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OF ISAE INTERNATIONAL SEMINAR

BANDAR LAMPUNG, AUGUST 10-12, 2017

“

**STRENGTHENING FOOD AND FEED SECURITY
AND ENERGY SUSTAINABILITY
TO ENHANCE COMPETITIVENESS**

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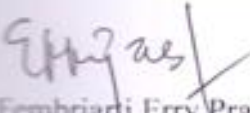
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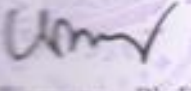
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Security and Energy Sustainability to
Enhance Competitiveness”**

**DEPARTEMENT OF AGRICULTURAL ENGINEERING
FACULTY OF AGRICULTURE
UNIVERSITY OF LAMPUNG**

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BANDAR LAMPUNG
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Security and Energy Sustainability to
Enhance Competitiveness”**

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PREFACE

Alhamdulillahirabbil'alamin, I would like to express how grateful we are to finished "Proceeding of ISAE International Seminar 2017, Bandar Lampung, August 10-12, 2017 with theme "Strengthening Food and Feed Security and Energy Sustainability to Enhance Competitiveness". We are here to communicate and gather dissemination of information and research results in the field of agriculture as part of planning the development of agriculture in the future towards food and biomass-based energy self-sufficiency. Through this proceeding, we shared the problem, ideas, knowledge and technology to arrange solutions that communicated and discussed at ISAE International Seminar, Bandar Lampung, August 10-12, 2017. This proceeding contains 118 papers that divided by 8 categories namely Agricultural Engineering, Agribusiness, Agricultural Technology, Agricultural Science, Energy, Food, Natural Resources, and Sistem and Agricultural Management from many universities and many institutes in Indonesia.

I would like to extend gratitude for all authors of the proceeding who communicate and share their research results, editorial team who work together to execute this proceeding, Agricultural Engineering Departement of University of Lampung, Faculty of Agriculture of University of Lampung, University of Lampung, PERTETA and committee members. Salutations to Dr. Ir. Sam Herodian, M.S. as Professional Staff of The Minister of Agriculture of Republic of Indonesia; Ir. Sutono, MM as Regional Secretary of Lampung Province ; Prof. Dr. Ir. Hasriadi Mat Akin, M.P. as Rector University of Lampung; Prof Dr. Ir. Irwan Sukri Banuwa, M.Si. as Dean of Agricultural Faculty of University of Lampung; Prof. Mikio Umeda from Kyoto University, Japan; Prof. Dr. Ir. Irwandi Jaswir, M.Sc. from International Islamic University, Malaysia; Dr. S. D. Filip To, PHD. PE from Mississippi State University, USA; Dr. Rosanna Marie C. Amongo from University of the Philippines Los Baños, The Philippines; Prof. Dr. Ir. Lilik Sutiarto, M.Eng. from Universitas Gadjah Mada, Indonesia; and Prof. Raden Achmad Bustomi Rosadi, M.S. from University of Lampung.

Last, we hope that you will have a great memories about the experience in Bandar Lampung and the relationship that have managed at Seminar can become better in the future.

Best Regard,

Dr. Ir. Sandi Asmara, M.Si
Chairman of ISAE IS 2017

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Rector of University of Lampung



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Dr. Ir. Sandi Asmara, M.Si

Chairman of ISAE IS 2017, Lampung



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International Islamic University, Malaysia



Prof. Mikio Umeda

Kyoto University, Japan



KEYNOTE SPEAKERS OF SEMINAR

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Prof. Dr. Ir. R. A. Bustomi Rosadi, M.S.

University of Lampung, Indonesia





LIST OF PAPER CODES

A

Abadi Jading	: A.1
Agus Haryanto	: E.3
Agus Hudoyo	: F.11
Agus Margiwyatno	: C.14
Agus Sutejo	: A.9
Ana Rochana	: D.19
Andreas Wahyu Krisdiarto	: E.4
Anjar Suprpto	: A.2
Anne Charina	: H.9
Anne Nuraini	: D.1
Anri Kurniawan	: A.3
Aprilianti	: B.3
Ardiyanto W Nugroho	: H.11
Ari Ganjar Herdiansah	: H.12
Asep Sapei	: G.1
Azmi Asyidda Mushoffa	: A.4

B

Bambang Susilo	: A.17
----------------	--------

C

Cicih Sugianti	: C.17
Cipta Ginting	: D.10

D

Desrial	: A.5
Devi Maulida Rahmah	: H.10
Devianti	: C.13
Dewi Rumbaina Mustikawati	: D.20
Dewi Sartika	: F.1
Dewi Sartika	: F.5
Dewi Sri Jayanti	: G.10
Dhanang Eka Putra	: D.11
Diding Suhandy	: C.1
Diding Suhandy	: C.4
Dika Supyandi	: B.11
Dwi Cahyani	: E.5
Dwi Dian Novita	: C.15

E

Eko Pramono	: D.12
-------------	--------

Elen Selviana	: G.3
Elly Rasmikayati	: F.9
Endriani	: D.2
Erlisa Yuniasih	: B.12
Etik Puji Handayani	: G.4

F

Fitriani	: B.5
----------	-------

G

Gatot Pramuhadi	: A.10
Gatot Tri Mulyadi Rekso	: D.13

H

Hasbi	: D.3
Hepi Hapsari	: H.1

I

I Made Anom Sutrisna Wijaya	: D.14
I Made Supartha Utama	: F.3
I Wayan Budiastra	: C.2
Ichwana	: G.5
Ifmalinda	: A.12
Iin Susilawati	: D.4
Indah Nurmayasari	: B.10
Indah Widanarti	: A.13
Indriyani	: E.2
Iqbal	: A.18
Iskandar Zulkarnain	: G.11
Iwan Setiawan	: H.2

J

Junaedi Prasetyo	: D.5
Junita Barus	: G.6

K

K. Dewi T. Pasaribu	: F.7
Kiman Siregar	: E.7
Kordiyana K. Rangga	: H.15
Kusumiyati	: C.3
Kuswanta Futas Hidayat	: D.21

L

Lies Sulistyowati	: H.3
Lisa Praharani	: F.10
Lucyana Trimo	: B.4

M

Mahra Arari Heryanto	: B.1
Maman Setiawan	: C.6
Mamat Kandar	: D.15
Mardhiah Hayati	: C.7
Meinilwita Yulia	: C.8
Mohamad Amin	: G.2
Muhammad Arief Budiman	: B.6
Muhammad Arief Budiman	: B.14
Muhtarudin	: D.18
Murad	: C.18

N

Neni Rostini	: F.8
Nila Wardani	: D.22
Nila Wardani	: D.23
Novia Dewi	: H.14
Nuraeni Dwi Dharmawati	: E.8
Nyang Vania Ayuningtyas H.	: D.16
Nyimas Popi Indriani	: D.6

O

Omil Charmyn Chatib	: A.11
---------------------	--------

P

Pandi Pardian	: B.7
Prakoso Bhairawa Putera	: G.7
Putu Sudira	: H.4

R

R. Mislaini	: A.16
Ramayanti Bulan	: A.15
Rani Andriani Budi Kusumo	: B.13
Redika Ardi Kusuma	: A.6
Rengga Arnalis Renjani	: A.14
Renny Eka Putri	: C.9
Risvan Kuswurjanto	: C.10
Ridwan Zahab	: G.12
Rosyid Ridho	: A.7
Rusdi Evizal	: H.5

