Journal of Scientific Research & Reports

25(6): 1-5, 2019; Article no.JSRR.53265
ISSN: 2320-0227

Agronomic Performance, Response and Efficient Use of Potassium in Genotypes Corn (*Zea mays*)

Weder Ferreira dos Santos[1], Fernando Assis de Assunção[2*], Layanni Ferreira Sodré[1], Lucas Carneiro Maciel[2], Magno De Oliveira[1], Hélio Bandeira Barros[2], Rubens Ribeiro da Silva[2], Joênes Mucci Peluzio[2], Adriano Silveira Barbosa[2] and Talita Pereira de Souza Ferreira[1]

[1]Department of Biodiversity and Biotechnology, Federal University of Tocantins, Farm 69-72 Street, Whiting, Lot 7 s/n - Seville Garden, Gurupi - TO, 77404-970, Gurupi, Tocantins, Brazil.
[2]Department of Agricultural Engineering, Tocantins Federal University, Farm 69-72 Street Badejos, Lot 7 s/n - Sevilha Garden, Gurupi - TO, 77404-970, Gurupi, Tocantins, Brazil.

Authors' contributions

This work was carried out in collaboration among all authors. Author WFS designed the study the oriented author FAA performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors LFS, LCM and RRS managed the analyses of the study. The other authors managed and conducted the literature searches. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/JSRR/2019/v25i630202
Editor(s):
(1) Dr. Mario A. Pagnotta, Professor, Department of Science and Technologies for Agriculture, Forestry, Nature and Energy (DAFNE), Tuscia University, Italy.
Reviewers:
(1) R. K. Lal, Central Institute of Medicinal and Aromatic Plants, India.
(2) Peter Hric, Slovak University of Agriculture, Slovakia.
Complete Peer review History: http://www.sdiarticle4.com/review-history/53265

Original Research Article

Received 10 October 2019
Accepted 19 December 2019
Published 07 January 2020

ABSTRACT

The study aims to select maize for the response and efficiency of the use of potassium (K), in the municipality of Gurupi, state of Tocantins. Two trials of maize genotypes were carried out in Gurupi-TO, in the off-season 2017, one for high K condition and another for K low, applied in coverage. The experimental design of each experiment was a randomized block design with three replicates and seven treatments. The average grain production BK (6997 kg ha^{-1}) was lower than the AK (7787 kg ha^{-1}), which confirms that the application of potassium fertilizers in maize makes this answer the applications collaborating with better yields. The genotype (G3) showed that high yield in BK environment (above the average, 4532 kg ha^{-1}) and low

**Corresponding author: E-mail: fernandopreto.fa@gmail.com;*

response rate application of paragraph, they are defined as efficient, unresponsive. The genotype G2 was classified as efficient and responsive being indicated for producers of both technological levels.

Keywords: Nutritional efficiency; efficiency indices; grain productivity; Zea mays L.

1. INTRODUCTION

Corn (*Zea mays* L.) stands out as a source of carbohydrate for people of different countries, taking an important role in the economy and food security. Corn also is used in animal feed is an important ingredient in feed formulation. Corn production has followed the growth of production of poultry and pork, demand has been growing year by year. Average productivity in Brazil around 5.718 kg ha^{-1} [1] using the correct application of all the technological package, based on soil correction, effective fertilization, weed control, and pests, and improved genetic material.

For the production of the required nutrient is more potassium (K), which operates in plant metabolic processes such as photosynthesis, protein synthesis, and enzymatic activation. Though a very nutrient extracted by corn, response to the last K was infrequent and modest when compared to those obtained for nitrogen (N) and phosphorus (P). Changes in corn crops allowed greater crop response to K, even in soils with medium and high availability. Among these changes, one can cite the use of genotypes with high productive potential [2].

Fageria and Kluthccouski [3] Developed a specific method for mineral stress applied to plant breeding, so it was possible the selection of efficient plants for the use of nutrients and responsive in its application. Thus, the efficient use of the nutrient is defined by the average grain yield in the low-level object of research nutrient, wherein the response to its use is obtained by the difference between the grain yield in the two nutrient levels divided by the difference between the applied doses.

