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ABSTRACT

Seed development in *Arabidopsis thaliana*, has been studied at several levels. However, little has been done to study the role of sugar metabolism genes in seed pod development in this species. As the fertilized egg progresses to a mature seed, the sugars composition during different stages of the developing changes. These changes are related to metabolic processes in the developing seeds, but also to the activity of sucrose- converting and transporting genes, active at the interphase between the maternal tissue and the endosperm. Sucrose synthase (SUS) is one of these genes; it catalyses the reversible reaction of sucrose breakdown in the presence of UDP to form fructose and UDP-glucose.

In this study we looked at glucose, fructose and sucrose concentration at different time points during seed pod development. These changes in sugar concentrations were analysed in both Colombia wild type and WS (Wassilewskija) ecotypes. By comparison of the sugar composition of these ecotypes, and linking these data with phenotypic observations in both ecotypes during development, we are able to comment on the possible role of sugars in seed pod development. Also, the sugar composition of wild type seed pods were compared with those of *Atsus* mutant seed pods, and possible effects sucrose synthase mutations on the phenotype of the developing *Arabidopsis thaliana* seeds were analysed. The effect of sucrose synthase knockouts in developing seed pods were studied by comparing biochemical and phenotypic characteristics data of the *Atsus* mutants within Colombia wild type plants.

Salk line plants were screened to identify plants carrying a homozygous insertion for T-DNA in five of the sucrose synthase genes. The developing seed pods of each of the homozygous mutants were characterized biochemically via High-Performance Anion-Exchange Chromatography (HPAEC). Furthermore, seed weight, number of seed per pod, germination rate and the morphological development of the embryo were closely analysed.

The study found out that there were some biochemical effects of *Atsus* knockout mutants, and some phenotypic effects of *Atsus* knockout mutants on the developing seed pods. However, in general the effects were not as pronounced as those that were seen in maize seed, pea seed and potato tuber as a result of sucrose synthase knockout. The general pattern of glucose, fructose and sucrose were similar to the Colombia wild type, although in mature seed pods the sucrose levels in *Atsus1*, *Atsus2*, *Atsus3* and *Atsus6* were slightly, but significantly lower than in the Colombia wild type.

Table of Contents

Chapter and Section number	Content	Page
	Abstract	i
	Table of Contents	ii
	Table of Tables	xi
	Table of Diagrams/Figures	xv
	Acknowledgments	xxii
	Dedication	xxiii
	Declaration	xxiv
	Abbreviations	xxv
Chapter 1	Introduction	
1.1	Introduction	1
1.2	Seed Development	2
1.3	<i>Arabidopsis thaliana</i> the model plant	4
1.4	<i>Arabidopsis</i> seed	7
1.5	Embryo development	7
1.6	Development and functions of endosperm	9
1.7	Suspensor	12
1.8	Sugar Transport in Developing Seeds	13
1.9	Sugar Metabolism in Developing Seed	15
1.10	Sucrose Metabolism Enzymes: Invertase and Sucrose Synthase	17
	1.10.1 Invertase	17
	1.10.2 Sucrose synthase	18
1.11	Sucrose Synthase in <i>Arabidopsis thaliana</i>	19
1.12	Sugar regulation in seed development in <i>Arabidopsis thaliana</i>	22
1.11	Hypothesis and Aims	26
Chapter 2	Materials and Methods	
2.1	Growth Conditions	27

2.2	Plant Material	27
2.3	DNA Extraction	31
2.3.1	Edwards's Method	31
2.3.2	Msc Method	32
2.4	Polymerase Chain Reaction (PCR)	32
2.5	Agarose Gel Electrophoresis	35
2.6	Gel Photographs	36
2.7	Determination of Age of the Pods	36
2.7.1	Tagging by cutting	36
2.7.2	Artificial Pollination	37
2.8	Harvesting	37
2.9	Seed Clearing	38
2.9.1	Potassium hydroxide clearing	38
2.9.2	Chlorohydrate clearing	38
2.9.3	Acetic acid and chlorohydrate clearing procedure	39
2.10	Microscopy and photography	40
2.11	Germination Assay	40
2.12	Seed Weight	40
2.13	Seed Count	42
2.14	Abortion Ratio	42
2.15	Whole Seed and Embryo Measurement	42
2.16	Sample Preparation for Sugar Analysis	47
2.16.2	Standard Curve Sample Preparation	49
2.16.2	Calculation of Sugar Content	49
2.17	Data Analysis	50
Chapter 3	Genotyping	
3.1	Introduction	51
3.2	Identification of Homozygous Mutant Plants	54
3.3	Genotyping <i>AtSUS1</i>	61
3.4	Screening for Homozygous <i>AtSUS1</i> plant	61
3.5	PCR with T-DNAF ₃ and T-DNAR ₃	61
3.6	PCR with BR151 and LBB1 primers	64

