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.
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Wisdom is the principal thing in all your getting; understanding is even more valuable than rubies. 

—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
0°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