The use of methodology [3] in studies with corn [4–8]. Currently, there are few commercial corn genotypes offered to farmers the Tocantins. The information about this efficiency and response could contribute to a proper decision as to which genotype to be used and the level of nutrients to be made available, for the economic maximum productivity.

The objective was to study the maize genotypes on the response and efficiency to the use of K in the municipality of Gurupi State of Tocantins.

2. MATERIALS AND METHODS

In 2017 (07.06.2017) there were two corn genotypes competition tests at the Federal University of Tocantins (UFT), Campus of Gurupi, and an installed under conditions of high K (AK, 450 kg ha^{-1}) and at low K (BK, 0 kg ha^{-1}).

The experimental design used in each test was a randomized block with seven treatments and three replications. The treatments consisted of seven genotypes (G1, G2, G3, G4, G5, G6 and G7).

Each plot consisted of four rows of five meters long, spaced 0.90 m between rows. At harvest were used two central rows of each row, discarding 0.50 m from the ends of the rows.

The operations of plowing, harrowing and ploughing were held. Planting the seeds and fertilizer in the planting furrow was made manually. The pre-plant fertilization was performed using 300 kg ha^{-1} NPK and Zn for all tests.

The nitrogen fertilization in both trials, urea was performed using a corresponding amount to 140 kg ha^{-1} N when the plants reached the V6 stage (6 leaves fully expanded) and V8 (8 sheets completely expanded).

For BK and AK, assays were used 0 and 45 kg potassium ha^{-1}, respectively, using as a source of potassium chloride. Cultural practices have always been carried out as necessary, in accordance with the technical recommendations for corn [9].

In the two central rows of each plot were harvested when all corn plants reached physiological maturity stage (R6). They were then threshed, and grains made and identified, each genotype in a single paper bag, which it was calculated the mass of grain from each plot corrected to 13% moisture and converted into kg ha^{-1} to thereby obtaining the yield.

To identify efficient genotypes regarding the use of K and responsive to its application was used the methodology proposed by Fageria and Kluthccouski [3]. Through these methods, the efficiency corresponded to the average grain yield of each genotype at the bottom N. While the answer to the application of K for each genotype yield resulted from the difference of the two tests, divided by the difference between K levels in coverage.

For the classification of genotypes for efficiency and response to K was used the graphical representation in the Cartesian plane. Thus, the y-axis is the answer to your application, while the x-axis, and is the efficiency in their use. The point of origin of the axes corresponds to the mean average response and efficiency of genotypes. In the first quadrant efficient and responsive genotypes are represented; in the second, not efficient and responsive; in the third, not efficient and not responsive; and in the fourth quadrant, efficient and not responsive.

After tabulating the grain, yield data were submitted to the normality test. Then Analysis of variance for each test and after a joint analysis following the criterion of homogeneity of the average squared residuals of the trials. The genotypes of efficiency and response rates were also subjected to analysis of variance and normality for each of these.

The mean genotypes, environments, and efficiency and response rates were compared with the test groups [10], 5% five percent significance level, using [11].

3. RESULTS AND DISCUSSION

The results of the analysis of variance shown in Table 1, it is verified that significant effects of the interaction between genotypes and genotypes and tests on the characteristics of grain, evidencing genetic variability. The coefficient of variation was classified as low, according to Pimentel-Gomes [12].

The grain yield averages of the seven genotypes ranged from 6717 kg ha^{-1} (G4), the BK situation, the 9250 kg ha^{-1} (G6) in the AK situation (Table 1). The average grain production BK (6997 kg ha^{-1}) was lower than the AK (7787 kg ha^{-1}), which confirms that the application of potassium fertilizers in maize makes this answer the applications collaborating with better yields. According to in corn in Tocantins second crop presents value lower than Table 1. One of the main factors of this low productivity in the Tocantins and the use of soil improvement and fertilization is not widespread, it does not meet the nutritional needs of the plant [1].

The genotypes used in the assay BK had their average ranging from 6717 kg ha^{-1} (G4) to 7615 kg ha^{-1} (G3), on average only one group. The highest means were obtained for genotypes G2 (7515 kg ha^{-1}) and G3 (7615 kg ha^{-1}).