S

Saiful Hikam	: D.7
Sakti Hutabarat	: E.9
Sandi Asmara	: H.16
Sapto Kuncoro	: C.16
Sari Virgawati	: C.11
Sienny Muliaty	: F.4
Sitti Nur Faridah	: G.8
Sri Endah Agustina	: E.6
Sugeng Triyono	: C.12
Sumiyati	: D.8
Suprihatin	: G.9
Suryani	: H.13
Syarif Hidayat	: H.6

T

Tamrin	: A.8
Teguh Endaryanto	: B.2
Tumiar Katarina Manik	: H.7
Tuti Karyani	: B.8

U

U. Hidayat Tanuwiria	: F.2
----------------------	-------

W

Wiludjeng Trisasiwi	: E.1
---------------------	-------

Y

Yayat Sukayat	: H.8
Yohanes Setiyo	: D.9
Yosefina Mangera	: D.17
Yudithia Maxiselly	: F.6
Yulia Pujiharti	: B.9
Yusmanizar	: C.5

TABLE OF CONTENTS

Preface	V
Opening Speechers of Seminar	vi
Keynote Speakers of Seminar	vii
List of Paper Codes	x
Table of Contents	xii
<i>A : Agricultural Engineering</i>	
A.1 EVALUATION OF THE PERFORMANCE OF PNEUMATIC CONVEYING RECIRCULATED DRYER FOR DRYING OF FLOURS MATERIALS	1
Abadi Jading, Nursigit Bintoro, Lilik Sutiarso, Joko Nugroho Wahyu Karyadi	
A.2 FIELD PERFORMANCE OF RICE COMBINE HARVESTER PROTOTYPE FOR TIDAL SWAMP LAND	9
Anjar Suprpto, Sulha Pangaribuan, Dony Anggit, Titin Nuryawati	
A.3 DESIGN AND MODELLING OF TEA PICKER MACHINE (<i>Camellia Sinensis</i> (L). Kuntze) TYPE RECIPROCATING SINGLE CUTTER WITH A BATTERY POWER SOURCE	15
Anri Kurniawan, Bambang Purwantana, Lilik Sutiarso	
A.4 A DRAFT FORCE CALCULATION FOR DITCHER IMPLEMENT ON SOYBEAN CULTIVATION UNDER SATURATED SOIL CULTURE	23
Azmi Asyidda Mushoffa, Wawan Hermawan, Radite Praeko Agus Setiawan	
A.5 DESIGN AND PERFORMANCE EVALUATION OF PRIME MOVER FOR OIL PALM FERTILIZER APPLICATOR	31
Desrial, Tineke Mandang, Dwi Budi Aswin, Taufik Nugraha	
A.6 STUDY OF HIGH ELECTROSTATIC FIELD PRETREATMENT TO MAINTAIN POSTHARVEST QUALITY OF CHERRY TOMATO	37
Redika Ardi Kusuma, Lilik Pujantoro, Dyah Wulandani	
A.7 DESIGN AND PERFORMANCE ANALYSIS OF SEPARATION MECHANISMS OF PULP AND MANGOSTEEN SEEDS	43
Rosyid Ridho, Wawan Hermawan, Usman Ahmad	
A.8 DESIGN OF MACHINE FOR SHELL REMOVAL OF OIL PALM SEED	49
Tamrin, Kuku Setiawan, Hanang Agung Prasetyo, Ardian M.	
A.9 DESIGN AND PERFORMANCE OF TEA SHOOT CHOPPER: THE FIRST STEP TO OBTAIN OPTIMUM TEA STALKS AND TEA LEAVES SEPARATION	57
Agus Sutejo, Sutrisno, Wawan Hermawan, Desrial	
A.10 FERTILIZING PERFORMANCE BY USING HAND GRANULE SPREADER TASCO GS-10	63
Gatot Pramuhadi, M. Ali Imran S, Henry Haryanto Yap	
A.11 MODIFICATION OF CORN (<i>Zea mays</i> L.) SHELLER BY ELECTRIC MOTOR POWER SOURCE	71
Omil Charmyn Chatib, Santosa, Oggi Alif Riyanda	

A.12	ANALYSIS OF WORKING CAPACITY AND FUEL CONSUMPTION OF HAND TRACTOR ON DRY LAND IN NAGARI TANJUNG BONAI LINTAU BUO UTARA TANAH DATAR Ifmalinda	77
A.13	CURING TOOL DESIGN OF MEAT AND FISH Indah Widanarti , Acep Ponadi Muchlis Alahudin	81
A.14	PERFORMANCE AND ERGONOMIC ANALYSIS OF CHILI (<i>Capsicum annuum</i> L.) PLANTING TOOLS USING TUGAL MECHANISM Rengga Arnalis Renjani, Putri Chandra Ayu, Rizki Aidil P. Putra, and Desrial	85
A.15	ANALYSIS OF BLADE FROM PORTABLE CHOPPER MACHINE FOR PALM OIL FROND USING FINITE ELEMENT METHOD Ramayanty Bulan, Safrizal, T. Saiful Bahri	91
A.16	DEVELOPMENT OF HOLER TOOL FOR PLASTIC MULCH WITH ELECTRIC HEATER R. Mislaini and Omil Charmyn Chatib	97
A.17	STUDY OF LOW TEMPERATURE PROCESSING WITH DOUBLE JACKET VACUUM EVAPORATOR FOR IMPROVING QUALITY OF DRAGON FRUIT-MILK CANDY Bambang Susilo	107
A.18	PERFORMANCE TES OF COMPOST APPLICATOR Iqbal, Mahmud Achmad, Muhammad Tahir Sapsal	113

B : Agribusiness

B.1	CONCEPTION-ADOPTION MODEL OF CRYSTAL GUAVA (A CASE STUDY OF BANDUNG REGENCY, WEST JAVA) Mahra Arari Heryanto, Pandi Pardian, Adi Nugraha	117
B.2	AGRICULTURAL SECTOR AND AGROINDUSTRY LINKAGE IN CREATING REGIONAL ECONOMIC MULTIPLIER IN NEW REGIONAL AUTONOMY Teguh Endaryanto, Lina Marlina	125
B.3	STRATEGY BUSINESS CILEMBU SWEET POTATOES CHIPS MAUTIK (CASE STUDY OF SWEET POTATOES CHIPS MAUTIK, CILEMBU VILLAGE, PAMULIHAN, SUMEDANG, WEST JAVA) Aprilianti, Gema Wibawa Mukti	133
B.4	STUDY ON IMPLEMENTATION OF GOOD AGRICULTURAL PRACTICE (GAP) IN IMPROVING PRODUCTIVITY AND COCOA FARMERS INCOME (CASE STUDY OF NATURAL AULIA FARMERS GROUP, KORONG AMBUNG KAPUA, NAGARI SUNGAI SARIAK, VII KOTO SUBDISTRICT, PADANG PARIAMAN DISTRICT, WEST SUMATERA PROVINCE) Lucyana Trimo, Syarif Hidayat, Yosini Deliana, Endah Djuendah	141
B.5	LOCAL PROCESSED FOOD INDUSTRY BASED CASSAVA IN IMPROVING RURAL ECONOMY Fitriani, Bina Unteawati, Cholid Fatih	147
B.6	COSTUMER SATISFACTION ON COFFEE OF CAFE'S MARKETING Muhammad Arief Budiman, Endah Djuwendah, Eti Suminartika	151
B.7	SUPPLY CHAIN ANALYSIS OF CRYSTAL GUAVA IN THE DISTRICT OF CIMAUNG, REGENCY OF BANDUNG Pandi Pardian, Mahra Arari Heryanto, and Dhany Esperanza	161