3.7	PCR with BR151 and BR151r primers	66
3.8	<i>AtSUS1</i> Genotyping Conclusion	68
3.9	Genotyping <i>AtSUS 2</i>	69
3.10	Screening for homozygous <i>AtSUS2</i> plant	69
3.11	PCR with T-DNAF ₃ and T-DNAR ₃	69
3.12	PCR with NR200 and LBA1 primers	71
3.13	PCR with NR200 and NR200r primers	73
3.14	<i>AtSUS2/N576296</i> Genotyping Conclusion	75
3.15	Salk Line N550900	76
3.16	Screening for Homozygous <i>AtSUS2</i> plant Salk line N550900	76
3.17	PCR with T-DNAF ₃ and T-DNAR ₃	76
3.18	PCR with NR212 and LBB1 primers	80
3.19	PCR with NR212 and NR212r primers	83
3.20	<i>AtSUS2</i> Genotyping Conclusion	86
3.21	Genotyping <i>AtSUS3</i>	87
3.22	Screening for homozygous <i>AtSUS3</i> plant	87
3.23	PCR with T-DNAF ₃ and T-DNAR ₃	87
3.24	PCR with NR201 and LBA1 primers	89
3.25	PCR with NR201and NR201r primers	91
3.26	<i>AtSUS3</i> Genotyping Conclusion	93
3.27	Genotyping <i>AtSUS5</i>	94
3.28	Screening for Homozygous <i>AtSUS5</i>	94
3.29	PCR with T-DNAF ₃ and T-DNAR ₃	94
3.30	PCR with NR203 and LBA1 primers	96
3.31	PCR with NR203 and NR203r primers	98
3.32	<i>AtSUS5</i> Genotyping Conclusion	100
3.33	Genotyping <i>AtSUS 6</i>	101
3.34	Screening for Homozygous <i>AtSUS6</i>	101
3.35	PCR with T-DNAf ₃ and T-DNAr ₃	101
3.36	PCR with NR204 and LBA1	103
3.37	PCR with NR204 and NR04r	105
3.38	<i>AtSUS6</i> Genotyping Conclusion	107

3.39	Discussions	108
3.39.1	Selection and screening of <i>AtSUS1</i> T-DNA insertion line	110
3.39.2	Selection and screening of <i>AtSUS2</i> T-DNA insertion line	110
3.39.3	Selection and screening of <i>AtSUS3</i> T-DNA insertion line	115
3.39.4	Selection and screening of <i>AtSUS4</i> T-DNA insertion line	115
3.39.5	Selection and screening of <i>AtSUS5</i> T-DNA insertion line	115
3.39.6	Selection and screening of <i>AtSUS6</i> T-DNA insertion line	116

Chapter 4

Biochemical analysis of *Arabidopsis thaliana* seed

4.1	Introduction	117
4.2	The Sucrose -Cleaving Enzymes	117
4.3	Effect of Change in Sugar Status in Developing Seed	118
4.4	Sugar as Gene Expression Regulator	119
4.5	Analysis of Sugars	120
4.6	Principle of HPLC	121
4.7	Wild type <i>Arabidopsis thaliana</i> sugar analysis	125
4.8	Glucose Analysis in Colombia wild type	127
4.9	Fructose Analysis in Colombia wild type seeds	129
4.10	Sucrose Analysis in Colombia wild type	129
4.11	Sugar Concentration at the Developmental Stages	129
4.12	Hexose Sucrose Ratio Analysis	132
4.13	Discussion of sugar content in developing wt Col seeds	134
4.14	Sugar metabolism in sucrose synthase mutants seeds	136
4.15	Biochemical Analysis of Sugar in <i>Arabidopsis</i> <i>thaliana</i> SUS1-mutant Seeds	136
4.16	Glucose levels in developing seed pods of <i>Atsus1-</i>	

