
Title	Page
Abstract	i
Declaration by Candidate	iv
Certificate of Supervisor	v
Certificate of Co-supervisor	vi
Acknowledgement	vii
Contents	xi
List of Figures and Tables	xix
Abbreviation	xxiv
Chapter 1: Introduction	1-30
1.1 Sweet potato	
1.1.1 Sweet potato: Origin and importance	
1.1.1.1 Sweet potato: An efficient source of energy	
1.1.1.2 Biochemical and nutritional composition of sweet potato	
1.1.1.2.1 Carbohydrate	
1.1.1.2.2 Protein	
1.1.1.2.3 Fiber and ash content	
1.1.1.2.4 Vitamins and minerals	
1.1.1.2.5 Antioxidants: phytochemicals and carotenoids	
1.1.1.3 Health benefits of sweet potato	
1.1.2 Sweet potato: Production and distribution across the globe	
1.1.3 Sweet potato: Botany and physiology	

1.1.4	Cultivation
1.1.5	Sweet potato: Cultivars, varieties and hybrids
1.1.6	Sweet potato: Problems, challenges and future perspectives
1.2	Nutrition and its ‘omic’ studies
1.2.1	Nutritional genomics or nutrigenomics
1.2.2	Nutritional epigenomics
1.2.3	Nutritranscriptomics
1.2.4	Nutriproteomics
1.2.5	Nutritional metabolomics
1.3	Enhancement of protein quality in crops
1.3.1	Improvement of protein quality in crops: Strategies and approaches
1.3.2	Transgenic approach vs. conventional breeding
1.4	Seed storage proteins and its role in nutritional improvement
1.4.1	Seed storage proteins: A vista for nutritional improvement
1.4.2	Seed storage protein AmA1: A promising candidate for nutritional improvement
1.5	Assessment of genetically modified crops
1.5.1	Targeted (compound-specific) approach using single compound analysis
1.5.2	Non-targeted (profiling/ fingerprinting) approach using profiling methods
1.5.2.1	Analysis of genome
1.5.2.2	Transcript analysis
1.5.2.3	Proteomics analysis

1.5.2.4	Metabolome analysis	
1.6	Transformation of AmA1 in sweet potato: Needs, challenges and future perspective	
Chapter 2:	Review of Literature.....	31-53
2.1	Traditional breeding of sweet potato: Problems, strategies, and achievements	
2.2	Regeneration in sweet potato	
2.2.1	Regeneration via different explant sources	
2.2.2	Somatic embryogenesis: As a route to regeneration	
2.2.2.1	Regeneration via suspension culture	
2.2.2.2	Regeneration via organogenesis and somatic embryogenesis	
2.2.3	Regeneration from protoplasts and somatic hybrids	
2.2.4	Anther culture	
2.3	Sweet potato: A potential candidate for transgene introduction	
2.3.1	Electroporation	
2.3.2	Particle Bombardment	
2.3.3	<i>Agrobacterium</i> -mediated transformation	
2.4	Development of transgenic sweet potato with agronomic importance	
2.4.1	Transgenic for stress tolerance	
2.4.1.1	Biotic stress	
2.4.1.2	Abiotic stress	
2.4.2	Transgenic for herbicide resistance	
2.4.3	Transgenic for nutritional improvements	

2.5	Overexpression of AmA1: An overview
2.6	Assessment of transgenic crops using ‘omic’ profiling techniques
2.6.1	Transcriptome profiling to compare transgenic crops <i>vis-à-vis</i> to wild type
2.6.2	Proteomics as a tool to compare transgenic crops
2.6.3	Metabolomics as tool to compare transgenic crops to their wild type counterparts
2.7	Sweet potato proteomics: An unexplored area
Chapter 3:	Establishment of Efficient Regeneration and Transformation System in Sweet Potato.....54-65
3.1	Introduction
3.2	Materials and methods
3.2.1	Explant source
3.2.2	Bacterial strains and constructs
3.2.3	Media and solutions
3.2.4	Mobilization of Expression Plasmid in <i>Agrobacterium</i>
3.2.4.1	Triparental mating
3.2.4.2	PCR Confirmation of recombinant clone
3.2.4.3	Colony hybridization
3.2.4.4	Probe preparation and nucleic acid hybridization
3.2.4.5	Post hybridization washing and autoradiography
3.2.4.6	Retrieval of positive clones and its maintenance
3.2.5	Genetic transformation of sweet potato

