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PROFIL PAIR-BATAN

Isotop dan radiasi untuk kesejahteraan

CIRA-BATAN PROFILE

Isotopes and radiation for welfare

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DAFTAR ISI

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Pusat Aplikasi Isotop dan Radiasi (PAIR) merupakan salah satu unit kerja setingkat eselon II di bawah Badan Tenaga Nuklir Nasional (BATAN). PAIR memiliki tugas dan fungsi melaksanakan penelitian dan pengembangan (litbang) aplikasi isotop dan radiasi untuk kesejahteraan masyarakat. Litbang yang dilakukan meliputi pangan, industri, kesehatan dan lingkungan.

Center for Isotopes and Radiation Application (CIRA) is one of research centers under the National Nuclear Energy Agency (BATAN). This center has task and function to do research and development of isotopes and radiation for the people welfare. Fields of research and development include food, industry, health, and environment.

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KATA PENGANTAR
PREFACE

Kepala PAIR-BATAN

The Director of CIRA-BATAN

Dr. Hendig Winarno

Assalamu'alaikum Wr. Wb.
Salam sejahtera bagi kita semua

Puji syukur kami panjatkan ke hadirat Tuhan Yang Maha Kuasa, karena atas perkenan-Nya Buku Profil PAIR-BATAN ini dapat diterbitkan. Profil PAIR-BATAN yang ditulis dalam dua bahasa (Indonsia dan Inggris) memuat informasi ringkas tentang organisasi, kegiatan litbang, dan dilengkapi dengan hasil yang telah dicapai dalam pemanfaatan isotop dan radiasi bagi kesejahteraan masyarakat.

Kami menyampaikan ucapan terimakasih dan penghargaan kepada semua pihak yang telah berperan dalam penyusunan buku Profil PAIR-BATAN ini.

Greetings from the Director
May there be happiness for all,

First of all, I would like to praise the Lord, Allah Almighty for the blessing, grace, and the opportunity to us for publishing the CIRA-BATAN profile. This Profile, that has been written in bilingual (Indonesian and English) edition, contains brief information regarding the organization of CIRA-BATAN and its activities in R&D and the results that have been achieved for the beneficial use of isotopes and radiation for the welfare of the people.

To all who have contributed to the preparation and publication of this Profile, I convey my appreciation and gratitude.

ORGANISASI
ORGANIZATION

Sejarah | History

PAIR didirikan pada 20 Desember 1966 dengan nama awal Pusat Penelitian Pasar Jumat, yang kemudian berubah menjadi PAIR berdasarkan Peraturan Kepala BATANNomor 14 Tahun 2013.

Kegiatan awal berupa pemanfaatan tenaga nuklir untuk teknik Uji Tak Merusak dan perunut untuk inspeksi kerusakan komponen produksi pada industri gula dan bejana tekan pada Perusahaan Listrik Negara (PLN). Teknik perunut mulai dimanfaatkan untuk mendeteksi kebocoran bendungan, pola gerakan sedimen dan pendangkalan pelabuhan.

Pada tahun 1972, PAIR telah memulai penelitian padi tahan hama wereng coklat dengan teknik mutasi radiasi melalui kolaborasi dengan IAEA. Penelitian efek radiasi gamma untuk tujuan lain, seperti dekontaminasi pangan, modifikasi bahan industri, degradasi pestisida, teknik serangga mandul, pemupukandan peternakan juga mulai dilaksanakan.

At its establishment on December 20, 1966, the center was named as Pasar Jumat Research Center. The name of the center has changed several times and as regulated in Head BATAN Regulation Number 14/2013 the new name of the center is Center for Isotopes and Radiation Applications (CIRA).

At its initial activities, NDT and/or tracer techniques have been applied routinely to investigate industrial production components failure at sugar industries, pressurized vessel at State owned electricity company, dam leakage, sediment movement pattern, and seaport shallowing.

In 1972, CIRA, collaborated with IAEA, has started a mutation breeding program of rice for resistance to brown plant hoppers. Gamma irradiation effect for other purposes, i.e., food decontamination, industrial material modification, pesticide degradation, sterile insect technique, fertilization, and livestock were also conducted.

Kedudukan Tugas dan Fungsi
Main Duties and Function

KEDUDUKAN
PAIR adalah unit kerja setingkat eselon II di bawah Deputi Sains dan Aplikasi Teknologi Nuklir (SATN), BATAN.

TUGAS
Melaksanakan perumusan dan pengendalian kebijakan teknis, pelaksanaan, dan pembinaan dan bimbingan di bidang penelitian dan pengembangan aplikasi isotop dan radiasi di bidang industri dan lingkungan, pertanian, dan proses radiasi.

FUNGSI
Melaksanakan penelitian dan pengembangan aplikasi isotop dan radiasi di bidang:
1. Industri dan lingkungan;
2. Pertanian;
3. Proses radiasi.
4. Pemantauan keselamatan kerja dan pengelolaan limbah berbahaya dan beracun dan zat radioaktif.
5. Layanan jasa iradiasi.

STATUS
CIRA is one of the research centers under BATAN Deputy Chair of Science and Nuclear Technology Application.

TASK
To conduct formulation and control of technical policy, implementation, and guidance and counseling in R&D, i.e., food, industry, health, and environment.