mutants	137
4.17 Fructose levels in developing seed pods of <i>Atsus1</i> -mutants	140
4.18 Sucrose levels in developing seed pods of <i>Atsus1</i> -mutants	143
4.19 Biochemical analysis of sugar in <i>Arabidopsis thaliana sus2</i> mutant seeds	146
4.20 Glucose levels in developing seed pods of <i>Atsus2</i> -mutants	146
4.21 Fructose levels in developing seed pods of <i>Atsus2</i> -mutants	149
4.22 Sucrose levels in developing seed pods of <i>Atsus2</i> -mutants	152
4.23 Biochemical analysis of sugar in <i>Arabidopsis thaliana sus3</i> mutant seeds	156
4.24 Glucose levels in developing seed pods of <i>Atsus3</i> -mutants	156
4.25 Fructose levels in developing seed pods of <i>Atsus3</i> -mutants	158
4.26 Sucrose levels in developing seed pods of <i>Atsus3</i> -mutants	161
4.27 Biochemical analysis of sugar in <i>Arabidopsis thaliana sus5</i> mutant seeds	164
4.28 Glucose levels in developing seed pods of <i>Atsus5</i> -mutant	164
4.29 Fructose levels in developing seed pods of <i>Atsus5</i> -mutants	168
4.30 Sucrose levels in developing seed pods of <i>Atsus5</i> -mutants	171
4.31 Biochemical Analysis of Sugar in <i>Arabidopsis thaliana sus6</i> mutant seeds	174
4.32 Glucose levels in developing seed pods of <i>Atsus6</i> -mutants	174
4.33 Fructose levels in developing seed pods of	

	<i>Atsus6</i> mutants	177
4.34	Sucrose levels in developing seed pods of <i>Atsus6</i> -mutants	180
4.35	Biochemical Analysis of Sugar in <i>Arabidopsis thaliana</i> <i>Ws</i> ecotype	183
4.36	Glucose levels in developing seed pods of <i>Ws</i>	184
4.37	Fructose levels in developing seed pods of <i>Ws</i>	187
4.38	Sucrose levels in developing seed pods of <i>Ws</i>	190
4.39	Hexose/Sucrose Ratio Analysis of <i>Ws</i> Discussion	193
4.40	Discussions	195
4.40.1	Methodology used in sugar analysis	195
4.40.2	The material analysed in sugar analysis	196
4.40.3	The effect of <i>AtSUS1</i> knockout on the sugar level of developing seeds	197
4.40.4	The effect of <i>AtSUS2</i> knockout on the sugar level of developing seeds	199
4.40.5	The effect of <i>AtSUS3</i> knockout on the sugar level of developing seeds	201
4.40.6	The effect of <i>AtSUS5</i> knockout on the sugar level of developing seeds	203
4.40.7	The effect of <i>AtSUS6</i> knockout on the sugar level of developing seeds	205
4.40.8	The effect of <i>AtSUS</i> knockout on developing seeds	206

Chapter 5 Phenotypic Characterization of Sucrose Synthase Mutants Seeds

5.1	Introduction	209
5.2	Endosperm dependent phenotype	209
5.3	Phenotypic effect of sucrose synthase mutants	211
5.4	Sugar Determines Phenotypes	212
5.5	Gene Expression	212

5.6	Results	215
5.6.1	Seed Weight in Wild Type and Mutant plants	215
5.6.2	Number of seed per pod	217
5.6.3	Phenotypic Analysis of <i>sus</i> Mutants relative to wt Segregate	219
5.6.4	Germination Ability of <i>sus</i> Mutants seeds	223
5.6.5	Percentage Plump and Shrivelled <i>sus</i> Mutant Seeds	227
5.7	Discussion	230
5.7.1	Seed weight	230
5.7.2	Numbers of seeds per pod	231
5.7.3	Seed Germination	232
5.7.4	Plump vs Shrivelled Seeds	235

