Agricultural Research & Technology
Open Access Journal
ISSN: 2471-6774

Juniper Publishers
key to the Researchers

Research Article
Volume 7 Issue 1 - May 2017
DOI: 10.19080/ARTOAJ.2017.07.555704

Agri Res & Tech: Open Access J

Effect of Different Rates of Imazapyr on *Striga hermonthica* Control on Yield of Some Maize (*Zea mays L*) Genotypes in Yola, Adamawa State

Mustapha A B, Yahichi Elam and D T Gungula

Department of Crop Production and Horticulture, Modibbo Adama University of Technology, Nigeria

Submission: April 04, 2017; **Published:** May 23, 2017

***Corresponding author:** Aliyu Bawuro Mustapha, Department of Crop Production and Horticulture, Modibbo Adama University of Technology, Nigeria, Email: aliyuaim@yahoo.co.uk

Abstract

The efficient and profitable production of maize is severely constrained by striga especially *Strigahermonthica* which lead to the study on the effect of imazapyr on some maize genotypes. The experiment was conducted at the Teaching and Research Farm and the Laboratory of the Department of Crop Production and Horticulture, Modibbo Adama University of Technology, Yola Adamawa State. The objective was to determine the method and rate of imazapyr application that will give effective striga control for the yield of maize. The treatments consisted of six genotypes of maize (IR-1, IR-3, IR-4, IR-7, IR-10, and IR-11) and six rates of imazapyr (0, 10, 30, 50, 70, and 90g/ha).Data were collected on thegrain yield Kg ha-1, Striga emergence and number of striga per plot. Data collected was analyzed statistically using the Generalized Linear Model (GLM) procedure of SAS (Statistical Analysis System Version 9, 1999) software and Least Significant Difference (LSD) was used to separate the means that were significantly different at 5% level of probability. Results on striga count per plot, maize genotype IR-10, IR-4 and IR-6 recorded the lowest number of striga per plot with 1.3, 1.5 and 1.6 respectively, while on the imazapyr rates, 90 and 70g/ha recorded the lowest number of striga per plot with 2 and 2.1 respectively. From the grain yield per hectare, maize genotypes IR-3, IR-4 and IR-1 recorded the highest yield with 3668, 3310 and 2056 kg/ha respectively, while from the imazapyr rates, 50 and 30g/ha recorded the highest grain yield with 3274 and 2858kg/ha respectively. Based on the findings, it can be concluded that the different maize genotypes used performed averagely good under striga infested conditions despite the fact that, there are good inbreeding lines, especially IR-1, IR-4 and IR-7. Similarly, lower rates of imazapyr (10, 30 and 50g/ha) performed better as compared to the higher rates (70 and 90g/ha) for growth and yield.

Keyword: Imazapyr; Striga; IR-Maizeand genotypes

Introduction

Striga attacks cereal crops with maize being the most susceptible. It greatly reduces productivity endangering the food and livelihoods of millions of farmers in Sub-Saharan Africa (SSA) [1]. Striga infests about 50 million lands in Sub-Saharan Africa resulting in devastating production and losses up to 8 billion US dollars among small scale farmers, these contributes to poverty and hunger in the region [2]. Approximately 21 million hectares of cereal production in Africa is infested by striga and it causes an annual grain loss of about 8 million metric tonnes [3]. The most deleterious effects occur under maize (*Zea mays L*) where about 2.5 million hectares suffer grain losses of 30+80% in western Kenya (African Agricultural Technology Foundation [AATF], 2006). According to Oswald (2005), efficient and profitable production of maize is severely constrained by striga especially *Striga hermonthica* Benth. In Kenya, striga infestation is most severely in Nyanza and western provinces [4] and is found in over 210,000 ha of farmland [5].

In monetary terms about $29 million per annum worth of maize is reportedly lost in the country [6]. In some cases, stiga infestation leads to complete loss of the local maize varieties. There is a general agreement [7-10] that the damaging effects of strigaspp is the most pronounced under low fertility conditions. Some resistance striga has been reported that delaying striga attachment by three weeks gave over 50 and 100% yield gains with resistance and susceptible maize varieties under *S. hermonthica* infection respectively.

Some of the challenges of adoption of the use of imazapyr in control of striga include non– uniform coverage of the fields because it would be expensive for most African farmers and would not fit their cropping systems which include intercropping.

As the Herbicide is systematically trans located in plants, maize seeds treated with imazapyr at the rate of 30g/ha loose viability within a month while other striga plants emerge again from twelve weeks after sowing indicating that the effect does not last long to give effective control for the entire growth period of the maize plants [11,12].This research work was carried out to determine the rate of imazapyr application that will give effective striga control for the yield of maize.

