) What will be the effect of liming in K response (with and without suppression of K_2O application)?
(4) What will be the effect of phosphogypsum application in K response (with and without suppression of K_2O application)?
(5) For how long will the suppression of P rates not influence crop yields?
(6) Will there be a consistent effect of timing of K application at regular practices?
(7) Will there be a continuous effect of K placement at regular practices?

Table 6. Soybean yield (2013-2014).

Treat #	Treat #	Replicate 1	2	3	4	Average	Comparison 4	5	6	8	9	11	12	13
		kg/ha				kg/ha								
1	1	3371	3248	3313	3326	**3314**								
2	2A	3700	3797	3712	3667	**3719**								
3	2B	3645	3937	3785	3744	**3778**								
4	3A	3750	3636	3861	3754	**3750**								
5	3B	3970	3609	4050	3628	**3814**								
6	4A	4049	3708	3835	3868	**3865**	A	A		A		A	A	A
7	4B	4034	3648	3840	3927	**3862**	A		A		A			
8	4C	4050	3880	3903	3896	**3932**	A							
9	4D	4061	3725	3916	3953	**3914**	A							
10	5A	3974	3652	3772	3930	**3832**								
11	5B	3623	3744	3702	3840	**3727**								
12	6A	3824	3889	3842	3742	**3824**		A						
13	6B	3607	3699	3779	3781	**3717**			A					
14	7A	3849	3655	3815	3856	**3794**		A						
15	7B	3987	3724	3818	3775	**3826**			A					
16	8A	3615	3665	3954	3772	**3752**				A				
17	8B	3921	3853	3737	4013	**3881**					A			
18	9A	3777	3981	3708	3900	**3841**				A				
19	9B	4031	3838	4050	3973	**3973**					A			
20	11A	3984	3808	3923	3977	**3923**						A		
21	11B	3699	3774	3948	3784	**3801**						A		
22	11C	3972	3746	3826	3935	**3870**						A		
23	12A	3743	3691	3752	3963	**3787**							A	
24	13A	3933	3901	3877	3840	**3888**								A
						CV, %	1.33	2.62	3.10	4.34	5.42	2.44	3.12	2.38
						msd	97.5	178	210	295	351	178	199	153

Same capital letters in the column indicate no statistical mean difference at p<0.05.
Comparisons 1 relates, with proper statistics, to Figures and not single average comparisons.
Comparison # 5 = treatments 12, 6 and 14 = lime application.
Comparison # 6 = treatments 13, 7 and 15 = lime application.
Comparison # 8 = treatments 16, 6 and 18 = phosphogypsum application.
Comparison # 9 = treatments 17, 7 and 19 = phosphogypsum application.
Comparison # 12 = treatments 6 and 23 = effect of time of application.
Comparison # 13 = treatments 6 and 24 = effect of K locality effect.
For details in such comparisons refer to Table 5.

Table 7. Weight of Soybean seeds (2013-2014).

Treat #	Treat #	Replicate 1	2	3	4	Average	Comparison 4	5	6	8	9	11	12	13
		g/1000				g/1000								
1	1	150.4	135.5	146.0	146.6	**144.6**								
2	2A	141.3	140.7	144.4	142.3	**142.2**								
3	2B	143.8	150.0	146.4	148.0	**147.1**								
4	3A	149.3	140.2	140.2	139.6	**142.3**								
5	3B	150.5	144.2	146.5	145.6	**146.7**								
6	4A	142.7	140.4	146.5	148.0	**144.4**	A	A		B		A	A	A
7	4B	148.1	151.0	147.9	140.8	**146.9**	A		A		A			
8	4C	147.1	141.0	139.4	137.8	**141.3**	A							
9	4D	138.7	148.2	142.1	140.0	**142.3**	A							
10	5A	149.7	143.1	136.3	139.2	**142.1**								
11	5B	145.2	142.7	143.8	139.1	**142.7**								
12	6A	143.9	146.4	144.0	146.7	**145.3**		A						
13	6B	139.2	146.2	141.2	148.8	**143.8**			A					
14	7A	136.0	143.2	138.8	147.9	**141.5**		A						
15	7B	141.9	142.2	148.8	142.1	**143.8**			A					
16	8A	143.0	138.5	138.5	136.5	**139.1**				B				
17	8B	142.1	137.2	138.6	138.8	**139.2**					A			
18	9A	150.6	148.0	150.0	148.1	**149.2**				A				
19	9B	135.4	136.0	147.1	136.1	**138.6**					A			
20	11A	138.1	141.3	147.2	146.5	**143.3**						A		
21	11B	138.2	142.6	142.8	136.4	**140.0**						A		
22	11C	148.5	140.5	136.7	146.5	**143.0**						A		
23	12A	143.0	141.9	142.1	149.3	**144.1**							A	
24	13A	144.0	150.3	143.3	135.5	**143.3**								A
						CV, %	3.01	2.10	3.16	1.94	1.78	3.20	1.36	4.59
						msd	8.15	5.38	8.13	4.97	3.81	8.59	3.26	10.98

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Comparison # 6 = treatments 13, 7 and 15 = lime application.
Comparison # 8 = treatments 16, 6 and 18 = phosphogypsum application.
Comparison # 9 = treatments 17, 7 and 19 = phosphogypsum application.
Comparison # 12 = treatments 6 and 23 = effect of time of application.
Comparison # 13 = treatments 6 and 24 = effect of K locality effect.
For details in such comparisons refer to Table 5.

Table 8. Soybean plant height (2013-2014).

Treat #	Treat #	Replicate 1	2	3	4	Average	Comparison 4	5	6	8	9	11	12	13
		cm				cm								
1	1	91.5	95.0	93.9	93.5	**93.5**								
2	2A	86.0	92.5	89.0	90.0	**89.4**								
3	2B	89.0	93.0	94.0	93.5	**92.4**								
4	3A	88.5	91.0	90.5	87.0	**89.3**								
5	3B	92.0	91.5	88.5	91.0	**90.8**								
6	4A	94.0	85.0	91.0	90.0	**90.0**	AB	A		A		A	A	A
7	4B	94.5	93.9	94.0	90.0	**93.1**	A		A		A			
8	4C	95.0	85.0	85.0	84.8	**87.5**	B							
9	4D	92.6	89.5	85.0	87.3	**88.6**	AB							
10	5A	85.0	86.0	85.5	85.5	**85.5**								
11	5B	93.5	89.5	91.0	91.3	**91.3**								
12	6A	90.5	90.5	89.5	89.0	**89.9**		A						
13	6B	94.0	91.5	94.0	91.3	**92.7**			A					
14	7A	89.5	90.5	94.0	92.5	**91.6**		A						
15	7B	93.5	91.5	93.2	94.5	**93.2**			A					
16	8A	88.0	95.5	96.0	94.1	**93.4**				A				
17	8B	86.0	93.5	89.0	95.5	**91.0**					A			
18	9A	93.5	92.5	95.0	95.0	**94.0**				A				
19	9B	86.5	95.5	95.8	97.5	**93.8**					A			
20	11A	83.3	81.0	87.0	86.0	**84.3**						A		
21	11B	88.0	86.5	88.5	86.5	**87.4**						A		
22	11C	92.0	84.5	79.5	91.5	**86.9**						A		
23	12A	87.5	90.5	89.5	87.0	**88.6**							A	
24	13A	92.0	90.0	89.5	93.0	**91.1**								A
						CV, %	3.00	2.88	1.70	3.74	7.92	4.07	3.99	2.67
						msd	5.08	4.63	2.81	6.15	8.13	6.67	5.93	4.03

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Comparison # 6 = treatments 13, 7 and 15 = lime application.
Comparison # 8 = treatments 16, 6 and 18 = phosphogypsum application.
Comparison # 9 = treatments 17, 7 and 19 = phosphogypsum application.
Comparison # 12 = treatments 6 and 23 = effect of time of application.
Comparison # 13 = treatments 6 and 24 = effect of K locality effect.
For details in such comparisons refer to Table 5.

Table 9. Soybean leaf K content (2013-2014).

Treat #	Treat #	Replicate 1	2	3	4	Average	Comparison 4	5	6	8	9	11	12	13
		g/kg				g/kg								
1	1	18.4	18.2	19.8	19.0	**18.9**								
2	2A	22.2	21.2	20.0	19.5	**20.7**								
3	2B	19.0	22.4	20.7	20.6	**20.7**								
4	3A	21.4	23.4	21.6	23.4	**22.5**								
5	3B	23.8	19.4	24.2	20.0	**21.9**								
6	4A	21.6	20.8	26.2	24.2	**23.2**	A	A		A		A	A	A
7	4B	23.7	24.4	23.6	19.6	**22.8**	A		A		A			
8	4C	22.7	23.0	26.6	22.6	**23.7**	A							
9	4D	27.4	19.8	23.8	22.2	**23.3**	A							
10	5A	26.2	24.4	24.9	21.8	**24.3**								
11	5B	23.6	23.4	20.8	23.6	**22.9**								
12	6A	24.0	25.4	26.8	22.0	**24.6**		A						
13	6B	19.0	24.6	21.8	18.0	**20.9**			A					
14	7A	23.6	18.2	22.4	26.4	**22.7**		A						
15	7B	22.2	21.4	19.0	20.8	**20.9**			A					
16	8A	23.4	27.6	26.0	25.5	**25.6**				A				
17	8B	21.0	24.6	25.0	24.7	**23.8**					A			
18	9A	22.8	27.2	25.2	25.7	**25.2**				A				
19	9B	23.8	23.2	26.7	29.2	**25.7**					A			
20	11A	19.4	20.4	22.4	26.6	**22.2**						A		
21	11B	25.6	25.8	25.6	21.2	**24.6**						A		
22	11C	23.2	25.0	24.7	22.6	**23.9**						A		
23	12A	19.6	18.4	19.2	20.4	**19.4**							B	
24	13A	21.8	26.0	22.2	24.0	**23.5**								A
						CV, %	10.0	11.4	8.95	7.24	4.30	10.6	7.53	11.43
						msd	4.37	4.78	3.43	3.18	1.55	4.70	2.67	4.44

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Comparison # 6 = treatments 13, 7 and 15 = lime application.
Comparison # 8 = treatments 16, 6 and 18 = phosphogypsum application.
Comparison # 9 = treatments 17, 7 and 19 = phosphogypsum application.
Comparison # 12 = treatments 6 and 23 = effect of time of application.
Comparison # 13 = treatments 6 and 24 = effect of K locality effect.
For details in such comparisons refer to Table 5.

Table 10. Maize 2nd crop yield (2013-2014).

Treat #	Treat #	Replicate 1	2	3	4	Average	Comparison 4	5	6	8	9	11	12	13
		kg/ha				kg/ha								
1	1	8515	7953	7939	8340	**8187**								
2	2A	9817	8490	9899	7914	**9030**								
3	2B	8811	8555	9072	9426	**8966**								
4	3A	9693	9159	8654	9184	**9172**								
5	3B	8948	8649	9223	8801	**8905**								
6	4A	9386	8969	9209	9505	**9267**	A	B		A		A	A	A
7	4B	9327	9011	9363	8908	**9152**	A		B		A			
8	4C	9933	9291	9302	9272	**9450**	A							
9	4D	8112	8483	9366	9305	**8817**	A							
10	5A	9173	8486	8512	8372	**8636**								
11	5B	9019	9231	8817	9467	**9134**								
12	6A	9137	8358	8940	8811	**8811**		B						
13	6B	9221	8721	8992	8650	**8896**			B					
14	7A	10145	9030	10569	10635	**10095**		A						
15	7B	9669	9395	9254	9496	**9454**			A					
16	8A	9836	9253	9378	9176	**9411**				A				
17	8B	8621	8632	8920	9027	**8800**					A			
18	9A	8455	9595	9283	8896	**9057**				A				
19	9B	9927	9752	8563	9108	**9337**					A			
20	11A	8657	9731	8803	9811	**9251**						A		
21	11B	9310	9556	8954	8638	**9115**						A		
22	11C	9002	8778	9211	9398	**9097**						A		
23	12A	9322	9152	9057	9849	**9345**							A	
24	13A	9463	9260	9693	9119	**9384**								A
						CV, %	4.39	3.54	1.80	4.70	5.01	4.77	1.72	7.17
						msd	757	591	294	774	812	824	267	332

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Comparison # 6 = treatments 13, 7 and 15 = lime application.
Comparison # 8 = treatments 16, 6 and 18 = phosphogypsum application.
Comparison # 9 = treatments 17, 7 and 19 = phosphogypsum application.
Comparison # 12 = treatments 6 and 23 = effect of time of application.
Comparison # 13 = treatments 6 and 24 = effect of K locality effect.
For details in such comparisons refer to Table 5.

Table 11. Weight of Maize 2nd crop seeds (2013-2014).

Treat #	Treat #	Replicate 1	2	3	4	Average	Comparison 4	5	6	8	9	11	12	13
		g/1000				g/1000								
1	1	276.7	266.3	285.7	283.2	**278.0**								
2	2A	314.5	281.4	305.9	270.6	**293.1**								
3	2B	310.6	284.8	287.2	274.4	**289.3**								
4	3A	308.4	301.4	309.4	281.8	**300.2**								
5	3B	311.0	285.4	284.0	299.1	**294.9**								
6	4A	324.2	324.6	292.4	306.3	**311.9**	A	A		A		A	A	A
7	4B	303.7	306.9	293.3	292.6	**299.1**	A		A		A			
8	4C	289.1	322.3	295.8	291.2	**299.6**	A							
9	4D	325.6	316.5	288.2	299.9	**307.6**	A							
10	5A	294.9	302.0	294.7	287.8	**294.9**								
11	5B	329.1	309.8	286.7	322.2	**312.0**								
12	6A	302.9	295.3	298.7	296.8	**298.4**		A						
13	6B	310.3	298.4	307.9	298.1	**303.6**			A					
14	7A	311.1	302.6	305.7	304.1	**305.9**		A						
15	7B	303.9	318.9	301.7	290.3	**303.7**			A					
16	8A	299.9	301.0	286.3	295.8	**295.7**				A				
17	8B	313.0	303.9	297.9	284.8	**299.9**					A			
18	9A	299.8	280.2	298.2	302.6	**295.2**				A				
19	9B	290.1	305.5	285.2	304.5	**296.3**					A			
20	11A	303.2	295.4	300.3	279.2	**294.5**						A		
21	11B	316.2	309.7	304.8	284.0	**303.7**						A		
22	11C	289.1	290.7	302.7	291.2	**293.4**						A		
23	12A	297.9	316.3	303.1	300.6	**304.5**							A	
24	13A	309.4	303.3	300.2	296.6	**302.4**								A
						CV, %	3.12	2.90	2.43	3.81	3.12	3.54	3.47	1.00
						msd	17.9	15.7	13.1	20.4	16.6	20.0	17.8	15.9

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Comparison # 5 = treatments 12, 6 and 14 = lime application.
Comparison # 6 = treatments 13, 7 and 15 = lime application.
Comparison # 8 = treatments 16, 6 and 18 = phosphogypsum application.
Comparison # 9 = treatments 17, 7 and 19 = phosphogypsum application.
Comparison # 12 = treatments 6 and 23 = effect of time of application.
Comparison # 13 = treatments 6 and 24 = effect of K locality effect.
For details in such comparisons refer to Table 5.

Table 12. Maize 2nd crop plant height (2013-2014).