Chapter 6

Internal Structure of Mutated Sucrose Synthase Seeds

6.1	Introduction	236
6.2	Overview of <i>Arabidopsis thaliana</i> seed development	236
6.3	Seed Clearing Techniques	237
6.4	Results	239
6.4.1	Colombia wild type Seed Development	239
6.4.2	Analysis of <i>Atsus1</i> internal structure	244
6.4.3	Analysis of <i>Atsus2</i> internal structure	248
6.4.4	Analysis of <i>Atsus3</i> internal structure	252
6.4.5	Analysis of <i>Atsus5</i> internal structure	256
6.4.6	Analysis of <i>Atsus6</i> internal structure	260
6.5	Discussion	264
6.5.1	The internal structure of <i>Atsus1</i> seed	265
6.5.2	The internal structure of <i>Atsus2</i> seed	266
6.5.3	The internal structure of <i>Atsus3</i> seed	267

6.5.4	The internal structure of <i>Atsus5</i> seed	267
6.5.5	The internal structure of <i>Atsus6</i> seed	267
6.5.6	General effect of <i>AtSUS</i> knockout on seed size and embryo development	268

Chapter 7 General Discussion, Conclusions and Further Work

7.1	Sugars content of Colombia wild type and Ws ecotypes of <i>Arabidopsis thaliana</i>	269
7.1.1	Colombia wild type sugars content	269
7.1.2	Ws wild type sugars content	270
7.1.3	Sugars content of Colombia wild type vs Ws wild type	270
7.1.4	Hexoses /sucrose ratio of Colombia and Ws ecotype	271
7.1.5	Physical characteristics of Colombia wild type seeds	274
7.1.6	Colombia wild type and wild type segregate	276
7.2	Sugar Analysing technique	279
7.3	The effect of <i>AtSUS</i> knockout of developing seeds	282
7.4	Summary of the effect of <i>AtSUS</i> knockout of developing seeds	286
7.5	Relevance and redundancy of <i>AtSUS</i> during seed development	293
7.6	Conclusions	294
7.7	Further works	296
7.7.1	Comparison of sugar analysis in seeds and pod walls	296
7.7.2	Comparison of sugar analysis in <i>Arabidopsis</i> and Oil seed rape	297

	7.7.3 Further analysis of Columbia wild type segregate	297
	7.7.4 Down regulation of sucrose synthase gene	298
Section 8	References	299
Section 9	Appendices	308

Table of Tables

Chapter and Section	Content	Page
Chapter 2	Materials and Methods	
2.1	The list of seeds used and their sources	30
2.2	Gene and the primers used in screening for plant carrying T-DNA insertions and their Sequences	34
Chapter 3	Genotyping	
3.1	<i>AtSUS</i> genes and different primers combination used in the screening process with the expected sizes.	58
3.2	Predicted PCR result for each of the three possible T-DNA insertion genotypes	60
3.8	The number of <i>AtSUS2</i> Salk line screened.	114
Chapter 4	Biochemical analysis of <i>Arabidopsis thaliana</i> seed	
4.1	Sugar content (ng / g pod) in wild type seed pod and corresponding p-value of comparison between the developmental stages	131
4.2	Glucose content (ng / g pod) in wild type and <i>Atsus1</i> seed pod and corresponding p-value of comparison between mutant and wild type seed pods	139
4.3	Fructose content (ng / g pod) in wild type and <i>Atsus1</i> seed pod and corresponding p-value of comparison between mutant and wild type seed pods	142
4.4	Sucrose content (ng / g pod) in wild type and <i>Atsus1</i> seed pod and corresponding p-value of comparison between mutant and wild type seed pods	145
4.5	Glucose content (ng / g pod) in wild type and <i>Atsus2</i> seed pod and corresponding p-value of comparison between mutant and wild type seed pods	148
4.6	Fructose content (ng / g pod) in wild type and <i>Atsus2</i> seed pod and corresponding p-value of comparison	151