B.8	RISK MANAGEMENT IN THE SUPPLY CHAIN OF MANGO EXPORT- ORIENTED IN SEDONG, CIREBON	163
	Tuti Karyani, Agriani Hermita, Hesty Nurul Utami, Hepi Hapsari, Elly Rasmikayati	
B.9	FINANCIAL ANALYSIS OF TWO VARIETIES INPARI IN RICE FARM ENVIRONMENTLY FRIENDLY	177
	Yulia Pujiharti and Zahara	
B.10	MOTIVATION AND PARTICIPATION OF FOOD BARN MEMBERS IN LAMPUNG PROVINCE	181
	Indah Nurmayasari, Fembriarti Erry Prasmatiw, Yuliana Saleh	
B.11	FARMER READINESS FOR ADOPTING STEVIA CULTIVATION (A CASE STUDY AT DISTRICT OF PASIR JAMBU, REGENCY OF BANDUNG)	185
	Dika Supyandi, Yayat Sukayat, Hepi Hapsari	
B.12	ANALYSIS OF BUSINESS MODEL FOR POPULACE TEA PRODUCTION ENTERPRISE ON CAP DUA PETANI GREEN TEA BAG PRODUCTS (CASE STUDY GAPOKTAN KARYA MANDIRI SEJAHTERA, CIBODAS VILLAGE, PASIR JAMBU SUBDISTRICT, BANDUNG REGENCY, WEST JAVA PROVINCE)	191
	Erlisa Yuniasih and Gema Wibawa Mukti	
B.13	THE ROLE OF EXTENSION WORKER IN DEVELOPING URBAN FARMING IN CISARANTEN KIDUL BANDUNG CITY	197
	Rani Andriani Budi Kusumo, Anne Charina, Yossini Deliana, Nurul Fazri	
B.14	ANALYSIS OF THE INFLUENCE OF INDEPENDENT VARIABLES FOR INDONESIAN ROBUSTA COFFEE BEANS	203
	Muhammad Arief Budiman, Sulistyodewi Nur Wiyono, Eti Suminartika	

C : Agricultural Technology

C.1	SIMULTANEOUS DETERMINATION OF L-ASCORBIC ACID AND GLUCOSE IN MIXTURE SOLUTION USING FTIR-ATR TERAHERTZ SPECTROSCOPY COMBINED WITH PLS2 REGRESSION	211
	Diding Suhandy, Meinilwita Yulia	
C.2	NIR SPECTROSCOPY APPLICATION FOR DETERMINATION OF TRIGONELLINE AND CHLOROGENIC ACID (CGA) CONCENTRATION IN COFFEE BEANS	219
	I Wayan Budiastara, Sutrisno, Sukrisno Widyotomo, Putri Chandra Ayu	
C.3	DETECTION OF RIDGE GOURD (<i>Luffa acutangula</i>) FRUIT QUALITY DURING STORAGE USING NEAR-INFRARED SPECTROMETER	225
	Kusumiyati, Syariful Mubarak, Jajang Sauman Hamdani, Farida, Wawan Sutari, Yuda Hadiwijaya, Ine Elisa Putri	
C.4	RIGHT-ANGLE FLUORESCENCE SPECTROSCOPY COUPLED WITH PLS-DA FOR DISCRIMINATION OF INDONESIAN PALM CIVET COFFEE	239
	Diding Suhandy, Meinilwita Yulia, Tetsuhito Suzuki, Yuichi Ogawa, Naoshi Kondo	
C.5	RAPID AND NON-DESTRUCTIVE QUANTIFICATION OF CHLOROGENIC ACID IN INTACT COFFEE BEANS BY DIFFUSE REFLECTANCE SPECTROSCOPY	245
	Yusmanizar, Imas Siti Setiasih, Sarifah Nurjanah, Mimin Muhaemin	
C.6	NON-DESTRUCTIVE DETERMINATION OF SWEETNESS AND FIRMNESS LEVEL FOR PAPAYA CALINA (<i>Carica papaya L.</i>) USING ULTRASONIC METHOD	249
	Maman Setiawan, I Wayan Budiastara	
C.7	A STUDY OF PHYSICAL AND CHEMICAL CHARACTERISTICS OF VARIOUS SWEET POTATO CLONES (<i>Ipomoea batatas L.</i>)	255
	Mardhiah Hayati, Sabaruddin, Efendi, Ashabul Anhar, Rita Hayati, Ari Sandi	

C.8	L-ASCORBIC ACID DETERMINATION USING FTIR-ATR TERAHERTZ SPECTROSCOPY COMBINED WITH PLS2 REGRESSION	261
	Meinilwita Yulia, Diding Suhandy, Tetsuhito Suzuki, Yuichi Ogawa, Naoshi Kondo	
C.9	ON-LINE MEASURING GRAIN MOISTURE CONTENT USING MICROWAVE PRINCIPLES	267
	Renny Eka Putri, Azmi Yahya, Nor Maria Adam, Samsuzana Abd Aziz	
C.10	EFFECTS OF ANALYSIS METHOD IN PREDICTION CANE QUALITY USING NIR SPECTROSCOPY	273
	Risvan Kuswurjanto, Linda Mustikaningrum	
C.11	VIS-NIR PROXIMAL SENSING TO ESTIMATE SOIL TEXTURE	279
	S.Virgawati, M. Mawardi, L. Sutiarto, S. Shibusawa, H. Segah, M. Kodaira	
C.12	APPLICATION OF MICROCONTROLLER TO CONTROL ROOM ENVIRONMENT OF A MUSHROOM HOUSE	289
	Sugeng Triyono, Dermiyati, Jamalam Lumbanraja, Hanung Pramono, Aditya H. Probowo	
C.13	NEAR INFRARED REFLECTANCE SPECTROSCOPY : FAST AND SIMULTANEOUS PREDICTION OF AGRICULTURAL SOIL NUTRIENTS CONTENT	295
	Devianti, Zulfahrizal, Sufardi, Agus Arip Munawar	
C.14	CLEAN TECHNOLOGY IN COPRA AND COCONUT SHELL PROCESSING INDUSTRY	299
	Agus Margiwiyatno, Wiludjeng Trisasiwi, Anisur Rosyad	
C.15	THE QUALITY OF FERMENTED CACAO BEANS IN SMALL-SCALE	305
	Dwi Dian Novita, Cicih Sugianti, Kartinia Sari	
C.16	THE TASTE OF ROBUSTA COFFEE POWDER FROM CLOSED STEAMING SYSTEM PROCESS IN HIGH TEMPERATURE	311
	Sapto Kuncoro, Lilik Sutiarto, Joko Nugroho, Rudiati Evi Masithoh	
C.17	EVALUATION OF QUALITY AND LIFE STORED THE WHITE COPRA FROM DRYING PROCESS USING SOLAR TRAY DRYER TYPE	317
	Murad, Rahmat Sabani, Guyup Mahardhian Dwi Putra	

