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Preface

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PREFACE

The 2nd International Conference on Food Security and Sustainable Agriculture in the Tropic (IC-FSSAT 2019) was held in Makassar, Indonesia on September 2 2019. As in previous conference, IC-FSSAT 2019 is dedicated to address issues related to food security and sustainable agriculture in the Tropics. This event was hosted by Faculty of Agriculture and Publication Management Centre (PMC), Universitas Hasanuddin.

The major goal and feature of the conference was to promote knowledge, science, and technology as well as to address issues in food security and sustainable agriculture in the tropics, by bringing together researchers, scientists, practitioners and scholars in the respected fields. While food security and sustainable agriculture issues had been discussed broadly in several conferences, our conference emphasizes on the tropical agriculture. A total of 7 Keynote/Invited Speakers from Australia, Germany, Taiwan, Czechoslovakia, Japan and Indonesia delivered an insight into the state of art of the challenges in food security and sustainable agriculture in the tropics and any possibilities that could arise in developing integrated problem solving and collaboration to create better world.

This proceedings present selected papers submitted to the conference by academics and researches from universities and research institutes. All papers were subjected to rigorous peer-reviews by conference committee members and international reviewers to ensure their compliance to meet the required standard for qualified scientific publication. This volume presents recent researches in the field of Food Security and Sustainable Agriculture in the Tropic covering various related areas of Crop Production and Environment, Plant Breeding and Biotechnology, Biodiversity and Climate Change, Integrated Pest and Disease Management, Genetically Modified Foods, Food Safety, and Product Development, Geospatial Agriculture, Agricultural Engineering and Sustainable Agriculture and Rural Development.

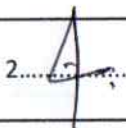
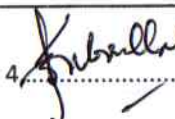
We would like to appreciate all authors who have contributed to this proceedings, the conference committee, speakers, attendees, organizing committee and sponsors who have made the 2nd IC-FSSAT a succes. We wish the conference will have significant contribution in field of food scurity and sustainable agriculture. We are also expecting that this conference proceedings contributes in looking at a new paradigm for food security and sustainable agriculture, especially in the tropic.

Rinaldi Sjahril

Chair of Organizing Commitee 2nd IC-FSSAT 2019


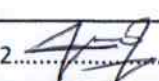
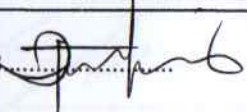
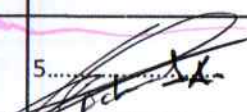

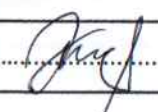
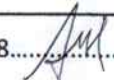


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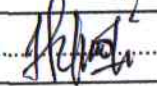
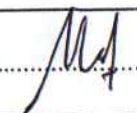
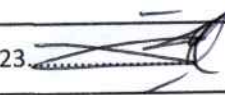
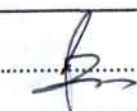
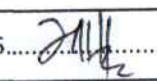
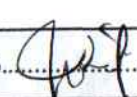
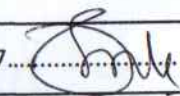
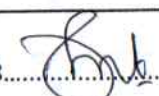
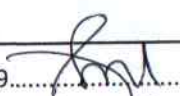
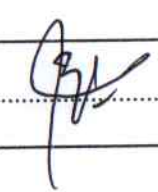
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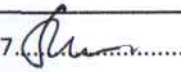
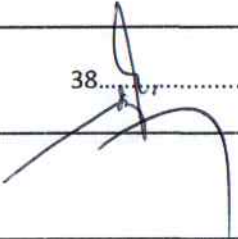
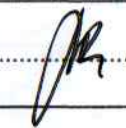
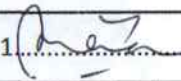

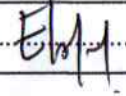
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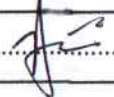

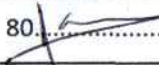


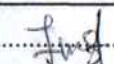

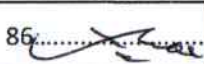
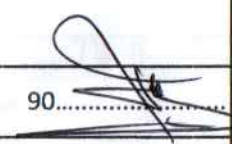
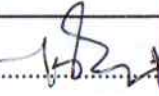
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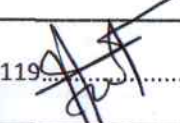
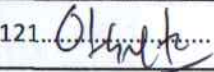
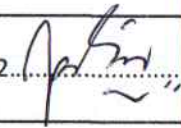


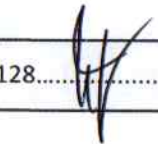
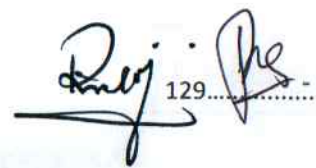
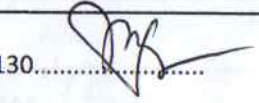
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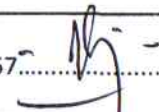
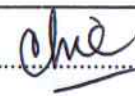
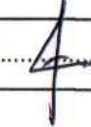

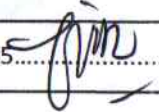
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		Anggota	A Yassi', K Mustari', A. Guricci', E Syam'un', M Riadi', T Dariati', and N Adyla S'	Growth and production of lowland rice (<i>Oryza sativa L.</i>) with water management systems on the application of various combination of fertilizers and planting	Earth Environ. Sci.	internasional
		Anggota	M.Riadi, R Sjahril, Maryati, E Syam'un, N Kasim, Rafiuddin, S Dewi	Growth and production of three rice varieties (<i>Oryza sativa L.</i>) in saline stress condition following halopriming	Earth Environ. Sci.	internasional