FUNCTION
To conduct R&D using isotopes and radiation techniques in the fields:
1. *Industry and environment;*
2. *Agriculture;*
3. *Radiation Processing;*
4. *Work safety monitoring and hazardous waste management and radioactive materials.*
5. *Irradiation services.*

Visi & Misi | Vision & Mission

VISI
VISION

Menjadi pusat riset Aplikasi Isotop dan Radiasi yang unggul di tingkat regional Asia-Pasifik dengan mengutamakan keselamatan dan berperan nyata dalam pembangunan nasional.

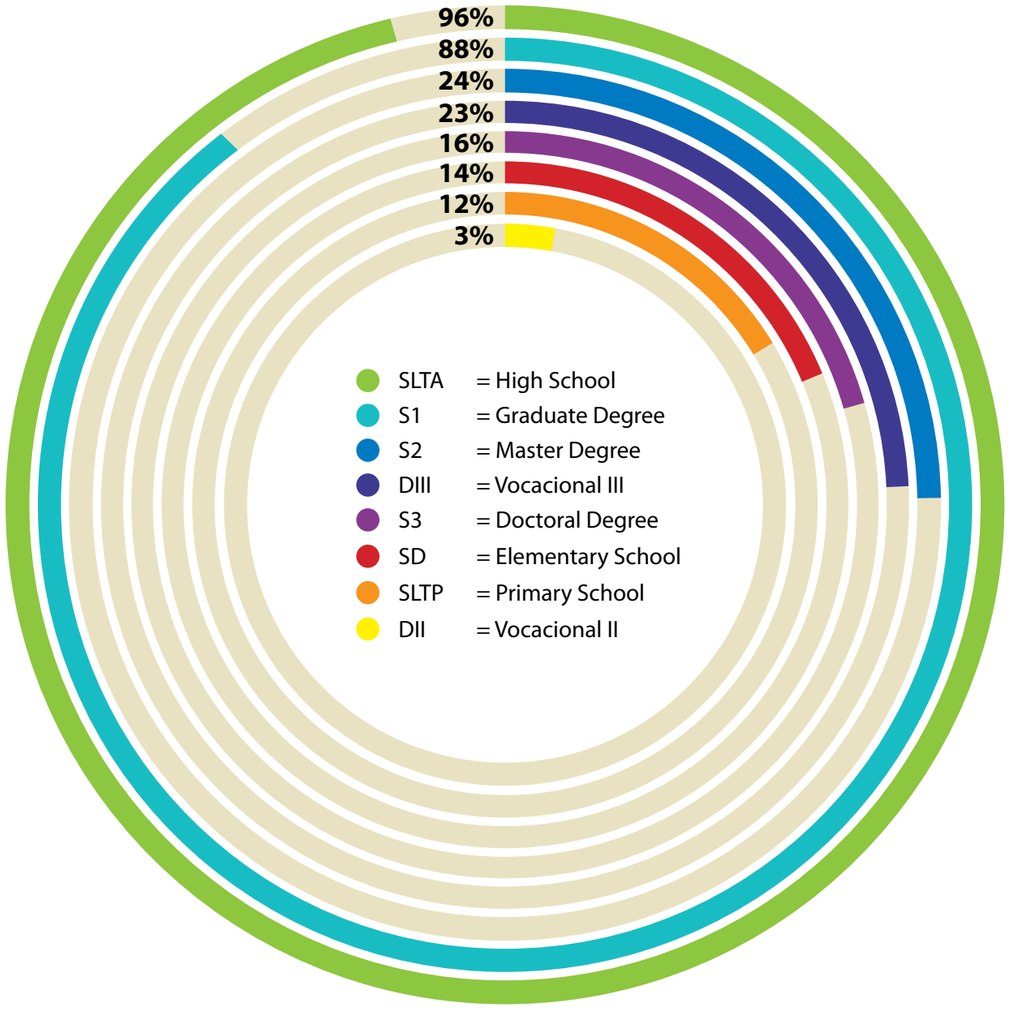
To become a leading isotopes and radiation research center in Asia-Pacific region, prioritize safety and actively participate in national development program.

MISI
MISSION

1. Melaksanakan litbang dalam aplikasi isotop dan radiasi di bidang pertanian, industri, kesehatan, sumber daya alam dan lingkungan berkontribusi pada pemecahan permasalahan nasional;
2. Mengembangkan aplikasi isotop dan radiasi untuk menghasilkan produk inovasi yang memiliki daya saing tinggi dan menyentuh kepentingan masyarakat luas, diserap dan dimanfaatkan oleh pengguna akhir;
3. Menumbuhkan jejaring kerjasama antar lembaga penelitian baik di dalam maupun luar negeri;
4. Menerapkan sistem manajemen mutu dalam meningkatkan kualitas hasil litbang;
5. Meningkatkan transparansi dalam pengelolaan administrasi menuju ke arah profesionalisme.

