

Abstract

Two on-farm experiments were conducted in Eastern Zimbabwe's Chinyika Resettlement Area (18° 02" and 18° 17" S and 32° 09" and 32° 24" E), during 2002/2003 rainy season, to evaluate the effects of three grain legumes species, genotypes and cowpea (*Vigna unguiculata* L.Walp) populations on witchweed (*Striga asiatica* L Kuntze) emergence, growth, development and maize (*Zea mays* L.) grain yield. Both experiments were 2*3*3 factorial with three cropping systems being sole cowpeas, maize SC513 cowpea intercrop and maize Pan6363 cowpea intercrops. The cowpea genotypes were Kavara and IT18, while three cowpea populations were 55 000, 65 000 and 75 000 plants ha⁻¹. For experiment 2, three legume species were soyabean [*Glycine max* (L.) Merrill], cowpea and bambara nut [*Vigna subterrenea* (L.) Verdc]. The cropping system, cowpea population, and genotypes significantly (P<0.001) affected *Striga asiatica* emergence across sites during 10 and 12 WACE. A significant interaction was observed between cropping system, genotypes, and cowpea populations. Maize SC513 intercropped with Kavara at 55 000 plants ha⁻¹ caused the highest *Striga* emergence, with Pan6363 Kavara intercrop at 55 000 plants ha⁻¹ having the lowest emergence. Maize SC513 IT18 intercrop at 55 000 plants ha⁻¹ caused the least emergence while Pan6363 IT18 intercrop at 55 000 plants ha⁻¹ had the highest emergence. A significant effect was observed between the two soyabean varieties, with Maize soyabean variety Magoye having the least emergence compared to Maize soyabean variety Hurungwe.. Across sites, *Striga* emergence increased and reached peak emergence at 12 WACE, and then declined during 14 WACE within maize legume intercrops. *Striga asiatica* dry matter accumulation was low and significant (P<0.05) across sites. The cropping system had significant (P<0.05) effect on *Striga asiatica* days to flowering from emergence. Maize legume intercrops had more days to flowering from emergence. Maize grain yield, cob and maize plant height were negatively and weakly correlated to *Striga asiatica* emergence. Results indicate that sole legumes suppressed *Striga asiatica* emergence. Intercrop of cowpea genotype IT18 gave the least *Striga asiatica* emergence thus have a suppressive effect on to *Striga asiatica* parasitism. Smallholder farmers in *Striga asiatica* infested farms should therefore be encouraged to plant sole legumes in rotation with cereal crops to reduce *Striga* parasitism.

Acknowledgement

I thank my supervisor Professor O. A. Chivinge and Dr A.B. Mashingaidze for the guidance they provided. I also acknowledge the financial assistance provided by Rockefeller Foundation, Forum Programme.

I would want to thank the technicians, Mr S. Marimo, Mr N. Nyaruwata, Mr G. Parirenyatwa and the farmers for hosting the trials.

I would also want to mention and acknowledge the companionship and advice I enjoyed during my stay at Chinyika and of particular mention is Sydney Mavengahama and Maxwell Handiseni.

I would want to acknowledge the encouragement I got from my brothers, Jerry, Cadwell, Samuel, Hama, Nangisai, Shingirai and Shumba, my uncle. I wish to thank Mr G. Thole and Dr E. Garwe of Marirangwe Farm (Women`s University in Africa) for allowing me to use their computers. Thanks to Horticulture Research Centre, Marondera for availing computers.

I would like to thank my wife Anna for withstanding the long absence from home that characterized the studies and my son Rukudzo for enduring my absence from home.

Lastly I wish to salute my late parents for their positive attitude towards my studies, may their soul rest in eternal peace.

Table of contents

Abstract	i
Acknowledgement	iii
Table of Contents	v
List of Tables	viii
List of Figures	viii
List of Abbreviations and Acronyms	ix
List of Appendices	x

Chapter 1: General Introduction

1.1. Physiology of <i>Striga</i> seeds	2
1.2. Morphology of <i>Striga asiatica</i> plants	3
1.3. Objectives	4
1.4. Hypothesis	4

Chapter 2: Literature Review

2.1. Occurrence	5
2.2. Yield Losses due to <i>S. asiatica</i>	5
2.3. Influence of <i>S. asiatica</i> on cropping system	6
2.4. Weed Control	7

2.5. Distribution	7
2.6. Difficulties in <i>S. asiatica</i> control	8
2.7. Seed Production	9
2.8. Seed Longevity	9
2.9. <i>Striga</i> management and control practices	10
2.10. Improved soil fertility as control measure	12
2.11. Use of tolerant crops	13
2.12. Non-host crops	15