Treat #	Treat #	Replicate 1	2	3	4	Average	Comparison 4	5	6	8	9	11	12	13
		cm				cm								
1	1	230.5	227.0	228.0	229.5	**228.8**								
2	2A	230.5	230.5	233.5	228.0	**230.6**								
3	2B	236.5	229.0	236.5	229.0	**232.8**								
4	3A	229.0	240.5	233.5	240.3	**235.8**								
5	3B	237.5	234.3	236.0	237.0	**236.2**								
6	4A	236.5	237.0	235.5	241.0	**237.5**	A	A		A		A	A	A
7	4B	239.0	229.0	234.0	230.5	**233.1**	A		A		A			
8	4C	236.0	236.5	237.0	233.0	**235.6**	A							
9	4D	235.5	231.5	238.5	240.0	**236.4**	A							
10	5A	241.0	238.0	234.0	237.5	**237.6**								
11	5B	238.0	231.5	238.5	236.5	**236.1**								
12	6A	237.5	233.0	242.5	238.0	**237.8**		A						
13	6B	240.5	243.0	233.0	241.0	**239.4**			A					
14	7A	242.0	245.0	238.0	245.0	**242.5**		A						
15	7B	242.1	240.5	239.5	235.5	**239.4**			A					
16	8A	244.5	237.5	237.5	232.0	**237.9**				A				
17	8B	233.5	233.5	232.8	237.5	**234.3**					A			
18	9A	243.5	230.5	235.5	240.5	**237.5**				A				
19	9B	236.5	237.0	238.5	233.5	**236.4**					A			
20	11A	237.0	241.5	237.5	240.5	**239.1**						A		
21	11B	240.5	234.5	238.5	240.0	**238.4**						A		
22	11C	233.5	234.5	238.0	240.0	**236.5**						A		
23	12A	240.0	232.5	239.5	247.5	**239.9**							A	
24	13A	241.5	237.5	240.0	243.0	**240.5**								A
						CV, %	1.43	1.54	1.64	1.89	1.44	1.00	1.41	2.59
						msd	6.36	6.42	6.94	8.02	6.01	4.33	5.61	3.27

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Comparison # 6 = treatments 13, 7 and 15 = lime application.
Comparison # 8 = treatments 16, 6 and 18 = phosphogypsum application.
Comparison # 9 = treatments 17, 7 and 19 = phosphogypsum application.
Comparison # 12 = treatments 6 and 23 = effect of time of application.
Comparison # 13 = treatments 6 and 24 = effect of K locality effect.
For details in such comparisons refer to Table 5.

Table 13. Maize 2nd crop leaf K content (2013-2014).

Treat #	Treat #	Replicate 1	2	3	4	Average	Comparison 4	5	6	8	9	11	12	13
		g/kg				g/kg								
1	1	20.2	18.6	16.2	17.6	**18.2**								
2	2A	16.6	15.0	16.6	15.2	**15.9**								
3	2B	18.0	17.0	16.0	17.2	**17.1**								
4	3A	15.2	15.8	15.6	18.6	**16.3**								
5	3B	16.2	17.0	17.8	17.4	**17.1**								
6	4A	21.0	15.0	21.4	20.2	**19.4**	A	A		A		A	A	A
7	4B	17.2	16.4	20.6	21.0	**18.8**	A		B		B			
8	4C	17.8	19.4	20.6	20.0	**19.5**	A							
9	4D	24.4	20.8	19.8	19.6	**21.2**	A							
10	5A	21.4	21.2	21.6	17.6	**20.5**								
11	5B	19.2	19.4	21.8	20.4	**20.2**								
12	6A	24.8	19.2	19.4	20.8	**21.1**		A						
13	6B	23.2	23.8	23.8	24.2	**23.8**			A					
14	7A	17.2	24.2	17.8	23.4	**20.7**		A						
15	7B	24.2	20.2	22.0	23.2	**22.4**			A					
16	8A	22.2	22.0	21.8	20.0	**21.5**				A				
17	8B	20.2	23.4	21.0	22.6	**21.8**					AB			
18	9A	20.6	21.8	21.6	21.6	**21.4**				A				
19	9B	22.7	22.6	20.4	22.8	**22.1**					A			
20	11A	20.8	15.6	17.8	18.8	**18.3**						A		
21	11B	21.4	18.0	15.8	23.8	**19.8**						A		
22	11C	23.6	20.0	20.6	18.8	**20.8**						A		
23	12A	18.8	19.4	21.6	22.0	**20.5**							A	
24	13A	20.8	23.8	21.4	20.2	**21.6**								A
						CV, %	11.3	17.6	7.10	9.53	8.68	11.4	9.84	7.76
						msd	4.17	6.40	2.73	3.52	3.23	4.19	3.26	3.27

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Comparison # 5 = treatments 12, 6 and 14 = lime application.
Comparison # 6 = treatments 13, 7 and 15 = lime application.
Comparison # 8 = treatments 16, 6 and 18 = phosphogypsum application.
Comparison # 9 = treatments 17, 7 and 19 = phosphogypsum application.
Comparison # 12 = treatments 6 and 23 = effect of time of application.
Comparison # 13 = treatments 6 and 24 = effect of K locality effect.
For details in such comparisons refer to Table 5.

Table 14. Soil K level (2013-2014).

Treat #	Treat #	Replicate 1	2	3	4	Average	Comparison 4	5	6	8	9	11	12	13
		g/kg				mg/kg								
1	1	30.0	29.0	31.0	30.0	**30.0**								
2	2A	30.0	24.0	25.0	28.0	**26.8**								
3	2B	25.0	27.0	27.0	24.0	**25.8**								
4	3A	32.0	28.0	26.0	29.0	**28.8**								
5	3B	37.0	34.0	28.0	27.0	**31.5**								
6	4A	33.0	32.0	30.0	35.0	**32.5**	A	A		A		A	A	A
7	4B	30.0	33.0	33.0	30.0	**31.5**	A		A		A			
8	4C	30.0	34.0	33.0	28.0	**31.3**	A							
9	4D	31.0	32.0	31.0	31.0	**31.3**	A							
10	5A	34.0	33.0	32.0	28.0	**31.8**								
11	5B	30.0	31.0	31.0	30.0	**30.5**								
12	6A	28.0	32.0	31.0	33.0	**31.0**		A						
13	6B	30.0	30.0	29.0	29.0	**29.5**			A					
14	7A	33.0	29.0	30.0	31.0	**30.8**		A						
15	7B	33.0	32.0	28.0	28.0	**30.3**			A					
16	8A	35.0	34.0	33.0	33.0	**33.8**				A				
17	8B	30.0	29.0	33.0	28.0	**30.0**					A			
18	9A	28.0	32.0	32.0	31.0	**30.8**				A				
19	9B	31.0	29.0	30.0	29.0	**29.8**					A			
20	11A	30.0	32.0	30.0	36.0	**32.0**						A		
21	11B	31.0	31.0	28.0	32.0	**30.5**						A		
22	11C	33.0	32.0	32.0	31.0	**32.0**						A		
23	12A	31.0	29.0	31.0	30.0	**30.3**							A	
24	13A	30.0	32.0	34.0	33.0	**32.3**								A
						CV, %	6.43	6.39	5.77	6.07	4.68	5.08	5.63	13.9
						msd	3.82	3.57	3.12	3.49	2.53	3.04	2.94	2.16

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Comparison # 6 = treatments 13, 7 and 15 = lime application.
Comparison # 8 = treatments 16, 6 and 18 = phosphogypsum application.
Comparison # 9 = treatments 17, 7 and 19 = phosphogypsum application.
Comparison # 12 = treatments 6 and 23 = effect of time of application.
Comparison # 13 = treatments 6 and 24 = effect of K locality effect.
For details in such comparisons refer to Table 5.

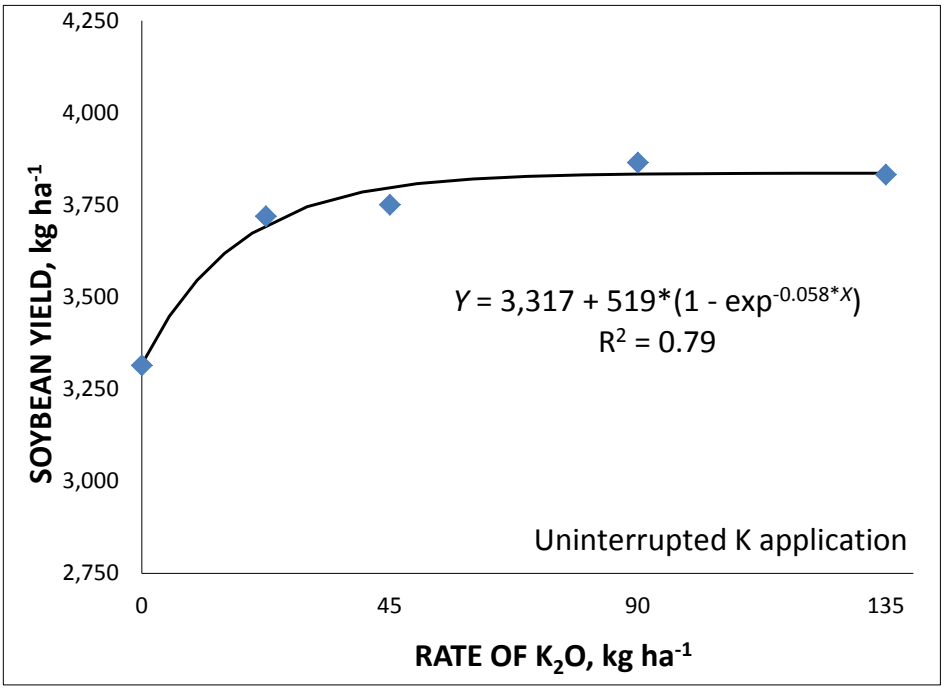


Figure 1. Soybean yield response curve to K_2O rates with uninterrupted K application (comparison 1, Table 5). Crop season 2013-2014.

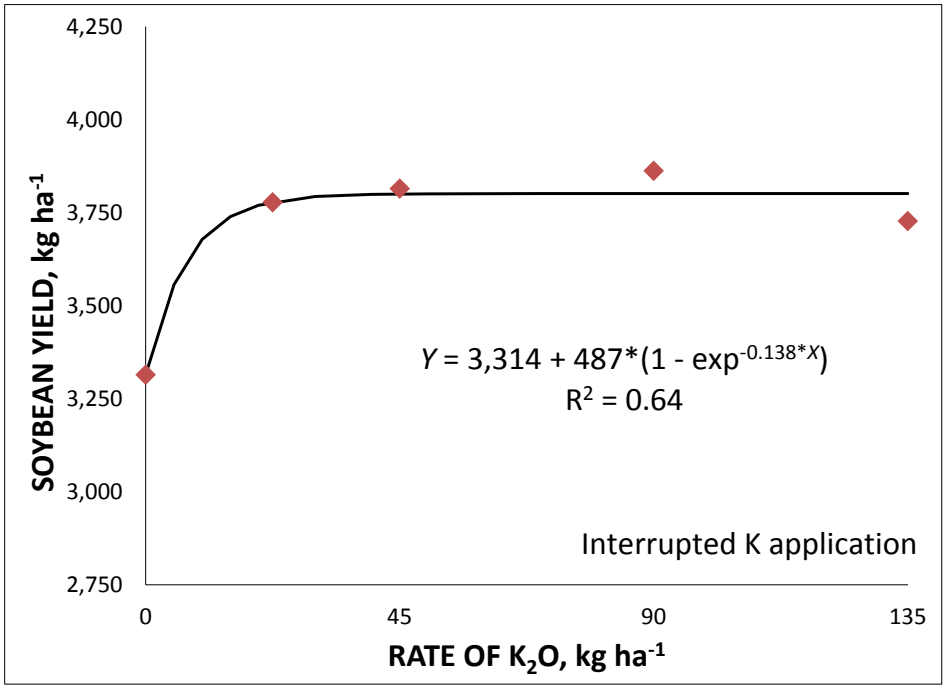


Figure 2. Soybean yield response curve to K_2O rates with interrupted K application (comparison 2, Table 5). Crop season 2013-2014.

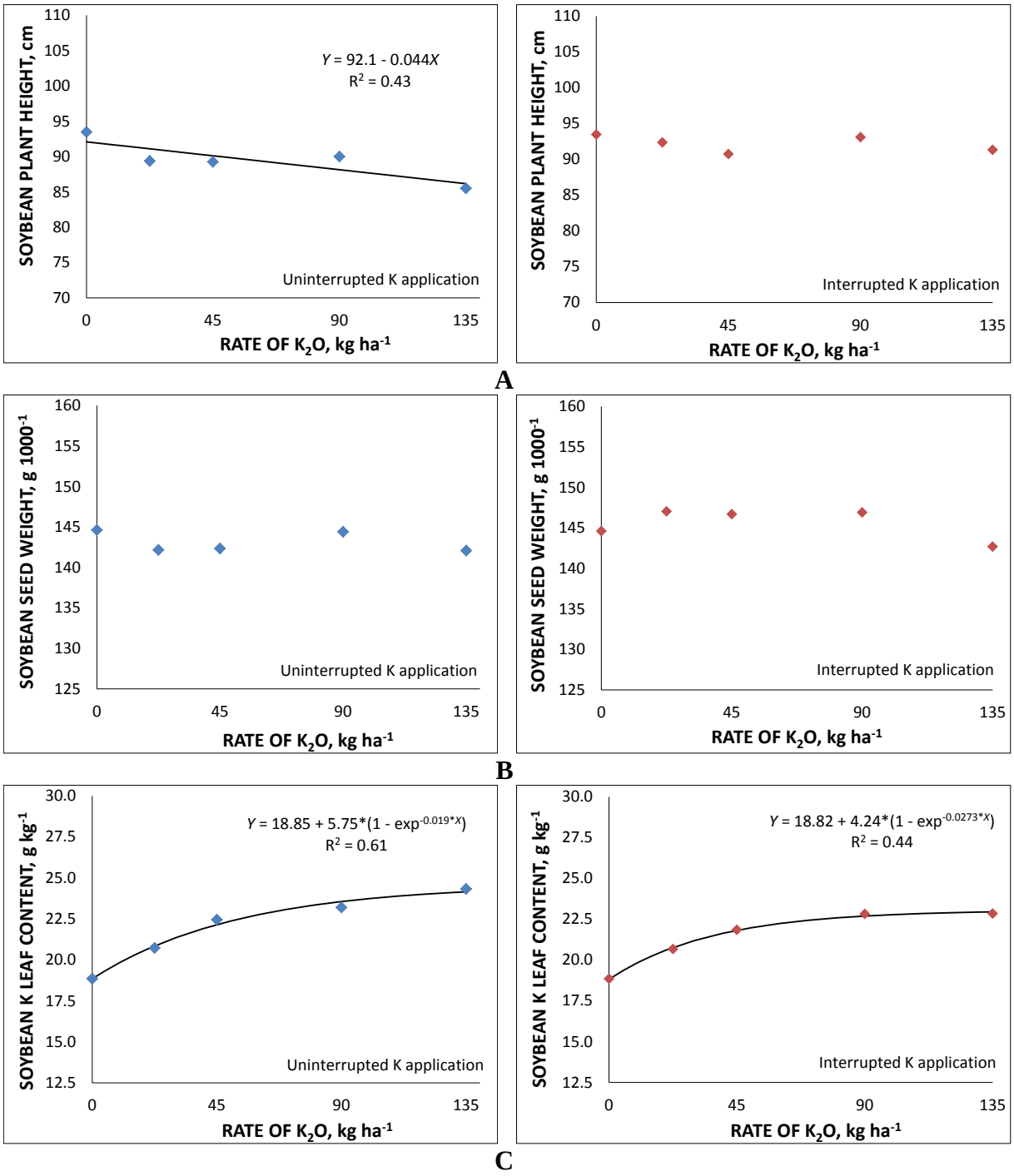


Figure 3. Soybean plant height (A), seed weight (B), and K leaf content (C) response curve to K_2O rates with uninterrupted or interrupted K application (comparisons 1 and 2 Table 5). Crop season 2013-2014.