3	Prof. Dr. Ir. Elkawakib Syam'un, MP. 19560318 198503 1 001	Anggota	Itji Diana Daud, Elkawakib, Kahar Mustari, Aris Baso and Nuniek Widiayani	Infection of <i>Ostrinia furnacalis</i> (Lepidoptera: Pyralidae) by <i>Endophytic Beauveria</i>	Journal of Biological Sciences	internasional
4	Prof. Dr. Ir. Yunus Musa, M.Sc. 19541220 198303 1 001	Ketua	Yunus Musa Abd. Mollah Sumiati	The Response of Three Cane Varieties' Bud Chips Seedlings with <i>Mycorrhizae Isolate</i>	IOP (ICROEST 2020)	internasional
		Ketua	Yunus Musa Abd Haris B A. Rini	Farmers Understanding and Practices on Shading and Pruning for Arabica Coffee – a Survey and Analysis on the Effects to the	IOP (ICROEST 2020)	internasional
		Anggota	Ambo Ala Yunus Musa Lorensia Kadola	Effect of Compost Enrichment with <i>Trichoderma</i> sp on the Growth of Arabica Coffee Seedlings	IOP (ICROEST 2020)	internasional
		Anggota	Muh. Farid BDR Yunus Musa Ifayanti Ridwan Saleh Amir Yassi	Screening of Indonesian rice (<i>Oryza sativa</i> L.) Genotypes Against Salinity Stress Using NaCl Under Hydroponic	IOP (ICROEST 2020)	internasional
		Anggota	Muh. Farid BDR Ifayanti Ridwan Saleh Nasaruddin Yunus Musa Ardian Reski Handayani Andi Rusdayani Amin	Evaluation on Morpho-Physiological Characters of Synthetic Maize Genotypes on Low Soil Nitrogen Level	IOP (ICROEST 2020)	internasional
		Anggota	Ifayanti Ridwan Muh. Farid BDR Yunus Musa Hatta Jamil Andi Rusdayani A	SINHAS-1 Maize Seed Production Through Male-Female Ratio and Pruning Technique	Agrotech Journal	akreditasi

4	Prof. Dr. Ir. Yunus Musa, M.Sc. 19541220 198303 1 001	Anggota	Muh. Farid Nasaruddin Yunus Musa Muhammad Fuad Anshori Ifayanti Ridwan	Genetic Parameters and Multivariate Analysis to Determine Secondary Traits in Selecting Wheat Mutant Adaptive on	Plant Breed. Biotech. 2020 (December)	internasional
		Anggota	Muh Farid, Yunus Musa, Hatta Jamil, Ifayanti Ridwan, Sakka Pati, Nursini, Abdul Wahid, dan Muhammad Fuad Anshori	Diseminasi Produk Jagung Sintetik Unhas (Sinhas 1) Dalam Pemenuhan Kebutuhan Benih Dan Produksi Jagung Di Kabupaten Takalar	Jurnal Dinamika Pengabdian	akreditasi
5	Dr. Ir. H. Nasaruddin, MS. 19550106 198312 1 001	Ketua	Nasaruddin Yunus Musa Amir Yassi Ade Rosmana Muh. Farid BDR Ismail Mustafa	Penyuluhan Teknis Pemangkasan Bentuk dan Pemangkasan Pemeliharaan Tanaman Kakao Klonal di Kabupaten Kolaka Utara Provinsi Sulawesi Tenggara	Jurnal Dinamika Pengabdian	akreditasi
		Ketua	Nasaruddin Muh Farid Akmal Ifayanti Ridwan Muhammad Fuad Anshori	Physiological and Agronomical Characteristics Evaluation of Soybean Grown under Oil Palm	Asian Journal of Plant Sciences	internasional
		Anggota	Muh. Farid BDR Ifayanti Ridwan Nasaruddin Yunus Musa Ardian Reski Handayani Andi Rusdayani Amin Nuniek Widiayani	Evaluation on Morpho-Physiological Characters of Synthetic Maize Genotypes on Low Soil Nitrogen Level Condition	IOP Earth and Environmental Science Conf. Series (ICROEST 2020)	internasional

5	Dr. Ir. H. Nasaruddin, MS. 19550106 198312 1 001	Anggota	M Farid BDR, Kahar Mustari, Risman Arisandi, Nasaruddin,	Response of M5 wheat (Triticum aestivum L.) mutant to low altitude growing condition	IOP Earth and Environmental Science Conf. Series	internasional
		Anggota	M Farid BDR, Nasaruddin, M F Anshori and A N J Chaerunnisa	Evaluation on reproductive and productivity characters of wheat (Triticum aestivum L.) genotypes	IOP Earth and Environmental Science Conf. Series (ICROEST 2020)	internasional
		Anggota	Muh. Farid BDR Muhammad Fuad Anshori Gracia Emanuella Nur Pratiwi Irna Ermiyanti ViviYovita	High Lycopene Tomato Breeding Through Diallel Crossing	Agrotech Journal	akreditasi
		Anggota	Rusnadi Padjung Muh. Farid BDR Nasaruddin Ifayanti Ridwan Muhammad Fuad Anshori Andi Dwie Mochammad Abduh Ahrani Akbar Fachri	Growth and Production of Corn in Various Planting Distances Systems	Agrotech Journal	akreditasi
		Ketua	Nasaruddin Muh. Farid BDR Yunus Musa Hari Iswoyo	Character Selection and Tolerance Screening Efectivity on Static Hydroponic Method Under Drought Stress in Rice	Agrotech Journal	akreditasi
		Anggota	Muh. Farid Nasaruddin Yunus Musa Muhammad Fuad Anshori Ifayanti Ridwan	Genetic Parameters and Multivariate Analysis to Determine Secondary Traits in Selecting Wheat Mutant Adaptive on Tropical Lowlands	Plant Breed. Biotech. 2020 (December)	internasional

6	Dr. Ir. Rafiuddin, MP. 19641229 198903 1 003	Ketua	Rafiuddin A. Mollah E. Pratiwi	Application of various types of local microorganisms to the growth and production	IOP (ICROEST 2020)	internasional
		Ketua	Rafiuddin Nasaruddin H.Y. Osmar	Growth of cacao seedlings on application of several	IOP (ICROEST 2020)	internasional
		Anggota	R. Padjung A. Mollah M.A.F Al-Ridho K. Mustari A. Ala Rafiuddin	Effect of exploitation system using a tapping stimulant on the production of four rubber plant clones (Hevea brasiliensis Mull-Arg.) in Bulukumba Regency	IOP (ICROEST 2020)	internasional
		Anggota	I. Ridwan A. Ala Irwansyah Rafiuddin BDR. M. Farid,	Good Agriculture Practice (GAP) of arabica coffee (Coffea arabica L.): Implementation on the smallholder estate in Enrekang Regency	IOP (ICROEST 2020)	internasional
		Anggota	Nur Fadhli Muh. Farid Rafiuddin Roy Efendi Azrai Muhammad	Multivariate analysis to determine secondary characters in selecting adaptive hybrid corn lines under drought stress	Biodiversitas	internasional