1. *To conduct R&D in isotopes and radiation applications in the fields of agriculture, industry, health, natural resources and environment that contribute to national problems solver.*
2. *To develop/innovate isotopes and radiation applications to produce products that are very competitive and align with the needs of end users.*
3. *To establish collaboration network for both national and international research institutions.*
4. *To implement quality management systems for improvement of R&D results.*
5. *To improve transparency in administration management toward professionalism.*

Tingkat Pendidikan SDM
Education Level of Human Resources

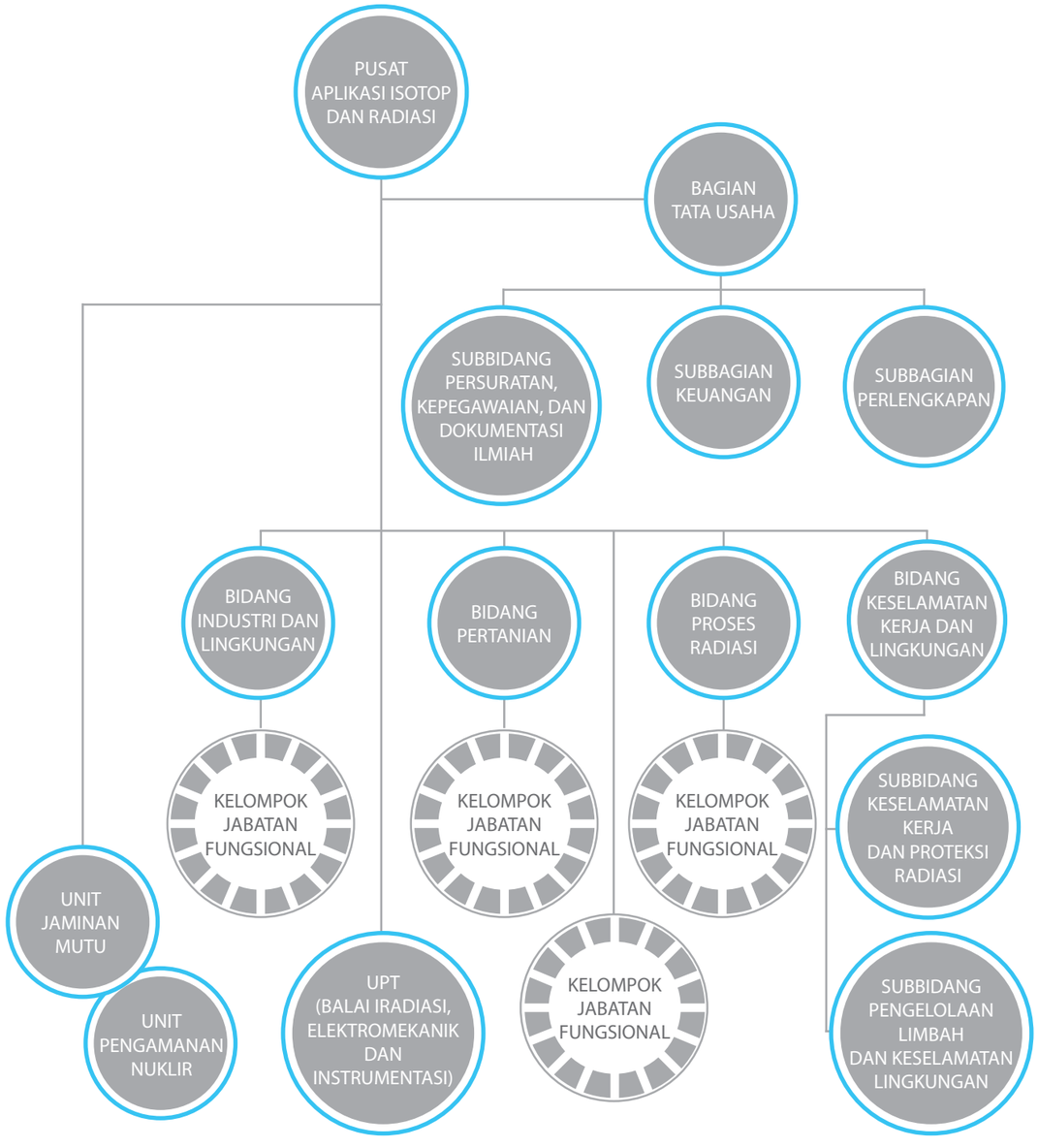


PENDANAAN | BUDGET

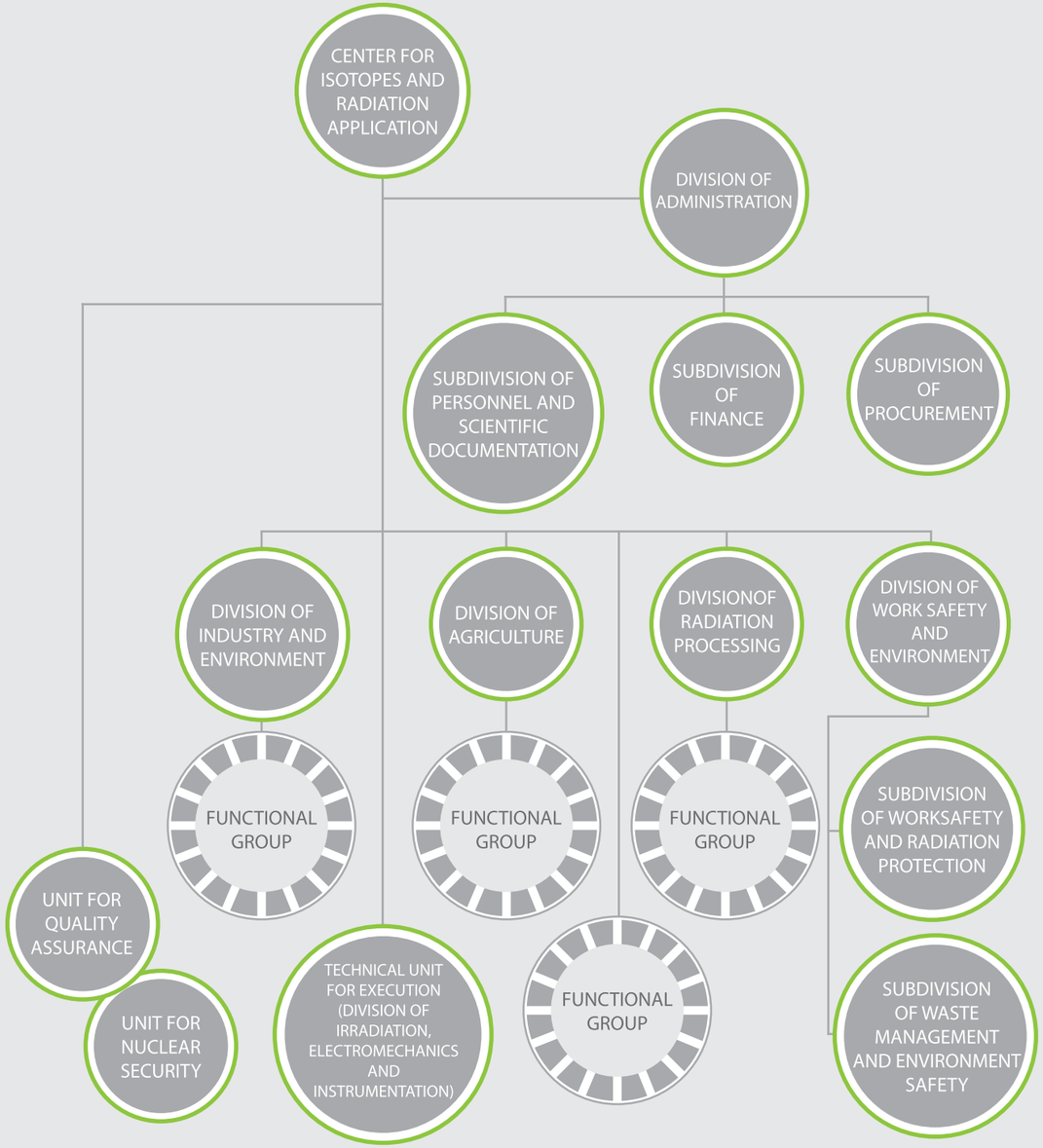
Kegiatan PAIR dibiayai dari dana anggaran DIPA BATAN dan sumber dana lainnya seperti Kementerian Ristek dan Dikti, Pemerintah Daerah, Swasta, serta lembaga internasional (IAEA, APEC, dll).

CIRA activities are funded by National Budget, and other sources i.e., Ministry of Research-Technology and Higher Education, Local Governments, Private Companies, and international agencies (IAEA, APEC, etc.).

Struktur Organisasi
Pusat Aplikasi Isotop dan Radiasi



Organization Structure
Center for Isotopes and Radiation Aplication



Perkantoran
Office Buildings

Pemeriksaan keamanan di pintu gerbang.

Security check at front gate.

Gedung perkantoran
PAIR memiliki gedung untuk kegiatan litbang bidang pertanian, proses radiasi, industri dan lingkungan, layanan administrasi dan pelaksana teknis.

Offices