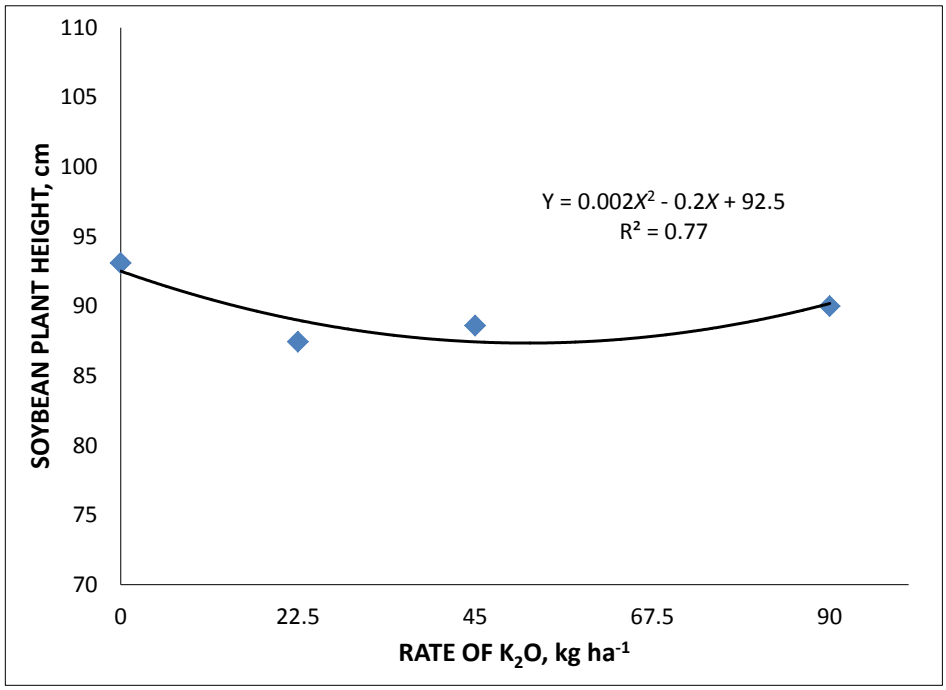


Figure 4. Soybean plant height in response to residual K_2O rates with polynomial model adjusted (comparison 4, Table 5). Crop season 2013-2014.

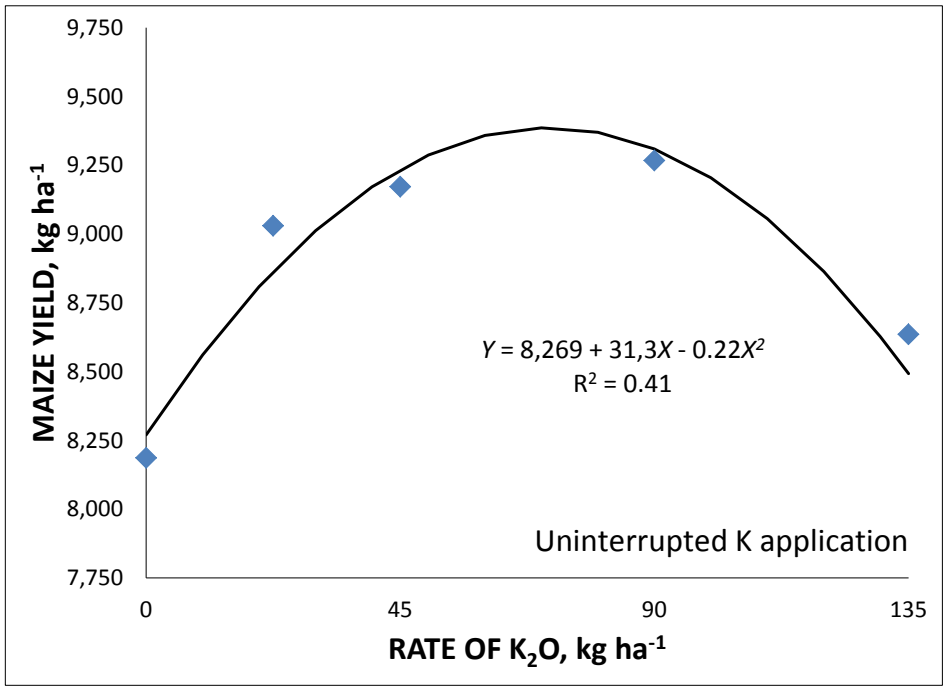


Figure 5. Maize 2nd crop yield response curve to K_2O rates with uninterrupted K application (comparison 1, Table 5). Crop season 2013-2014.

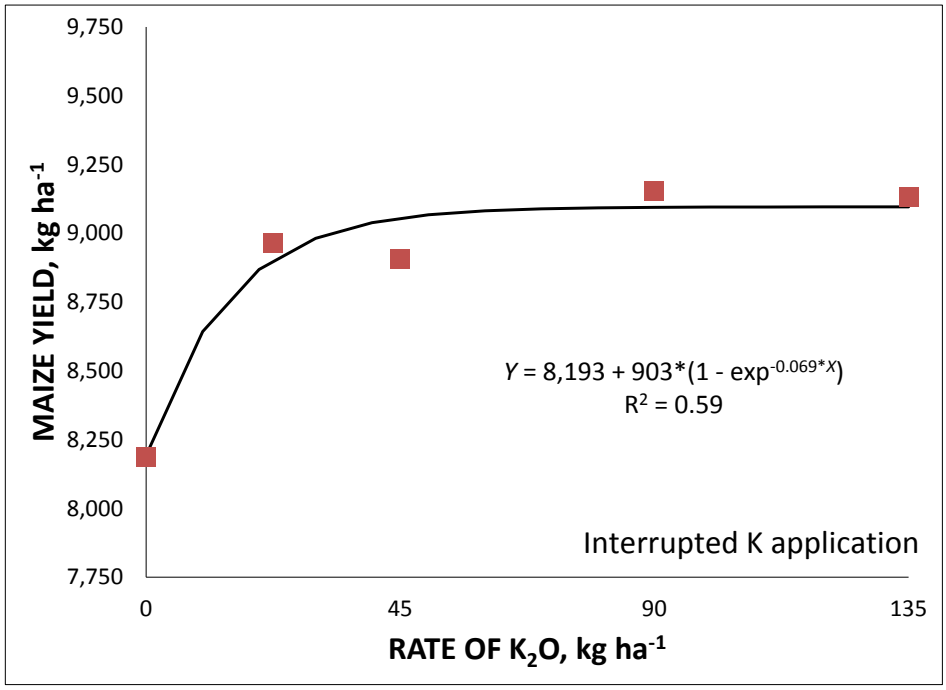
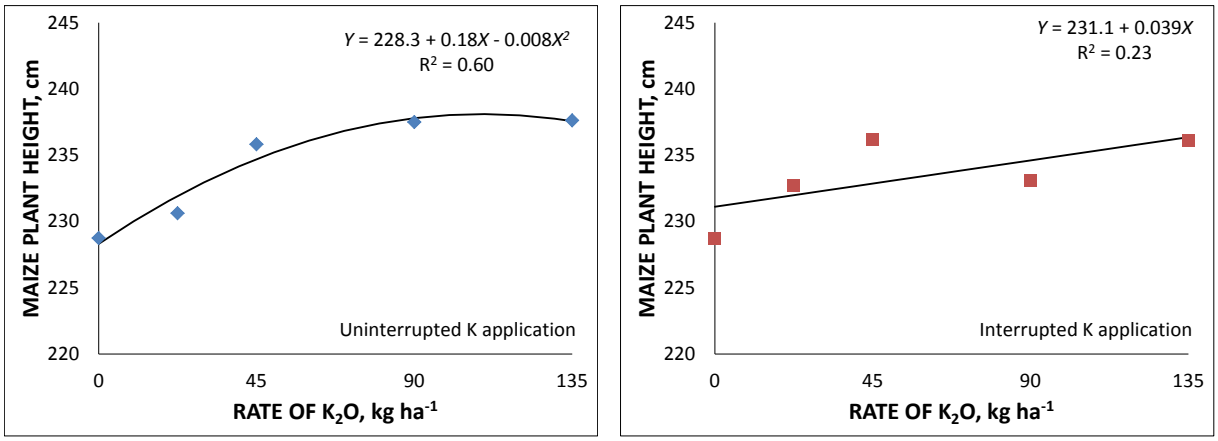
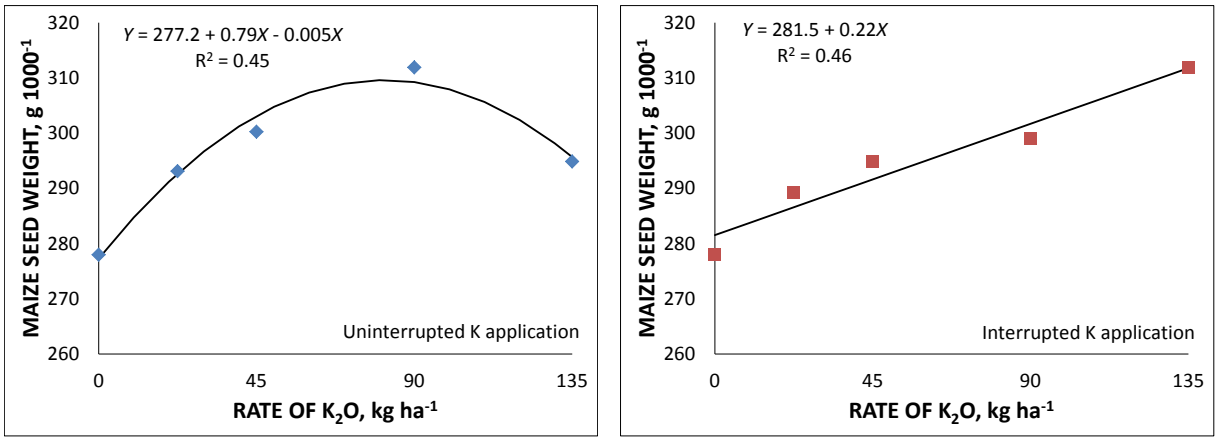


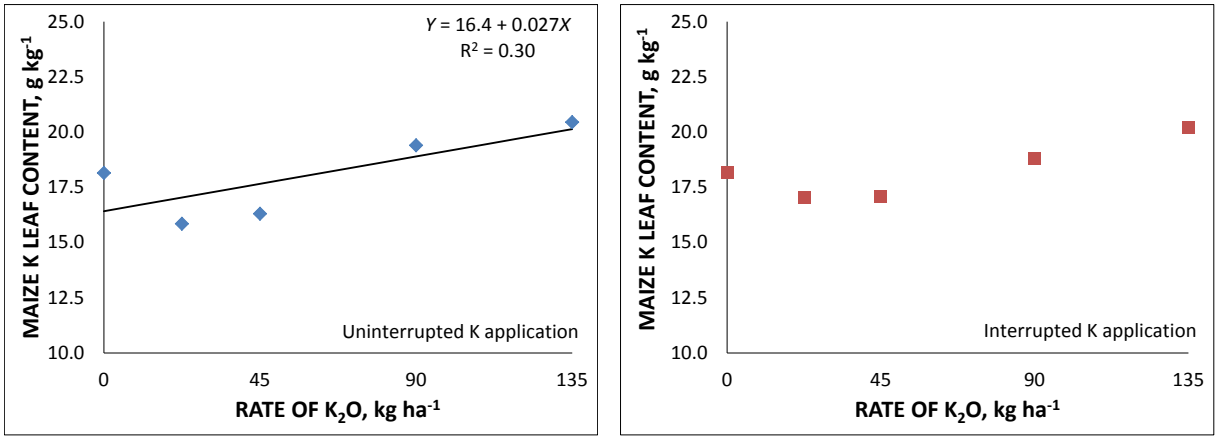
Figure 6. Maize 2nd crop yield response curve to K_2O rates with interrupted K application (comparison 2, Table 5). Crop season 2013-2014.



A



B



C

Figure 7. Maize 2nd crop plant height (A), seed weight (B), and K leaf content (C) response curve to K_2O rates with uninterrupted or interrupted K application (comparisons 1 and 2 Table 5). Crop season 2013-2014.

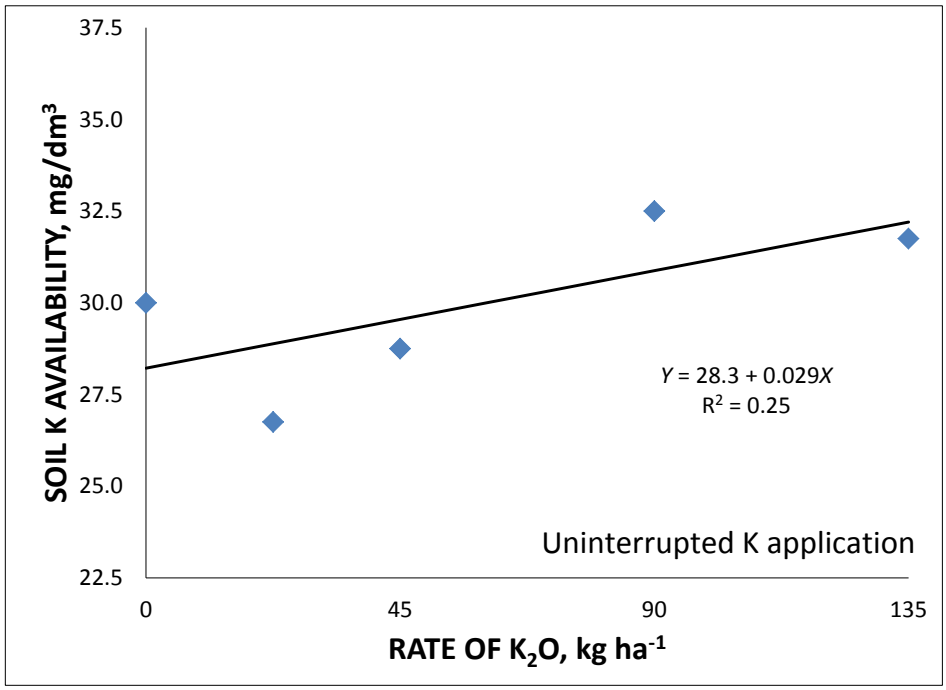


Figure 8. Soil K availability response curve to K_2O rates with linear model adjusted (comparison 1). Crop season 2013-2014.

