APPENDIX

Appendix 2.1 Abbreviated ANOVA table for the effect of species and parthenium density on grass dry mass accumulation over a period of 11 weeks expressed as percentage of control

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	5	8.07834260	1.61566852	4.65	0.0119
Error	13	4.52147834	0.34780603		
Corrected Total	18	12.59982094			
R^2		C.V	Root MSE	Mean	
0.641147		13.39973	0.589751	4.401215	
Source	DF	Type III SS	Mean Square	F Value	Pr > F
spp	2	6.90293438	3.45146719	9.92	0.0024
par	1	0.62146505	0.62146505	1.79	0.2042
spp*par	2	0.15566820	0.07783410	0.22	0.8025

Appendix 2.2 Abbreviated ANOVA table for the effect of species and parthenium density on grass re-growth dry mass accumulation over a period of 4 weeks expressed as percentage of control

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	5	2.07973276	0.41594655	0.43	0.8162
Error	11	10.55043148	0.95913013		
Corrected Total	16	12.63016423			
R^2		C.V	Root MSE	Mean	
0.164664		22.40880	0.979352	4.370391	
Source	DF	Type III SS	Mean Square	F Value	Pr > F
spp	2	1.92697603	0.96348801	1.00	0.3975
par	1	0.00485808	0.00485808	0.01	0.9445
spp*par	2	0.22441916	0.11220958	0.12	0.8907

APPENDIX

Appendix 2.3 Abbreviated ANOVA table for the effect of species and parthenium density on grass dry mass accumulation over a period of 19 weeks expressed as percentage of control

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	5	4.96181143	0.99236229	2.44	0.0908
Error	13	5.29132570	0.40702505		
Corrected Total	18	10.25313712			
R^2		C.V		Root MSE	Mean
0.483931		18.09478		0.637985	3.525797
Source	DF	Type III SS	Mean Square	F Value	Pr > F
spp	2	2.07445954	1.03722977	2.55	0.1165
par	1	0.27947773	0.27947773	0.69	0.4223
spp*par	2	2.58295902	1.29147951	3.17	0.0755

Appendix 2.4 Abbreviated ANOVA table for the effect of grass species and parthenium density on parthenium dry mass accumulation over a period of 19 weeks

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	5	4840.794912	968.158982	8.27	0.0011
Error	13	1522.516667	117.116667		
Corrected Total	18	6363.311579			
R^2		C.V		Root MSE	Mean
0.760735		25.87703		10.82205	41.82105
Source	DF	Type III SS	Mean Square	F Value	Pr > F
spp	2	4010.139394	2005.069697	17.12	0.0002
par	1	115.055217	115.055217	0.98	0.3397
spp*par	2	441.293333	220.646667	1.88	0.1912

Appendix 2.5 Abbreviated ANOVA table for the effect of species and parthenium density on grass dry mass accumulation over a period of 14 weeks expressed as percentage of control

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	5	1.31306050	0.26261210	3.55	0.0474
Error	9	0.66512700	0.07390300		
Corrected Total	14	1.97818751			

R^2	C.V	Root MSE	Mean
0.663769	6.323438	0.271851	4.299102

Source	DF	Type III SS	Mean Square	F Value	Pr > F
spp	2	0.83822442	0.41911221	5.67	0.0255
par	1	0.37817593	0.37817593	5.12	0.0500
spp*par	2	0.09390834	0.04695417	0.64	0.5519

Appendix 2.6 Abbreviated ANOVA table for the effect of grass species and parthenium density on parthenium dry mass accumulation over a period of 14 weeks

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	7	1852.346970	264.620996	13.91	<.0001
Error	14	266.391667	19.027976		
Corrected Total	21	2118.738636			

R^2	C.V	Root MSE	Mean
0.874269	36.28217	4.362107	12.02273

Source	DF	Type III SS	Mean Square	F Value	Pr > F
spp	3	1472.468500	490.822833	25.79	<.0001
par	1	245.707500	245.707500	12.91	0.0029
spp*par	3	323.049093	107.683031	5.66	0.0094

APPENDIX

Appendix 2.7 Skukuza Climatic Data

2004

Month	Ave max temp (ºC)	Ave min temp (ºC)	Rainfall (mm)
January	32.7	21.3	208.2
February	31.6	20.9	153.7
March	29.2	19.5	84.7
April	28.6	16.4	59.6
May	27.5	9.6	0.6
June	25.6	5.2	13.9
July	25.0	5.2	24.3
August	28.5	10.0	6.3
September	29.3	11.5	33.4
October	31.2	16.3	36.2
November	33.1	19.5	252.4
December	32.8	20.2	132.4

2005

Month	Ave max temp (ºC)	Ave min temp (ºC)	Rainfall (mm)
January	33.3	21.9	130.9
February	34.1	20.7	53.6
March	31.9	18.6	52.9
April	30.8	16.2	31.1
May	***	***	6.5

