



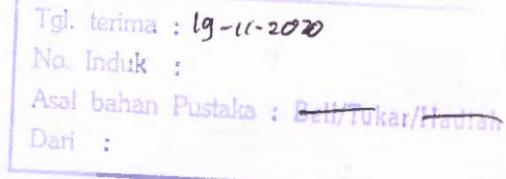
## TEA RESEARCH INSTITUTE



**ANNUAL TECHNICAL REPORT YEAR 2018**

## TABLE OF CONTENTS

TABLE OF CONTENTS.....	ii
KALRO -TEA RESEARCH INSTITUTE .....	v
MANAGEMENT STAFF.....	vi
A TABLE OF ACRONYMS AND ABBREVIATIONS .....	viii
INSTITUTE DIRECTOR'S REPORT .....	ix
STAFF TRAINING / WORKSHOPS / SEMINARS/ SYMPOSIA / FELLOWSHIPS/ TRANSFERS.....	xiii
LIST OF PUBLICATIONS .....	xvi
VISITORS TO TEA RESEARCH INSTITUTE DURING THE YEAR 2018.....	xix
CROP IMPROVEMENT AND MANAGEMENT PROGRAMME .....	1
TEA BREEDING AND GENETIC IMPROVEMENT (TBGI) SECTION .....	1
TEA IMPROVEMENT INVESTIGATIONS.....	1
Breeding experiments.....	2
Progeny Trials .....	2
Clonal Field Trials.....	3
TRI/CIM/TBGI/CFT/2005/1 .....	3
TRI/CIM/TBGI/CFT/2005/3 .....	5
TRI/CIM/TBGI/CFT/2005/4 .....	6
TRI/CIM/TBGI/CFT/2005/5 .....	6
TRI/CIM/TBGI/CFT/2005/6 .....	8
TRI/CIM/TBGI/CFT/2006/1 .....	9
TRI/CIM/TBGI/CFT/2006/2 .....	10
TRI/CIM/TBGI/CFT/2007/2 .....	11
TRI/CIM/TBGI/CFT/2007/4 .....	13
TRI/CIM/TBGI/CFT/2008/1 .....	14
TRI/CIM/TBGI/CFT/2008/2 .....	15
Clonal Adaptability Trials (Participatory Clonal Field Trials) .....	16
TRI/CIM/TBGI/CFT/OP/KANGAITA/2011.....	16
TRI/CIM/TBGI/CFT/OP/KANGAITA/2014.....	17
TRI/CIM/TBGI/CAT/OP/TIMBILIL/2015.....	18
TRI/CIM/TBGI/CAT/TIMBILIL/2011 .....	19
TRI/CIM/TBGI/CAT/JFK/2011 .....	19
TRI/CIM/TBGI/CAT/KANGAITA/2011 .....	19
TRI/CIM/TBGI/CAT/MICHIMIKURU/2012 .....	21
TRI/CIM/TBGI/CAT/KAPTRAKWA/2012 .....	21
TRI/CIM/TBGI/CAT/KIPKEBE/2013 .....	23
TRI/CIM/TBGI/CAT/SAGAMIAN/2014.....	24
TRI/CIM/TBGI/CAT/BUNGOMA/2015.....	25
MOLECULAR INVESTIGATIONS .....	34
Genetic Markers .....	34
TRI/CIM/TBGI/GENET 3b: Detection of genetic diversity in tea using molecular markers. ....	34
TRI/CIM/TBGI/GENET 3b: Tea genotyping by sequencing project.....	35
TRI/CIM/TBGI/GENET 3c: Tea and its related species.....	35
TRI/CIM/TBGI/GENET 3d: Quantitative trait loci mapping in tea. ....	41
TRI/CIM/TBGI/GENET 3e: Germplasm evaluation and characterisation .....	42