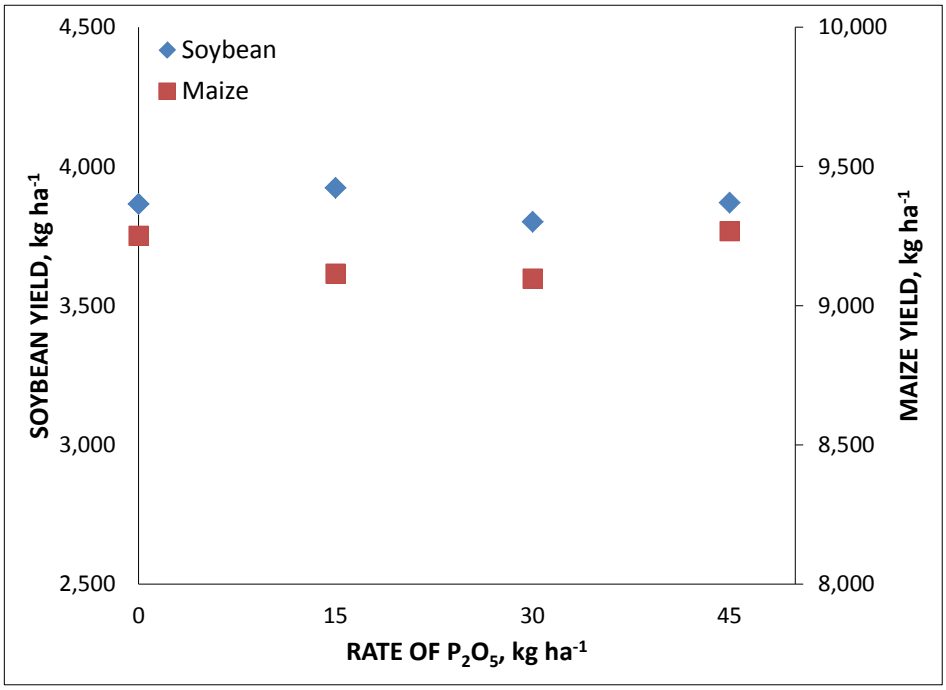


Figure 9. Soybean and maize yield response curve to residual P_2O_5 rates (comparison 11, Table 5). Crop season 2013-2014.

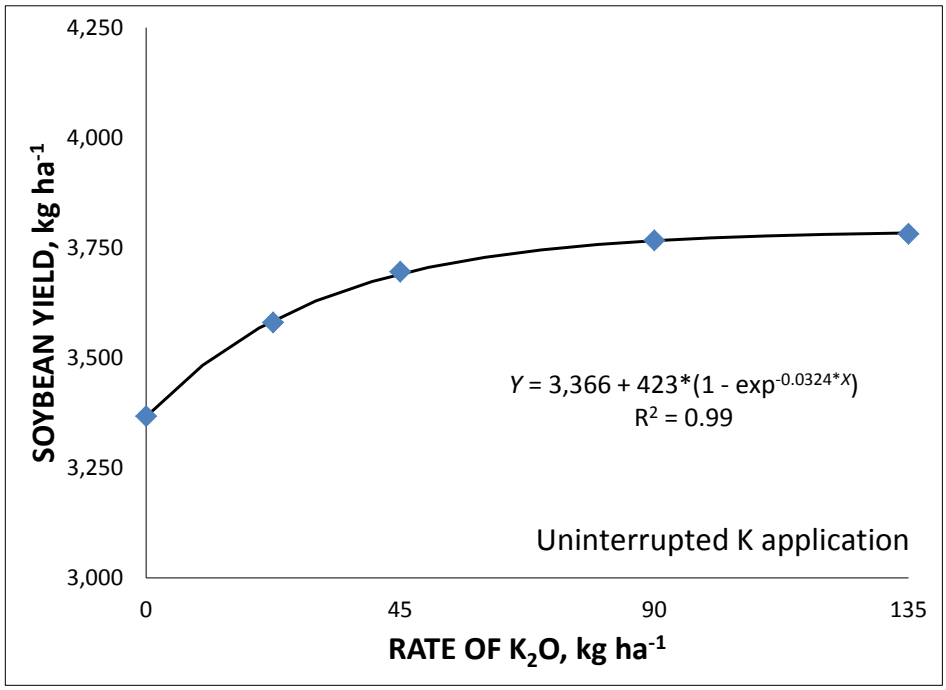


Figure 10. Average soybean yield response curve to K_2O rates with uninterrupted K application along the four years of the project.

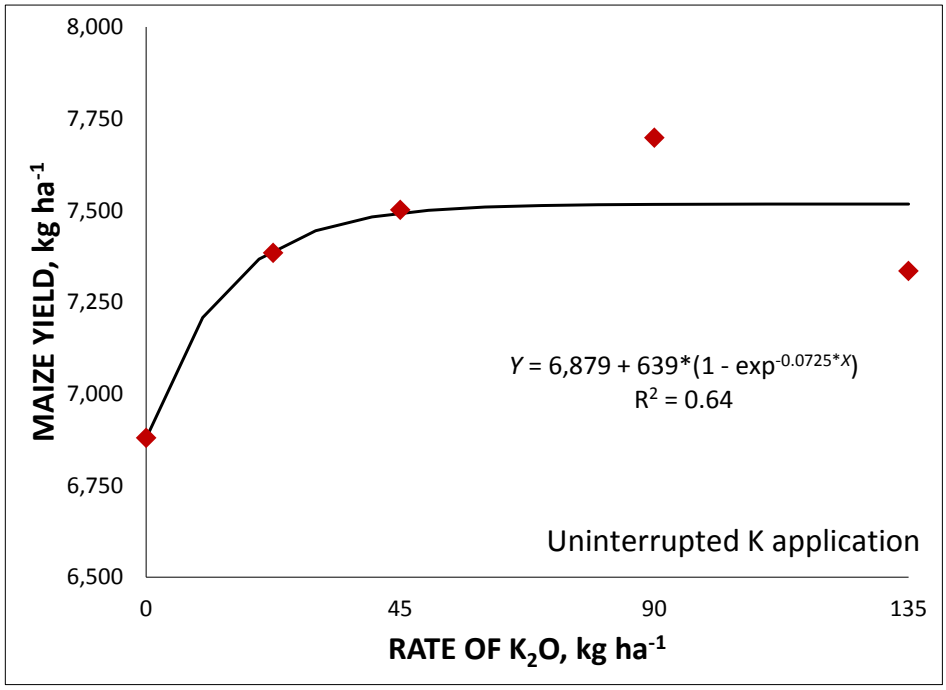


Figure 11. Average maize 2nd crop yield response curve to K_2O rates with uninterrupted K application along the four years of the project.

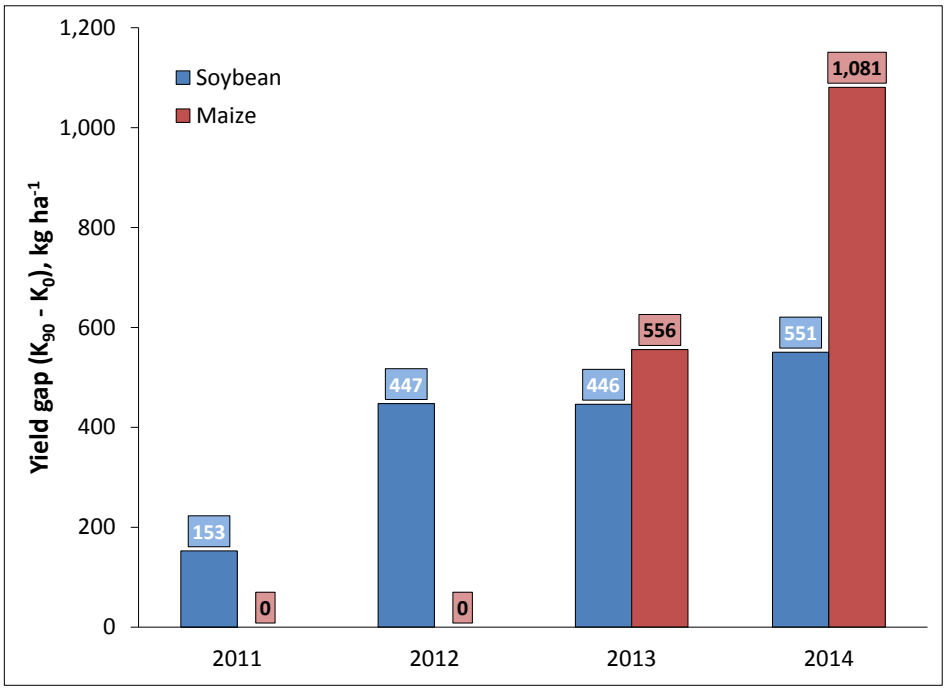


Figure 12. Yield gap (difference between 90 kg K_2O/ha application and control) for soybean and maize 2nd crop along the four years of the project.

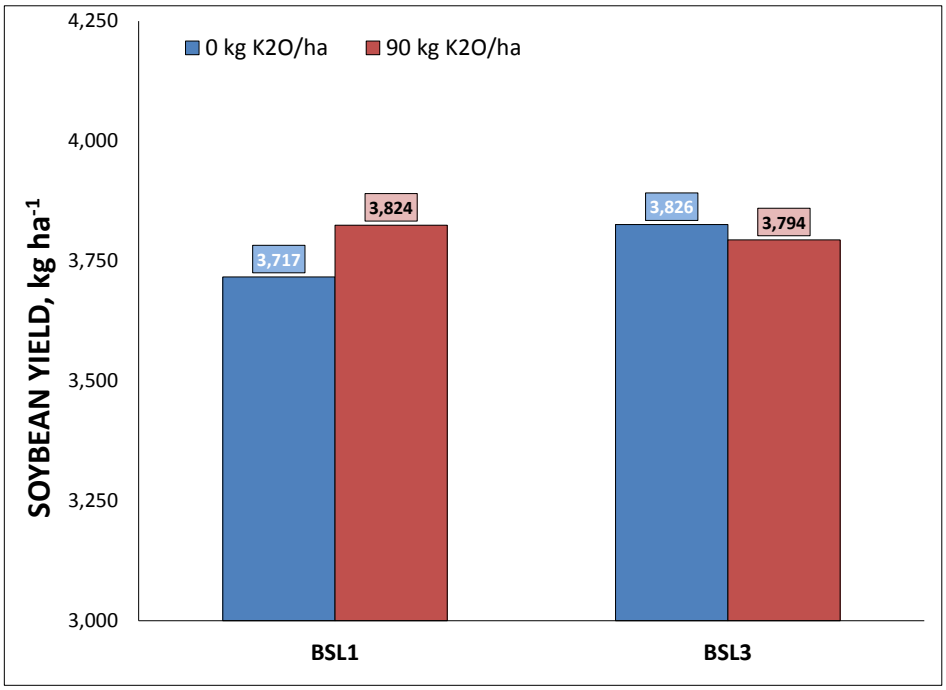


Figure 13. Soybean yield as affected by level of bases saturation in the soil and K_2O application. Crop season 2013-2014.

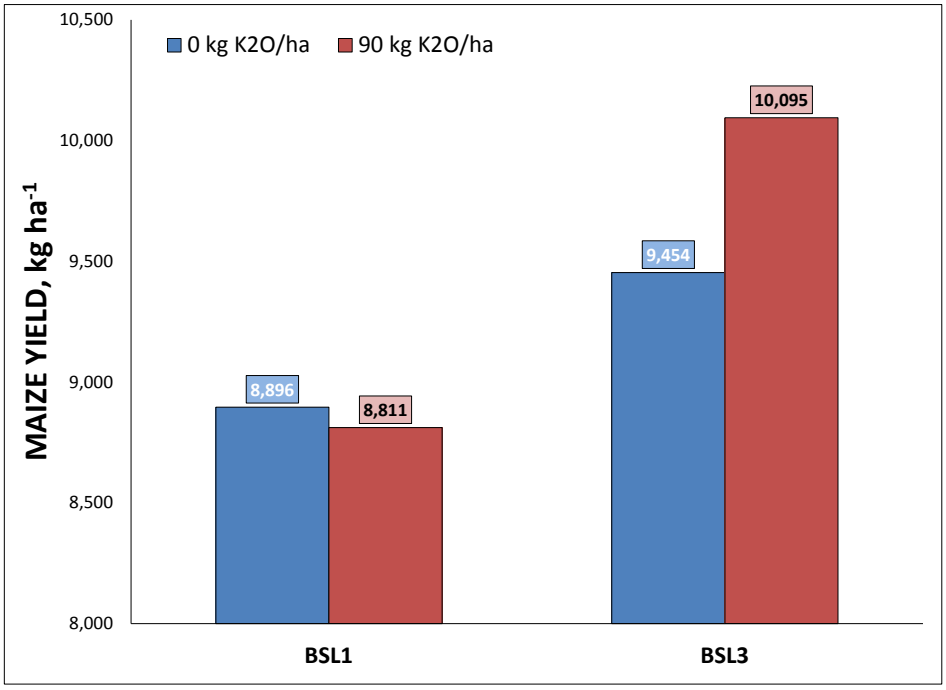


Figure 14. Maize 2nd crop yield as affected by level of bases saturation in the soil and K_2O application. Crop season 2013-2014.

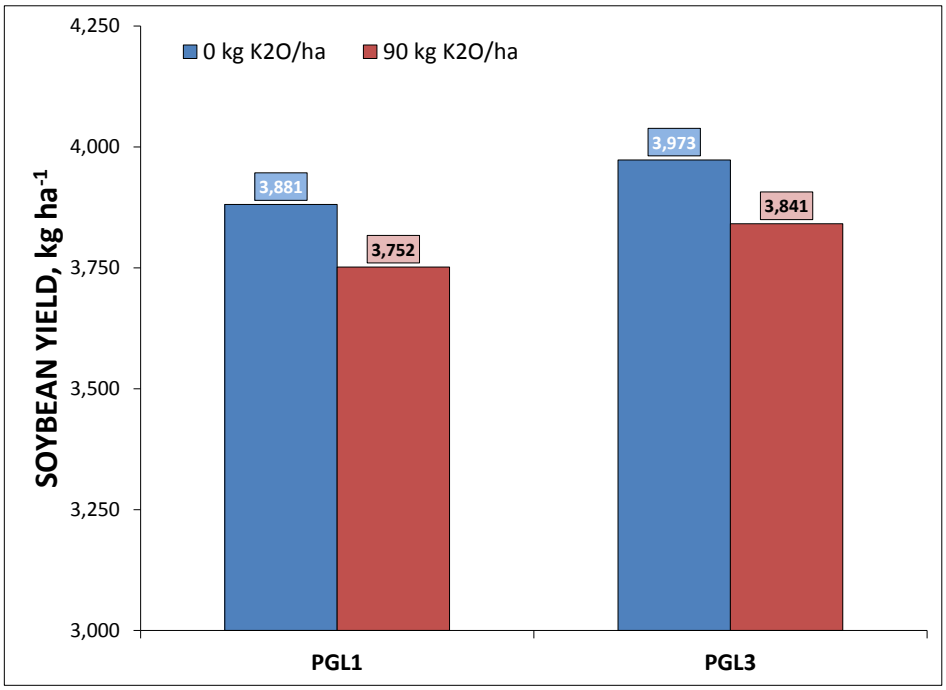


Figure 15. Soybean yield as affected by level of phosphogypsum application and K_2O application. Crop season 2013-2014.