7	Dr. Ir. Fachirah Ulfa, MP. 19641024 198903 2 003	Ketua	1. Prof. Dr. Ir. Kahar Mustari, MS 2. Dr. Ifayanti Ridwan Saleh 3. Dr. Hari iswoyo, M.Sc 4. Dr. Amirullah Dachlan 5. Hasmi	Higher NPK Nutrient Absorption due to the use of humic acid affects the growth and yield of baby corn applied with mungbean extract	Earth and Environmental Science	internasional
8	Dr. Ir. Hj. Syatrianty A. Syaiful, MS. 19620324 198702 2 001	Anggota	Muhammad Aksan Akib Andi Nuddin Retno Pradiyaningsih Tutik Kuswinanti Kahar Mustari Syatrianty Andi Syaiful Sarjiya Antonius	Exploration of Endomichorizal Fungus in Area Contaminated with Heavy Metal	Plant Cell Biotechnology and Molecular Biology	internasional
		Anggota	Muhammad Aksan Akib Demmaroa Retno Pradiyaningsih Tutik Kuswinanti Kahar Mustari Syatrianty Andi Syaiful Sarjiya Antonius	Indigenous Arbuscular Michorizhal From Jompie Botanical Garden of Pare Pare Which Isolated at Ptererospermum	Plant Cell Biotechnology and Molecular Biology	internasional
		Anggota	Amalia Oktavianty Hazairin Zubair Syatrianty A. Syaiful	Land Suitability Evaluation of Crops that Form Agroforestry	IOP Conference Series Earth and Environmental Science	internasional
		Anggota	2. K. Mustari 3. S. A. Syaiful 4. M. Riadi 5 Rinaldi Sjahril 6. N. Ahyani	Screening of eight mutants of Sinjai lokal red rice (<i>Oryza sativa</i>) to salinity stress	IOP Conference Series: Earth and Environmental Science	internasional
9	Dr. Ir. Muh. Farid BDR, MP. 19670520 199202 1 001	Anggota	Nasaruddin Muh Farid Akmal Ifayanti Ridwan Muhammad Fuad Anshori	Physiological and Agronomical Characteristics Evaluation of Soybean Grown under Oil Palm Stands Applied with Tri-po Enriched Compost	Asian Journal of Plant Sciences	internasional

		Ketua	Muh. Farid BDR Yunus Musa Ifayanti Ridwan Saleh Amir Yassi	Screening of Indonesian rice (<i>Oryza sativa</i> L.) Genotypes Against Salinity Stress Using NaCl Under Hydroponic Condition	IOP Earth and Environmental Science Conf. Series (ICROEST 2020)	internasional
9	Dr. Ir. Muh. Farid BDR, MP. 19670520 199202 1 001	Ketua	Muh. Farid BDR Ifayanti Ridwan Nasaruddin Yunus Musa Ardian Reski Handayani Andi Rusdayani Amin Nuniek Widiayani	Evaluation on Morpho-Physiological Characters of Synthetic Maize Genotypes on Low Soil Nitrogen Level Condition	IOP Earth and Environmental Science Conf. Series (ICROEST 2020)	internasional
		Anggota	Sri Sudewi Ambo Ala Baharuddin Muhammad Farid	Keragaman Organisme Pengganggu Tanaman (OPT) pada Tanaman Padi Varietas Unggul Baru	Jurnal Agrikultura	akreditasi
		Anggota	Sri Sudewi Ambo Ala Baharuddin M. Farid BDR	Isolation of phosphate solubilizing bacteria from the rhizosphere of local aromatic rice in Bada	IOP (ICROEST 2020)	internasional
		Anggota	Sri Sudewi Ambo Ala Baharuddin M. Farid BDR	The isolation, characterization endophytic bacteria from roots of local rice plant Kamba in,	Biodiversitas	internasional
		Anggota	Sri Sudewi Ambo Ala Baharuddin Patandjengi M. Farid BDR Abdul Rahim Saleh	Screening Of Plant Growth Promotion Rhizobacteria (PGPR) to increase local aromatic rice plant growth	International Journal of Pharmaceutical Research	internasional

		Ketua	M Farid BDR, Kahar Mustari, Risman Arisandi, Nasaruddin, Ambo Ala, Nurlina Kasim, Amirullah Dachlan and Ifayanti Ridwan	Response of M5 wheat (Triticum aestivum L.) mutant to low altitude growing condition	IOP Earth and Environmental Science Conf. Series (ICROEST 2020)	internasional
		Ketua	M Farid BDR, Nasaruddin, M F Anshori and A N J Chaerunnisa	Evaluation on reproductive and productivity characters of wheat (Triticum aestivum L.) genotypes grown in the lowlands	IOP Earth and Environmental Science Conf. Series (ICROEST 2020)	internasional
		Ketua	M Farid BDR, N Widiyani, M F Anshori and Zulqaida	Ratio of ammonium and nitrate to response of chinese broccoli variety (Brassica oleracea Var. Alboglabra) in hydroponic culture	IOP Earth and Environmental Science Conf. Series (ICROEST 2020)	internasional
		Ketua	Muh. Farid BDR Muhammad Fuad Anshori Gracia Emanuella Nur Pratiwi Irna Ermiyanti ViviYovita Musdalifa Nasaruddin	High Lycopene Tomato Breeding Through Diallel Crossing	Agrotech Journal	akreditasi
9	Dr. Ir. Muh. Farid BDR, MP. 19670520 199202 1 001	Anggota	Rusnadi Padjung Muh. Farid BDR Nasaruddin Ifayanti Ridwan Muhammad Fuad Anshori Andi Dwie Mochammad Abduh Ahrani Akbar Fachri	Growth and Production of Corn in Various Planting Distances Systems	Agrotech Journal	akreditasi