D : Agricultural Science

D.1	THE RESPONSES OF POTATO (<i>Solanum tuberosum</i> L.) CULTIVAR GRANOLA TO DIFFERENT MEDIA AND ORGANIC COMPOUNDS IN IN VITRO CULTURE AND ACCLIMATIZATION IN MEDIUM LAND	321
	Anne Nuraini, Erni Suminar, Neni Rostini, Dewi Susanti	
D.2	POTENCY OF BIOFERTILIZER FOR INCREASING YIELD OF SOYBEAN ON THE DRYLAND ACID	327
	Endriani	
D.3	INCREASING OF PRODUCTIVITY AND PRODUCTION OF LOWLAND BY ENHANCING PLANTING INDEX (IP 200)	333
	Hasbi, Daniel Saputra, Tri Tunggal	
D.4	EFFECT OF MIXED CROPPING BETWEEN <i>Brachiaria Humidicola</i> GRASS WITH LEGUME ON DRY MATTER YIELD OF FORAGE, CRUDE PROTEIN CONTENT AND CRUDE FIBER CONTENT OF GRASS	337
	Iin Susilawati, U. Hidayat Tanuwiria, M. Fauzi Al Irsyad, Kania Ayu Puspadewi	
D.5	RESPONSE OF SEVERAL SOYBEAN VARIETIES ON ACID DRY LAND IN GUNUNG GEULIS BOGOR	341
	Junaedi Prasetyo, Prihanti Kamukten, Reza Y Purwoko, M. Muchlish Adie	

D.6	NITROGEN, PHOSPHOR AND CALCIUM UPTAKE ON PADJADJARAN CORN HYBRID AS FEED FORAGE INTERCROPPED WITH SOY BEAN Nyimas Popi Indriani, Yuyun Yuwariah, Sudarjat, Dedi Ruswandi, Anne Nuraini, Hepi Hapsari, Muhamad Kadapi	345
D.7	THE SELECTION OF LOCAL GENETIC SOURCE RICE POPULATION DIFFERENTIATED BY THEIR GENETIC MARKERS IN LOWLAND AND UPLAND ORGANIC ENVIRONMENT Saiful Hikam, Paul B. Timotiwiu, Denny Sudrajat	349
D.8	COMPOSTING OF RICE STRAW Sumiyati, I Wayan Tika, Yohanes Setiyo, I Putu Gede Budisanjaya	357
D.9	QUALITY OF POTATO SEEDS FROM SOME MODELS OF CULTIVATION AFTER STORAGE Yohanes Setiyo, Dewa Gde mayun Permana, IGA Iani Triani, IBP Gunadnya	361
D.10	PRELIMINARY RESEARCH ON THE EFFICACY OF BIOLOGICAL AGENTS INDUCING RESISTANCE IN MAIZE PLANTS TO CONTROL DOWNY MILDEW AND LEAF BLIGHT Cipta Ginting, Joko Prasetyo, Tri Maryono, Mila Safitri, Ika Ayuningsih	367
D.11	STRUCTURE, BEHAVIOR, AND PERFORMANCE OF RUBBER MARKETING IN SINTANG DISTRICT ON WEST KALIMANTAN Dhanang Eka Putra, Slamet Hartono, Masyhuri, Lestari Rahayu Waluyati	373
D.12	A STUDY OF VIGOR OF STORABILITY OF SEEDS OF SOME SORGHUM (<i>Sorghum bicolor</i> L. Moench.) GENOTYPES WITH ACCELERATED AGEING Eko Pramono, Muhammad Kamal, F. X. Susilo, Paul B. Timotiwiu	383
D.13	CHEMICAL AND PHYSICAL PROPERTIES OF CASSAVA STARCH CM-CHITOSAN-ACRYLIC ACID HYDROGEL PREPARED FROM RADIATION-INDUCED CROSSLINKING Gatot Trimulyadi Rekso	389
D.14	APPLICATION OF ONE CYCLE RED-BLUE ARTIFICIAL LIGHT IMPROVED THE PRODUCTIVITY OF CHRYSANTHEMUM I Made Anom Sutrisna Wijaya, Ni Wayan Anik Wahyuni, I Made Nada	395
D.15	ENDOPHYTE FUNGAL EXPLORATION FROM GRAMINAE ROOT WITH PLANT GROWTH PROMOTER POTENTIAL Mamat Kandar, I. Nyoman P. Aryantha, Sony Suhandono	403
D.16	ACTIVITY OF SOIL MICROORGANISMS DURING THE GROWTH OF SWEET CORN (<i>Zea mays saccharata</i> Sturt) IN SECOND PLANTING TIME WITH THE APPLICATION OF COMBINATION ORGANONITROFOS, INORGANIC FERTILIZERS, AND BIOCHAR Nyang Vania Ayuningtyas Harini, Dermiyati, Agus Karyanto, Ainin Niswati	409
D.17	THE SHIFTING OF WEED COMPOSITION AT SOME PLANT SPACING SETTINGS AND THE PROPORTION OF INORGANIC NITROGEN AND COMPOST NITROGEN OF WHEAT CROP Yosefina Mangera	417
D.18	THE EFFECT OF RATION BASED OF THE FERMENTED PALM OIL BY PRODUCT AND ZN-LYSINATE ON THE PERFORMANCE AND DIGESTIBILITY GOAT Muhtarudin, K. Adhianto, A. Haryanto, Liman, S. Tantalo. A. Ramadhani, M. T. Aldhi	425
D.19	CORN CROP WASTE PRODUCT ABSORPTION of N, P, and Ca at VARIOUS ALTITUDES IN THE WEST JAVA Ana Rochana, Nyimas Popi Indriani, Rachmat Wiradimadja, Budi Ayuningsih, Dedi Rahmat, Tidi Dhalika, Heryawan Kemal Mustafa, Iin Susilawati	429
D.20	POTENTIAL OF LIQUID SMOKE FROM AGRICULTURAL WASTE MATERIAL AS NATURAL PESTICIDE Dewi Rumbaina Mustikawati	433

D.21	PADDY YIELDS INCREASING EFFORTS BY FERTILIZER DOSING TECHNOLOGY IN THREE SUB-DISTRICT PADDY PRODUCER CENTRE IN TULANG BAWANG BARAT DISTRICT	439
	Kuswanta Futas Hidayat, Irwan Sukri Banuwa, Purba Sanjaya	
D.22	THE USE OF BACTERIA <i>Coryne bacterium</i> ANTAGONISTS AS PREVENTIVE ACTIONS TO REDUCE MAIN DISEASES IN RICE	445
	Nila Wardani and Yulia Pujiharti	
D.23	PERFORMANCE OF GROWTH,DISEASE, AND PRODUCTION OF HOT CHILI BY APPLYING SUSTAINABLE AQUACULTURE	451
	Nila Wardani and Nina Mulyanti	