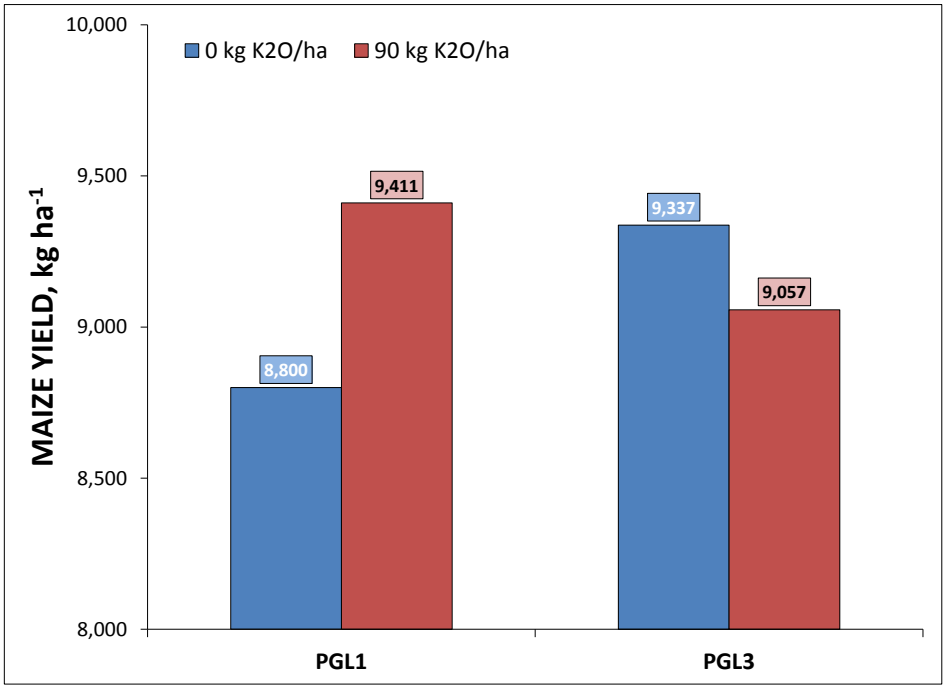


Figure 16. Maize 2nd crop yield as affected by level of phosphogypsum application and K_2O application. Crop season 2013-2014.

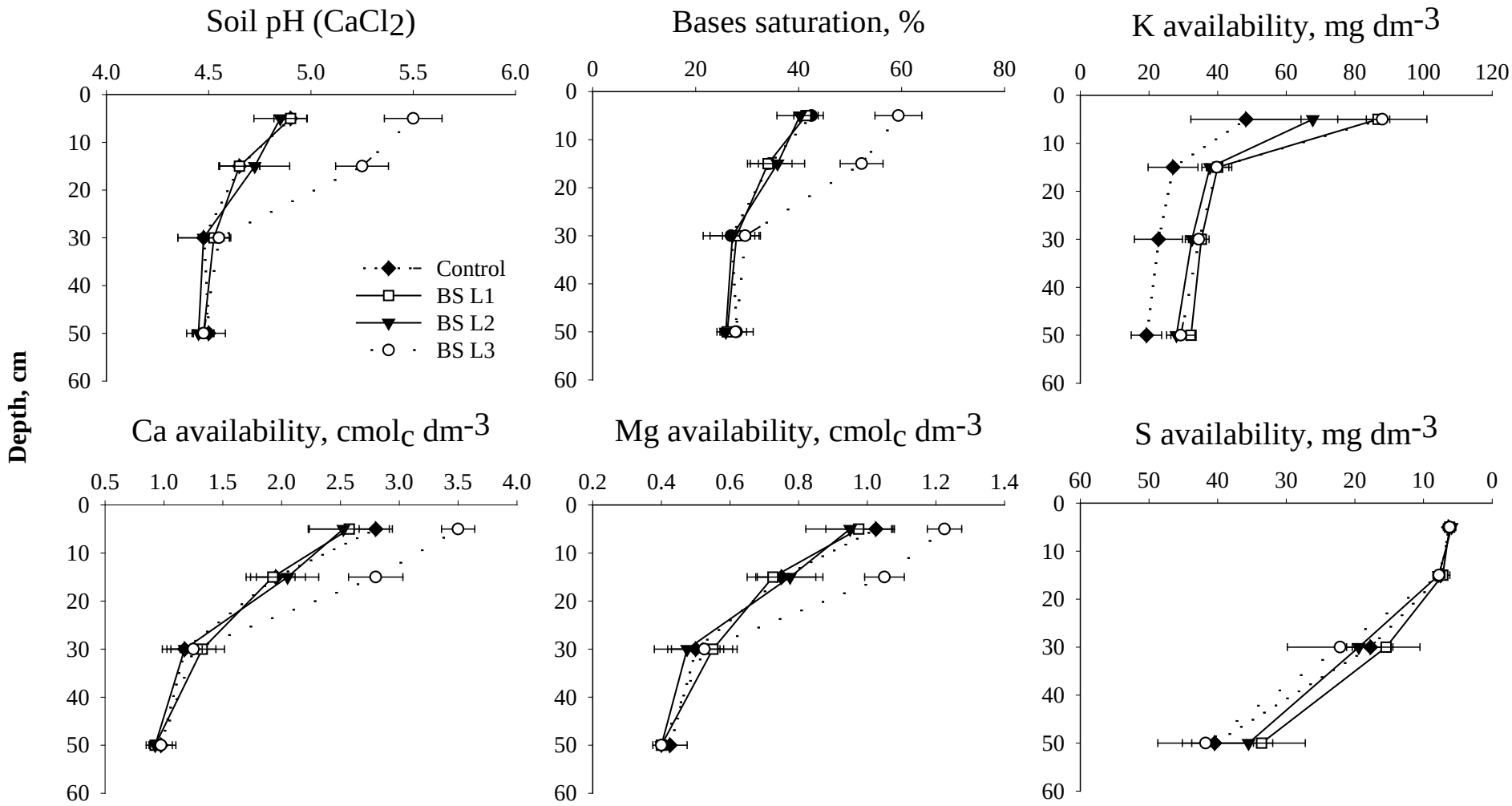


Figure 17. Soil chemical properties for different soil depths as affected by liming at the beginning of the trial (2010/2011). Soil samples were collected prior to the lime application in 2013. Bars refer to standard deviation of means.

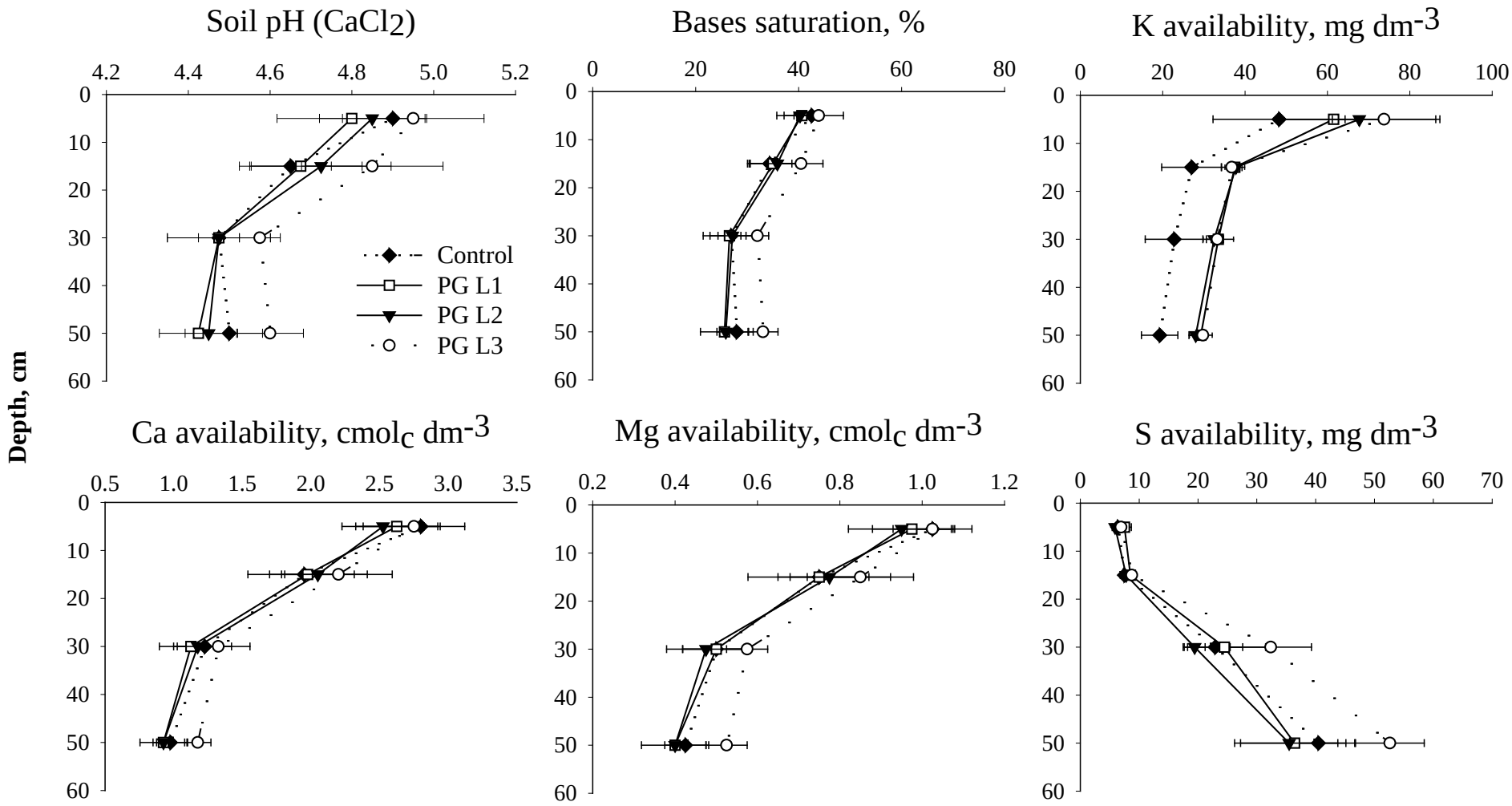


Figure 18. Soil chemical properties for different soil depths as affected by phophogypsum application at the beginning of the trial (2010/2011). Soil samples were collected prior to the lime application in 2013. Bars refer to standard deviation of means.

Table 15. Summary of statistical analysis for all comparisons since the beginning of the project.

Parameter	Season	Comparisons					
		5	6	8	9	12	13
				Soybean			
Grain yield	2010/11	ns	ns	ns	ns	ns	ns
	2011/12	ns	ns	ns	ns	ns	ns
	2012/13	ns	ns	ns	ns	ns	ns
	2013/14	ns	ns	ns	ns	ns	ns
Seed weight	2010/11	-	-	-	-	-	-
	2011/12	ns	ns	ns	ns	ns	ns
	2012/13	ns	ns	ns	ns	ns	ns
	2013/14	ns	ns	*	ns	ns	ns
Plant height	2010/11	-	-	-	-	-	-
	2011/12	ns	ns	ns	ns	ns	ns
	2012/13	ns	ns	ns	ns	ns	ns
	2013/14	ns	ns	ns	ns	ns	ns
K leaf content	2010/11	ns	ns	*	*	ns	ns
	2011/12	ns	ns	ns	ns	ns	ns
	2012/13	ns	ns	ns	ns	ns	*
	2013/14	ns	ns	ns	ns	*	ns
				Maize 2nd crop			
Grain yield	2010/11	ns	ns	ns	ns	ns	ns
	2011/12	-	-	-	-	-	-
	2012/13	*	ns	ns	*	ns	ns
	2013/14	*	*	ns	ns	ns	ns
Seed weight	2010/11	-	-	-	-	-	-
	2011/12	-	-	-	-	-	-
	2012/13	ns	ns	ns	ns	ns	ns
	2013/14	ns	ns	ns	ns	ns	ns
Plant height	2010/11	-	-	-	-	-	-
	2011/12	-	-	-	-	-	-
	2012/13	ns	ns	*	ns	ns	ns
	2013/14	ns	ns	ns	ns	ns	ns
K leaf content	2010/11	-	-	-	-	-	-
	2011/12	-	-	-	-	-	-
	2012/13	ns	ns	ns	ns	ns	ns
	2013/14	ns	*	ns	*	ns	ns
				Soil			
K availability	2010/11	-	-	-	-	-	-
	2011/12	ns	ns	ns	ns	ns	*
	2012/13	ns	ns	ns	ns	ns	ns
	2013/14	ns	ns	ns	ns	ns	ns

ns: not statistical significant.
*: statistical significant.

Appendix A. Raw data of soybean agronomical features and nutritional status, season 2013-2014.

T#	T#	Rep	Plot#	Yield (kg/ha)	SW[(1)] (g/1000)	PH[(2)] (cm)	Nutrient leaf status (g/kg)					
							N	P	K	Ca	Mg	S
1	1	1	1083	3371.0	150.4	91.5	47.6	2.7	18.4	8.70	4.05	2.24
1	1	2	1086	3247.9	135.5	95.0	46.2	2.7	18.2	8.50	4.30	2.18
1	1	3	1088	3312.8	146.0	93.9	44.8	3.0	19.8	7.50	3.75	2.43
1	1	4	1089	3325.5	146.6	93.5	46.2	2.8	19.0	8.10	4.05	2.19
2	2A	1	1065	3699.6	141.3	86.0	47.6	2.5	22.2	7.95	3.30	2.90
2	2A	2	1053	3796.7	140.7	92.5	46.2	2.6	21.2	8.40	3.60	2.64
2	2A	3	1062	3712.0	144.4	89.0	48.3	2.6	20.0	8.40	3.45	2.87
2	2A	4	1057	3666.6	142.3	90.0	46.2	2.5	19.5	8.40	3.75	2.84
3	2B	1	1066	3645.1	143.8	89.0	49.0	2.9	19.0	7.80	3.60	2.87
3	2B	2	1054	3937.3	150.0	93.0	47.6	2.5	22.4	8.10	3.00	2.70
3	2B	3	1061	3784.8	146.4	94.0	46.2	2.9	20.7	8.10	3.60	2.74
3	2B	4	1058	3744.0	148.0	93.5	50.4	3.0	20.6	8.25	3.60	2.80
4	3A	1	1052	3750.0	149.3	88.5	44.8	2.8	21.4	7.95	3.15	2.80
4	3A	2	1063	3635.8	140.2	91.0	47.6	2.7	23.4	7.65	3.00	2.70
4	3A	3	1056	3860.5	140.2	90.5	49.0	2.6	21.6	8.70	3.60	2.87
4	3A	4	1060	3754.4	139.6	87.0	47.6	2.8	23.4	7.95	3.30	2.88
5	3B	1	1051	3970.2	150.5	92.0	47.6	3.0	23.8	7.20	3.00	2.70
5	3B	2	1064	3609.0	144.2	91.5	46.2	3.1	19.4	7.95	3.45	2.80
5	3B	3	1055	4050.1	146.5	88.5	44.8	2.7	24.2	7.50	3.15	2.84
5	3B	4	1059	3627.7	145.6	91.0	45.5	2.7	20.0	7.95	3.15	2.86
6	4A	1	1099	4048.5	142.7	94.0	50.4	2.8	21.6	7.95	2.85	2.46
6	4A	2	1111	3707.9	140.4	85.0	47.6	2.9	20.8	8.00	3.75	2.62
6	4A	3	1110	3835.0	146.5	91.0	49.0	3.0	26.2	7.95	2.70	2.50
6	4A	4	1106	3868.0	148.0	90.0	51.8	3.1	24.2	8.10	2.70	2.75
7	4B	1	1100	4034.4	148.1	94.5	48.7	3.2	23.7	8.70	3.15	2.30
7	4B	2	1112	3648.0	151.0	93.9	44.8	2.7	24.4	8.55	3.15	2.33
7	4B	3	1109	3839.6	147.9	94.0	46.2	3.1	23.6	8.70	2.85	2.45
7	4B	4	1105	3926.7	140.8	90.0	47.6	3.1	19.6	8.55	3.45	2.72
8	4C	1	1113	4050.4	147.1	95.0	49.0	3.3	22.7	7.80	3.00	2.65
8	4C	2	1101	3879.8	141.0	85.0	49.0	3.1	23.0	8.51	3.15	2.29
8	4C	3	1104	3902.6	139.4	85.0	51.8	2.6	26.6	8.25	2.85	2.32
8	4C	4	1108	3895.7	137.8	84.8	49.0	2.6	22.6	8.85	3.15	2.58
9	4D	1	1114	4060.8	138.7	92.6	47.6	3.1	27.4	8.75	3.45	2.56
9	4D	2	1102	3725.1	148.2	89.5	50.4	2.9	19.8	8.70	2.85	2.59
9	4D	3	1103	3915.9	142.1	85.0	47.6	3.5	23.8	8.40	3.00	2.21
9	4D	4	1107	3953.0	140.0	87.3	50.4	3.3	22.2	8.70	3.00	2.35
10	5A	1	1082	3974.0	149.7	85.0	46.2	2.8	26.2	7.65	3.00	2.20
10	5A	2	1079	3651.8	143.1	86.0	49.7	3.1	24.4	7.31	3.00	2.45
10	5A	3	1077	3772.0	136.3	85.5	47.6	2.6	24.9	7.20	3.00	2.32
10	5A	4	1076	3929.6	139.2	85.5	50.4	2.8	21.8	7.50	3.30	2.53
11	5B	1	1081	3623.0	145.2	93.5	44.8	2.6	23.6	8.10	3.30	2.49
11	5B	2	1080	3743.7	142.7	89.5	47.6	3.2	23.4	7.20	3.30	2.26
11	5B	3	1078	3702.0	143.8	91.0	46.2	2.7	20.8	7.43	3.15	2.67
11	5B	4	1075	3839.9	139.1	91.3	46.2	2.7	23.6	7.50	3.15	2.21
12	6A	1	1115	3824.3	143.9	90.5	44.8	3.0	24.0	7.80	2.70	2.14
12	6A	2	1118	3889.0	146.4	90.5	47.6	3.1	25.4	8.25	2.70	2.13
12	6A	3	1125	3842.2	144.0	89.5	49.0	3.1	26.8	7.50	2.70	2.17
12	6A	4	1123	3741.5	146.7	89.0	44.8	3.1	22.0	7.95	2.70	2.34
13	6B	1	1129	3607.3	139.2	94.0	49.0	3.1	19.0	7.65	2.85	2.22
13	6B	2	1127	3698.7	146.2	91.5	46.2	3.3	24.6	8.40	3.00	2.20
13	6B	3	1119	3779.0	141.2	94.0	47.6	3.1	21.8	8.55	2.85	2.10
13	6B	4	1124	3781.3	148.8	91.3	46.2	2.8	18.0	8.10	3.00	2.54