Chapter 3: Materials and Methods

3.1. Location of study	21
3.2. Site Selection	21
3.3. Experimental Design	22
3.4. Land Preparation, Planting and Fertilization	23
3.5. Data collection	23
3.5.1. <i>Striga asiatica</i> parameters	23
3.5.2. Crop parameters	23
3.6. Weeding and Topdressing	24

Chapter 4: Results

4.1 <i>Striga asiatica</i> emergence	25
4.2. <i>Striga asiatica</i> days to flowering	32
4.3. <i>Striga asiatica</i> dry matter accumulation	35
4.4. <i>Striga asiatica</i> seed production	35
4.5. Maize plant height	36
4.6. Correlations between <i>Striga asiatica</i> and maize parameters	37
4.7. Discussion	37
4.7.1. <i>Striga asiatica</i> emergence	37
4.7.2. <i>Striga asiatica</i> days to flowering	40
4.7.3. <i>Striga asiatica</i> seed production	41
4.7.4. <i>Striga asiatica</i> dry matter accumulation	41
4.8. Maize grain yield, cob and stover weights	41
4.9. Correlations between <i>Striga asiatica</i> and maize parameters	42
4.10. Grain yield and total land equivalent ratios	43

Chapter 5: General Discussion

5.1. Conclusions	47
5.2. Recommendations	48

References	49
-------------------	----

List of Appendices	56
--------------------	----

List of Tables

Table 4.1.1. Effect of cropping system on <i>Striga</i> emergence at sites in Chinyika Resettlement Area in 2002/2003 season.	25
Table 4.1.2. Effect of cowpea genotype on <i>Striga</i> emergence at 10 WACE at site 3	26
Table 4.1.3. Interaction between cropping system and cowpea genotype on <i>Striga asiatica</i> emergence at 12 WACE at site 1.	27
Table 4.2. Effect of cropping system on <i>Striga asiatica</i> days to flowering across sites.	33
Table 4.3. Effect of cropping system on <i>Striga asiatica</i> dry matter accumulation across sites.	35
Table 4.4. Effect of cropping system on <i>Striga asiatica</i> seed production across sites.	36
Table 4.5. Correlations between <i>Striga asiatica</i> emergence, maize yield and growth parameters during 2002/2003 season.	37

List of Figures

Fig.4.1.1. Effect of cowpea density and maize genotype in maize cowpea intercrops on <i>Striga</i> emergence when cowpea variety Kavara were planted at site 4.	28
Fig.4.1.2. Effect of cowpea density and maize genotype in maize cowpea intercrops on <i>Striga</i> emergence when cowpea variety IT18 were planted at site 4.	29
Fig.4.1.3. Interaction effect between crop species and cowpea variety on <i>Striga asiatica</i> emergence during 12 WACE at site 1 during 2002/2003.	31
Fig. 4.2.1. Interaction effect of cropping system and cowpea genotype on <i>Striga asiatica</i> days to flowering at site 4.	32
Fig.4.2.2. Interaction effect between cropping system and crop species on <i>Striga asiatica</i> days to flowering at site 1 during 2002/2003 season.	34

List of Abbreviations and Acronyms

AA	Ammonium Nitrate
AREX	Agricultural Research and Extension
CIMMYT	International Maize and Wheat Improvement Centre
CRA	Chinyika Resettlement Area
EC	Emulsifiable Concentrate
FAO	Food and Agricultural Organisation
G	Granules
GTZ	Gesellschaft Fur Technische Zusammenarbeit
ICRAF	International Centre for Research in Agroforestry
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IDRC	International Development Research Centre
IITA	International Institute of Tropical Agriculture
N	Nitrogen
RCBD	Randomised Complete Block Design
SADC	Southern Africa Development Community
SH	Smallholder Holder
TLER	Total Land Equivalent Ratio
WACE	Weeks After Crop Emergence