In AK assay, the medium ranged from 6891 kg ha^{-1} (G7) to 9250 kg ha^{-1} (G6) and were found two groups averages for productivity, where the group with the lowest mean G1 genotypes (6976 kg ha^{-1}), G3 (7884 kg ha^{-1}), G4 and G5 (7586 kg ha^{-1}) and G7 (6891 kg ha^{-1}) and the group with the highest means were G2 genotypes (8691 kg ha^{-1}) and G6 (9250 kg ha^{-1}).

The methodology [3] discloses the application of efficient genotypes K (G2 and G3) (right vertical axis of the quadrants I and IV of Fig. 1). These sound genotypes were suitable for low technology farmers, where cultivation with large doses K fertilizer is not used [5,7,8] mainly due to the high cost of this nutrient [6].

The responsive genotypes (G2, G4 and G6) are represented by the quadrants I and II (Fig. 1). Sodré et al. [6] Like corn, emphasize that these genotypes are quadrants of interest, for when grown in appropriate fertilization environments, respond to increases in the dose of the nutrient.

In the first quadrant of Fig. 1, are genotypes (G2) responsive and efficient, efficient because they have reached good yields in the absence of fertilization and responsive because with the K fertilization, increased significance with their average productivity. The genotypes represented in the first quadrant express a possible adaptation to both K deficit conditions such as conditions of great availability [5,6,8] genotypes of this quadrant are recommended for crops that love from the low to the high technological level.

The G4 and G6 genotypes by having grains present in low yield BK assay were considered inefficient, but have characterized its conditions responsive genotypes (Quadrant II of Fig. 1). These properties are for genotypes that have a high technological level [6].

Table 1. Productivity and response to the use of potassium maize genotypes in 2017 harvests, and Gurupi over

Genotypes	Productivity (kg ha^{-1})		Answer
	High K	Low K	
G1	6976 Ab	6751 Aa	5,0
G2	8691 Aa	7515 Ba	26,1
G3	7884 Ab	7615 Aa	5,2
G4	7586 Ab	6717 Aa	19,3
G5	7586 Ab	6766 Aa	10,3
G6	9250 Aa	6793 Ba	54,6
G7	6891 Ab	6788 Aa	2,3
Mean	7787 A	6997 B	18,0

Means followed by the same letter in uppercase and lowercase column line belong to the same group according to the grouping criterion [10], the 5% significance level

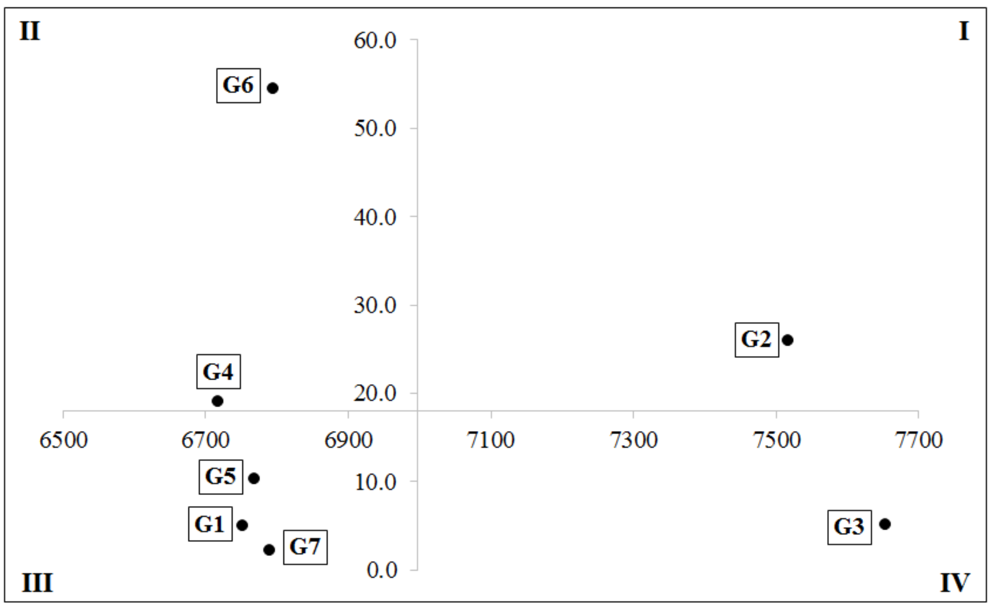

Fig. 1. Efficient use and response to potassium application in corn genotypes by Fageria & Kluthcouski methodology [3]. In the first quadrant are represented efficient and responsive genotypes (ER); in the second quadrant are represented non-efficient and responsive genotypes (NER); in the third quadrant are represented inefficient and non-responsive genotypes (NENR); in the fourth quadrant are represented efficient and non-responsive genotypes (ENR)