E : Energy

E.1	ISOLATION OF CELLULASE ENZYME FROM COW RUMEN TO HYDROLYZE NYPA MIDRIB IN PRODUCING BIO-ETHANOL	457
	Wiludjeng Trisasiwi, Agus Margiwiyatno, Gunawan Wijonarko, Erni Astutiningsih, Nova Damayanti	
E.2	ENERGY EFFICIENCY ESTIMATION IN RICE STORAGING WITH VARIATIONS' TECHNOLOGY AND GETTING THE BEST QUALITY RICE IN PLASTIC SACKS	463
	Indriyani, Nur'aeni, Ria Delta, Lies Kumaradewi	
E.3	KINETICS OF BIODIESEL PRODUCTION FROM WASTE COOKING OIL THROUGH MICROWAVE-ASSISTED TRANSESTRIFICATION REACTION	467
	Agus Haryanto, Melauren Oktavina Renata, Sugeng Triyono	
E.4	PHYSICAL DIMENSION OF OIL PALM FRESH FRUIT BUNCH AT MINERAL AND PEAT LAND	473
	Andreas Wahyu Krisdiarto, Daru Tri Hidayat	
E.5	FEASIBILITY STUDY OF PLANT MICROBIAL FUEL CELL TECHNOLOGY IN INDONESIA'S RURAL AREA	477
	Dwi Cahyani, Agus Haryanto	
E.6	ENERGY AUDITING IN CPO (CRUDE PALM OIL) PRODUCTION PROCESS	483
	S. Endah Agustina	
E.7	LIFE CYCLE ENERGY ANALYSIS OF OIL PALM PLANTATION SYSTEM FOR BIODIESEL PRODUCTION IN ACEH PROVINCE	489
	Kiman Siregar, Agus Arif Munawar, Syafriandi, Edi Iswanto Wiloso, Saminuddin B.Tou	
E.8	PROCESS ANALYSIS OF RAW PALM OIL MILL EFFLUENT USING SINGLE FEEDING SYSTEM	497
	Nuraeni Dwi Dharmawati, Gading Yulta Farida, Wahyono, Rengga Arnalis Renjani	
E.9	INDONESIAN PALM OIL: FROM GLOBAL MARKET TO DOMESTIC MARKET FOR BIOFUEL	505
	Sakti Hutabarat	

F : Food

F.1	STUDY CONTROL OF <i>Salmonella</i> Sp. CONTAMINATION ON WHITE SHRIMP (<i>Litopenaeus vannamei</i>) USING NATURAL ANTIMICROBIAL FROM EXTRACT OF CHERRY TOMATOES FRUITS (<i>Lycopersicum cerasiformae</i> Mill.)	515
	Dewi Sartika, Suharyono A. S, Febry Darma Putri	

F.2	PROTECTION OF FISHMEAL PROTEIN WITH TAMMARIND SEED TANNIN ON FERMENTABILITY, DRY MATTER AND ORGANIC MATTER DIGESTIBLE, AND UNDEGRADED DIETARY PROTEIN <i>IN VITRO</i>	523
	U. Hidayat Tanuwiria, A Budiman, Iin Susilawati, Thomas Julian	
F.3	THE EFFECTIVENESS OF VEGETABLE OILS AS COATING MATERIALS TO REDUCE DETERIORATION OF TOMATO FRUIT DURING STORAGE	531
	I Made Supartha Utama, Made Arya Nugeraha Inggas, Nirma Yopita Sari Tarigan, N. L. Yulianti, Pande Ketut Diah Kencana, Gede Arda, G. Luther	
F.4	EFFECT OF SOYBEAN DIET TO IMPROVE FAT ACCUMULATION: A REVIEW	539
	Sienny Muliaty, Prihanti P. Kamukten, Reza Y. Purwoko, Lili Indrawati, Erliana Ginting	
F.5	THE PROFILE OF RED DRAGON FRUIT PEEL EXTRACT AS A NATURAL ANTIMICROBIALS IN REDUCING <i>E. Coli</i>	549
	Dewi Sartika, Sutikno, Syarifah R.M	
F.6	RESPONSE OF COCOA (<i>Theobroma cacao</i> L.) SEEDLING TOWARDS WATERING INTERVAL AND SHELTER DENSITY	553
	Yudithia Maxiselly, Jessica Amanda Claudia, Cucu Suherman	
F.7	SHELF LIFE STUDY OF WHEY PROTEIN CONCENTRATE (WPC) AT VARIOUS PACKAGING MATERIALS WITH ACCELERATED SHELF LIFE TESTING (ASLT) APPROACH	557
	K. Dewi T. Pasaribu, Robi Andoyo, Efri Mardawati	
F.8	STABILITY AND ADAPTABILITY ANALYSIS ON YIELD AND YIELD COMPONENTS OF SEVEN RED PEPPER (<i>Capsicum</i> sp.) GENOTYPES	567
	Neni Rostini, Noladhi Wicaksana, Sudarjat, Anas, Anne Nuraini, Endjang Sujitno, Taemi Fahmi, Liferdi, Yati Haryati, Triasfitriya, Masayu	
F.9	STUDY OF CONSUMER BEHAVIOR : TREND PURCHASE OF COFFEE AND THEIR OPINION TO VARIETY OF PRODUCTS AND POTENTIAL OF THE COFFEE SHOP	573
	Elly Rasmikayati, Pandi Pardian, Hepi Hapsari, Risyad M. Ikhsan, Bobby Rachmat Saefudin	
F.10	EFFECT OF PARITY ON MILK YIELD AND LACTATION LENGTH OF ANGLO NUBIAN GOATS	581
	Lisa Praharani, Rantan Krisnan, Rahmat Quanta Supryati	
F.11	ANALYSIS OF MINIMIZING THE SOYBEAN IMPORT IN INDONESIA: FORECAST OF ITS PRODUCTION AND CONSUMPTION	585
	Agus Hudoyo, Indah Nurmayasari	

G : Natural Resources

G.1	THE APPLICATION OF TERRACE AND GABION ON SLOPE STABILIZATION	591
	Asep Sapei, Eko Santoso Pajuhi	
G.2	CLIMATE CHANGE ON MAXIMUM RAINFALL DAN FLOOD AT BANDAR LAMPUNG	597
	Mohamad Amin, Ridwan, Ahmad Tusi	
G.3	GROWTH PATTERNS AND CONDITION FACTORS OF SNAKEHEAD FISH (<i>Channa sriata</i> (Bloch, 1793)) IN THE FLOOD PLAIN AREA OF SEBANGAU PALANGKA RAYA	605
	Elen Selviana, Ridwan Affandi, M. Mukhlis Kamal	
G.4	APPLICATION METHOD OF BIOCHAR ON THE SOIL AMELIORATION TO INCREASE PRODUCTION OF RICE (<i>Oryza sativa</i> L.)	611
	Etik Puji Handayani	