[(1)] Seed weight. [(2)] Plant height.

Continuing …

T#	T#	Rep	Plot#	Yield (kg/ha)	SW[(1)] (g/1000)	PH[(2)] (cm)	Nutrient leaf status (g/kg)					
							N	P	K	Ca	Mg	S
14	7A	1	1116	3848.9	136.0	89.5	49.0	2.8	23.6	8.40	3.45	2.19
14	7A	2	1128	3654.5	143.2	90.5	47.6	2.8	18.2	8.55	3.45	2.17
14	7A	3	1120	3815.4	138.8	94.0	46.2	2.8	22.4	8.40	3.15	2.15
14	7A	4	1122	3856.0	147.9	92.5	47.6	3.1	26.4	8.25	3.45	2.49
15	7B	1	1130	3987.0	141.9	93.5	46.2	2.6	22.2	7.80	3.30	2.07
15	7B	2	1117	3723.5	142.2	91.5	50.4	3.1	21.4	8.25	3.70	2.57
15	7B	3	1126	3817.6	148.8	93.2	47.6	3.2	19.0	8.70	3.60	2.40
15	7B	4	1121	3774.9	142.1	94.5	49.0	2.5	20.8	8.85	3.90	2.80
16	8A	1	1131	3615.0	143.0	88.0	50.4	2.8	23.4	8.25	2.85	2.03
16	8A	2	1134	3665.1	138.5	95.5	49.0	2.9	27.6	8.85	3.30	2.07
16	8A	3	1135	3954.1	138.5	96.0	46.2	3.1	26.0	8.70	3.15	2.02
16	8A	4	1140	3772.3	136.5	94.1	49.0	2.8	25.5	8.85	3.00	2.03
17	8B	1	1146	3920.8	142.1	86.0	46.9	3.1	21.0	8.55	3.00	1.89
17	8B	2	1144	3853.4	137.2	93.5	49.0	3.0	24.6	8.55	3.60	2.01
17	8B	3	1142	3736.6	138.6	89.0	47.6	2.7	25.0	8.40	3.00	1.91
17	8B	4	1137	4013.2	138.8	95.5	50.4	3.0	24.7	8.40	3.00	2.05
18	9A	1	1132	3777.0	150.6	93.5	49.0	2.8	22.8	8.70	2.55	2.18
18	9A	2	1143	3980.8	148.0	92.5	46.2	2.8	27.2	7.95	2.70	1.95
18	9A	3	1141	3708.0	150.0	95.0	47.6	2.9	25.2	8.60	2.85	2.12
18	9A	4	1138	3899.7	148.1	95.0	44.8	2.7	25.7	8.70	2.85	2.14
19	9B	1	1145	4031.3	135.4	86.5	47.6	2.8	23.8	8.60	3.15	2.14
19	9B	2	1133	3837.8	136.0	95.5	48.3	3.3	23.2	7.65	2.85	2.45
19	9B	3	1136	4050.0	147.1	95.8	47.6	3.2	26.7	8.70	3.00	2.37
19	9B	4	1139	3973.0	136.1	97.5	46.2	3.4	29.2	9.30	3.15	2.30
20	11A	1	1098	3984.1	138.1	83.3	50.4	2.6	19.4	8.55	3.00	2.30
20	11A	2	1085	3808.4	141.3	81.0	47.6	3.1	20.4	8.25	3.60	2.38
20	11A	3	1094	3923.0	147.2	87.0	47.6	2.6	22.4	7.80	3.15	2.21
20	11A	4	1092	3977.1	146.5	86.0	48.3	2.6	26.6	7.65	3.15	2.47
21	11B	1	1084	3698.8	138.2	88.0	49.0	3.3	25.6	7.95	3.60	2.34
21	11B	2	1095	3774.0	142.6	86.5	50.4	3.2	25.8	8.25	3.60	2.64
21	11B	3	1087	3948.0	142.8	88.5	44.8	3.1	25.6	8.10	3.45	2.27
21	11B	4	1091	3783.9	136.4	86.5	47.6	2.8	21.2	7.95	3.30	2.50
22	11C	1	1097	3972.0	148.5	92.0	46.2	2.7	23.2	9.45	3.45	2.63
22	11C	2	1096	3745.9	140.5	84.5	49.5	3.1	25.0	7.35	3.30	2.45
22	11C	3	1093	3826.4	136.7	79.5	50.4	2.7	24.7	7.65	3.60	2.45
22	11C	4	1090	3934.5	146.5	91.5	49.0	2.9	22.6	8.10	3.45	2.37
23	12A	1	1068	3743.0	143.0	87.5	49.0	3.1	19.6	8.25	3.75	2.99
23	12A	2	1069	3690.5	141.9	90.5	47.6	2.9	18.4	7.50	3.30	2.50
23	12A	3	1072	3752.4	142.1	89.5	46.2	2.6	19.2	7.50	3.15	2.24
23	12A	4	1073	3963.0	149.3	87.0	47.6	2.9	20.4	7.20	3.15	2.36
24	12B	1	1067	3933.0	144.0	92.0	46.2	2.5	21.8	7.20	3.00	2.60
24	12B	2	1070	3900.7	150.3	90.0	49.0	2.7	26.0	7.80	3.15	2.45
24	12B	3	1071	3876.7	143.3	89.5	47.6	3.0	22.2	7.20	3.00	2.61
24	12B	4	1074	3839.8	135.5	93.0	44.8	2.8	24.0	6.90	3.00	2.14

(1) Seed weight. (2) Plant height.

Appendix B. Raw data of maize agronomical features and nutritional status, season 2013-2014.

T#	T#	Rep	Plot#	Yield (kg/ha)	SW[(1)] (g/1000)	PH[(2)] (cm)	Nutrient leaf status (g/kg)					
							N	P	K	Ca	Mg	S
1	1	1	1083	8515.1	276.7	230.5	39.2	2.4	20.2	5.25	2.70	1.67
1	1	2	1086	7952.6	266.3	227.0	35.0	2.6	18.6	5.40	2.85	1.71
1	1	3	1088	7938.9	285.7	228.0	35.0	2.7	16.2	5.40	3.00	1.90
1	1	4	1089	8340.0	283.2	229.5	36.4	2.3	17.6	5.70	3.15	1.74
2	2A	1	1065	9816.9	314.5	230.5	33.6	2.2	16.6	4.95	3.75	1.70
2	2A	2	1053	8489.8	281.4	230.5	33.6	2.4	15.0	4.65	3.15	1.70
2	2A	3	1062	9898.8	305.9	233.5	37.8	2.2	16.6	5.10	3.90	1.71
2	2A	4	1057	7914.1	270.6	228.0	36.4	2.2	15.2	4.65	3.60	1.60
3	2B	1	1066	8810.8	310.6	236.5	36.4	2.4	18.0	4.80	3.75	1.64
3	2B	2	1054	8555.3	284.8	229.0	39.2	2.3	17.0	4.95	3.75	1.76
3	2B	3	1061	9071.8	287.2	236.5	33.6	2.7	16.0	4.95	3.60	2.03
3	2B	4	1058	9426.1	274.4	229.0	35.0	2.5	17.2	5.25	3.80	1.66
4	3A	1	1052	9692.8	308.4	229.0	35.0	2.2	15.2	4.80	3.45	1.83
4	3A	2	1063	9158.6	301.4	240.5	36.4	2.3	15.8	4.35	2.85	1.65
4	3A	3	1056	8653.8	309.4	233.5	33.6	2.7	15.6	4.05	2.85	1.77
4	3A	4	1060	9184.0	281.8	240.3	35.0	2.3	18.6	4.65	3.30	1.66
5	3B	1	1051	8948.5	311.0	237.5	32.2	2.5	16.2	5.10	3.90	2.02
5	3B	2	1064	8648.8	285.4	234.3	39.2	2.3	17.0	5.10	3.90	2.10
5	3B	3	1055	9223.1	284.0	236.0	35.0	2.6	17.8	4.20	3.00	1.65
5	3B	4	1059	8801.4	299.1	237.0	37.8	2.6	17.4	4.50	3.75	1.80
6	4A	1	1099	9385.9	324.2	236.5	39.2	2.7	21.0	4.35	2.55	2.04
6	4A	2	1111	8969.5	324.6	237.0	33.6	2.6	15.0	4.50	2.55	1.76
6	4A	3	1110	9209.1	292.4	235.5	36.4	2.7	21.4	4.35	2.40	2.21
6	4A	4	1106	9505.4	306.3	241.0	35.0	2.5	20.2	4.35	2.25	1.76
7	4B	1	1100	9326.5	303.7	239.0	35.0	2.6	17.2	4.20	2.25	2.05
7	4B	2	1112	9011.4	306.9	229.0	39.2	2.7	16.4	4.80	2.55	1.72
7	4B	3	1109	9363.5	293.3	234.0	35.0	2.7	20.6	4.65	2.55	1.74
7	4B	4	1105	8908.1	292.6	230.5	32.2	2.7	21.0	3.90	2.10	1.93
8	4C	1	1113	9932.7	289.1	236.0	42.0	2.4	17.8	5.25	2.85	1.75
8	4C	2	1101	9290.9	322.3	236.5	40.6	2.8	19.4	4.80	2.85	1.85
8	4C	3	1104	9302.3	295.8	237.0	44.8	2.3	20.6	4.50	2.40	1.71
8	4C	4	1108	9272.3	291.2	233.0	42.0	2.6	20.0	4.20	2.25	1.73
9	4D	1	1114	8111.9	325.6	235.5	37.8	2.6	24.4	4.95	2.70	1.75
9	4D	2	1102	8482.8	316.5	231.5	35.0	2.5	20.8	4.95	2.70	1.92
9	4D	3	1103	9366.0	288.2	238.5	39.2	2.7	19.8	4.65	2.55	1.97
9	4D	4	1107	9305.4	299.9	240.0	40.6	2.8	19.6	4.50	2.40	1.67
10	5A	1	1082	9172.7	294.9	241.0	36.4	2.4	21.4	3.60	1.95	1.71
10	5A	2	1079	8485.8	302.0	238.0	35.0	2.2	21.2	3.30	1.95	1.74
10	5A	3	1077	8512.0	294.7	234.0	39.2	2.5	21.6	3.45	1.65	1.84
10	5A	4	1076	8372.2	287.8	237.5	33.6	2.3	17.6	3.60	1.80	2.08
11	5B	1	1081	9018.9	329.1	238.0	36.8	2.2	19.2	4.50	2.55	1.98
11	5B	2	1080	9231.0	309.8	231.5	33.6	2.1	19.4	4.20	2.10	1.82
11	5B	3	1078	8817.5	286.7	238.5	37.8	2.7	21.8	3.75	1.80	2.10
11	5B	4	1075	9466.7	322.2	236.5	35.0	2.4	20.4	4.50	2.40	2.16
12	6A	1	1115	9136.6	302.9	237.5	35.0	2.7	24.8	4.65	2.40	1.72
12	6A	2	1118	8357.9	295.3	233.0	40.6	2.9	19.2	5.10	2.85	1.68
12	6A	3	1125	8939.7	298.7	242.5	35.0	2.4	19.4	3.90	2.10	2.12
12	6A	4	1123	8811.4	296.8	238.0	39.2	2.7	20.8	4.35	2.40	1.86
13	6B	1	1129	9220.8	310.3	240.5	35.0	2.4	23.2	4.50	2.40	1.70
13	6B	2	1127	8720.9	298.4	243.0	40.6	2.6	23.8	4.20	2.25	1.70
13	6B	3	1119	8991.6	307.9	233.0	32.2	2.7	23.8	4.95	2.70	1.71
13	6B	4	1124	8650.4	298.1	241.0	33.6	2.6	24.2	4.50	2.55	1.67

[(1)] Seed weight. [(2)] Plant height.