*** data not available

Appendix 2.8 Field trial soil sample analysis results

	pH (water)	P Bray mg kg⁻¹	Ammonium acetate extractable			
			Ca	K	Mg	Na
					mg kg⁻¹	
Sample 1 (plot 7)	7.5	58.2	4683	422	479	22
Sample 2 (plot 17)	7.9	37.9	4913	1071	455	57

Appendix 2.9 Field trial layout for 2003/2004 and 2004/2005 growth seasons (Factorial experiment: 3 grasses × 3 parthenium densities × 4 replicates)

36	35	34	33	32	31	30	29	28
19	20	21	22	23	24	25	26	27
18	17	16	15	14	13	12	11	10
1	2	3	4	5	6	7	8	9

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2004 Growth season

Species	Parthenium m^{-2}	Plot no.	Species	Parthenium m^{-2}	Plot no.	Species	Parthenium m^{-2}	Plot no.
E.curvula	0	32	*P. maximum*	0	36	*D. eriantha*	0	19
	0	29		0	24		0	16
	0	7		0	3		0	1
	0	5		0	11		0	31
	0	15		0	8		0	25
	0	23		0	28		0	26
	5	7		5	9		5	18
	5	17		5	20		5	33
	5	27		5	4		5	6
	7.5	13		7.5	12		7.5	35
	7.5	14		7.5	34		7.5	21
	7.5	10		7.5	30		7.5	22

2005 Growth season

Species	Parthenim m^{-2}	Plot no.	Species	Parthenium m^{-2}	Plot no.	Species	Parthenium m^{-2}	Plot no.
E.curvula	0	32	*P. maximum*	0	36	*D. eriantha*	0	19
	0	5		0	24		0	16
	0	7		0	3		0	1
	0	23		0	11		5	18
	5	17		0	8		5	33
	5	15		0	28		5	6
	5	2		5	9		7.5	26
	7.5	13		5	20		7.5	21
	7.5	14		5	4		7.5	31
	7.5	10		7.5	12			
				7.5	34			
				7.5	30			

Species	Parthenim m^{-2}	Plot no.
Parthenium	5	22
	5	27
	7.5	25
	7.5	29
	7.5	35

APPENDIX

Appendix 3.1 Abbreviated ANOVA table for the effect of growth stage on leaf parthenin concentration

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	11	59.01385049	5.36489550	22.33	<.0001
Error	64	15.37696962	0.24026515		
Corrected Total	75	74.39082010			

R^2	C.V	Root MSE	Mean
0.793295	22.69907	0.490168	2.159421

Source	DF	Type III SS	Mean Square	F Value	Pr > F
growth stage	11	59.01385049	5.36489550	22.33	<.0001

Appendix 5.1 Phytotoxicity of parthenin on five different plant species (Taken from Belz *et al*., 2005)

Species	ED$_{50}$ [a] [μg ml^{-1}]	
	root length	germination
Ageratum conyzoides	51.8 (38.7-64.8) [b]	289.9 (253.7-326.2)
Echinochloa crus-galli	220.6 (200.8-240.4)	645.8 (514.3-777.2)
Eragrostis curvula	167.8 (146.0-189.7)	491.3 (396.2-586.3)
Eragrostis tef	226.7 (200.6-252.8)	687.5 (211.5-1163.5)
Lactuca sativa	328.4 (296.4-360.3)	450.4 (399.4-501.5)

[a] concentration causing 50% response; [b] asymptotic 95% confidence interval.

Appendix 5.2 Calculation of potential parthenin concentration in soil

Amount of soil in top 10 cm of 1 m^2:   100 cm x 100 cm x 2 cm
                                            = 20 000 cm^3

For the 2.1 soil (sand):

Weight per volume (g 1000 ml^{-1}) $\rightarrow$ 1390 $\pm$ 37
Water holding capacity (g 100 g^{-1}) $\rightarrow$ 34.7 $\pm$ 5.0

Mass of 2.1 soil: 20 000 cm^3 x 1.39 g
                       = 27 800 g

Water holding capacity (g 100 g^{-1}) $\rightarrow$ 34.7 $\pm$ 5.0

H_2O in 2.1 @ 100% WHC = 9646.6 ml
H_2O in 2.1 @ 40% WHC = 3858.6 ml

1 parthenium plant (maturity) $\rightarrow$ 236.1 mg parthenin * 0.4 = 94.44 mg parthenin

Assuming a stand of 96 parthenium plants m^{-2} $\rightarrow$ 9.07 g parthenin

 Therefore potential [parthenin] in top 2 cm of soil @ 40% WHC $\rightarrow$
       9.07 g/3859 ml
       = 9070 mg/3859ml
       = 2.35 mg ml^{-1} = 2350 µg ml^{-1}