Materials and Methods

The experiment was conducted at the Teaching and Research Farm and the Laboratory of the Department of Crop Production and Horticulture, Modibbo Adama University of Technology, Yola Adamawa State. Six maize genotypes were obtained from Department of Crop Production and Horticulture, Modibbo Adama University of Technology. The treatments consisted of six genotypes of maize (IR-1, IR-3, IR-4, IR-7, IR-10, and IR-11) and six rates of imazapyr (0, 10, 30, 50, 70, and 90g/ha). Field experiment was laid in factorial design (6x6x3) appropriate to Split Plot Design. Six genotypes of maize (IR-1, IR-3, IR-4, IR-7, IR-10, and IR-11) were treated with imazapyr and assigned to main plot treatments while six rates of imazapyr (0, 10, 30, 50, 70, and 90g/ha) were assigned to sub-plot treatment which gave a total of 36 treatment combinations and it was replicated three times.

Data collected were analyzed statistically using the Generalized Linear Model (GLM) procedure of SAS (Statistical Analysis System Version 9, 1999) software and Least Significant Difference (LSD) was used to separate the means that were significantly different at 5% level of probability.

Results

Effects of imazapyr rates on grainyield per hectare (kg)of various maize genotypes

Table 1: Mean Effects of ImazapyrRates on Yield per Hectare (kg) of various Maize Genotypes in 2013, 2014 and 2015.

	2013	2014	2015
Genotype			
IR-1	2056	2756	2538
IR-3	3668	3804	3765
IR-4	3310	2370	2733
IR-7	1800	2462	2138
IR-10	1290	1747	1551
IR-11	1686	1867	1922
P<F	0.001	0.001	0.001
LSD	920.7	613.3	620.2
Imazapyr rates (g/ha)			
0	1479	2178	2136
10	2433	2321	2352
30	2039	3074	2696
50	2858	2865	2939
70	1729	1856	1872
90	3274	2711	3075
P<F	0.001	0.001	0.001
LSD	529.8	563.9	568.4
Interaction	**	**	**

** =Highly significant

The mean effects of imazapyr rates and on grain yield per hectare of various maize genotypes for 2013, 2014 and 2015 are presented in Table 1. In 2013, there were highly significant differences (P≤0.01) among the maize genotype in grain yield per hectare. IR-3 recorded the highest yield per hectare (3668kg) followed by IR-4 which had 3310kg yield per hectare. These genotypes differed significantly from the rest of the genotypes on grain yield per hectare. The lowest mean value of yield per hectare was recorded from IR-10 (1290kg) followed by IR-11 and IR-7 which had 1686 and 1800 kg per hectare respectively. In 2014 and 2015, similar trends were observed.

Regarding the imazapyr rates, there were highly significant differences (P≤0.01) among the treatments on yield per hectare in 2013, 2014 and 2015 (Table 2). In 2013, the highest grain yield per hectare was recorded from treatment 90g/ha (3274kg) followed by 70g/ha which had 1729kg per hectare. The lowest mean value of grain yield per hectare was recorded by control treatment which had 1479kg per hectare, followed by 70 and 30g/ha which had 1729 and 2039kg per hectare respectively. Similar trends were observed in 2014 and 2015.

Table 2: Interaction between Imazapyr and Maize Genotypes on Yield (kg) per Hectare in 2013, 2014 and 2015.

	Maize Genotypes 2013						Maize Genotypes 2014						Maize Genotypes 2015					
Imazapyr	IR-1	IR-3	IR-4	IR-7	IR-10	IR-11	IR-1	IR-3	IR-4	IR-7	IR-10	IR-11	IR-1	IR-3	IR-4	IR-7	IR-10	IR-11
0	2764	2933	1333	631	453	756	3822	3822	1156	2133	1244	889	3575	3624	1247	2224	1322	1012
10	2311	4356	4178	1333	1333	1084	2667	6222	1778	1440	1200	622	2528	5214	1625	1512	1312	8012

How to cite this article: Aliyu B M, Yachi E , D Gungula. Effect of Different Rates of Imazapyr on *Striga hermonthica* Control on Yield of Some Maize (*Zea mays L*) Genotypes in Yola, Adamawa State. Agri Res & Tech: Open Access J. 2017; 7(1): 555704. DOI: 10.19080/ARTOAJ.2017.07.555704.