G.5	FLOOD HANDLING SOLUTION BASED ON FLOOD RATE REVIEW AND EFFECTIVE CAPACITY OF RIVER (CASE STUDY OF KRUENG PEUSANGAN WATERSHED) Ichwana and Dewi Sri Jayanti	617
G.6	UTILIZATION OF PADDY WASTE AS A SOIL AMENDMENTS AND IT IS EFFECT ON SOIL PROPERTIES OF ULTISOLS UPLAND EAST LAMPUNG Junita Barus and Soraya	623
G.7	UTILIZATION OF SCIENCE AND TECHNOLOGY FOR EMPOWERMENT OF CLIMATE CHANGE-TRIGGERED DISASTER VICTIMS Prakoso Bhairawa Putera, Rita Nur Suhaeti, Akmadi Abbas	627
G.8	THE LAND CONSERVATION EFFORTS FOR WATERSHED'S HYDROLOGICAL FUNCTION Sitti Nur Faridah, Mahmud Achmad, Elsa Hasak Almunawwarah	633
G.9	OPTIMIZATION OF BIOFILTRATION PROCESS FOR PRE-TREATMENT OF RAW WATER FROM POLLUTED RIVER WATER Suprihatin, Mohamad Yani, Endah Purwa Ari Puspitaningrum	639
G.10	LAND MANAGEMENT FOR FULFILLING REQUIREMENT AND AVAILABILITY OF GRAIN FOOD Dewi Sri Jayanti, Mustafiril, Ichwana, Fitriani	645
G.11	AGROTECHNOLOGY APPROACH OF LABORATORIUM LAPANG TERPADU FACULTY OF AGRICULTURE UNIVERSITY OF LAMPUNG BY LAND UNITS Iskandar Zulkarnain, Irwan Sukri Banuwa, Tamaluddin Syam, Henrie Buchari	655
G.12	INTEGRATION OF OPERATION SYSTEM BETWEEN DAM AND WEIR WITH DIFFERENT TIME BASE FOR IRRIGATION Ridwan Zahab, Putu Sudira, Sahid Susanto, Lilik Sutiarto	665

H : System and Agricultural Management

H.1	FARMERS RESPOND TO SCHOOL FIELD MANAGEMENT INTEGRATED PLANT CORN (SLPTT-JAGUNG) (CASE IN MEKAR LAKSANA FARMER GROUP, ARJASARI SUB-DISTRICT, BANDUNG DISTRICT) Hepi Hapsari, Anne Nuraini, Nyi Mas Popi Indriani, Tuti Karyani, Yuyun Yuwariah	675
H.2	THREATS OF SOCIAL PROBLEMS IN SUSTAINABLE AGRICULTURE DEVELOPMENT IN RURAL AREAS OF WEST JAVA, INDONESIA Iwan Setiawan, Siska Rasiska, Adi Nugraha	681
H.3	STUDY ON FOOD SECURITY IN RICE PRODUCTION CENTER (SURVEY IN BUAHDUA DISTRICT, SUMEDANG-WEST JAVA) Lies Sulistyowati, Ananda Putri Sari, Trisna Insan Noor, Iwan Setiawan, Hepi Hapsari	687
H.4	SEDIMENT YIELD CALCULATION ON A RESERVOIR USING SWAT MODEL Putu Sudira, Bayu Dwi Apri N, Abdul Holik	695
H.5	COMPETITIVE AND SUSTAINABLE PRODUCTION OF COCOA IN TANGGAMUS, LAMPUNG PROVINCE, INDONESIA Rusdi Evizal, Fembriarti Erry Prasmatiwi, Maria Christina Pasaribu, Ivayani, Lestari Wibowo, Winda Rahmawati, Agus Karyanto	705
H.6	FARMER'S UNDERSTANDING ON ECOFRIENDLY FARMING SYSTEM (CASE STUDY ON VEGETABLE'S FARMER IN SUKAMANAH VILLAGE, SUBDISTRICT OF PANGALENGAN, DISTRICT OF BANDUNG, WEST JAVA) Syarif Hidayat, Taupik, Lucyana Trimo	713

H.7	ENGAGING FARMERS' COMMUNITY IN CLIMATE CHANGE RESPONSE AND ADAPTATION PLANS: CASE STUDY SEDAYU, TANGGAMUS REGENCY, LAMPUNG PROVINCE, INDONESIA	719
	Tumiar Kataruna Manik, Bustomi Rosadi, Onny Krisna Pandu Perdana	
H.8	FARMER GROUP: AN ACCELERATOR TO DEVELOP UNPAD CHILLI SEED (PERSPECTIVE OF SUSTAINABLE DIFFUSION OF INNOVATION)	729
	Yayat Sukayat, Hepi Hapsari, Neni Rostini, Yosini Deliana, Iwan Setiawan, Dika Supyandi	
H.9	READINESS OF ORGANIC VEGETABLES FARMER GROUPS IN DEALING MEA	733
	Anne Charina, Rani Andriani Budi Kusumo, Agriani Hermita, Yosini Deliana	
H.10	IDENTIFICATION OF AGRICULTURAL BUSINESS INNOVATION PROCESS FOR STRATEGIC EXPORT COMMODITY IN PT MALABAR KOPI INDONESIA THROUGH HISTORICAL ANALYSIS	739
	Devi Maulida Rahmah, Fahmi Rizal, S. Rosalinda	
H.11	FORMULATING POLICIES IN FORESTRY AND AGRICULTURAL LAND USE MANAGEMENT TO MEET FOOD SECURITY PROGRAMS AND EMISSION REDUCTION TARGET IN INDONESIA	745
	Ardiyanto W. Nugroho	
H.12	URBAN FARMING: A POLITICAL PERSPECTIVE (A CASE STUDY IN BANDUNG CITY)	753
	Ari Ganjar Herdiansah, Adi Nugraha, Oekan S. Abdoellah	
H.13	THE POTENTIAL OF SUSTAINABLE URBAN FARMING DEVELOPMENT	757
	Suryani and Rini Fitri	
H.14	EVALUATION ON RSPO STANDARD APPLICATION OF OIL PALM KKPA SMALLHOLDERS TOWARDS CERTIFICATION IN KAMPAR KIRI TENGAH SUB-DISTRICT, KAMPAR DISTRICT: APPLICATION OF RAPFISH APPROACH	761
	Novia Dewi, Sakti Hutabarat, Suardi Tarumun	
H.15	THE COMMUNITY ABILITY IN SUPPORTING THE LOCAL RESOURCE-BASED PRODUCTIVE EFFORT IN FOOD SELF-SUFFICIENT VILLAGES OF LAMPUNG PROVINCE	765
	Kordiyana K. Rangga	
H.16	MODEL AND STRATEGY OF DEVELOPMENT PLANNING OF FOOD SECURITY IN METRO BASED ON EMERGENCY STATUS	771
	Sandi Asmara, Roni Kastaman, Ace Setiawan, Ade Moetangad	

ANALYSIS OF MINIMIZING THE SOYBEAN IMPORT IN INDONESIA: FORECAST OF ITS PRODUCTION AND CONSUMPTION

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ABSTRACT

Since 1975, Indonesia has been importing soybean. In 2014, Indonesia imported almost 2 million tons. It implies that the production of soybean has not been fulfilling its consumption. Indonesia would like to minimize it. This paper attempts to analyze the possibility for decreasing the soybean import. Data used are the FAO's data in the period 1961-2014. Data are analyzed by econometric models and time series analysis. The result revealed that Indonesia still needs the soybean import.