CIRA has several buildings to house research and development activities in agriculture, radiation processing, industry and environment, administration and technical services.

Perpustakaan
Perpustakaan PAIR dilengkapi dengan pustaka cetak dan elektronik khususnya yang berkaitan dengan aplikasi isotop dan radiasi.

Library
CIRA library is provided with printed and electronic publications especially those related to isotopes and radiation applications.

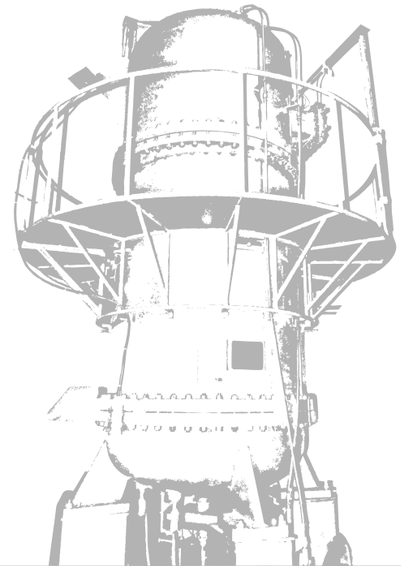
Peralatan Iradiasi
Irradiators

Iradiator Karet Alam (IRKA) adalah salah satu dari tiga iradiator gamma yang dimiliki PAIR dan merupakan iradiator dengan aktivitas maksimum 300 kCi.

Latex Irradiator is one of the three gamma irradiators owned by CIRA and its maximum activity is 300 kCi.

Selain IRKA, terdapat pula IRPASENA dan Gamma chamber 4000A dengan aktivitas maksimum masing-masing 80 dan 10 kCi.

Besides Latex Irradiator, there are IRPASENA and Gamma Chamber 4000A irradiators with maximum activities of 80 and 10 kCi, respectively.



PAIR juga memiliki fasilitas iradiasi elektron yaitu MBE GJ-2 dengan spesifikasi utama tegangan tinggi 2 MV dan arus berkas eletrkon 10 mA.

CIRA also has an electron irradiation facility, namely EBM GJ-2, with the main specification of 2 MV high-voltage and 10 mA beam current.

Laboratorium Utama
Main Laboratories

LABORATORIUM BANK JARINGAN
Peralatan: deep freezer, laminar air flow, lyophilizer dan vacuum sealer, dll.

TISSUE BANK LABORATORY
Equipments: deep freezer, laminar air flow, lyophilizer and vacuum sealer, etc.