List of Appendices

Appendix A: Effect of cowpea genotypes and populations on <i>Striga asiatica</i> emergence, growth and development for 2002/2003 season.	56
A1. Analysis of Variance for <i>Striga asiatica</i> emergence at 10 WACE at site 1	56
A2. Analysis of Variance for <i>Striga asiatica</i> emergence at 12 WACE at site 1	56
A3. Analysis of Variance for <i>Striga asiatica</i> days to flowering from emergence at site1	57
A4. Analysis of Variance for <i>Striga asiatica</i> seed capsules at site1	57
A5. Analysis of Variance for <i>Striga asiatica</i> dry matter at site1	58
A6. Analysis of Variance for <i>Striga asiatica</i> emergence at 10 WACE at site 2	58
A7. Analysis of Variance for <i>Striga asiatica</i> emergence at 12 WACE at site 2	58
A8. Analysis of Variance for <i>Striga asiatica</i> days from flowering to emergence at site 2	59
A9. Analysis of Variance for <i>Striga asiatica</i> seed capsules at site 2	59
A10. Analysis of Variance for <i>Striga asiatica</i> dry matter at site 2	59
A11. Analysis of Variance for <i>Striga asiatica</i> emergence at 10 WACE at site 3	60
A12. Analysis of Variance for <i>Striga asiatica</i> emergence at 12 WACE at site 3	60
A13. Analysis of Variance for <i>Striga asiatica</i> days to flowering from emergence at site 3	60
A14. Analysis of Variance for <i>Striga asiatica</i> seed capsules at site 3	61
A15. Analysis of Variance for <i>Striga asiatica</i> dry matter at site 3	61
A16. Analysis of Variance for <i>Striga asiatica</i> emergence at 10 WACE at site 4	61
A17. Analysis of Variance for <i>Striga asiatica</i> emergence at 12 WACE at site 4	62
A18. Analysis of Variance for <i>Striga asiatica</i> days to flowering from emergence at site 4	62
A19. Analysis of Variance for <i>Striga asiatica</i> seed capsules at site 4	62
A20. Analysis of Variance for <i>Striga asiatica</i> dry matter at site 4	63

Appendix B. Effect of grain legume species and genotype on <i>Striga asiatica</i> emergence, growth and development during 2001/2002 season.	63
B1. Analysis of Variance for <i>Striga asiatica</i> emergence at 8 WACE at site 1	63
B2. Analysis of Variance for <i>Striga asiatica</i> emergence at 10 WACE at site 1	64
B3. Analysis of Variance for <i>Striga asiatica</i> emergence at 12 WACE at site 1	64
B4. Analysis of Variance for <i>Striga asiatica</i> emergence at 14 WACE at site 1	64
B5. Analysis of Variance for <i>Striga asiatica</i> seed capsules at site 1	65
B6. Analysis of Variance for <i>Striga asiatica</i> days to flowering from emergence at site 1	65
B7. Analysis of Variance for <i>Striga asiatica</i> dry matter at site 1	65
B8. Analysis of Variance for <i>Striga asiatica</i> emergence at 8 WACE at site 2	66
B9. Analysis of Variance for <i>Striga asiatica</i> emergence at 10 WACE at site 2	66
B10. Analysis of Variance for <i>Striga asiatica</i> emergence at 12 WACE at site 2	66
B11. Analysis of Variance for <i>Striga asiatica</i> emergence at 14 WACE at site 2	67
B12. Analysis of Variance for <i>Striga asiatica</i> days to flowering from emergence at site 2	67
B13. Analysis of Variance for <i>Striga asiatica</i> seed capsules at site 2	67
B14. Analysis of Variance for <i>Striga asiatica</i> dry matter at site 2	68

Appendix C. Effect of grain legume species and genotype on <i>Striga asiatica</i> emergence, growth and development during 2002/2003 season.	68
C1. Analysis of Variance for <i>Striga asiatica</i> emergence at 8 WACE at site 1	68
C2. Analysis of Variance for <i>Striga asiatica</i> emergence at 10 WACE at site 1	69
C3. Analysis of Variance for <i>Striga asiatica</i> emergence at 12 WACE at site 1	69
C4. Analysis of Variance for <i>Striga asiatica</i> days to flowering at site 1	69
C5. Analysis of Variance for <i>Striga asiatica</i> seed capsules at site 1	70
C6. Analysis of Variance for <i>Striga asiatica</i> dry matter at site 1	70
C7. Analysis of Variance for <i>Striga asiatica</i> emergence at 8 WACE at site 2	70
C8. Analysis of Variance for <i>Striga asiatica</i> emergence at 10 WACE at site 2	71
C9. Analysis of Variance for <i>Striga asiatica</i> emergence at 12 WACE at site 2	71
C10. Analysis of Variance for <i>Striga asiatica</i> days to flowering from emergence at site 2	71
C11. Analysis of Variance for <i>Striga asiatica</i> dry matter at site 2	72
C12. Analysis of Variance for <i>Striga asiatica</i> dry matter at site 2	72
C13. Analysis of Variance for <i>Striga asiatica</i> emergence at 10 WACE at site 3	72
C14. Analysis of Variance for <i>Striga asiatica</i> emergence at 12 WACE at site 3	73
C15. Analysis of Variance for <i>Striga asiatica</i> days to flowering from emergence at site 3	73
C16. Analysis of Variance for <i>Striga asiatica</i> seed capsules at site 3	73
C17. Analysis of Variance for <i>Striga asiatica</i> dry matter at site 3	74