Continuing …

T#	T#	Rep	Plot#	Yield (kg/ha)	SW[(1)] (g/1000)	PH[(2)] (cm)	Nutrient leaf status (g/kg)					
							N	P	K	Ca	Mg	S
14	7A	1	1116	10145.1	311.1	242.0	30.8	2.9	17.2	4.95	2.85	1.78
14	7A	2	1128	9029.9	302.6	245.0	33.6	2.7	24.2	4.80	2.70	1.76
14	7A	3	1120	10568.9	305.7	238.0	36.4	2.5	17.8	4.50	2.55	1.70
14	7A	4	1122	10634.7	304.1	245.0	37.8	2.7	23.4	4.65	2.70	1.75
15	7B	1	1130	9669.1	303.9	242.1	35.0	2.8	24.2	4.95	2.70	1.66
15	7B	2	1117	9395.0	318.9	240.5	37.8	2.3	20.2	5.14	3.30	1.70
15	7B	3	1126	9254.3	301.7	239.5	32.2	2.5	22.0	4.95	2.85	1.75
15	7B	4	1121	9495.9	290.3	235.5	35.0	2.8	23.2	5.10	3.15	1.72
16	8A	1	1131	9836.1	299.9	244.5	37.8	2.5	22.2	4.05	2.10	2.14
16	8A	2	1134	9253.0	301.0	237.5	35.0	2.6	22.0	4.35	2.40	2.13
16	8A	3	1135	9378.1	286.3	237.5	36.4	2.7	21.8	4.20	2.40	2.10
16	8A	4	1140	9175.8	295.8	232.0	40.6	2.3	20.0	4.05	2.10	1.94
17	8B	1	1146	8621.0	313.0	233.5	35.0	2.7	20.2	5.10	2.85	1.94
17	8B	2	1144	8631.5	303.9	233.5	33.6	2.7	23.4	4.65	2.55	2.03
17	8B	3	1142	8920.0	297.9	232.8	39.2	2.6	21.0	4.80	2.85	2.26
17	8B	4	1137	9027.4	284.8	237.5	37.8	2.7	22.6	4.65	2.55	1.72
18	9A	1	1132	8454.6	299.8	243.5	35.0	2.7	20.6	4.20	2.25	1.77
18	9A	2	1143	9594.8	280.2	230.5	35.0	2.4	21.8	5.10	2.70	1.74
18	9A	3	1141	9282.7	298.2	235.5	33.6	2.5	21.6	4.95	2.70	1.68
18	9A	4	1138	8896.5	302.6	240.5	39.2	3.0	21.6	4.43	2.40	1.81
19	9B	1	1145	9926.9	290.1	236.5	39.2	3.1	22.7	4.50	2.40	2.00
19	9B	2	1133	9752.1	305.5	237.0	33.6	2.7	22.6	4.80	2.85	1.72
19	9B	3	1136	8562.5	285.2	238.5	37.8	2.8	20.4	5.10	2.85	1.86
19	9B	4	1139	9107.7	304.5	233.5	35.0	2.8	22.8	4.80	2.70	1.75
20	11A	1	1098	8657.2	303.2	237.0	40.6	2.2	20.8	4.01	2.10	1.97
20	11A	2	1085	9731.3	295.4	241.5	37.8	2.7	15.6	4.35	2.40	1.77
20	11A	3	1094	8803.1	300.3	237.5	39.2	2.5	17.8	4.95	2.85	1.90
20	11A	4	1092	9811.1	279.2	240.5	36.4	2.4	18.8	3.45	1.80	1.84
21	11B	1	1084	9310.3	316.2	240.5	36.4	2.5	21.4	4.20	2.25	1.78
21	11B	2	1095	9556.3	309.7	234.5	35.7	2.4	18.0	5.10	2.85	1.82
21	11B	3	1087	8954.2	304.8	238.5	36.4	2.4	15.8	4.05	2.10	2.03
21	11B	4	1091	8637.5	284.0	240.0	39.2	2.6	23.8	3.75	1.95	1.79
22	11C	1	1097	9001.6	289.1	233.5	36.4	2.6	23.6	4.65	2.55	1.89
22	11C	2	1096	8777.9	290.7	234.5	37.8	2.5	20.0	4.50	2.70	2.05
22	11C	3	1093	9210.6	302.7	238.0	35.0	2.3	20.6	4.80	2.55	1.79
22	11C	4	1090	9398.5	291.2	240.0	37.8	2.4	18.8	4.50	2.70	2.31
23	12A	1	1068	9322.4	297.9	240.0	36.4	2.2	18.8	4.20	2.85	1.74
23	12A	2	1069	9152.3	316.3	232.5	33.6	2.2	19.4	4.05	2.40	1.66
23	12A	3	1072	9056.6	303.1	239.5	37.8	2.4	21.6	3.60	2.40	1.70
23	12A	4	1073	9849.0	300.6	247.5	36.4	2.6	22.0	3.45	1.95	1.80
24	12B	1	1067	9463.4	309.4	241.5	35.0	2.1	20.8	3.45	2.10	1.68
24	12B	2	1070	9259.9	303.3	237.5	39.2	2.6	23.8	3.00	2.25	1.63
24	12B	3	1071	9693.1	300.2	240.0	35.0	2.5	21.4	3.45	1.80	1.64
24	12B	4	1074	9118.9	296.6	243.0	39.2	2.7	20.2	4.05	2.10	1.80

[(1)] Seed weight. [(2)] Plant height.

Appendix C. Raw data of soil testing after the maize harvest, season 2013-2014.

T#	T#	Rep	Plot#	Soil pH		P	K	Ca	Mg	H	CEC	OM	BS
				H_2O	$CaCl_2$	mg/dm^3		cmol$_c$/dm^3				g/kg	%
1	1	1	1083	5.6	4.8	12.6	30	2.4	0.9	5.2	8.6	35.8	3.4
1	1	2	1086	5.7	5.0	17.4	29	2.9	1.0	5.2	9.2	39.9	4.0
1	1	3	1088	5.6	4.8	15.4	31	2.3	0.9	5.1	8.4	34.8	3.3
1	1	4	1089	5.7	4.9	16.1	30	2.7	1.0	5.0	8.8	36.8	3.8
2	2A	1	1065	5.8	5.1	14.4	30	2.7	1.0	4.2	8.0	33.9	3.8
2	2A	2	1053	6.0	5.2	15.4	24	2.9	1.2	4.6	8.8	37.8	4.2
2	2A	3	1062	5.8	5.1	10.9	25	2.5	1.0	4.2	7.8	32.1	3.6
2	2A	4	1057	5.8	5.1	12.6	28	2.8	1.0	4.5	8.4	33.9	3.9
3	2B	1	1066	6.0	5.2	14.9	25	3.1	1.2	4.3	8.7	35.8	4.4
3	2B	2	1054	5.8	5.0	12.6	27	2.7	1.0	4.6	8.4	34.8	3.8
3	2B	3	1061	5.8	5.0	10.5	27	2.3	0.9	4.1	7.4	30.4	3.3
3	2B	4	1058	5.9	5.1	15.9	24	2.9	1.1	4.2	8.3	35.8	4.1
4	3A	1	1052	5.9	5.1	13.5	32	3.0	1.1	4.4	8.6	36.8	4.2
4	3A	2	1063	5.7	5.0	11.7	28	2.8	1.0	5.0	8.9	36.8	3.9
4	3A	3	1056	5.7	4.9	12.2	26	2.4	1.0	4.8	8.3	34.8	3.5
4	3A	4	1060	6.0	5.3	11.7	29	3.3	1.2	4.3	8.9	37.8	4.6
5	3B	1	1051	5.8	5.0	13.0	37	2.6	1.0	4.5	8.2	35.8	3.7
5	3B	2	1064	5.9	5.1	14.9	34	3.1	1.1	4.7	9.0	38.9	4.3
5	3B	3	1055	5.6	4.8	14.4	28	2.2	0.8	4.5	7.6	31.2	3.1
5	3B	4	1059	6.0	5.2	15.2	27	3.2	1.2	4.4	8.9	36.8	4.5
6	4A	1	1099	5.8	5.0	11.3	33	2.6	1.0	4.7	8.4	35.8	3.7
6	4A	2	1111	5.9	5.1	14.0	32	2.9	1.1	4.5	8.6	34.8	4.1
6	4A	3	1110	6.0	5.2	14.9	30	3.0	1.2	4.7	9.0	39.9	4.3
6	4A	4	1106	5.9	5.1	15.4	35	3.0	1.1	4.6	8.8	36.8	4.2
7	4B	1	1100	5.9	5.1	12.2	30	2.9	1.1	4.4	8.5	36.8	4.1
7	4B	2	1112	5.8	5.1	12.2	33	2.8	1.0	4.4	8.3	33.0	3.9
7	4B	3	1109	5.7	4.9	13.0	33	2.5	1.0	5.0	8.6	33.0	3.6
7	4B	4	1105	5.7	5.0	12.6	30	2.3	0.9	4.1	7.4	29.5	3.3
8	4C	1	1113	5.7	5.0	13.5	30	2.5	0.9	4.5	8.0	33.9	3.5
8	4C	2	1101	5.8	5.0	11.3	34	2.7	1.0	4.4	8.2	33.9	3.8
8	4C	3	1104	5.6	4.8	13.5	33	2.1	0.8	4.6	7.6	30.4	3.0
8	4C	4	1108	5.6	4.9	11.7	28	2.4	1.0	5.0	8.5	34.8	3.5
9	4D	1	1114	5.7	4.9	11.7	31	2.5	1.0	4.8	8.4	34.8	3.6
9	4D	2	1102	5.8	5.1	11.7	32	2.8	1.0	4.4	8.3	34.8	3.9
9	4D	3	1103	5.8	5.0	10.5	31	2.6	1.0	4.3	8.0	32.1	3.7
9	4D	4	1107	5.8	5.1	14.9	31	2.8	1.0	4.3	8.2	33.9	3.9
10	5A	1	1082	5.7	4.9	14.0	34	2.6	1.0	5.2	8.9	37.8	3.7
10	5A	2	1079	5.7	4.9	12.2	33	2.8	1.0	5.2	9.1	38.9	3.9
10	5A	3	1077	5.5	4.8	12.2	32	2.3	0.8	5.1	8.4	34.8	3.2
10	5A	4	1076	5.7	5.0	11.7	28	2.6	1.0	4.9	8.6	35.8	3.7
11	5B	1	1081	6.0	5.2	13.0	30	3.1	1.2	4.6	9.0	39.9	4.4
11	5B	2	1080	5.9	5.2	14.4	31	3.2	1.2	4.5	9.0	37.8	4.5
11	5B	3	1078	5.8	5.0	12.6	31	2.9	1.1	4.8	8.9	36.8	4.1
11	5B	4	1075	5.9	5.2	14.0	30	3.2	1.2	4.6	9.1	38.9	4.5
12	6A	1	1115	5.6	4.8	12.6	28	2.3	0.9	4.8	8.1	33.0	3.3
12	6A	2	1118	5.7	5.0	14.4	32	2.7	1.0	4.8	8.6	35.8	3.8
12	6A	3	1125	5.6	4.8	11.7	31	2.2	0.9	4.8	8.0	33.0	3.2
12	6A	4	1123	5.6	4.9	12.6	33	2.3	0.9	5.0	8.3	34.8	3.3
13	6B	1	1129	5.7	4.9	11.3	30	2.5	1.0	5.0	8.6	35.8	3.6
13	6B	2	1127	5.6	4.8	12.6	30	2.5	0.9	5.2	8.7	37.8	3.5
13	6B	3	1119	5.8	5.0	13.5	29	2.8	1.0	4.9	8.8	36.8	3.9
13	6B	4	1124	5.5	4.8	10.5	29	2.2	0.8	4.8	8.0	33.9	3.1

Continuing …

T#	T#	Rep	Plot#	Soil pH		P	K	Ca	Mg	H	CEC	OM	BS
				H_2O	$CaCl_2$	mg/dm^3		cmol$_c$/dm^3				g/kg	%
14	7A	1	1116	6.2	5.4	10.5	33	3.2	1.2	3.3	7.8	32.1	57.6
14	7A	2	1128	6.3	5.5	9.7	29	3.6	1.3	3.3	8.3	33.9	60.1
14	7A	3	1120	6.2	5.4	10.9	30	3.3	1.2	3.5	8.1	33.9	56.7
14	7A	4	1122	6.4	5.6	11.7	31	3.6	1.2	2.8	7.7	32.1	63.5
15	7B	1	1130	6.2	5.5	10.5	33	3.4	1.2	3.4	8.1	33.9	57.9
15	7B	2	1117	6.3	5.6	12.2	32	3.3	1.2	2.7	7.3	30.4	62.9
15	7B	3	1126	6.2	5.5	12.2	28	3.8	1.3	3.6	8.8	36.8	59.0
15	7B	4	1121	6.5	5.7	9.3	28	3.7	1.3	2.3	7.4	31.2	68.8
16	8A	1	1131	5.8	5.0	10.9	35	2.4	0.9	4.0	7.4	31.2	45.9
16	8A	2	1134	6.0	5.2	13.5	34	2.6	1.0	3.7	7.4	31.2	49.9
16	8A	3	1135	5.7	4.9	15.4	33	2.2	0.8	4.3	7.4	30.4	41.8
16	8A	4	1140	5.7	4.9	13.3	33	2.3	0.9	4.2	7.5	30.4	43.9
17	8B	1	1146	5.7	4.9	6.7	30	2.4	0.9	4.7	8.1	33.0	41.8
17	8B	2	1144	5.8	5.0	7.7	29	2.6	1.0	4.5	8.2	35.8	44.9
17	8B	3	1142	5.8	5.1	5.9	33	2.8	1.0	4.4	8.3	33.9	46.9
17	8B	4	1137	5.7	4.9	10.1	28	2.4	0.9	4.3	7.8	27.9	43.4
18	9A	1	1132	5.6	4.8	10.1	28	2.4	0.9	5.1	8.5	34.8	39.8
18	9A	2	1143	6.0	5.2	12.5	32	3.2	1.2	4.4	8.9	36.8	50.5
18	9A	3	1141	6.1	5.4	12.5	32	2.6	1.1	4.4	8.2	41.0	46.2
18	9A	4	1138	5.6	4.8	14.9	31	2.3	0.9	4.9	8.2	33.9	40.1
19	9B	1	1145	5.9	5.1	12.7	31	2.9	1.1	4.3	8.4	33.9	48.7
19	9B	2	1133	5.8	5.0	12.6	29	2.9	1.0	4.7	8.7	36.8	45.8
19	9B	3	1136	5.9	5.2	12.6	30	3.1	1.1	4.3	8.6	35.8	49.9
19	9B	4	1139	5.8	5.1	13.0	29	2.7	1.0	4.2	8.0	34.8	47.3
20	11A	1	1098	5.6	4.9	10.5	30	2.3	0.9	4.6	7.9	32.1	41.6
20	11A	2	1085	5.9	5.2	17.9	32	3.1	1.1	4.4	8.7	37.8	49.3
20	11A	3	1094	5.8	5.1	17.9	30	2.8	1.0	4.5	8.4	34.8	46.3
20	11A	4	1092	5.6	4.9	19.0	36	2.5	1.0	5.2	8.8	35.8	40.9
21	11B	1	1084	6.0	5.2	16.9	31	3.2	1.2	4.4	8.9	36.8	50.4
21	11B	2	1095	5.7	4.9	15.4	31	2.6	1.0	4.9	8.6	35.8	42.9
21	11B	3	1087	5.8	5.1	18.5	28	3.0	1.1	4.7	8.9	37.8	47.0
21	11B	4	1091	5.6	4.8	16.9	32	2.4	0.9	5.0	8.4	34.8	40.3
22	11C	1	1097	5.9	5.1	13.0	33	3.1	1.2	4.7	9.1	38.9	48.3
22	11C	2	1096	6.0	5.2	10.9	32	3.4	1.2	4.6	9.3	37.8	50.4
22	11C	3	1093	5.6	4.8	14.9	32	2.2	0.8	4.8	7.9	32.1	39.1
22	11C	4	1090	5.8	5.1	14.4	31	2.8	1.0	4.4	8.3	33.9	46.9
23	12A	1	1068	5.9	5.1	15.4	31	3.1	1.2	4.6	9.0	38.9	48.8
23	12A	2	1069	5.8	5.1	14.9	29	3.1	1.1	4.7	9.0	36.8	47.6
23	12A	3	1072	5.5	4.7	13.0	31	2.0	0.7	4.7	7.7	31.2	36.2
23	12A	4	1073	5.8	5.0	14.4	30	2.3	1.0	4.1	7.5	30.4	45.2
24	12B	1	1067	6.0	5.3	16.4	30	3.4	1.2	4.5	9.2	37.8	51.0
24	12B	2	1070	5.7	4.9	11.7	32	2.4	0.9	4.6	8.0	33.0	42.4
24	12B	3	1071	5.6	4.8	13.5	34	2.2	0.8	4.6	7.7	32.1	40.2
24	12B	4	1074	6.0	5.2	15.4	33	3.3	1.2	4.6	9.2	37.8	49.9

Appendix D. Raw data of soil testing after the maize harvest and before liming application, season 2012-2013.