LABORATORIUM PANGAN IRADIASI
Peralatan: vacuum sealer, activity water meter dan Chromameter, dll.

IRRADIATION FOOD LABORATORY
Equipments: vacuum sealer, activity water meter and chromameter, etc.

LABORATORIUM BAHAN INDUSTRI
Peralatan: universal testing machine, differential thermal analyzer dan Fourier transform infrared (FTIR), dll.

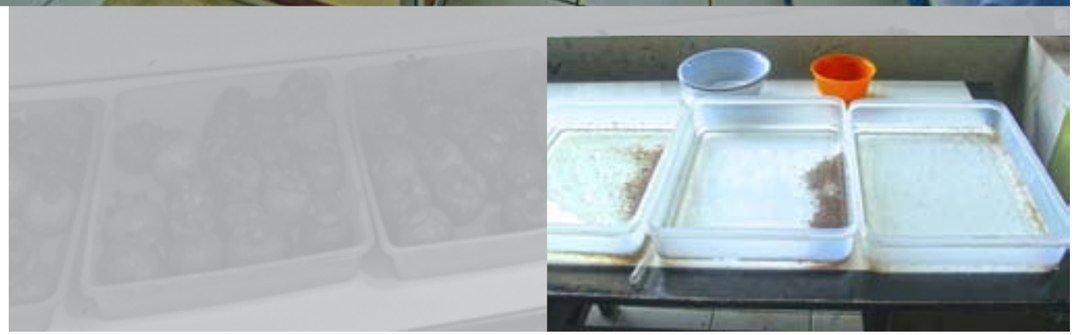
INDUSTRIAL MATERIALS LABORATORY
Equipments: universal testing machine, differential thermal analyzer (DSC) and Fourier transform infrared (FTIR), etc.

LABORATORIUM KULTUR JARINGAN
Peralatan/fasilitas: Laminar Air Flow, Autoclave, Polymerase Chain Reaction (PCR) dan Microscope serta ruang tumbuh, dll.

TISSUE CULTURE LABORATORY
Equipments: Laminar Air Flow, Autoclave, Polymerase Chain Reaction (PCR), and Microscope including growth room, etc.

GREEN HOUSE
Peralatan : Hand Tractor dan Compressor vacuum, dll.

GREEN HOUSE
Equipments: Hand Tractor and Compressor vacuum, etc.



LABORATORIUM TEKNIK SERANGGA MANDUL (TSM)
Microscope, Alat Pemisah Pupa dan Aspirator serta kandang nyamuk, dll.

STERILE INSECT TECHNIQUE EQUIPMENTS
Microscope, sexing of pupae, aspirator and mosquito cage, etc.

LABORATORIUM NUTRISI TERNAK
Liquid Scintillation Counter (LSC), Rumen Simulation Technique (RUSITEC), High Speed Centrifuge dan Nitrogen Analyzer serta kandang percobaan, dll.

ANIMAL NUTRITION LABORATORY
Liquid Scintillation Counter (LSC), Rumen Simulation Technique (RUSITEC), High Speed Centrifuge, Nitrogen Analyzer and experimental cage, etc.

LABORATORIUM KESEHATAN DAN REPRODUKSI TERNAK
Gamma Counter, Laminar air flow, kamera mikroskop dan inkubator vaksin, dll.

ANIMAL REPRODUCTION AND HEALTH LABORATORY
Gamma Counter, Laminar air flow, microscope camera and vaccine incubator, etc.

LABORATORIUM HIDROLOGI DAN PANAS BUMI
Peralatan: Liquid Scintillation Counter (LSC), Gas Chromatography (GC), Mass Spectrometer (MS) dan Liquid Water Isotope Analyzer (LWIA), dll.

HYDROLOGY AND GEOTHERMAL LABORATORY
Equipment: Liquid Scintillation Counter (LSC), Gas Chromatography (GC), Mass Spectrometer (MS), Liquid Water Isotope Analyzer (LWIA), etc.

LABORATORIUM SEDIMEN, KELAUTAN DAN LINGKUNGAN
Peralatan: Inductively Coupled Plasma Atomic Emission Spectroscopy (ICP-AES), Alpha Spectrometer, Waterproof Detectors, Milling Machine, dll.

SEDIMENT, MARINE, AND ENVIRONMENT LABORATORY
Equipment: Inductively Coupled Plasma Atomic Emission Spectroscopy (ICP-AES), Alpha Spectrometer, Waterproof Detectors, Milling Machine, etc.

LABORATORIUM INVESTIGASI TAK RUSAK
DAN DIAGNOSIS (NID)
Peralatan/fasilitas: X-ray & Gamma Radiography, Gamma Tomography, ruang Non Destructive Evaluation (NDE), dll.

NON DESTRUCTIVE INVESTIGATIONS AND DIAGNOSIS (NID)
Equipment/facilities: X-ray & Gamma radiographies and Tomography facilities, Non Destructive Evaluation (NDE) room, etc.

Fasilitas Penunjang
Supporting Facilities

FASILITAS ANALISIS SAMPEL LINGKUNGAN:
Low Background Counter (LBC), Multi Channel Analyzer (MCA), dll.

ENVIRONMENTAL SAMPLE ANALYSIS FACILITIES:
Low Background Counter (LBC), Multi Channel Analyzer (MCA), etc.

FASILITAS PENGELOLAAN LIMBAH B3 DAN RADIOAKTIF
Pemecah botol B3, survey meter, ruang pemilah, penyimpan sementara limbah radioaktif dan B3, dll.