9

Dr. Ir. Muh. Farid BDR, MP.
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Anggota	Nasaruddin Muh. Farid BDR Yunus Musa Hari Iswoyo	Character Selection and Tolerance Screening Effectivity on Static Hydroponic Method Under Drought Stress in Rice	Agrotech Journal	akreditasi
Anggota	Ifayanti Ridwan Muh. Farid BDR Yunus Musa Hatta Jamil Andi Rusdayani A Muhammad Fuad Anshori	SINHAS-1 Maize Seed Production Through Male-Female Ratio and Pruning Technique	Agrotech Journal	akreditasi
Ketua	Muh. Farid Nasaruddin Yunus Musa Muhammad Fuad Anshori Ifayanti Ridwan	Genetic Parameters and Multivariate Analysis to Determine Secondary Traits in Selecting Wheat Mutant Adaptive on Tropical Lowlands	Plant Breed. Biotech. 2020 (December)	internasional
Anggota	Nasaruddin Yunus Musa Amir Yassi Ade Rosmana Muh. Farid BDR Ismail Mustafa	Penyuluhan Teknis Pemangkasan Bentuk dan Pemangkasan Pemeliharaan Tanaman Kakao Klonal di Kabupaten Kolaka Utara Provinsi Sulawesi Tenggara	Jurnal Dinamika Pengabdian	akreditasi
Ketua	Muh Farid, Yunus Musa, Hatta Jamil, Ifayanti Ridwan, Sakka Pati, Nursini, Abdul Wahid, dan Muhammad Fuad Anshori	Diseminasi Produk Jagung Sintetik Unhas (Sinhas 1) Dalam Pemenuhan Kebutuhan Benih Dan Produksi Jagung Di Kabupaten Takalar	Jurnal Dinamika Pengabdian	akreditasi

		Anggota	I. Ridwan A. Ala Irwansyah Rafiuddin M. Farid, BDR. F. Haring	Good Agriculture Practice (GAP) of arabica coffee (Coffea arabica L.): Implementation on the smallholder estate in Enrekang Regency	IOP (ICROEST 2020)	internasional
10	Dr. Ir. Amirullah Dachlan, MP. 19560822 198601 1 001	Anggota	1. Fachirah Ulfa, 2. Ifayanti Ridwan Saleh, 3. Kahar Mustari, 4. Amirullah Dachlan, 5. Hari Iswoyo, 6. Hasmi	Higher NPK nutrient absorption due to the use of humic acid affects the growth and yield of baby corn applied with mungbean extract.	IOP Conference Series: Earth and Environmental Science	internasional
		Anggota	1. Muh. Farid BDR., 2. Kahar Mustari, 3. Risman Arisandi, 4. Nasaruddin, 5. Ambo Ala, 6. Nurlina Kasim, 7. Amirullah Dachlan, 8. Ifayanti Ridwan Sakeh	Respon of M5 wheat (Triticum aestivum) mutant to low altitude growing condition	IOP Conference Series: Earth and Environmental Science	
11	Prof. Dr. Ir. Kaimuddin, M.Si. 19600512 198903 1 003	Anggota	Muhidin E Syam'un Y Musa G R Sadimantara S Leomo, G A K Sutariati	Effect dual inoculation of Azotobacter and Azospirillum on the productive trait upland red rice cultivar	IOP (ICROEST 2020)	internasional
		Ketua	Eka Wulko Syam'un Nurjannah Ruslan Hari Iswoyo Ifayanti Ridwan Amir Yassi Tandu Ramba	Respon of M5 wheat (Triticum aestivum) mutant to low altitude growing condition	IOP (ICROEST 2020)	internasional
		Anggota	R Dermawan (Ketua) N E Dunga R Sjahril A Mollah N S Yuniarti	Response of growth and development of butternut squash (Cucurbita moschata) to the combination of bioslurry and NPK fertilization	IOP (ICROEST 2020)	internasional

11	Prof. Dr. Ir. Kaimuddin, M.Si. 19600512 198903 1 003	Ketua	K Mustari Khairunnisa A Farmy Zul A H Bahrun	Water requirement for cocoa (Theobroma cacao L.) plant and the effect of climate factors	IOP (ICROEST 2020)	internasional
		Anggota	A Yassi (Ketua) I Ekawati	Paddy-fish cultivation within an integrated farming system	IOP (ICROEST 2020)	internasional
		Ketua	Nasaruddin D Darwis	Effect of soil management and biofertilizer application on cocoa's flower and fruit development	IOP (ICROEST 2020)	internasional
12	Dr. Ir. Rusnadi Padjung, M.Sc. 19600222 198503 1 002	Ketua	R Padjung, E Syam'un, F Haring, Kasim, Y Suni	Weeds diversity and the production of shallot (Allium ascalonicum L.) due to the application of azolla fertilizers and	IOP Conference Series: Earth and Environmental Science	internasional
		Ketua	R. Padjung A. Mollah M.A.F Al-Ridho	Effect of exploitation system using a tapping stimulant on the production of four	IOP (ICROEST 2020)	internasional
		Ketua	R. Padjung M. Farid Bdr Nasaruddin I. Ridwan Anshori M.Fuad	Growth and Production of Corn in Various Planting Distances Systems	Agrotech Journal	internasional