3.2.5.1	Maintenance of different sweet potato cultivars and preparation of explants
3.2.5.2	Preparation of <i>Agrobacterium</i> culture for transformation
3.2.5.3	Co-cultivation
3.2.5.4	Selection and regeneration
3.3	Results
3.3.1	Mobilization of the Recombinant Plasmids
3.3.2	Establishment of regeneration system via the expression of <i>GUS</i>
3.3.3	Transformation of <i>AmA1</i> in cv. SP-6
3.3.4	Selection of putative transformants
3.4	Discussion
Chapter 4:	Molecular Analysis of Transgenic Plants.....66-85
4.1	Introduction
4.2	Materials and methods
4.2.1	Plant growth and maintenance
4.2.2	Molecular analysis of putative transgenic lines
4.2.3	Molecular analysis of the putative transgenic lines at transcript level
4.2.3.1	Northern blot analysis
4.2.3.2	qRT-PCR analysis
4.2.4	Analysis of copy number of transgene
4.2.5	Molecular analysis of putative transgenic lines at protein level
4.2.5.1	Quantitative enzyme assay of <i>GUS</i> (β -glucuronidase, EC 3.2.1.31)
4.2.5.2	Immunoblot analysis of putative transgenic lines

4.2.5.2.1	Protein extraction and SDS- PAGE
4.2.5.2.2	Immunoblotting
4.2.5.2.3	Densitometric quantitation
4.2.5.3	Comparative proteomics
4.2.5.3.1	Protein isolation and 2-DE
4.2.5.3.2	Image acquisition and data analysis
4.3	Results
4.3.1	Confirmation of the <i>GUS</i> putative transformants
4.3.2	Transcript accumulation and enzyme assay of <i>GUS</i> transformants
4.3.3	Molecular analysis of putative <i>AmAl</i> transformants by PCR
4.3.4	Analysis of transgene expression
4.3.4.1	Immunoblot analysis
4.3.4.2	Evaluation of the transcript abundance by northern blot analysis
4.3.5	Evaluation of transcript abundance by qRT-PCR
4.3.5.1	Standardization of endogenous control
4.3.5.2	Transcript accumulation of <i>AmAl</i>
4.3.5.3	Determination of transgene copy number
4.3.6	Comparative proteomics
4.4	Discussion
Chapter 5:	Agrophysiological and Biochemical Characterization.....86-100
5.1	Introduction
5.2	Materials and methods
5.2.1	Plant growth and maintenance

5.2.2	Assessment of agrophysiological traits
5.2.3	Evaluation of tuber color difference
5.2.4	Biochemical and proximate analysis
5.2.5	Assessment of amino acid content
5.2.6	Water holding capacity (WHC)
5.2.7	Evaluation of storage performance
5.2.8	Structural and chemical characterization
5.2.9	Statistical analysis
5.3	Results
5.3.1	Assessment of the agrophysiological traits
5.3.2	Evaluation of tuber color difference
5.3.3	Biochemical and proximate analysis
5.3.3.1	Proximate composition
5.3.3.2	Assessment of increase in total protein content in transgenic events
5.3.3.3	Assessment of amino acid content
5.3.3.4	Analysis of carbohydrates
5.3.3.5	Quantitative determination of water holding capacity
5.3.3.6	Evaluation of storage stress response
5.3.3.7	Structural and chemical characterization
5.4	Discussion
Chapter 6:	Metabolite Profiling of Tuber in Sweet Potato.....101-117
6.1	Introduction
6.2	Materials and methods

6.2.1	Plant growth and maintenance, and tissue harvesting	
6.2.2	Determination of phytophenols and carotenoids	
6.2.3	qRT- PCR analysis of flavonoid pathway genes	
6.2.4	Metabolite profiling of tuber	
6.2.5	Statistical analysis	
6.3	Results	
6.3.1	Determination of phytophenols and carotenoids	
6.3.2	Differential expression of flavonoid pathway genes	
6.3.3	Metabolite profiling of tuber	
6.3.3.1	Functional classification and significance	
6.3.3.2	Comparative metabolome profiling	
6.3.3.2.1	Allocation of metabolites in wild type and transgenic events	
6.3.3.2.2	Differential display of metabolites	
6.3.3.3	Evaluation of transgene mediated effect on metabolites	
6.4	Discussion	
Chapter 7:	Summary.....	118-122
Bibliography.....		123-159
	Appendix.....	I-V
	Publications	