T#	Rep	Plot#	Depth	Soil pH		P	K	S	Ca	Mg	Al	BS
			cm	H_2O	$CaCl_2$	mg/dm^3			cmol$_c$/dm^3			%
1	1	1083	0-10	5.6	4.9	19.5	38	6.7	2.8	1.0	0.0	41.4
1	1	1083	10-20	5.3	4.6	16.4	27	8.1	1.9	0.7	0.3	31.5
1	1	1083	20-40	5.3	4.5	2.3	24	38.9	1.2	0.5	0.4	28.3
1	1	1083	40-60	5.4	4.6	1.1	22	45.4	1.1	0.5	0.3	32.1
1	2	1086	0-10	5.7	4.9	19.0	36	6.5	3.0	1.1	0.0	42.6
1	2	1086	10-20	5.6	4.8	13.1	20	7.8	2.3	0.9	0.0	40.8
1	2	1086	20-40	5.3	4.6	3.8	16	9.7	1.6	0.6	0.3	31.7
1	2	1086	40-60	5.3	4.5	1.7	15	36.0	1.0	0.4	0.4	27.1
1	3	1088	0-10	5.7	4.9	11.4	48	5.7	2.7	1.0	0.0	42.9
1	3	1088	10-20	5.4	4.6	8.6	24	6.5	1.7	0.7	0.3	32.8
1	3	1088	20-40	5.1	4.3	3.2	19	34.3	0.8	0.4	0.5	19.1
1	3	1088	40-60	5.2	4.4	1.7	16	36.9	0.8	0.4	0.4	24.3
1	4	1089	0-10	5.7	4.9	21.2	71	6.5	2.7	1.0	0.0	43.1
1	4	1089	10-20	5.3	4.6	13.1	37	7.5	1.9	0.7	0.3	32.4
1	4	1089	20-40	5.3	4.5	3.5	32	18.7	1.3	0.5	0.4	28.4
1	4	1089	40-60	5.2	4.5	1.4	24	43.5	1.0	0.4	0.4	28.2
12+13	1	1115+1129	0-10	5.6	4.8	18.4	82	5.4	2.3	0.9	0.0	38.8
12+13	1	1115+1129	10-20	5.3	4.5	11.8	40	6.7	1.8	0.7	0.3	31.9
12+13	1	1115+1129	20-40	5.3	4.5	3.5	35	19.2	1.3	0.6	0.4	28.1
12+13	1	1115+1129	40-60	5.2	4.5	1.1	32	34.1	1.0	0.4	0.4	27.9
12+13	2	1118+1127	0-10	5.7	4.9	26.5	88	5.5	2.7	1.0	0.0	42.0
12+13	2	1118+1127	10-20	5.5	4.7	14.4	36	6.0	2.2	0.8	0.2	36.4
12+13	2	1118+1127	20-40	5.2	4.5	2.6	34	11.6	1.2	0.5	0.4	25.8
12+13	2	1118+1127	40-60	5.2	4.4	1.7	31	34.8	0.9	0.4	0.4	25.4
12+13	3	1119+1125	0-10	5.7	5.0	15.9	90	6.6	3.0	1.1	0.0	44.4
12+13	3	1119+1125	10-20	5.4	4.7	14.9	40	8.3	1.9	0.7	0.3	34.4
12+13	3	1119+1125	20-40	5.3	4.5	2.6	36	20.2	1.2	0.5	0.4	26.1
12+13	3	1119+1125	40-60	5.2	4.5	1.4	34	34.3	0.9	0.4	0.4	25.9
12+13	4	1123+1124	0-10	5.6	4.9	20.1	87	7.3	2.3	0.9	0.0	40.5
12+13	4	1123+1124	10-20	5.4	4.7	13.5	44	7.8	1.8	0.7	0.3	33.5
12+13	4	1123+1124	20-40	5.3	4.6	7.5	36	10.8	1.6	0.6	0.3	31.7
12+13	4	1123+1124	40-60	5.2	4.5	2.6	32	31.2	0.9	0.4	0.4	25.3
14+15	1	1116+1130	0-10	6.3	5.6	23.1	97	6.7	3.6	1.2	0.0	61.8
14+15	1	1116+1130	10-20	6.1	5.3	20.7	46	8.1	3.0	1.1	0.0	53.4
14+15	1	1116+1130	20-40	5.3	4.5	6.4	37	12.7	1.4	0.6	0.3	30.6
14+15	1	1116+1130	40-60	5.2	4.4	1.7	34	47.0	0.9	0.4	0.4	24.8
14+15	2	1117+1128	0-10	6.4	5.6	15.4	70	5.6	3.5	1.2	0.0	63.6
14+15	2	1117+1128	10-20	6.2	5.4	12.2	36	6.5	3.0	1.1	0.0	56.7
14+15	2	1117+1128	20-40	5.3	4.6	3.2	33	27.3	1.2	0.5	0.4	29.6
14+15	2	1117+1128	40-60	5.3	4.5	2.6	24	33.9	1.1	0.4	0.3	30.0
14+15	3	1120+1126	0-10	6.1	5.3	15.4	87	5.7	3.3	1.2	0.0	53.2
14+15	3	1120+1126	10-20	5.8	5.1	14.0	39	7.9	2.6	1.0	0.0	46.7
14+15	3	1120+1126	20-40	5.4	4.6	4.4	37	19.2	1.4	0.6	0.3	32.6
14+15	3	1120+1126	40-60	5.3	4.5	1.4	30	37.9	0.9	0.4	0.4	28.0
14+15	4	1121+1122	0-10	6.3	5.5	22.5	98	6.8	3.6	1.3	0.0	58.9
14+15	4	1121+1122	10-20	6.1	5.2	12.2	38	8.5	2.6	1.0	0.0	52.1
14+15	4	1121+1122	20-40	5.2	4.5	2.9	31	29.4	1.0	0.4	0.4	25.6
14+15	4	1121+1122	40-60	5.3	4.5	1.7	29	48.2	1.0	0.4	0.4	28.1

Continuing …

T#	Rep	Plot#	Depth	Soil pH		P	K	S	Ca	Mg	Al	BS
			cm	H_2O	$CaCl_2$	mg/dm^3			cmol$_c$/dm^3			%
16+17	1	1131+1146	0-10	5.5	4.7	19.0	76	7.6	2.3	0.9	0.2	37.0
16+17	1	1131+1146	10-20	5.4	4.6	10.2	38	9.0	1.9	0.7	0.3	33.8
16+17	1	1131+1146	20-40	5.2	4.5	2.6	35	34.6	1.0	0.4	0.4	26.8
16+17	1	1131+1146	40-60	5.1	4.3	1.4	31	49.7	0.7	0.3	0.5	20.3
16+17	2	1134+1144	0-10	5.7	5.0	24.4	68	6.7	3.0	1.1	0.0	45.0
16+17	2	1134+1144	10-20	5.6	4.9	16.4	39	7.6	2.6	1.0	0.0	41.9
16+17	2	1134+1144	20-40	5.2	4.5	3.2	35	21.8	1.1	0.5	0.4	25.1
16+17	2	1134+1144	40-60	5.2	4.4	1.4	32	30.0	0.9	0.4	0.4	24.0
16+17	3	1135+1142	0-10	5.6	4.9	24.4	49	6.6	2.7	1.0	0.0	41.5
16+17	3	1135+1142	10-20	5.4	4.6	16.9	34	8.3	1.8	0.7	0.3	32.1
16+17	3	1135+1142	20-40	5.2	4.4	2.9	28	23.0	1.1	0.5	0.4	24.7
16+17	3	1135+1142	40-60	5.3	4.5	2.0	26	39.0	1.0	0.4	0.4	26.7
16+17	4	1137+1140	0-10	5.4	4.6	14.9	53	9.1	1.8	0.7	0.3	33.0
16+17	4	1137+1140	10-20	5.3	4.6	10.6	39	11.4	1.6	0.6	0.3	32.3
16+17	4	1137+1140	20-40	5.2	4.5	6.1	36	12.5	1.3	0.6	0.4	29.6
16+17	4	1137+1140	40-60	5.3	4.5	1.7	28	27.0	1.1	0.5	0.3	31.4
18+19	1	1132+1145	0-10	5.6	4.8	16.9	62	6.8	2.6	1.0	0.0	39.9
18+19	1	1132+1145	10-20	5.5	4.7	11.0	34	8.3	1.8	0.7	0.2	36.9
18+19	1	1132+1145	20-40	5.3	4.5	5.1	31	40.1	1.2	0.5	0.4	28.8
18+19	1	1132+1145	40-60	5.4	4.6	1.4	30	53.4	1.1	0.5	0.3	33.5
18+19	2	1133+1143	0-10	5.9	5.1	16.4	66	7.3	3.1	1.1	0.0	48.9
18+19	2	1133+1143	10-20	5.7	5.0	10.2	36	8.9	2.7	1.0	0.0	44.0
18+19	2	1133+1143	20-40	5.4	4.6	3.2	34	24.1	1.3	0.6	0.3	33.3
18+19	2	1133+1143	40-60	5.3	4.5	2.6	29	51.2	1.2	0.5	0.3	31.4
18+19	3	1136+1141	0-10	5.8	5.1	19.5	77	7.1	3.0	1.1	0.0	47.1
18+19	3	1136+1141	10-20	5.7	5.0	11.0	40	9.3	2.3	0.9	0.0	44.3
18+19	3	1136+1141	20-40	5.4	4.6	3.8	34	35.4	1.4	0.6	0.3	33.6
18+19	3	1136+1141	40-60	5.3	4.6	2.3	30	60.0	1.1	0.5	0.3	30.4
18+19	4	1138+1139	0-10	5.6	4.8	15.4	90	6.5	2.3	0.9	0.0	39.7
18+19	4	1138+1139	10-20	5.5	4.7	11.0	37	8.5	2.0	0.8	0.2	36.7
18+19	4	1138+1139	20-40	5.3	4.6	2.9	34	29.9	1.4	0.6	0.3	32.2
18+19	4	1138+1139	40-60	5.5	4.7	2.0	30	45.9	1.3	0.6	0.2	37.0
6+7	1	1099+1100	0-10	5.6	4.9	11.8	63	6.6	2.6	1.0	0.0	41.1
6+7	1	1099+1100	10-20	5.4	4.7	8.6	38	7.9	2.0	0.7	0.3	35.1
6+7	1	1099+1100	20-40	5.2	4.5	2.0	34	21.2	1.1	0.4	0.4	26.6
6+7	1	1099+1100	40-60	5.3	4.5	1.4	28	36.8	0.9	0.4	0.4	26.3
6+7	2	1112+1111	0-10	5.8	5.0	13.5	96	5.8	2.9	1.1	0.0	45.9
6+7	2	1112+1111	10-20	5.6	4.8	9.4	37	7.8	2.3	0.9	0.0	39.9
6+7	2	1112+1111	20-40	5.2	4.5	3.8	30	18.0	1.1	0.5	0.4	24.7
6+7	2	1112+1111	40-60	5.2	4.4	2.3	28	29.6	0.9	0.4	0.4	24.3
6+7	3	1110+1109	0-10	5.4	4.7	13.1	61	5.8	2.2	0.8	0.3	35.1
6+7	3	1110+1109	10-20	5.3	4.5	9.4	39	7.6	1.7	0.7	0.4	28.7
6+7	3	1110+1109	20-40	5.1	4.3	3.8	34	17.8	1.1	0.4	0.4	23.8
6+7	3	1110+1109	40-60	5.2	4.4	1.4	26	28.9	0.9	0.4	0.4	24.7
6+7	4	1105+1106	0-10	5.6	4.8	14.0	51	5.4	2.4	0.9	0.0	39.0
6+7	4	1105+1106	10-20	5.6	4.9	9.8	37	7.8	2.2	0.8	0.0	39.8
6+7	4	1105+1106	20-40	5.4	4.6	3.5	32	20.7	1.4	0.6	0.3	33.4
6+7	4	1105+1106	40-60	5.3	4.5	1.7	30	46.7	1.0	0.4	0.4	28.1

Estação Experimental Cachoeira

SAFRA 2013/2014

75,6 m

95 m

6,3 m	6,3 m	6,3 m	6,3 m	6,3 m	6,3 m	6,3 m	6,3 m	6,3 m	6,3 m	6,3 m	6,3 m	
3 NPK0 1058	**5** NPK0 1059	**24** NPK3 (sup) 1074	**11** NPK0 1075	**22** NPK3 1090	**21** NPK3 1091	**6** NPK3 1106	**9** NPK2 1107	**14** NPK3 1122	**12** NPK3 1123	**18** NPK3 1138	**19** NPK0 1139	9,5 m
corredor de 3 m												
2 NPK1 1057	**4** NPK2 1060	**23** NPK3 (2cob) 1073	**10** NPK4 1076	**1** NPK0 1089	**20** NPK3 1092	**7** NPK0 1105	**8** NPK1 1108	**15** NPK0 1121	**13** NPK0 1124	**17** NPK0 1137	**16** NPK3 1140	9,5 m
corredor de 1 m												
4 NPK2 1056	**3** NPK0 1061	**23** NPK3 (2cob) 1072	**10** NPK4 1077	**1** NPK0 1088	**22** NPK3 1093	**8** NPK1 1104	**7** NPK0 1109	**14** NPK3 1120	**12** NPK3 1125	**19** NPK0 1136	**18** NPK3 1141	9,5 m
corredor de 3 m												
5 NPK0 1055	**2** NPK1 1062	**24** NPK3 (sup) 1071	**11** NPK0 1078	**21** NPK3 1087	**20** NPK3 1094	**9** NPK2 1103	**6** NPK3 1110	**13** NPK0 1119	**15** NPK0 1126	**16** NPK3 1135	**17** NPK0 1142	9,5 m
corredor de 1 m												
3 NPK0 1054	**4** NPK2 1063	**24** NPK3 (sup) 1070	**10** NPK4 1079	**1** NPK0 1086	**21** NPK3 1095	**9** NPK2 1102	**6** NPK3 1111	**12** NPK3 1118	**13** NPK0 1127	**16** NPK3 1134	**18** NPK3 1143	9,5 m
corredor de 3 m												
2 NPK1 1053	**5** NPK0 1064	**23** NPK3 (2cob) 1069	**11** NPK0 1080	**20** NPK3 1085	**22** NPK3 1096	**8** NPK1 1101	**7** NPK0 1112	**15** NPK0 1117	**14** NPK3 1128	**19** NPK0 1133	**17** NPK0 1144	9,5 m
corredor de 1 m												
4 NPK2 1052	**2** NPK1 1065	**23** NPK3 (2cob) 1068	**11** NPK0 1081	**21** NPK3 1084	**22** NPK3 1097	**7** NPK0 1100	**8** NPK1 1113	**14** NPK3 1116	**13** NPK0 1129	**18** NPK3 1132	**19** NPK0 1145	9,5 m
corredor de 3 m												
5 NPK0 1051	**3** NPK0 1066	**24** NPK3 (sup) 1067	**10** NPK4 1082	**1** NPK0 1083	**20** NPK3 1098	**6** NPK3 1099	**9** NPK2 1114	**12** NPK3 1115	**15** NPK0 1130	**16** NPK3 1131	**17** NPK0 1146	9,5 m

Appendix E. Field trial layout.