30	951	1476	3484	1600	1867	2853	3556	1778	1600	5244	1511	2756	3245	1685	1645	2455	1421	2812
50	3289	3556	4356	1769	1511	2667	3289	1440	3556	2222	1636	3200	3142	1520	3412	2313	1622	3200
70	1156	3022	2062	1467	1067	1600	1778	1200	1422	1867	3022	1778	1669	1251	1414	1981	2982	1689
90	1867	6667	4444	4000	1511	1156	1422	622	4711	1868	1867	1956	1531	2431	4732	1784	1899	1824
P<f	0.001						0.001						0.022					
LSD	1447						1371						6.054					

Interactions between imazapyr and maize genotype on yield

The interactions between imazapyr and maize genotypes on yield per hectare for 2013, 2014 and 2015 are presented in Table 2. In 2013, there were highly significant Interactions between the imazapyr rates and maize genotypes. Interactions between IR-3x90g/ha recorded the highest yield per hectare which had 6667kg, followed by IR-4x50g/ha and IR- 3x10g/ha with 4356 kg respectively. The lowest yield per hectare was recorded from interactions between IR-10 x control, IR-7 x control, and IR-11 x control which had 453, 631 and 756kg respectively. Similar trends were observed in 2014 and 2015.

Discussion

Effects of imazapyr rate on grainyield on the various maize genotypes

The low grain yield observed among the maize genotypes despite the low *Strigae* mergence counts could be attributed to other factors such as low yield potential. Previous studies on *Strigae* control in maize have also revealed low grain yield and low *Strigae* mergence for susceptible genotypes [13,14]. The significant differences among the maize genotypes could be due to differences in the ability of the genotypes to exploit resources especially water and nutrients [15]. Also, the kernel yield performance of the treated maize is in agreement with the findings of Kanampiu et al. [16] and Lado et al. [17] who observed that treated IR-maize gave higher kernel yield than the untreated ones.

Furthermore the herbicides might have helped in controlling *Striga*, thereby making more nutrients and photosynthates available to support grain development and more grain yield. This finding is supported by reports of Tuinstra et al. [18] on sorghum and of Kwaga [19] on ground nut. Citaden et al. [20] similarly reported cowpea line 59 to be imazapyr-tolerant to 400 g ha-1.This is encouraging to farmers because the combination of herbicide seed treatment with herbicide-tolerant genotypes could be useful in Nigeria [21-24].

Conclusion

Based on the findings from this research work, it can be concluded that the different maize genotypes that were used performed averagely good under striga infested conditions, most especially IR-1, IR-7 and IR-4 which supported speedy germination, growth viza-viz yield. This might not be unconnected to its inherent abilities alongside the conducive environmental condition. Furthermore, the different rates of imazapyr used for the striga control on the different maize genotypes had a positive influence, most noticeably were the good records observed from the lower rates of imazapyr from 10g/ha-50g/ha. Unlike the higher rates of 70-90g/ha which had poor performance of the maize genotypes under striga infested condition for growth and resultantly yield.

References

1. Schulz S, Hussaini MA, Kling J, Berner DK, Ikie FO (2003) Evaluation of integrated *S. Hermonthica* control technologies under farmer management. Experimental Agriculture 39: 99-108.
2. Kambabe VH, Ganunga RP (2003) Evaluation and development of late and intermediate maize varieties for tolerance/resistance to *Striga Asiatic* in Malawi. Proceedings of the nineteenth Biennial Weeds Science Society Conference for Eastern Africa. Lilongwe, WSSEA, USA, pp. 97-103.
3. Gressel J, Hanau A, Head G, Marasas W, Obilana AB, et al. (2004) Major heretofore intractable biotic constraints to African food security that may be amenable to novel biotechnological solutions. Crop Protection 23: 661-689.
4. Manyong VM, Alene AD, Olanrewaju A, Ayedun B, Rweyendela V, et al. (2008a) Baseline study of striga control using Imazapyr- Resistant (IR) maize in Western Kenya. An agricultural collaborative study on striga control by African Agricultural Technology Foundation and the International Institute of Tropical Agriculture, Nairobi, Kenya, p. 55.

How to cite this article: Mustapha AB, Yahichi Elam and D T Gungula. Effect of Different Rates of Imazapyr on *Striga hermonthica* Control on Yield of Some Maize (*Zea mays L*) Genotypes in Yola, Adamawa State. Agri Res & Tech: Open Access J. 2017; 7(1): 555704. DOI: 10.19080/ARTOAJ.2017.07.555704.

5. African Agricultural Technology Foundation (AATF) (2006) Empowering African farmers to eradicate Striga from maize cropland. African Agricultural Technology Foundation, Kenya, pp. 17.

6. Woomer PL, Savala CN (2007) Striga management through herbicide resistance: A Public-Private Partnership in Action. AAAE Conference Proceedings, USA, pp. 489-496.

7. Parker C (1984) The influence of *Strigaspp* on sorghum under varying nitrogen. In: Parker C, Muselman LJ, Polhill RM, Wilson AK (Eds.), Proceedings of the Third International Symposium on parasitic weeds. ICARDA/International Parasitic Weeds Research Group, 1984, Allepo, Syria, pp. 90-98.