		Anggota	Harli A. Karim Laode Asrul Baja S	Development of Climate Requirements for Compatibility of Land Cocoa in	Agriculture and Applied Biology 2020, Vol. 1, No. 1, 30–37	internasional
13	Dr. Ir. Nurlina Kasim, M.Si. 19620618 199103 2 001	Ketua	3. S. A. Syaiful 4. M. Riadi 5 Rinaldi Sjahril 6. N. Ahyani	Screening of eight mutants of Sinjai lokal red rice (<i>Oryza sativa</i>) to salinity stress	IOP Conference Series: Earth and Environmental Science	internasional
		Anggota	R Padjung, E Syam'un, F Haring, Kasim, Y Suni	Weeds diversity and the production of shallot (<i>Allium ascalonicum</i> L.) due to the application of azolla fertilizers and oxyfluorfen	IOP Conference Series: Earth and Environmental Science	internasional
		Ketua	N Kasim, N Taufik, E Syam'un	Response of tomato plant on various concentrations and frequency of gibberellin	IOP Conference Series: Earth and Environmental Science	internasional
		Anggota	Kahar Mustari, Risman Arisandi, Nasaruddin,	(<i>Triticum aestivum</i> L.) mutant to low altitude growing condition	IOP Conference Series: Earth and Environmental	internasional
		Ketua	N Widiayani and A Revaldi	Growth and production of sixth generation of brown rice mutants in a high altitude location	IOP Conference Series: Earth and Environmental Science	internasional
		Anggota	1. Muh. Riadi (Ketua), 2. Rinaldi Sjahril (Anggota), 3. Maryati, 4. E Syam'un, 5. Rafiuddin and 6. S Dewi	Growth and production of three rice varieties (<i>Oryza sativa</i> L.) in saline stress condition following halopriming and hydropriming treatment	IOP Conference Series: Earth and Environmental Science	internasional

14	Dr. Ir. Muh. Riadi, MP. 19640905 198903 1 003	Anggota	1. Abdul Mollah (Ketua) 2. A H Bahrin (Anggota) 3. Megananda P Sarahdibha (Anggota) 4. Nurfaida (Anggota) 5. Tigin Dariati (Anggota) 6. Cri Wahyuni Brahmi Yanti (Anggota)	Growth and production of purple waxy corn (Zea mays ceratina Kulesh) on the application of NPK fertilizers and humic acid	IOP (ICROEST 2020)	internasional
		Anggota	1. Ria Megasari (Ketua), 2. M. Darmawan (Anggota) 3. Rinaldi Sjahril (Anggota), 4. Erse Drawana Pertiwi (Anggota)	Pengujian Sistem Tanam Legowo Terhadap Hasil Padi Gogopengujian Sistem Tanam Legowo Terhadap Hasil Padi Gogo	Agrium Jurnal Ilmu Pertanian	akreditasi
15	Dr. Ir. Amir Yassi, M.Si. 19591103 199103 1 002	Anggota	Dian Yustia Kahar Mustari Tutuk Kuswinanti	ENDOPHYTIC FUNGI ORIGIN OF LOCAL RICE SINJAI AS A PLANT GROWTH	JOURNAL OF CRITICAL REVIEWS	internasional
		Anggota	Elkawakib Syam'un Nurjannah Ruslan Hari Iswoyo Ifayanti Ridwan Amir Yassi Tandu Ramba	Evaluation of CropSyst model in simulating the growth and production of Katokkon chili (Capsicum chinense Jacq)	IOP (ICROEST 2020)	internasional
		Anggota	Amir Yassi, Kaimuddin, Hari Iswoyo, Rahmansyah Dermawan, Ifayanti Ridwan, Tandu Ramba	Implementation of organic farming using local composting methods in two local rice varieties of Tana Toraja		internasional
16	Ir. Hj. A. Rusdayani Amin, MS. 19561211 198503 2 001	Anggota	Ifayanti Ridwan Muh. Farid BDR Yunus Musa Hatta Jamil Andi Rusdayani A Muhammad Fuad Anshori	SINHAS-1 Maize Seed Production Through Male-Female Ratio and Pruning Technique	Agrotech Journal	akreditasi

17	Ir. Rinaldi Sjahril, M.Agr, P.hD. 19660925 199412 1 001	Anggota	1. Ria Megasari (Ketua), 2. M. Darmawan, 3. Rinaldi Sjahril (Anggota), 4. M. Riadi, 5. Erse Drawana Pertiwi	Pengujian Sistem Tanam Legowo Terhadap Hasil Padi Gogopengujian Sistem Tanam Legowo Terhadap Hasil Padi Gogo	Agrium Jurnal Ilmu Pertanian	akreditasi
		Anggota	1. R Dermawan (Ketua), 2. Kaimuddin, 3. N E Dunga, 4. R Sjahril (Anggota), 5. A Mollah and 6. N S Yuniarti	Response of growth and development of butternut squash (<i>Cucurbita moschata</i>) to the combination of bioslurry and NPK fertilization	IOP Conf. Series: Earth and Environmental Science	internasional
		Ketua	1. Trisnawaty A. R 2. Muhammad Riadi 3. Rafiuddin 4. Tadashi Sato 5. Kinya Toriyama 6. Yoriko Hayashi 7. Tomoko Abe	Selection of Early Maturing and High Yielding Mutants of Toraja Local Red Rice Grown from M2-M3 Population after Ion Beam Irradiation	Hayati Journal of Bioscience	internasional
		Ketua	1. Muh. Riadi, 2. Ifayanti Ridwan, 3. Kasmia, 4. I Suryani and 5. AR Trisnawaty	Kinship of katokkon chili (<i>Capsicum chinense</i> Jacq.) in Tana Toraja and North Toraja Regencies	IOP Conference Series: Earth and Environmental Science	internasional
		Anggota	1. A P Hanifa (Ketua), 2. J P Millner, 3. C R M Mc Gill and 4. Rinaldi Sjahril (Anggota)	Total anthocyanin, flavonoid and phenolic content of pigmented rice landraces from South Sulawesi.	IOP Conference Series: Earth and Environmental Science	internasional
			Ir. Rinaldi Sjahril, M.Agr, P.hD. 19660925 199412 1 001	Anggota	1. Muh. Riadi (Ketua), 2. Rinaldi Sjahril (Anggota), 3. Maryati, 4. E Syam'un, 5. N Kasim, 6. Rafiuddin and 7. S Dewi	Growth and production of three rice varieties (<i>Oryza sativa</i> L.) in saline stress condition following halopriming and hydropriming treatment