	between mutant and wild type seed pods	
4.7	Sucrose content (ng / g pod) in wild type and <i>Atsus2</i> seed pod and corresponding p-value of comparison between mutant and wild type seed pods	154
4.8	Glucose content (ng / g pod) in wild type and <i>Atsus3</i> seed pod and corresponding p-value of comparison between mutant and wild type seed pods	157
4.9	Fruuctose content (ng / g pod) in wild type and <i>Atsus3</i> seed pod and corresponding p-value of comparison between mutant and wild type seed pods	160
4.10	Sucrose content (ng / g pod) in wild type and <i>Atsus3</i> seed pod and corresponding p-value of comparison between mutant and wild type seed pods	163
4.11	Glucose content (ng / g pod) in wild type and <i>Atsus5</i> seed pod and corresponding p-value of comparison between mutant and wild type seed pods	167
4.12	Fructose content (ng / g pod) in wild type and <i>Atsus5</i> seed pod and corresponding p-value of comparison between mutant and wild type seed pods	170
4.13	Sucrose content (ng / g pod) in wild type and <i>Atsus5</i> seed pod and corresponding p-value of comparison between mutant and wild type seed pods	173
4.14	Glucose content (ng / g pod) in wild type and <i>Atsus6</i> seed pod and corresponding p-value of comparison between mutant and wild type seed pods	176
4.15	Fruuctose content (ng / g pod) in wild type and <i>Atsus6</i> seed pod and corresponding p-value of comparison between mutant and wild type seed pods	179
4.16	Sucrose content (ng / g pod) in wild type and <i>Atsus6</i> seed pod and corresponding p-value of comparison between mutant and wild type seed pods	181
4.17	Glucose content (ng / g pod) in wild type and Ws seed pod and corresponding p-value of comparison between mutant and wild type seed pods	186
4.18	Fuctose content (ng / g pod) in wild type and WS seed	

	pod and corresponding p-value of comparison between mutant and wild type seed pods	189
4.19	Sucrose content (ng / g pod) in wild type and WS seed pod and corresponding p-value of comparison between mutant and wild type seed pods	192
Chapter 5	Phenotypic Characterization of Sucrose Synthase Mutants Seeds	
5.1	The weight of 100 seeds and % differences between the means of the wt and the <i>sus</i> mutants with their corresponding p values	216
5.2	The genotypes, the number of seed/pod and % differences with their corresponding <i>p</i> values	216
5.3	The weight of 100 seeds and % differences between the means of the wt segregate and the <i>sus</i> mutants with their corresponding <i>p</i> values	220
5.4	The number of seed/pod and % differences between the segregate wild type and the <i>sus</i> mutants with their corresponding <i>p</i> values	222
Chapter 6	Internal Structure of Mutated Sucrose Synthase Seeds	
6.1	The Average length (μm) of <i>Atsus1</i> seeds at different DAP	246
6.2	The Average width (μm) of <i>Atsus1</i> seeds at different DAP	246
6.3	The length of developing embryo from DAP4 to DAP6 of <i>Atsus1</i> seed	247
6.4	The Average length (μm) of <i>Atsus2</i> seeds at different DAP	250
6.5	The Average width (μm) of <i>Atsus2</i> seeds at different DAP	250
6.6	The length of developing embryo from DAP4 to DAP6 of <i>Atsus1</i> seed	251

6.7	The Average length (μm) of <i>Atsus3</i> seeds at different DAP	254
6.8	The Average width (μm) of <i>Atsus3</i> seeds at different DAP	254
6.9	The length of developing embryo from DAP4 to DAP6 of <i>Atsus1</i> seed	255
6.10	The Average length (μm) of <i>Atsus5</i> seeds at different DAP	258
6.11	The Average width (μm) of <i>Atsus5</i> seeds at different DAP	259
6.12	The length of developing embryo from DAP4 to DAP6 of <i>Atsus1</i> seed	259
6.13	The Average length (μm) of <i>Atsus6</i> seeds at different DAP	262
6.14	The Average width (μm) of <i>Atsus6</i> seeds at different DAP	262
6.15	The length of developing embryo from DAP 4 to DAP6 of <i>Atsus6</i>	263

Chapter 7 General Discussion, Conclusions and Further Work

7.1	Overview of <i>Atsus</i> mutants' parameters and point of significant difference with Colombia wild type of <i>Arabidopsis thaliana</i>	289
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Table of Diagrams/Figures