HAZARDOUS AND RADIOACTIVE WASTES MANAGEMENT FACILITIES
Hazardous bottles crusher, survey meter, selection room, hazardous and radioactive wastes temporarily storage, etc..

FASILITAS BENGKEL INDUK
Mesin pemotong pelat metal, mesin bubut, mesin skrap, dll.

WORKSHOP
Metal-plate cutting, lathe, scrape machines, etc.

HASIL LITBANG

PRODUCTS OF RESEARCH & DEVELOPMENT

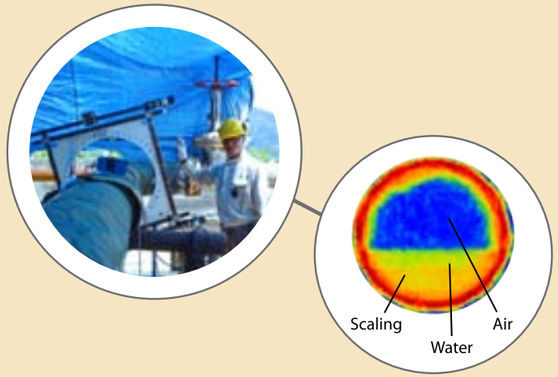
Industri | Industry

Aplikasi isotop dan radiasi dalam industri :

- Kebocoran bendungan
- Potensi panas bumi
- Inter-koneksi antar sumur produksi/injeksi
- Optimasi unit proses di kilang industri
- Uji tak rusak
- Komposit plastik ramah lingkungan
- Kopolimer iradiasi karet alam-stirena

Applications of isotopes and radiation in Industries :

- *Dam leakage*
- *Geothermal potential*
- *Production/injection wells inter-connection*
- *Processing unit Optimization in industrial plants*
- *Non- destructive testing*
- *Environmentally friendly plastics composite*
- *Natural rubber latex-styrene co-polymers*



Aplikasi teknik gamma tomografi untuk inspeksi penampang lintang kondisi material di dalam pipa panasbumi, Dieng, Jawa Tengah.

Application of gamma tomography technique for cross-sectional inspection of material condition in geothermal pipe, Dieng, Central Java.

Aplikasi teknik gamma scanning untuk pemeriksaan secara on-line kondisi material di dalam unit-unit proses kilang industri petrokimia, Banten.

Application of gamma scanning technique for on-line inspection of material condition in processing unit of petrochemical industrial plant, Banten.

Kegiatan penelitian potensi geothermal di daerah Kamojang dan G. Tampomas, Jawa Barat; Ulu Belu, Lampung; dan Lahendong, Sulawesi Utara.

Geothermal potential investigations in Kamojang and Mt. Tampomas, West Java; Ulu Belu, Lampung; and Lahendong, North Sulawesi.

Kegiatan penelitian kebocoran bendungan Sengguruh, Jawa Timur, dengan teknik radioisotop Au-198.

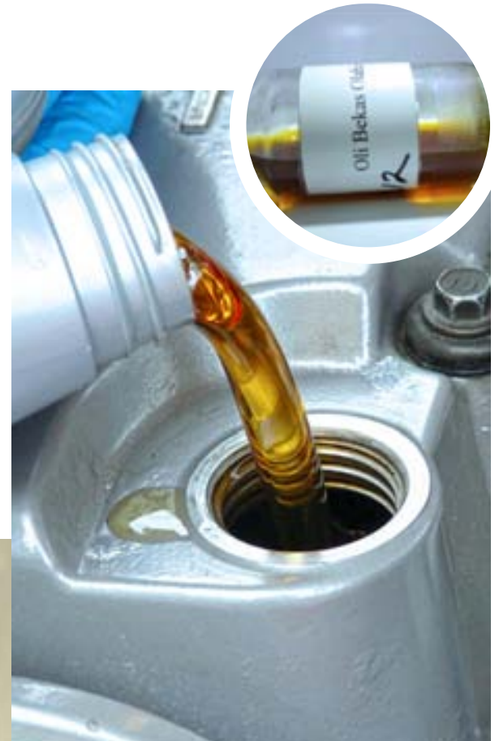
Leakage study in Sengguruh Dam, East Java, using radioisotope Au-198.

Produk plastik ramah lingkungan (biodegradabel) hasil teknologi iradiasi.

Environmentally friendly (biodegradable) plastics produced by irradiation technology.

Kopolimer karet alam-stirena iradiasi sebagai peningkat indeks viskositas pada pelumas mineral dan pelumas sintetis.

Irradiated natural rubber-styrene copolymers for viscosity index enhancer of mineral and synthetic lubricants.



Pangan | Food

Aplikasi isotop dan radiasi dalam bidang pangan :

- Varietas unggul tanaman pangan
- Efisiensi pemupukan
- Pengendalian hama tanaman ramah lingkungan
- Oligokhitosan
- Pangan olahan siap saji
- Formulasi pakan
- Vaksin iradiasi
- Reproduksi ternak

Isotopes and radiation application for foods :

- *Food crop superior varieties*
- *Fertilization efficiency*
- *Environmentally friendly pest control*
- *Oligochitosan*
- *Ready to eat food*
- *Animal feed formulation*
- *Irradiated vaccine*
- *Animal reproduction*

Varietas mutan padi Inpari Sidenuk:
Umur genjah (103 hari), hasil tinggi (9,1 t/ha), nasi pulen (Kadar amilosa 20,6%).

