INTEGRATED PEST MANAGEMENT OF MELOIDOGYNE INCOGNITA ON BAMBARA GROUNDNUT (VIGNA SUBTERRANEA)

by

BAONE CYNTHIA KWEREPE

Submitted to the Faculty of Biological and Agricultural Sciences
(Department of Microbiology and Plant Pathology)

UNIVERSITY OF PRETORIA

in partial fulfilment of the requierements for the degree of PhD

UNIVERSITY OF PRETORIA

PRETORIA

DECEMBER 2000



ACKNOWLEDGEMENT

I would like to express my sincere gratitude to my promoter Dr. N. Labuschagne for his guidance, support and encouragement throughout my research and the production of this thesis. Without his patience and understanding this project would not have been completed. My thanks also go to my co-promoter, Prof. A. S. Claassens for his valuable contributions and advice.

Thanks and appreciation are extended to the following people and institutions for their contributions to and involvement in one way or another in my work:

- Johan Janse van Rensburg and Willem Landman for assisting with the logistics during the initial stages of the project
- Jacob Manamela for assisting with management of the experiments at the farm
- Gene Beyers for his enthusiastic support throughout my work at the "Proefplaas".
 Without him life at the "Proefplaas" would have been tough.
- Amelita Lombard, Kerien van Dyk, Roger Bagnall, Daleen Muller and Fanie Verwey
 for their kindness and support and for providing technical assistance whenever the going got tough
- Dr Swanevelder, Oil and Protein Seed Centre, ARC, Potchefstroom, for providing the germplasm used in the screening experiments
- Dr Alec Mc Donald and his nematology colleagues at the Oil and Protein Seed Centre, ARC, Potchefstroom for their support and encouragement
- The nematology staff of the Plant Protection Research Institute, Pretoria, notably Dr Kleynhans and Marietta Marais for assisting with the identification work

University of Pretoria etd - Kwerepe B C 2000

- Dr Martie Botha and the nematology colleagues at the Cotton and Tobacco Research
 Institute, ARC, Rustenburg for their kindness and support
- Dr Hernie Le Roux for his advice and assistance especially regarding literature on biofumigation
- Dr Amanda Lourens and Rina Owen for assistance with statistical analysis
- My friends and colleagues from Botswana, Thabisile Balole, Venus Sebina, Howard Sigwele, Isaac Bok and Otsoseng Oagile, for assisting with experimental work and providing moral support.

My deepest thanks go to my husband Raymond and son Kagiso for their support and sacrifices throughout my studies. I would also like to thank my mother and the Busang and Kwerepe families for their support and encouragement.

I am very grateful to the W K. Kellogg Foundation for their financial sponsorship and to the Botswana College of Agriculture management for granting me the study leave without which this project could not have been possible.

Finally I would like to dedicate this thesis to my late sister Mosadithebe Pamela Magogwe who unfortunately could not live long enough to witness this moment. Her encouragement and support towards my studies will always be remembered. May her soul rest in peace.

University of Pretoria etd – Kwerepe B C 2000

CONTENTS

CHAP	TER 1	PAGE	
	GENERAL INTRODUCTION	1	
	1.1 Bambara groundnut	1	
	1.2 Root-knot nematodes	2	
	1.3 Damage caused by Meloidogyne spp.	3	
	1.4 Control of Meloidogyne spp.	4	
	1.4.1 Resistance/Tolerance	5	
	1.4.2 Organic amendments	8	
	1.4.3 Biofumigation	12	
	1.4.4 Solarization	14	
	1.4.5 Integrated pest management (IPM)	16	
	1.5 Objectives	17	
	1.6 References	18	
CHAPTER 2:			
	SCREENING OF BAMBARA GROUNDNUT (VIGNA SUBTERRANEA	4)	
	LANDRACES FOR RESISTANCE/TOLERANCE TO MELOIDOGYN	E	
	INCOGNITA RACE 2	33	
	Abstract	33	
	2.1 Introduction	33	
	2.2 Materials and Methods	34	

University of Pretoria etd – Kwerepe B C 2000

2.3 Results	37	
2.4 Discussion	40	
2.5 References	44	
CHAPTER 3:	66	
CONTROL OF MELOIDOGYNE INCOGNITA RACE 2 ON		
BAMBARA GROUNDNUT (VIGNA SUBTERRANEA) BY		
MEANS OF POULTRY AND CATTLE MANURE		
Abstract	66	
3.1 Introduction	6	
3,2 Materials and Methods	68	
3.3 Results	71	
3.4 Dicussion	73	
3.5 References	77	
CHAPTER 4:		
CONTROL OF MELOIDOGYNE INCOGNITA RACE 2 ON		
BAMBARA GROUNDNUT (VIGNA SUBTERRANEA BY		
MEANS OF BIOFUMIGATION AND SOLARIZATION		
Abstract	81	
4.1 Introduction	81	
4.2 Materials and Methods	84	

University of Pretoria etd – Kwerepe B C 2000

4.3 Results			89	
4.4 Discussion			93	
4.5 References			98	
CHAPTER 5				
COMPARISON OF SOIL AME	NDMENTS, B	IOFUMIGATION		
AND BIOLOGICAL CONTROL	L AGENTS FC	R THE CONTROL		
OF MELOIDOGYNE INCOGNITA RACE 2 ON BAMBARA				
GROUNDNUT (VIGNA SUBTE	'RRANEA)			
Abstract			115	
5.1 Introduction			115	
5.2 Materials and Methods			116	
5.3 Results			118	
5.4 Discussion			120	
5.5 References			124	
CHAPTER 6			130	
GENERAL DISCUSSION			130	
6.1 References			136	
SUMMARY			138	
SAMEVATTING				