Chapter and Figure	Content	Page
Chapter 1	Introduction	
	1.1 Fertilization in wild type <i>Arabidopsis thaliana</i>	3
	1.2 An adult <i>Arabidopsis</i> plant	5
	1.3 Sucrose metabolism path way	16
Chapter 2	Materials and Methods	
	2.1 Seedlings growing in a Petri dish	28
	2.2 Seedlings growing in individual pot after 14 days of sowing	28
	2.3 <i>Arabidopsis thaliana</i> plants in growing cabinet	29
	2.4 Olympus BX 40 microscope	41
	2.5 Plump seed and Shrivelled seed	43
	2.6 The schematic diagram of a developing seed	44
	2.7 The schematic diagram of a developing seed	44
	2.8 The graticule	46
	2.9 The picture of a graticule ruler taken under microscope	46
	2.10 Dionex DX500 chromatograph	48
Chapter 3	Genotyping	
	3.1 Possible results of T-DNA insertion in different locations in a gene	53
	3.2 Schematic diagram of PCR with two T-DNA primers	55
	3.3 Schematic diagram of PCR with left border primers and gene specific primers	55
	3.4 Schematic diagram of PCR with two endogenous primers	55
	3.5 Schematic diagram of Salk line T-DNA and it primers	57
	3.6 Agarose gel under UV light and PCR product with F ₃ and R ₃	

primers	63
3.7 Agarous gel under UV light and PCR product with LBB1 and BR151 primers	65
3.8 Agarous gel under UV light and PCR product with BR151 and BR151r primers	67
3.9 Agarous gel under UV light and PCR product with F ₃ and R ₃ primers	70
3.10 Agarous gel under UV light and PCR product with NR200 and LBA1 primers	72
3.11 Agarous gel under UV light and PCR product with NR200 and NR200r primers	74
3.12 Agarous gel under UV light and PCR product with F ₃ and R ₃ primers	78
3.13 Agarous gel under UV light and PCR product with F ₃ and R ₃ primers	79
3.14 Agarous gel under UV light and PCR product with NR212 and LBB1 primers	81
3.15 Agarous gel under UV light and PCR product with NR212 and LBB1 primers	82
3.16 Agarous gel under UV light and PCR product with NR212 and NR212r primers	84
3.17 Agarous gel under UV light and PCR product with NR212 and NR212r primers	85
3.18 Agarous gel under UV light and PCR product with F ₃ and R ₃ primers	88
3.19 Agarous gel under UV light and PCR product with NR201 and LBA1 primers	90
3.20 Agarous gel under UV light and PCR product with NR201 and NR201r primers	92
3.21 Agarous gel under UV light and PCR product with F ₃ and R ₃ primers	95
3.22 Agarous gel under UV light and PCR product with NR203 and LBB1 primers	97
3.23 Agarous gel under UV light and PCR product with NR203 and	

	NR203r primers	99
3.24	Agarous gel under UV light and PCR product with F ₃ and R ₃ primers	102
3.25	Agarous gel under UV light and PCR product with NR204 and LBA1 primers	104
3.26	Agarous gel under UV light and PCR product with NR204 and NR204r primers	106

Chapter 4 Biochemical analysis of *Arabidopsis thaliana* seed

4.1	Schematic diagram of HPLC	124
4.2	Sugar profile of wild type <i>Arabidopsis thaliana</i> developing seed pods at different days after pollination (DAP)	128
4.3	The sugar changes in the seed development process of <i>Arabidopsis thaliana</i> Colombia wild type.	131
4.4	The hexose /sucrose ratio was calculated with the mean concentrations of hexose (glucose and fructose) and sucrose	133
4.5	Glucose profile of <i>Atsus1</i> and Colombia wild type <i>Arabidopsis thaliana</i> developing seed pods at different days after pollination (DAP)	138
4.6	Changes in glucose amount during seed development of <i>Arabidopsis thaliana sus1</i> mutant	139
4.7	Fructose profile of <i>Atsus1</i> and Colombia wild type <i>Arabidopsis thaliana</i> developing seed pods at different days after pollination (DAP)	141
4.8	Changes in fructose amount during seed development of <i>Arabidopsis thaliana sus1</i> mutant	142
4.9	Sucrose profile of <i>Atsus1</i> and Colombia wild type <i>Arabidopsis thaliana</i> developing seed pods at different days after pollination (DAP)	144
4.10	Changes in sucrose amount during seed development of <i>Arabidopsis thaliana sus1</i> mutant	145
4.11	Glucose profile of <i>Atsus2</i> and Colombia wild type <i>Arabidopsis</i>	