Keywords : Soybean, Production, Consumption, Import

I. INTRODUCTION

Indonesia has been a soybean importer since 1975 (the FAO's data). In addition, the growth of its import increases. This is shown that the production of soybean has not been enough for its need. Since soybean is one of the important foods, it has priority to increase its production. In this case, even the government has a target that Indonesia can be self-sufficiency in soybean.

Hermanto et al. analyzed the soybean outlook in the period 2015-2019 by analyzing three scenarios. This study is shown that Indonesia cannot be self-sufficiency. However, Indonesia can decrease the amount of soybean import [1]. By using time series analysis, Hadi forecasted the production and the consumption of soybean in Indonesia [2]. The result of this study is similar with the previous study done by Hermanto et al. In short run, Indonesia can decrease the soybean import by increasing its productivity and harvested area. In the long run, these two attempts could make Indonesia self-sufficient in soybean.

The other study is done by Adillah. It used the simultaneous forecast [3]. One of the results of this study is Indonesia can decrease the soybean import because the production growth is higher than the consumption growth.

Although those three previous studies already tried to predict the production and the consumption of soybean in Indonesia, we still need to know the possibility that Indonesia can decrease its import due to the slow growing of its production and the fast grow of population. Therefore, we need to forecast the production and the consumption of soybean and then compare them.

II. MATERIALS AND METHODS

The production of soybean is affected by the production factors used. We consider the acreage of land and the amount of seed used for growing soybean are the production factors that affect its production. Other production factors, such as fertilizer and labor, are not included in the model analysis. These data are not available. Because most of the time the use of fertilizer, labor and other production factors is proportional with the acreage of land for growing soybean, we can assume that they are complement with the land.

The farmers have preference whether to plant soybean or other crops in their land. They always compare the profits of many crops depending on the price and the productivity of each crop. Since 1994, the mass adoption or the diffusion of the hybrid corn has been making the farmers prefer corn to soybean. Therefore, we included this factor in the model analysis for the soybean production. The empirical model for the soybean production can be seen in Equation (1).

$$Prod_t = b_0 + b_1 AH_t + b_2 Seed_t + b_3 D_t + e_{1t} \quad (1)$$

where :

t : 1961, 1962, ..., 2014

$Prod$: Soybean production (million tons)

AH : Area Harvested for soybean (million hectares)

$Seed$: Seed planted for soybean (million tons)

D : Dummy variable for the diffusion of the hybrid corn

$D = 0$ for t : 1961, 1962, ..., 1993

$D = 1$ for t : 1994, 1995, ..., 2015

b : Parameter estimates

e : Error term

For forecasting the independent variables, AH and $Seed$, we use time series analysis, ARIMA. A general empirical model for ARIMA can be seen in Equation (2).

$$X_t = \beta_1 X_{t-1} + \dots + \beta_p X_{t-p} - e_t - \alpha_1 e_{t-1} - \dots - \alpha_q e_{t-q} \quad (2)$$

where :

t : 1961, 1962, ..., 2014

X : Variable being forecasted

β, α : Parameter estimates

e : Error term

AH : Area Harvested for soybean (million hectares)

$Seed$: Seed planted for soybean (million tons)

The domestic supply of soybean is its production minus the use for seed and its losses. The amount of seed used and the losses are forecasted by ARIMA.

Soybean can be directly consumed as a food. We call it Food. It can be processed to tempeh, tofu, vegetable oil etc. We call it Processing. Therefore, the consumption of soybean can be as the Food or the Processing. The summation of the food and the processing is the consumption of soybean. We use ARIMA for forecast the Food and the Processing.

If the domestic supply is smaller than the consumption of soybean, we need to import it, vice versa.

The main source of the data is the FAO's website the other source of data is Central Agency on Statistics Indonesia.

III. RESULTS AND DISCUSSION

A. Production and Domestic Supply

The data used for estimating the empirical model of the soybean production is from 1961 until 2015. In this period, the minimum production was 0.35 million tons in 1963 and the maximum one was 1.87 million tons in 1992. During this period, the soybean production growth had been 1.79 percent/year. The production and the area harvested for soybean can be seen in Fig. 1.

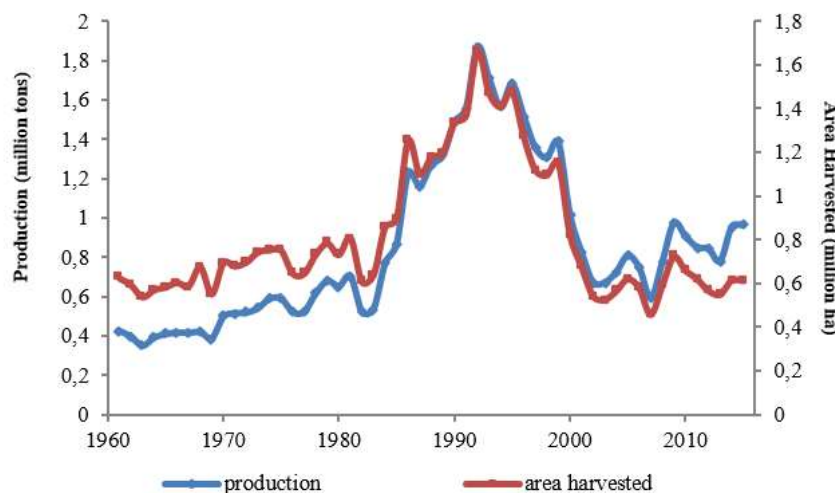


Fig. 1. The production and the area harvested for soybean in Indonesia, 1961-2015

Fig. 1 shows that after the maximum production reached in 1993, it had been declining. After 2000, the production had been below one million tons.

Fig. 1 also shows that the production had been fluctuating with the harvested area. The ration between the production and the harvested area is the productivity of the land. The maximum productivity was 1.57 tons/ha in 2015 and the minimum one was 0.62 tons/ha in 1968. Since the production had been going together with the harvested area, the growth of the productivity is low, i.e. only 1.64 percent/year. This growth also can be seen in Fig. 2.

