



Betram Gordon Kuol (Autor)

Breeding for Drought Tolerance in Sesame (*Sesamum indicum* L.) in Sudan

Betram Gordon Kuol

BREEDING FOR DROUGHT TOLERANCE IN SESAME (*Sesamum indicum* L.) IN SUDAN



Cuvillier Verlag Göttingen

<https://cuvillier.de/de/shop/publications/2951>

Copyright:

Cuvillier Verlag, Inhaberin Annette Jentzsch-Cuvillier, Nonnenstieg 8, 37075 Göttingen,
Germany

Telefon: +49 (0)551 54724-0, E-Mail: info@cuvillier.de, Website: <https://cuvillier.de>

TABLE OF CONTENTS

	Page
ACKNOWLEDGMENTS.....	i
ABSTRACT.....	iii
ZUSAMMENFASSUNG.....	v
LIST OF TABLES.....	xi
LIST OF GRAPHS.....	xvi
LIST OF FIGURES.....	xvii
LIST OF ABBREVIATIONS.....	xviii
I. INTRODUCTION AND OBJECTIVES.....	1
II: LITERATURE REVIEW.....	4
2.1. Extent of variability in sesame.....	4
2.1.1. Phenotypic and genotypic variability	4
2.1.1.1. Vegetative and reproductive characters.....	4
2.1.1.2. Oil, protein and fatty acid composition.....	5
2.2. Resistance mechanism to drought.....	6
2.2.1. Avoidance mechanism.....	7
2.2.2. Tolerance mechanism.....	8
2.2.3. Escape mechanism.....	8
2.3. Effect of drought on sesame.....	9
2.3.1. Growth and assimilates distribution.....	10
2.3.2. Yield and yield components.....	13
2.3.3. Oil, protein and fatty acid composition.....	15
2.4. Adaptation to drought.....	18
2.5. Improvement of drought tolerance.....	19
2.6. Correlation between traits.....	20
2.7. Impact of drought on estimation of genetic parameters.....	22
2.7.1. Heritability.....	22
2.7.2. Gene action in the inheritance of traits.....	25
2.8. Genotype-environment interactions.....	28
2.9. Evaluation of drought tolerance.....	30
III. MATERIALS ANS METHODS.....	33
3.1. Part one: Assessment of genetic variability.....	33
3.1.1. Genetic material.....	33
3.1.2. Methods.....	33
3.1.2.1. Data collection.....	34
3.1.2.1.1. Vegetative traits.....	34
3.1.2.1.2. Reproductive traits	35
3.1.2.1.3. Quality traits.....	35
3.1.2.1.4. Drought tolerance parameters.....	38
3.1.2.2. Statistical analysis.....	39
3.1.2.2.1. Individual and combined analyses of variance.....	39
3.1.2.2.2. Mean separation.....	39

3.1.2.2.3. Coefficient of variation.....	40
3.1.2.2.4. Phenotypic and genotypic variances.....	40
3.1.2.2.5. Heritability	40
3.1.2.2.6. Genetic coefficient of variation.....	41
3.1.2.2.7. Phenotypic coefficient of correlation.....	41
3.2. Part two: Inheritance study.....	48
3.2.1. Materials.....	48
3.2.2. Methods.....	48
3.2.2.1 Gene action analysis.....	49
3.3. Part three: Evaluation.....	52
IV. RESULTS.....	53
4.1. Part one: extent of variability.....	53
4.1.1. Phenotypic variability for vegetative and reproductive traits.....	53
4.1.2. Response of genotypes to water treatments.....	63
4.1.3. Genotype-environment interaction.....	74
4.1.4. Phenotypic, genotypic and environmental variances.....	75
4.1.5. Coefficient of variation, genetic coefficient of variation and heritability.....	75
4.1.6. Correlation between traits.....	76
4.2. Part two: Inheritance study.....	79
4.2.1. Variability within the generations.....	79
4.2.2. Gene action analysis.....	79
4.2.2.1. Reproductive traits.....	79
4.2.2.2. Yield and yield components	81
4.2.2.3. Quality characters.....	83
4.3. Part three: Evaluation.....	119
4.3.1. Effect of environment on parental genotypes and progenies.....	119
4.3.1.1. Vegetative traits and yield components.....	119
4.3.1.2. Quality traits.....	124
4.3.2. Effect of drought on parental genotypes and progenies.....	129
4.3.2.1. Vegetative traits and yield components.....	129
4.3.2.2. Quality traits.....	130
4.3.3. Phenotypic variability for traits.....	133
4.3.3.1. Vegetative traits and yield components.....	133
4.3.3.2. Quality traits.....	136
4.3.4. Genetic analysis of drought tolerance.....	138
4.3.4.1. Correlation between traits.....	138
4.3.4.1.1. Correlation between vegetative traits and yield components.....	138
4.3.4.1.2. Correlation between yield components and quality traits	141
4.3.4.1.3 Correlation between traits and drought tolerance parameters.....	143
4.3.4.1.4 Correlation between drought tolerance parameters.....	143

4.3.5. Genotypic variability for drought tolerance.....	145
4.3.5.1. Heritability of drought tolerance parameters.....	146
4.3.5.2. Means of drought tolerance parameters.....	146
V. DISCUSSION.....	149
5.1. Part one: Variability study.....	150
5.1.1. Phenotypic and genotypic variability.....	150
5.1.1.1. Morphological and reproductive traits.....	150
5.1.1.2. Quality traits.....	151
5.1.2. Response to water treatment.....	152
5.1.2.1. Morphological and reproductive traits.....	152
5.1.2.2. Quality traits.....	153
5.1.3. Genotype-environment interactions.....	155
5.1.4. Genetic coefficient of variation and heritability.....	157
5.1.5. Correlation between traits.....	158
5.2. Part two: Inheritance study (gene action analysis).....	159
5.2.1. Vegetative traits.....	160
5.2.2. Quality traits.....	164
5.3. Part three: Evaluation.....	166
5.3.1. Effect of environment on parental genotypes and progenies.....	166
5.3.1.1. Yield and yield components.....	166
5.3.1.2. Quality traits.....	167
5.3.2. Effect of drought on parental genotypes and progenies.....	168
5.3.2.1. Yield components.....	168
5.3.2.2. Quality traits.....	168
5.3.3. Phenotypic variability for traits.....	169
5.3.3.1. Yield components.....	169
5.3.3.2. Quality traits.....	169
5.3.4. Genetic analysis of drought tolerance	170
5.3.4.1. Correlation between traits.....	170
5.3.4.1.1. Correlation between yield components and quality traits	170
5.3.4.1.2. Correlation between traits and drought tolerance parameters.....	171
5.3.4.1.3. Correlation between drought tolerance parameters.....	172
5.3.5. Genetic variability for drought tolerance.....	173
5.3.6. Heritability of drought tolerance parameters	174
5.3.7. Selection criteria for drought tolerance.....	175
VI SUMMARY AND CONCLUSION.....	178
6.1. Summary.....	178
6.1.1. Assessment of variability for drought tolerance.....	178
6.1.2. Inheritance study.....	179
6.1.3. Evaluation of drought tolerance.....	180

6.2. Conclusion.....	182
6.2.1. Variability study.....	182
6.2.2. Inheritance study.....	182
6.2.3. Evaluation of parental genotypes and progenies for drought tolerance.....	184
7. REFERENCES.....	185
8. APPENDIX.....	207