	<i>thaliana</i> developing seed pods at different days after pollination	147
4.12	Changes in glucose amount during seed development of <i>Arabidopsis thaliana sus2</i> mutant	148
4.13	Fructose profile of <i>Atsus2</i> and Colombia wild type <i>Arabidopsis thaliana</i> developing seed pods at different days after pollination (DAP)	150
4.14	Changes in fructose amount during seed development of <i>Arabidopsis thaliana sus2</i> mutant	151
4.15	Sucrose profile of <i>Atsus2</i> and Colombia wild type <i>Arabidopsis thaliana</i> developing seed pods at different days after pollination (DAP)	153
4.16	Changes in sucrose amount during seed development of <i>Arabidopsis thaliana sus2</i> mutant	154
4.17	Glucose profile of <i>Atsus3</i> and Colombia wild type <i>Arabidopsis thaliana</i> developing seed pods at different days after pollination (DAP)	156
4.18	Changes in glucose amount during seed development of <i>Arabidopsis thaliana sus3</i> mutant	157
4.19	Fructose profile of <i>Atsus3</i> and Colombia wild type <i>Arabidopsis thaliana</i> developing seed pods at different days after pollination (DAP)	159
4.20	Changes in fructose amount during seed development of <i>Arabidopsis thaliana sus3</i> mutant	160
4.21	Sucrose profile of <i>Atsus3</i> and Colombia wild type <i>Arabidopsis thaliana</i> developing seed pods at different days after pollination (DAP)	162
4.22	Changes in sucrose amount during seed development of <i>Arabidopsis thaliana sus3</i> mutant	163
4.23	Glucose profile of <i>Atsus5</i> and Colombia wild type <i>Arabidopsis thaliana</i> developing seed pods at different days after pollination (DAP)	167
4.24	Changes in glucose amount during seed development of <i>Arabidopsis thaliana sus5</i> mutant	
4.25	Fructose profile of <i>Atsus5</i> and Colombia wild type <i>Arabidopsis</i>	

	<i>thaliana</i> developing seed pods at different days after pollination (DAP)	169
4.26	Changes in fructose amount during seed development of <i>Arabidopsis thaliana sus5</i> mutant	170
4.27	Sucrose profile of <i>Atsus5</i> and Colombia wild type <i>Arabidopsis thaliana</i> developing seed pods at different days after pollination (DAP)	172
4.28	Changes in sucrose amount during seed development of <i>Arabidopsis thaliana sus5</i> mutant	173
4.29	Glucose profile of <i>Atsus6</i> and Colombia wild type <i>Arabidopsis thaliana</i> developing seed pods at different days after pollination (DAP)	175
4.30	Changes in glucose amount during seed development of <i>Arabidopsis thaliana sus6</i> mutant	176
4.31	Fructose profile of <i>Atsus6</i> and Colombia wild type <i>Arabidopsis thaliana</i> developing seed pods at different days after pollination (DAP)	178
4.32	Changes in fructose amount during seed development of <i>Arabidopsis thaliana sus6</i> mutant	179
4.33	Sucrose profile of <i>Atsus6</i> and Colombia wild type <i>Arabidopsis thaliana</i> developing seed pods at different days after pollination (DAP)	181
4.34	Changes in sucrose amount during seed development of <i>Arabidopsis thaliana sus6</i> mutant	182
4.35	Glucose profile of Ws and Colombia wild type <i>Arabidopsis thaliana</i> developing seed pods at different days after pollination (DAP)	185
4.36	Changes in glucose amount during seed development of <i>Arabidopsis thaliana</i> Ws ecotype	186
4.37	Fructose profile of Ws and Colombia wild type <i>Arabidopsis thaliana</i> developing seed pods at different days after pollination (DAP)	188
4.38	Changes in fructose amount during seed development of <i>Arabidopsis thaliana</i> Ws ecotype	189
4.39	Sucrose profile of Ws and Colombia wild type <i>Arabidopsis thaliana</i>	

	developing seed pods at different days after pollination (DAP)	191
4.40	Changes in sucrose amount during seed development of <i>Arabidopsis thaliana</i> Ws ecotype	192
4.41	The hexose /sucrose ratio of Ws wild type	194