		Anggota	1. Ifayanti Ridwan (Ketua), 2. Y Musa, 3. S Khadjiah,	Response of Soybean (Glycine max L.) to Arbuscular	IOP Conference Series: Earth and Environmental	internasional
		Anggota	1. Kasmiasi (Ketua), 2. Rinaldi Sjahril (Anggota), 3. M Riadi,	The effects of colchicine concentration and	IOP Conference Series: Earth and Environmental	internasional
		Anggota	1. Feranita Haring (Ketua), 2. S Rantetandung, 3. M Riadi, 4. Rafiuddin and	Selection of purification and formation of double haploid Toraja endemic	IOP Conference Series: Earth and Environmental Science	internasional
		Anggota	1. N Qalby (Ketua), 2. R Sjahril (Anggota), 3. A Dachlan and 4. A Sakae	Colchicine induced polyploidy in Common Ice plant Mesembryanthemum crystallinum L	IOP Conference Series: Earth and Environmental Science	internasional
		Anggota	1. M Darmawan (Ketua), 2. Rinaldi Sjahril (Anggota), 3. M Riadi, 4. R Asmuliani, 5. A Khairun and 6. Erse D. Pertiwi	Growth test and production of several local upland rice varieties in Gorontalo Province	IOP Conference Series: Earth and Environmental Science	internasional
		Anggota	1. M M Putra (Ketua), 2. M Riadi and 3. Rinaldi Sjahril (Anggota)	Black rice mutant strain selection results of M3 generation mutation breeding	IOP Conference Series: Earth and Environmental Science	internasional
17	Ir. Rinaldi Sjahril, M.Agr, P.hD. 19660925 199412 1 001	Anggota	1. A M Okasa (Ketua), 2. M Riadi, 3. K Toriyama, 4. K. Ishii, 5. Y. Hasyashi, 6. T Sato, 7. T Abe, 8. Trisnawaty, 9. N J Panga and 10.Rinaldi Sjahril (Anggota)	Mutation breeding for improvement of aromatic rice mutant by using ion beam irradiation	IOP Conference Series: Earth and Environmental Science	internasional
		Anggota	1. S Kannapadang (Ketua), 2. Rinaldi Sjahril (Anggota) and 3. M Riadi	Characteristic of panicle in M4 red rice mutants	IOP Conference Series: Earth and Environmental Science	internasional

		Anggota	1. N Kasim (Ketua), 2. Y Musa, 3. K Mustari, 4. S A Syaiful, 5. M Riadi, 6. Rinaldi Sjahril (Anggota) and 7. N Ahyani	Screening of eight mutants of Sinjai lokal red rice (<i>Oryza sativa</i>) to salinity stress	IOP Conference Series: Earth and Environmental Science	internasional
		Anggota	1. Suhardi (Ketua), 2. M T Sapsal, 3. Rinaldi Sjahril (Anggota) and 4. Samsuar	Effect of canopy cover level on solar radiation for conservation plant photosynthesis under the stand of cocoa plants	IOP Conference Series: Earth and Environmental Science	internasional
		Anggota	1. D R Sari (Ketua), 2. L Asrul, 3. Rinaldi Sjahril (Anggota), and 4. K Osozawa	Path coefficient analysis for growth characters of sago palm related to trunk formation at three years after transplanting	IOP Conference Series: Earth and Environmental Science	internasional
		Ketua	1. Irma Jamaluddin 2. Asman 3. Marhamah Nadir	Uji Ketahanan Penyakit Karat Putih Pada Tanaman Krisan Transgenik Putatif Secara In Vitro	Prosiding Seminar Nasional	akreditasi
18	Dr. Ir. Katriani Mantja, MP. 19660421 199103 2 004	Ketua	Feranita Haring, Elkawakib Syam'un, Laode Asrul, Asmiaty Sahur, Ifayanti Ridwan	Growth and production of cayenne pepper (<i>Capsicum frutescens</i> L.) on various concentrations of bio-	IOP Conference Series: Earth and Environmental Science	internasional
		Ketua	R Dermawan, H Iswoyo, Peniwati	Response of two melon varieties to combination of growing media enriched with baglog waste compost	IOP Conference Series: Earth and Environmental Science	internasional
		Anggota	R Padjung, E Syam'un, F Haring, Kasim, Y Suni	Weeds diversity and the production of shallot (<i>Allium ascalonicum</i> L.) due to the application of	IOP Conference Series: Earth and Environmental Science	internasional

19	Dr. Ir. Abd. Haris B., M.Si. 19670811 199403 1 003	Ketua	1. Naharia O (Ketua) 2. Irianto Y 3. Kuntoro D 4. Taulu S 5. Satiman U	Combination Of Water Saving Technology And Organic Fertilizer For Ch4 Mitigation In Rice Paddy Cultivation	JOURNAL OF CRITICAL REVIEWS (Q4)	internasional
		Ketua	1. R. Amin 2. F. Alimi	Application of corn cultivation techniques by smallholder farmers		internasional
		Ketua	Fachirah Ulfa Asmira Majjuara	Utilization of Trichoderma and Liquid Organic Fertilizer on Estimation and Production of Hot Pepper (<i>Capsicum frutescens</i> L.)		internasional
		Anggota	1. Yunus Musa (Ketua) 2. A. Rini	Farmers Understanding and Practices on Shading and Pruning for Arabica Coffee – a Survey and Analysis on the Effects to the		internasional
19	Dr. Ir. Abd. Haris B., M.Si. 19670811 199403 1 003	Anggota	1. Abdul Mollah (Ketua) 2. Megananda P Sarahdibha 3. Nurfaida 4. Tigin Dariati 5. Cri Wahyuni Brahmi Yanti	Growth and production of purple waxy corn (<i>Zea mays ceratina</i> Kulesh) on the application of NPK fertilizers and humic acid	IOP (ICROEST 2020)	internasional
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21	Nurfaida, SP. M.Si 19730223 200501 2 001	Anggota	Abdul Mollah AH Bahrnun Megananda P Sarahdiba Tigin Dariati Muhammad Riadi Cri Wahyuni Brahmi Yanti	Growth and production of purple waxy corn (<i>Zea mays ceratina</i> Kulesh) on the application of NPK fertilizers and humid acid	ICROEST 2020 IOP Conf. Series: Earth and Environmental Science	internasional
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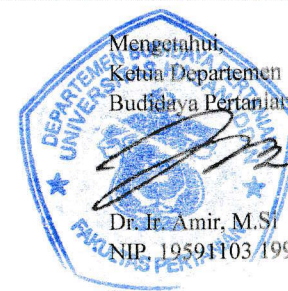
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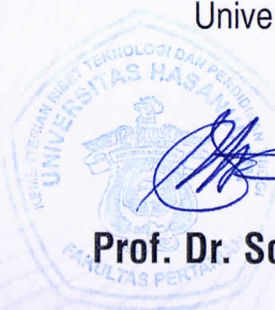
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Characteristic of panicle in M4 red rice mutants