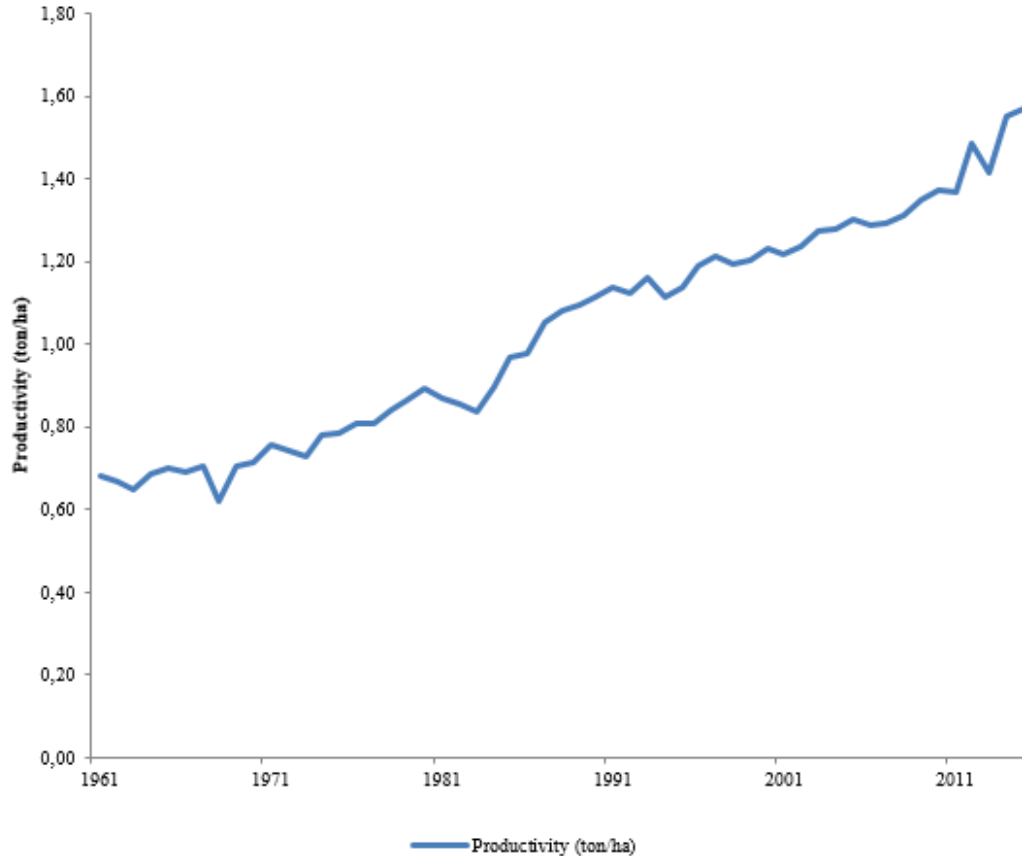


Fig. 2. The productivity of soybean in Indonesia, 1961-2015

By using the OLS method, the estimation of the empirical model for the soybean production can be seen in Table 1.

Table 1. The Estimated Forecast Model for Soybean Production

Independent variables	Coefficient	t-value
Intercept	-0.231*	-6.162
Area harvested	0.999*	25.639
Seed	9.158*	8.234
Dummy	-0.178*	-8.212
F-value	979.7930*	
R Square	0.9830	
Standard error	0.0546	
Observations	55	
DW	1.488	

*: Statistically significant at the 1% level

Note:

Dependent variable: Rice Production (million tonnes)

Independent variables: Area Harvested (million hectares); Seed (million tonnes); and

Year (1961=1, 1962=2, ..., 2015=55)

Table 1 shows that all the independent variables are significant. In addition, their signs follow the theory. For example, on the average, holding the other variables constant, if the area harvested increases one hectare, the production will increase 1 ton. The sign of dummy variable also makes sense since the hybrid corn is a substitution crop for soybean.

The R Square is quite high. The Durbin Watson (DW) value shows that the model does not have the autocorrelation problem. Therefore, the forecast model shown in Table 1 can be used for predicting the soybean production.

Firstly, we forecast the area harvested and the seed by using ARIMA. Secondly, we substituted these values to the soybean forecast model. The result of this calculation can be seen in Table 2.

Table 2. The Forecast of Soybean Production

Year	Confidence Interval (95%)		
	Average	Lower limit	Upper limit
2017	0.92	0.58	1.25
2018	0.95	0.61	1.29
2019	0.98	0.64	1.32
2020	1.01	0.67	1.34
2021	1.04	0.70	1.38
2022	1.07	0.73	1.40
2023	1.10	0.76	1.44
2024	1.13	0.79	1.46
2025	1.16	0.82	1.50
2026	1.19	0.85	1.52
2027	1.22	0.88	1.55
2028	1.25	0.91	1.58

The domestic supply is the production minus the use for seed and the losses. We forecast these using ARIMA. We calculate the forecast of soybean domestic supply (Table 3).

Table 3. The Forecast of Soybean Domestic Supply (million tons)

Year	Confidence Interval (95%)		
	Average	Lower limit	Upper limit
2017	0.73	0.40	1.07
2018	0.76	0.43	1.10
2019	0.79	0.45	1.13
2020	0.82	0.48	1.15
2021	0.85	0.51	1.18
2022	0.87	0.54	1.21
2023	0.90	0.57	1.24
2024	0.93	0.59	1.26
2025	0.96	0.62	1.29
2026	0.98	0.65	1.32
2027	1.01	0.68	1.35
2028	1.04	0.70	1.38

B. Consumption

We consume soybean as the seed called Food or the processed food called Processing, i.e. tempeh, tofu etc. Therefore, we forecast the amount of soybean for Food and for Processing. ARIMA is used for forecasting them. The summation of Food and Processing is the soybean consumption. Its forecast can be seen in Table 4.

Table 4. The Forecast of Soybean Consumption

Year	Confidence Interval (95%)		
	Average	Lower limit	Upper limit
2017	2.60	1.68	3.51
2018	2.64	1.61	3.67
2019	2.67	1.54	3.81
2020	2.71	1.47	3.95
2021	2.75	1.40	4.09
2022	2.78	1.34	4.23
2023	2.82	1.28	4.36
2024	2.86	1.21	4.50
2025	2.89	1.15	4.64
2026	2.93	1.09	4.77
2027	2.97	1.03	4.91
2028	3.00	0.97	5.04

C. Import

The difference between the consumption and the domestic supply is the import of soybean. The result of the forecast for the soybean import can be seen in Table 5. We use the average of consumption for calculating the confidence interval.

Table 5 shows that Indonesia still needs to import soybean to fulfil its consumption. In 2017, on the average, the soybean import will be 1.87 million tons. It increases slowly, i.e. 0.47 percent/year. In 2028, the average of soybean import will be 1.96 million tons.

The amount of import can be decreasing if the production is relatively high, i.e. in the upper limit of the production confidence interval. Therefore, the efforts of increasing the soybean production is still important in order to minimize its import.

Table 5. The Forecast of Soybean Import

Year	Confidence Interval (95%)		
	Average	Lower limit	Upper limit
2017	2.60	1.68	3.51
2018	2.64	1.61	3.67
2019	2.67	1.54	3.81
2020	2.71	1.47	3.95
2021	2.75	1.40	4.09
2022	2.78	1.34	4.23
2023	2.82	1.28	4.36
2024	2.86	1.21	4.50
2025	2.89	1.15	4.64
2026	2.93	1.09	4.77
2027	2.97	1.03	4.91
2028	3.00	0.97	5.04

IV. CONCLUSION

Since the soybean production is far less than its consumption, Indonesia still needs to import soybean. In 2017, on the average, the soybean import will be 1.87 million tons. It increases slowly, i.e. 0.47 percent/year. In 2028, the average of soybean import will be 1.96 million tons.

The amount of import can be decreasing if the production is relatively high, i.e. in the upper limit of the production confidence interval. Therefore, the effort for increasing the soybean production is still important in order to minimize its import.

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