**Chapter 5 Phenotypic Characterization of Sucrose Synthase Mutants
Seeds**

5.1	Mature seed of <i>Arabidopsis thaliana</i>	210
5.2	Comparison between the germination percentage of Colombia wild type and the SUS mutant at 2 days after 48 hours incubation	224
5.3	Comparison between the germination percentage of Colombia wild type and the SUS mutant at 4 days after 48 hours incubation	225
5.4	Overview of germinating Colombia wild type seeds at 2 days after 48 hours incubation in dark room	226
5.5	Overview of germinating Colombia wild type seeds at 4 days after 48 hours incubation in dark room with the first cotyledon leaves	228
5.6	Comparison between % plump seeds and % shrivelled seeds of Colombia wild type and the SUS mutants	229
5.7	Picture A shows a plump seed and B a shrivelled seed	292

Chapter 6 Internal Structure of Mutated Sucrose Synthase Seeds

6.1	The pictures show that some pods contain seed of different embryonic stages	241
6.2	Length and width of developing Colombia ecotype of <i>Arabidopsis thaliana</i> seed	242
6.3	Seeds from the same pod but different embryonic stages	243
6.4	Sequential pictures of <i>Atsus1</i> seed development	245
6.5	Figures A and B compare <i>Atsus1</i> and Colombia wild type length and width during development respectively	246
6.6	Embryo length from DAP 4 to DAP 6 of <i>Atsus1</i> and Colombia wild type	247

6.7	Sequential pictures of <i>Atsus2</i> seed development	249
6.8	Figures A and B compare <i>Atsus2</i> and Colombia wild type length and width during development respectively	250
6.9	Embryo length from DAP 4 to DAP 6 of <i>Atsus2</i> and Colombia wild type	251
6.10	Sequential pictures of <i>Atsus3</i> seed development	253
6.11	Figures A and B compare <i>Atsus3</i> and Colombia wild type length and width during development respectively	254
6.12	Embryo length from DAP 4 to DAP 6 of <i>Atsus3</i> and Colombia wild type	255
6.13	Sequential pictures of <i>Atsus5</i> seed development	257
6.14	Figures A and B compare <i>Atsus5</i> and Colombia wild type length and width during development respectively	258
6.15	Embryo length from DAP 4 to DAP 6 of <i>Atsus5</i> and Colombia wild type	259
6.16	Sequential pictures of <i>Atsus6</i> seed development	261
6.17	Figures A and B compare <i>Atsus6</i> and Colombia wild type length and width during development respectively	262
6.18	Embryo length from DAP 4 to DAP 6 of <i>Atsus6</i> and Colombia wild type	263

Chapter 7 General Discussion, Conclusions and Further Work

7.1	The initial steps in sucrose metabolism pathway	281
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*Wisdom is the principal thing in all your
Getting get understanding –King Solomon.*

DECLARATION

I declare that the work contained in this thesis has not been submitted for any other award and that it is all my own work.

Name: Benjamin Oladipo Odunlami

Signature:

Date: 19/10/2009

Abbreviations

ANOVA-Analysis of variance
AtSUS-*Arabidopsis thaliana* sucrose synthase
DAP- Day after pollination
DNA- Deoxyribonucleic acid
°C – degree centigrade
Col- Columbia
EF- Elongation factor
el- embryo length
g- gram
GC- Gas chromatography
GSP –gene specific primer
h- hour
HPAEC-High performance anion exchange chromatography
mA- milliamplitude
Min -minute
ml- millilitre
mM - millimolar
mRNA –messenger ribonucleic acid
MΩ/cm - ohm meters per centimetre
NASC –Nottingham Arabidopsis stock centre
ng- microgram
PCR- Polymerase chain reaction
PTGS- Post transcription gene silencing
%- percentage
RAM- root apical meristem
RNAi – RNA interference
TAIR - The Arabidopsis Information Resource
T-DNA- transfer DNA
TIAG- the *Arabidopsis* genome initiative
TES-
s- second
sd- standard deviation

sl- seed length
SUS- sucrose synthase
sw- seed width
T-DNA- transfer DNA
TLC- thin layer chromatography
T3- third generation
SAM – stem apical meristem
SPS- sucrose phosphate synthase
UDP- Uridine diphosphate
 μeq - microequivalents
 μl - micro litre
 μg - micro gram
 μM - micro molar
UNEP- United Nation Environmental Protection
UTR- untranslated region
UV- ultraviolet light
v/v- volume per volume
Ws- Wassilewskija