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Abstract. The need for rice is always increasing every year in line with population growth making rice commodities have a very important role. Red rice which has been known for a long time, needs to be given priority in research to overcome the problem of food and nutrition shortages. Rice panicle, a crucial organ that has economic values, is an important yield component to improve. This study aimed to obtain information on relationship within the panicle characters on rice production. The experiment was conducted within 6 month using 10 red rice mutant lines M4 and 2 non-mutant lines as controls. Data from yield components used were number of grains per panicle, panicle density, percentage of filled grain per panicle, grain length, grain width, and grain thick. Based on the results of the path analysis on these characters, it is known that four characters that have a total positive and significant direct effect on the weight of grain per panicle were the number of grains per panicle, panicle density, panicle length and percentage of filled grain per panicle. Hence, these characters are important and effective to be used as a selection component in increasing grain production in red rice plants. Tests of several M4 generation red rice mutants based on grain characterization show very significant differences in grain length and grain width characters. The longest grain is GK2 strain (10.33 mm) and the widest grain is G9 strain (3.29 mm).

1. Introduction

Rice (*Oryza sativa* L.) is the main food of most of Indonesia's population [1]. Almost all residents in this country consume rice every day. The need for rice to meet food needs always increases every year in line with population growth. In terms of increasing and strengthening food security in Indonesia, rice commodity has a very important and strategic role [2,3].

Intensification of national superior rice has been done but it has not been able to meet food needs. On the other hand, there are available local rice that has not been used and cultivated intensively. Local rice varieties planted by farmers are varieties that have been planted for decades and are selected by nature. Local rice planting is favoured by farmers because some have good adaptability to the sub-optimal environment including peat land ecology, delicious rice taste, fragrant aroma, proven resistance to pests and good quality rice. New varieties are partly undesirable by farmers because they require intensive maintenance and optimal environment optimal [4,5].



Local rice that is widely known by the community in general is red rice. In addition to containing carbohydrate, fat, protein, fiber and minerals, red rice also contains anthocyanin and is widely consumed as a healthy food [6]. Local red rice generally has the characteristics of a long life, long panicles, little tillers and a fairly high posture [7]. According to Okasa et al. [7], another characteristic of local rice is that it has strong and deep roots but is not responsive to the application of fertilizer, deep age, high stems so that it easily fell and low production. However the quality of rice is comparable to the national rice varieties.

Rice production is determined by one of its main organs, namely rice panicles. Various components of the yield continue to be improved, one of which is an important organ of economic value, namely rice panicle. Lack information on genetic studies and morphology of the local rice panicles encourages in-depth study of morphological characters of the rice panicles to produce varieties with panicle ideotypes that can increase yield potential. Rice panicles consist of complex branches and grains found along branches [9]. The contribution of these two components will determine the yield of rice in addition to the number of productive tillers. The yield on rice plants is determined by the characters associated with the yield components, especially panicle characters [10], hence this research needs to be done to determine the direct effect of panicle characters on production yields.

2. Materials and Methods

This research was carried out in the Paddy Field in Tana Toraja Regency, Gandang Batu Sillanan District, Buntu Limbong Village and continued at the Laboratory of Plant Breeding and Seed Sciences, Faculty of Agriculture, Universitas Hasanuddin. The research took place in December to July 2019. The experiment was arranged based on a Randomized Block Design (RBD) with two replications. The treatments were 10 M4 generation mutant lines and 2 non-mutant lines as controls.

Land management was carried out using a tractor until the land is clean and ready for planting. The seedlings were planted in a 1 m x 1 m nursery bed. After the seeds are 3 weeks old, the seeds were transferred to the prepared land. Planting was conducted manually. The spacing of 30 cm x 30 cm was used with one seed per planting hole. The soil condition at the time of planting was muddy. Weeding was done 2 times at 7 days after planting (DAP) and 15 DAP. Fertilizing was carried out 2 times, namely at 2 weeks after planting (WAP) for the first fertilization and 8 WAP for the second fertilization. Pests control was conducted by spraying the infected plants based on the types of pests that attack. Harvesting was marked if the rice grain has yellowed according to harvest criteria. Harvesting was conducted manually.

Observations were made on each of the 12 samples from each treatment line and control line. Characteristics of yield components observed for panicle characteristics were number of grains per panicle, panicle density, panicle length, percentage of filled grain per panicle, weight of 100 seeds and grain yield per panicle. Panicle density data was obtained from the division between the number of grains per panicle and panicle length. Data were tabulated using MS Excel 2010. Path coefficient analysis was performed using SPSS version 16. Characteristics of yield components observed for grain characteristics were grain length, grain width, and grain color. The observational data obtained were analyzed using analysis of variance and if there was a significant effect on treatment data analysis was continued with the Least Significance Differences (LSD) test.

3. Results and Discussion

3.1. Panicle characteristics

Path analysis is used to determine the direct and indirect effects of characters that contribute to grain yield. The characters tested using cross analysis were the characters that have a significant correlation coefficient value with the grain weight per panicle character [10]. The results of the path analysis of red rice panicle characters are shown in Table 1. The results show that all characters (the number of grains per panicle, panicle density, panicle length, percentage of filled grain per panicle and weight of

100 seeds) had a positive correlation coefficient on production per panicle with values of 0.095, 0.0592, 0.244, 0.249, 0.163, respectively.