TRI/CIM/TBGI/GENET 7: Diallel crosses in tea .....	43
TRI/CIM/TBGI/GENET 9: Mutation Breeding .....	46
TRI/CIM/TBGI/GENET 9/2011: Gamma-treated seeds/clones .....	47
TRI/CIM/TBGI/GENET 2: Tissue culture studies in tea .....	48
TRI/CIM/TBGI/GENET 2: In-vitro technology for mutation breeding in tea .....	48
<b>INTEGRATED PESTS AND DISEASE MANAGEMENT INVESTIGATIONS .....</b>	<b>49</b>
Advisory, Diagnostic tests and Pest and Disease surveillance .....	49
TRI/CIM/IPDM/SURV/ 1b: Monitoring of pests through Pest and disease Advisory Services .....	49
<b>ENTOMOLOGICAL STUDIES .....</b>	<b>49</b>
Integrated management of mites in tea .....	49
TRI/CIM/IPDM/ENT/7e: Integration of fertilization regimes, selective insecticides and predacious mites for the management of tea pests Kenya.....	49
TRI/CIM/IPDM ENT.7f (CHEM 37F): Effects of different rates of fertilizers and different types (Sheep manure, NPKs, Mea and blends) on prey mite population in Kangaita in 2018 .....	50
TRI/CIM/IPDM/CAT/2011-2012: Evaluation of clonal adaptability trials for cultivar-site matching .....	51
GOK/KALRO/2018/04: Evaluation and promotion of assorted botanical extracts for control of fall armyworm .....	58
<b>PATHOLOGICAL INVESTIGATIONS .....</b>	<b>61</b>
TRI/CIM/IPDM/PATH (g): Evaluation of Trichotech wp (Trichoderma asperellum 8x10 <sup>9</sup> g) on the control of armillaria root rot of tea (in vitro tests) .....	61
<b>SUSTAINABLE ECOSYSTEM MANAGEMENT &amp; CONSERVATION (SEMC) PROGRAMME .....</b>	<b>71</b>
<b>SOIL FERTILITY, PLANT NUTRITION AND FERTILIZER USE SECTION .....</b>	<b>71</b>
TRI/SEMC/CHEM 21F: Effect of plant population and nitrogen fertilizer rates on clone AHP S15/10 in Timbilil Estate Kericho .....	71
TRI/SEMC/CHEM 12F: Responses to nitrogen fertilizer of different tea clones, TRFK 31/8, TRFK 6/8, EPK TN 14-3, AHP S15/10 at Timbilil Estate, Kericho .....	73
TRI/SEMC/CHEM 58F: Evaluation of Dharani Herbal Powder (DHP) (soil application) for optimizing mature tea crop productivity in Kericho .....	74
TRI/SEMC/CHEM 37: Effect of supplementing NPKS 25:5:5:5 (changed to NPK 26:5:5 from 2005) with micronutrients on high yielding clone AHP S15/10 tea, Timbilil estate Kericho .....	75
TRI/SEMC/CHEM 7: Long term response of seedling tea to high rates of NPK fertilizer, Timbilil Estate, Kericho .....	76
<b>HORTICULTURAL STUDIES .....</b>	<b>77</b>
TRI/SEMC/CED 13: Effect of plucking frequency and nitrogen rates on the components of yield of clones EPK TN14-3 and TRFK 56/89 .....	77
TRI/SEMC/CED 18: Effects of shade tree species on yield in Timbilil Estate .....	79
TRI/SEMC/CED 48: Effects of environment on response of tea cultivars to planting density .....	79
TRI/SEMC/BOTGENT1/CED 49: Effects of tea bush growth habit (bush architecture) and planting density on tea growth and yields.....	80
<b>NUTRITIONAL INVESTIGATIONS .....</b>	<b>82</b>
Effects of farmyard manure, enriched manure and NPKS fertilizers on tea .....	82
TRI/SEMC/CHEM 37F: Effects of alternating inorganic with organic manure on the performance of clonal tea (TRFK 31/8) plants under strongly acid soil at Kangaita TRFK Sub-station, Kirinyaga.....	83
<b>ENVIRONMENTAL STUDIES .....</b>	<b>85</b>

TRI/SEMC/CED 24: Development, implementation and monitoring of the TRI Environmental policy to ensure conformity to EMCA, 2015.....	85
TRI/CED 52/SEMC/WEATHER/11: Assessment of hail and frost damage on tea: Effects of hail damage on tea physiology.....	86
TRI/CED 52/SEMC/PROJECT/29: Assessment of hail and frost damage on tea: Effects of frost damage on tea physiology in the west of Rift Valley .....	89
TRI/SEMC/CED 51: Effect of weather variability on tea production for the year 2018.....	90
<b>TEA PRODUCT DIVERSIFICATION &amp; VALUE ADDITION .....</b>	<b>92</b>
<b>PRODUCT DEVELOPMENT AND VALUE ADDITION .....</b>	<b>92</b>
TRI/TPVA/FS/36: Effects of processing technologies on chlorogenic acid, gallic acid and theanine in selected Kenyan tea cultivars .....	92
TRI/TPVA/KEN-SUD1: Effect of selected packaging material, storage conditions and storage duration on plain Black CTC tea quality parameters and organoleptic properties .....	93
TRI/TPVA/FS/17: Effects of processing technologies on biochemical quality parameters and organoleptic properties in selected tea clones .....	100
TRI/TPVA/AC/10: Optimization of brewing and processing conditions of purple-leaved Kenyan tea and their effects on the chemical and sensory quality.....	103
TRI/TPVA/FS/31: Product diversification, value addition and branding of Kenyan tea using geographical indicators .....	105
<b>BIOCHEMICAL INVESTIGATIONS .....</b>	<b>109</b>
TRI/TPVA/FS/26: Variation of anthocyanin in second generation purple teas and a comparison with anthocyanin rich foods .....	109
TRI/TPVA/BIOC005: Identification of quantitative trait loci (QTLs) associated with agronomic traits in tea ( <i>Camellia sinensis</i> ) (L.) O. Kuntze.....	111
<b>ECONOMICS AND FIELD ADVISORY (EFA) PROGRAMME .....</b>	<b>113</b>
<b>FIELD ADVISORY .....</b>	<b>113</b>
TRI/EFA/FA/1a: Visits and visitors.....	113
TRI/EFA/FA/1b: Visitors.....	114
TRI/EFA/FA/2:Field/Open Days/Shows .....	115
TRI/EFA/FA/3: Shows /County exhibition participated by TRI staff.....	115
TRI/EFA/FA/4FA/3:Training/courses/Symposia/Seminars.....	115
TRI/EFACC/FA/5:Demonstrations .....	116
TRI/EFACC/FA/6:Publications .....	116
<b>SOCIO-ECONOMICS .....</b>	<b>117</b>
SOECO17/04: Socio-Economic studies .....	117
<b>APPENDICES.....</b>	<b>121</b>