The Rice mutant variety of Inpari Sidenuk:
Early maturity (103 days), high yield (9.1 t/ha), good eating quality (amylose content of 20.6%).

Varietas mutan padi Pandan Putri:
umur 35 - 40 hari lebih genjah dibandingkan varietas asalnya Pandan Wangi, sementara sifat lain seperti bentuk gabah, aroma dan rasa nasi sama dengan varietas asal. Pandan wangi merupakan varietas lokal Kabupaten Cianjur, Jawa Barat.

The Rice mutant variety of Pandan Putri:
growth duration is 35-40 days earlier than that of the original variety Pandan Wangi, while other characteristics such as grain shape, aroma and quality remain the same as those of original variety. Pandan wangi is local variety of Cianjur, West Java.

Varietas Kedelai Mutiara 1:
Potensi hasil tinggi (4 t/ha), ukuran biji besar (24,3 g/100 biji), tahan terhadap karat daun, bercak daun dan penggerek pucuk.

Variety Soybean Mutiara 1:
High yield potential (4 t/ha), big grain size (24.3 g/100 grain), resistant to rust, spotting leaf and hopper attack.

Varietas mutan kedelai hitam Mutiara 2:
Rerata hasil 2,32 t/ha, berbiji agak besar, kandungan protein 38,36 %, tahan penyakit karat daun dan hama penghisap polong, sesuai untuk bahan baku kecap.

The black soybean mutant variety of Mutiara 2:
Average yield of 2.32 t/ha, big grain size, protein of 38.36 %, resistant to leaf rust disease and pod sucker insect and ideal for soya sauce.

Varietas mutan kedelai Gamasugen 1:
Super genjah (umur 66-68 hari), rerata hasil 2,4 t/ha), tahan penyakit karat daun & hawar daun coklat, kandungan protein 37,34% dan lemak 13,2%.

The soybean mutant variety of Gamasugen 1:
Very early maturity (66-68 days), average yield of 2,4 t/ha, resistant to rust and mildew diseases, protein and fat content of 37,34% and 13,2%, respectvely.

Varietas mutan gandum Ganesha 1:
Dihasilkan dari iradiasi varietas WL-2265.

Wheat mutant variety of Ganesha 1:
Produced by irradiating variety of WL-2265.

Sorgum varietas Pahat:
Tahan kekeringan, hasil tinggi, cocok untuk pangan.

Sorghum variety of Pahat:
Drought tolerant, high yield, suitable for food.

Galur mutan sorgum:
Biomass tinggi dan cocok untuk pakan ternak ruminansia.

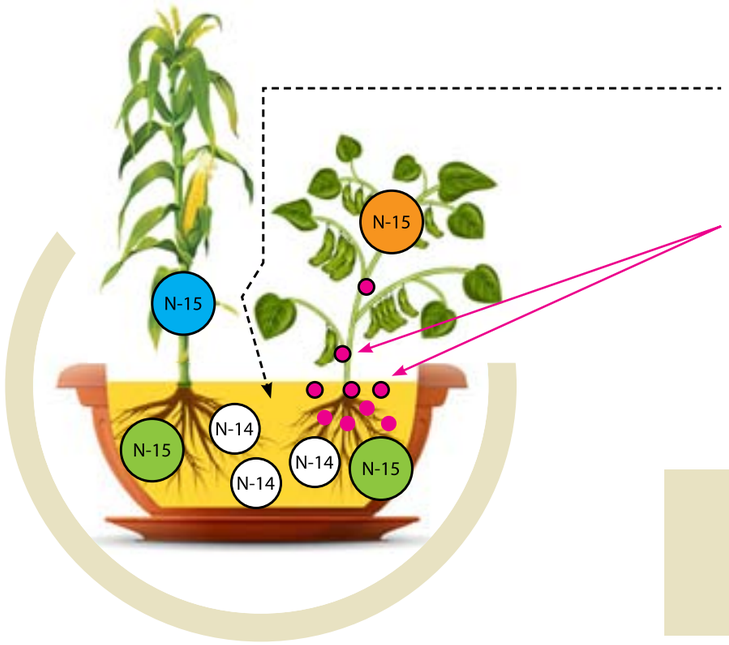
Sorghum mutant line:
High biomass production and suitable for ruminant feed.

Produk makanan siap saji iradiasi:
Rendang daging, semur daging, semur ayam, pepes ikan, dll.

Ready to eat irradiated food:
Beef rendang, beef semur, chicken semur, fish pepes, etc.

Oligokhitosan:
Zat pemercepat tumbuh dan pembasmi penyakit pada tanaman.

Oligochitosan:
Plant growth promoter and plant diseases repellent.



^{15}N (ISOTOP)

$(^{15}NH_4)_2SO_4$ (PUPUK)

10,2% a.e. (MISAL)

N_2-udara

N-15 < N-15

PENGENCERAN ISOTOP ^{15}N

Teknik tracer isotop pada tanaman pangan.

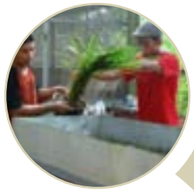
Isotopic tracer technique for crops.

Efisiensi penggunaan pupuk hijau (Sesbania rostata) dengan teknik isotop.

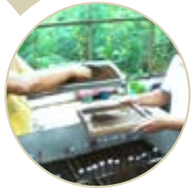
Utilization of isotope technique for green fertilizer efficiency (Sesbania rostata).