Table 1 Direct, indirect and total effects of the characters panicle components to the grain weight per panicle

Characters of panicle components	Direct effects	Indirect effects					Total effects
		X1	X2	X3	X4	X5	
X1	0.095	-	-0.182	-0.112	-0.484	0.501	0.0131**
X2	0.592	0.572	-	0.928**	0.741**	-0.224	0.3591**
X3	0.244	0.729	0	-	0.805**	-0.083	0.3744**
X4	0.249	0.111	0.006	0.002	-	-0.119	0.3105**
X5	0.163	0.097	0.483	0.797	0.714	-	-0.0030ns

X1 = number of grain per panicle, X2 = Density of panicle, X3 = panicle length, X4 = Percentage of grain content per panicle, X5 = Weight of 100 seeds, ** = significant at the 0.01 level, ns = non-significant.

Characters in these conditions have a direct influence that tends to be uniform among characters. Characters with the highest direct effect on grain weight per panicle was the panicle density (0.592). The direct effect is a reflection of the magnitude of the correlation coefficient. Jumin [12] stated that the nature of each genetic and the environment in which the variety grows will affect the grain density of each panicle. Lower grain density can also be caused by non-genetic factors, such as pests and diseases.

The character with the smallest direct effect was found in the number of grains per panicle (0.095). According to Singh and Chaudary [13] significant value of the correlation coefficient between characters show direct influence, then the correlation value shows the actual relationship between the two characters. If the correlation coefficient value is significant while the direct effect is negative or very small, then the indirect effect causes the correlation coefficient value to be significant.

In this study four characters found to have a total positive and significant direct effect on grain weight per panicle, namely the number of grains per panicle, panicle density, panicle length and percentage of filled grain per panicle with a total value of direct influence of 0.0131, 0.3591, 0.3744, and 0.3105, respectively. The character that has the highest total direct influence was the panicle length (0.3744), hence can be used as a selection criterion for selecting superior mutant line of red rice with high grain yield per panicle and only one character has a negative and insignificant total direct effect value to the production of grain per panicle that is the weight of 100 seeds (-0.0030). This is consistent with the opinion of Puji [14] which states that panicle length is a parameter that determines the high and low productivity of a strain / variety and panicle length components are the main supporting factors for yield potential because the longer the panicle the greater the chance of the number of grain in one rice plant.

The diagram shows that the number of grains per panicle, panicle density, panicle length, percentage of filled grains per panicle, and the weight of 100 seeds has a positive correlation coefficient on grain production per panicle ie 0.095, 0.592, 0.244, 0.249, 0.163 (Figure 1).

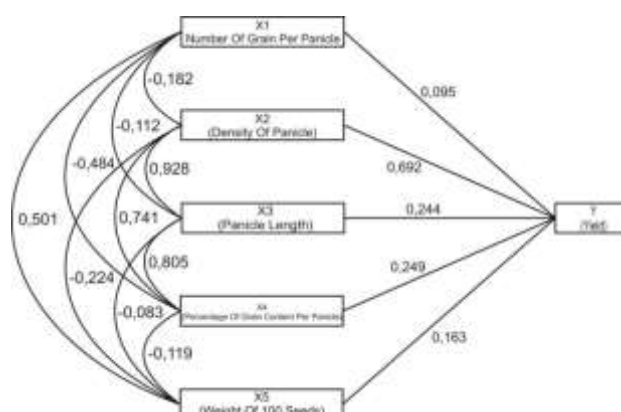


Figure 1. A path diagram of some rice panicle characters on grain production per panicle. X1 = number of grain per panicle, X2 = Density of panicle, X3 = panicle length, X4 =Percentage of grain content per panicle, X5 = Weight of 100 seeds.

3.2. Characteristics of grain

The grain characters observed in this study were grain length and grain width (Table 2). Table 2 shows that the average grain length of some mutant rice lines showed significant differences. The longest grain length was obtained in the GK2 strain (10.33 mm), while the shortest grain length was obtained in the G8 strain (7.68 mm). The table 2 also shows that the grain width in some mutant rice lines shows very significant differences. The widest grain width was obtained in the G9 strain (3.29 mm), while the narrowest grain width was obtained in the GK2 strain (2.32 mm).

Table 2 Average length and width of grain of several local red rice mutant lines.

Lines	Grain Length	Grain Width
GK1	7.77 cd	2.64 g
GK2	10.33 a	2.32 h
G1	7.87 bcd	2.90 e
G2	8.19 bcd	2.94 d
G3	8.27 bc	2.83 f
G4	8.16 bcd	2.90 e
G5	8.36 b	2.99 bc
G6	8.07 bcd	2.95 cd
G7	8.34 b	3.01 b
G8	7.68 d	2.86 ef
G9	7.90 bcd	3.29 a
G10	7.97 bcd	2.78 g

Values in each average column followed by different letters for each treatment showed significant differences according to LSD 5%.

The length and width of the grain were varied significantly between the lines tested. The difference is caused by genetic differences that cause each cultivar to have special characteristics and that are different from each other. This is consistent with the statement of Fitri [15] which stated that the genetic makeup is one of the factors causing diversity in plant appearance. Conservation effort and breeding programs are among the urgent activities needed to prevent extinction [16-18]. Genetic characteristics of the species and population is needed as basic consideration in formulating appropriate conservation strategy for the species [19]. The genetic program will be expressed on a

variety of plant traits which include the shape and function of plants that produce different plant growth diversity.

4. Conclusions

- a) Based on the results of this path analysis there are four characters that have a total positive and significant direct effect on the weight of grain per panicle, namely the number of grains per panicle, panicle density, panicle length and percentage of filled grain per panicle with the total value of each direct effect 0.0131, 0.3591, 0.3744, and 0.3105, so these characters are important and effective to be used as a selection component in increasing grain production in red rice plants.
- b) Tests of several M4 generation red rice mutants based on grain characterization showed very significant differences in grain length and grain width characters. Where the one who has the longest grain is the GK2 strain (10.33 mm) and the one who has the widest grain is the G9 strain (3.29 mm) which can support grain production in red rice plants.

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