8. Farina MPW, Thomas PEL, Channon P (1985) Nitrogen, phosphorus and potassium effect on the incidence of *strigaasiastica* (L) Kuntze in maize. Weeds Research 25(6): 443-447.

9. Kabambe VH (1991) The development of cultural methods for controlling striga in maize. In: Ransom JK, Musselman AD, Parker G (Eds.), Proceedings of the Fifth International Symposium of parasitic Weeds. CIMMYT, Nairobi, Nigeria, pp. 46-56.

10. Pieterse AH, Verkleij JAC (1991) Effects of soil conditions on striga development: a review. In: Ransom JK, Musselman AD, Worsham PC (Eds.), Proceeding of the fifth International Symposium of Parasitic Weeds. CIMMYT, Nairobo, Kenya, pp. 329-339.

11. Abayo GO, English T, Eplee RE, Kanampiu FK, Ramson JK, et al. (1998) Control of parasitic witchweeds (*Strigaspp*) on corn (*Zea mays*) resistance to acetolactate synthase inhibitors. Weeds Science 46(4): 459-466.

12. Abayo GO, Ramson JK, Gressel J, Odhiambo GD (1996) *Striga hermonthica* control with acetolactate synthase inhibiting herbicides seed-dressed to corn with target site resistance. In: Moreno M, T, Cubero JI, Berner D, Joel DM, Mussleman LJ, Parker C (Eds.), Advances in Parasitic Weeds Research. pp. 762-768.

13. Badu-Apraku B, Fakorede MAB, Lum AF (2007) Evaluation of experimental varieties from recurrent selection for *Striga* resistance in two extra-early maize populations in the savannas of West and Central Africa. Experimental Agriculture 43: 183-200.

14. Kim SK, Adetimirin VO, The C, Dossou R (2002) Yield losses in maize due to *Strigaher montheca* in West and Central Africa. International Journal of Pest Management 48(3): 211-217.

15. Hoisington D (2002) Appropriateness of biotechnology to African Agriculture: *Striga* and maize paradigms. Plant Cell, Tissue and Organs Culture 69(2): 105-110.

16. Kanampiu FK, Ransom JK, Gressel J, Jewell D, Freiese D, et al. (2002) Appropriateness of biotechnology to African Agriculture: *Striga* and maize paradigms. Plant Cell, Tissue and Organs Culture 69: 105-110.

17. Lado A, Hussaini MA, Kamara AY (2016) Influence of Imazaquin Seed Treatment on Control of Strigagesnerioides and its Consequence on Yield and Yield Componentsof Selected Cowpea Genotypes. Journal of Biology, Agriculture and Healthcare 6(6): 30-36.

18. Tuinstra MR, Soumana S, Al-khatip K, Kapranu I, Toure A, et al. (2009) Efficacy of herbicide seed treatments for controlling *Striga* infestation of sorghum. Crop Science 49: 923-929.

19. Kwaga YM,Olufaju OO, Tanimu B (2010) Effect of herbicide seed treatment on the reaction ofgroundnut (*Arachis hypogea* L.) to *Alectravogelii* Benth. American-Eurosian Journal of Agriculture and Environmental Sciences 7(6): 623-627.

20. Citaden CT, Cruz ARR, Arago FJI (2013) Development of transgenic Imazpyr tolerant cowpea (*Vignaunguiculata*(L.) Walp). Plant Cell 32(4): 537-543.

21. Adu-Tutu KO, Drennan DSH (1991) Effect of sulfonyurea herbicides on striga. In: Ransom JK, Musselman AD, Worsham PC (Eds.), Proceeding of the fifth International Symposium of Parasitic Weeds. Nairobo, CIMMYT, pp. 361-371.

22. Garcia-Torres L, Lopez-Granados F (1991) Control of bromerape (*Orobanchecrenata*Forsk) in broad bean (*Viciafaba*L) with imadazolines and herbicides. Weeds Research 31: 227-235.

23. Oswald A (2005) Striga control technologies and their dissemination. Crop Protection 24: 333-342.

24. Statistical Analysis System (SAS) (1999) SAS/Stat User's Guide, Version 9, SAS Institute Inc. Cary NC USA, p. 378.

DOI: 10.19080/ARTOAJ.2017.07.555704

How to cite this article: Aliyu B M, Yachi E , D Gungula. Effect of Different Rates of Imazapyr on *Striga hermonthica* Control on Yield of Some Maize (*Zea mays L*) Genotypes in Yola, Adamawa State. Agri Res & Tech: Open Access J. 2017; 7(1): 555704. DOI: 10.19080/ARTOAJ.2017.07.555704.