In quadrant III are the genotypes had a low yield, mean the average of the genotypes (6997 kg ha^{-1}), also the lowest response rates K, these genotypes are not considered efficient, unresponsive (G1, G5, and G7). Genotypes classified as not efficient and not responsive are not recommended being used in any agricultural property, including those who take low-tech [13,14].

The genotype (G3) showed that high yield in BK environment (above the average, 4532 kg ha^{-1}) and low response rate application of paragraph, they are defined as efficient, unresponsive (Quadrant IV of Fig. 1). The genotypes listed are arranged in this quadrant properties for adopting low technology [6,15].

4. CONCLUSION

The G3 genotype was classified as efficient and not responsive is indicated for low-tech producers. The G4 and G6 genotypes were classified as not efficient and responsive is recommended for high technological level producers. The G2 genotype was classified as efficient and responsive is indicated for producers of both technological levels.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. CONAB - National Supply Company. Accompaniment of the Brazilian Grain Harvest. 19. 2018/19 harvest; 2019. Available from: http://www.conab.gov.br
2. Gomes MDP, et al. Initial development of corn in response to potassium doses. Brazilian Journal of Corn and Sorghum. 2018;17(1):27–36.
3. Fageria ND, Kluthccouski J. Methodology for evaluation of rice and bean cultivars for adverse soil conditions. EMBRAPA / CNPAF. 1980;22.
4. Oak RP, Pine RGV, Davide LM. Efficiency of corn cultivars in nitrogen absorption and use in a greenhouse environment. Semina: Agricultural Sciences. 2012;6:2125–2136.
5. Santos WF, Pelúzio JM, Afférri FS, Sodré LF, Hackenhaar C, et al. Efficiency and response to nitrogen use in corn genotypes for protein yield. Technology & Agricultural Science Magazine. 2016;33:6–11.
6. Sodré LF, Ascênio SD, Pelúzio JM, Afférri FS, Santos WF, et al. High and low nitrogen cultivation in Tocantins corn genotypes for oil production. Agriculture Magazine. 2016;91:174–183.
7. Santos WF, Sodre LF, Maciel LC, Silva RM, Afferri FS, et al. Selection of corn genotypes for their response and nitrogen efficiency. Technology & Agricultural Science Magazine. 2017;11: 73–76.
8. Santos WF, Sodré LF, Silva RM, Ferreira TP, Almeida AF, et al. Nitrogen response and efficiency for grain yield in maize genotypes. Technology & Agricultural Science Magazine. 2018;12:25–30.
9. Fancelli AL, Grandson DD. Corn production. 2004;2:360–360.
10. Scott A, Knott M. Cluster analysis method for grouping means in analysis of variance. Cluster analysis method for grouping means in analysis of variance Biometrics. 1974;30(30):507–512.
11. Ferreira DF. Sisvar: A computer analysis system. Science and Agrotechnology; 2011.
12. Pimentel-Gomes F. Experimental statistics course. In: PF, editor. Experimental Statistics Course. 2009;15:451–451.
13. Fidelis RR, Nascimento LC, Santos MM, Silva GF, Tonello LP, et al. Effect of phosphate fertilization on physiological quality of upland rice seeds. Bioscience Journal. 2013;29(1):15–21.
14. Fidelis RR, Santos MM, Santos GR, Silva RR, Veloso DA. Classification of corn populations regarding efficiency and response to phosphorus use; 2014.
15. Passos NG, Sousa SA, Lopes MBS, Varavallo MA, Oliveira TC, et al. Efficiency of nitrogen use in rice genotypes in tropical lowland soils of the state of Tocantins. Agro @ mbiente Magazine Online. 2015;9:8–16.

Peer-review history:
The peer review history for this paper can be accessed here:
http://www.sdiarticle4.com/review-history/53265