Laboratorium untuk aplikasi fitosanitari.

Laboratory for fitosanitary application.



Preparing the number of BPH



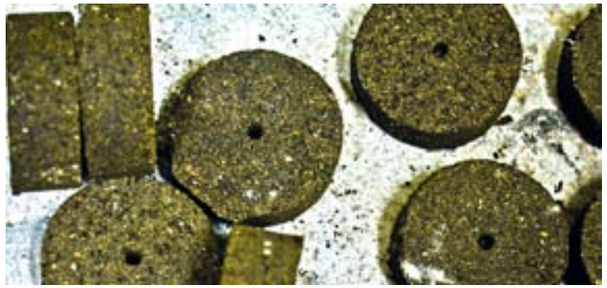
Planting the Tested lines / varieties

Investing BPH (instar 2 - 3)

Scoring

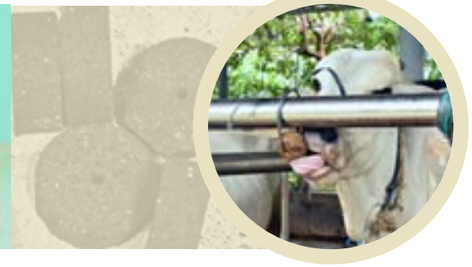
Metoda screening hama wereng coklat.

Screening method for brown plant hopper.



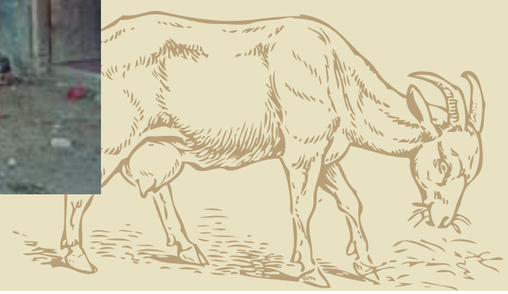
Mikrostar LA2 bahan fermentasi jerami padi, sorgum dan jagung untuk pakan ternak.

Fermented materials of Mikrostar LA2 for stall, sorghum and corn for animal feed.



Penimbangan domba.

Animal weighing.



Probiotic of Pro-G untuk ikan.

Probiotic of Pro-G for Fish.

Vaksin iradiasi untuk pencegahan fasciolosis, FasciVac, yang telah diusulkan Paten tahun 2011.

Irradiated vaccine for Fasciolosis control and prevention, and has been submitted for Patent in 2011.

Kit RIA Progesteron untuk mendeteksi Status Reproduksi Ternak.

Progesterone RIA kit for animal reproduction status detection method.

Kesehatan | Health

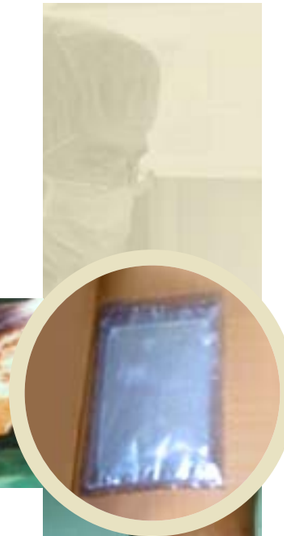
Produk teknologi isotop dan radiasi dalam bidang kesehatan :

- Biomaterial: membran amnion allograft, xenograft, alloplast, hidrogel
- Pangan steril
- Teknik serangga mandul (TSM)

Application of isotopes and radiation for health:

- *Biomaterials: amniotic membrane allograft, xenograft, alloplast and hydrogel.*
- *sterile food*
- *Sterile insect technique (SIT)*



Produk bank jaringan, di antaranya amnion membrane sebagai pembalut luka dan mempercepat penyembuhan luka, bone xenograft dan bone allograft (berbentuk chip dan granul) untuk pengganti tulang di bidang ortopedi dan periodonsia, pericardium dan periosteum membrane untuk perangsang pertumbuhan tulang. Hidrogel sterilisasi radiasi sebagai pembalut luka dan penurun demam.

Tissue bank product, for example membrane amnion for wound dressing and accelerate wound healing, radiation sterilized bone graft product (allograft, xenograft) for bone substitute in orthopedics and periodontics, and percardium and periosteum membranes use for guided bone regeneration (GBR). Radiation sterilized hydrogel for wound dressing application and cool fever.

Dalam TSM, nyamuk jantan dipilih untuk diiradiasi, kemudian disebarkan ke komunitas target pengendalian.

In SIT, male mosquito was selected for radiation, then released to the controlled target community.



Lingkungan | Environment

Aplikasi isotop dan radiasi dalam bidang lingkungan:

- Laju erosi lahan
- Sediment budget
- Daerah/laju resapan air tanah
- Interaksi air tanah/air permukaan
- Kesetimbangan air danau
- Iklim purba
- Bioremediasi

Application of isotopes and radiation for environment:

- *Erosion rate.*
- *Sediment budget*
- *Recharge area/ rate of groundwater.*
- *Groundwater and surface water interaction.*
- *Lake balance and dynamic.*
- *Paleoclimate.*
- *Bioremediation*

Bioremediasi di lahan kering untuk produksi bawang merah dengan menggunakan pupuk bio-organik berbasis radiasi dosis rendah.

Bioremediation on drought area for growing onion using low dose irradiated bioorganic fertilizer.


Isotop alam pada karang untuk studi kondisi iklim di masa lalu.

Natural isotope in corral for study of climate conditons in the past.

Kegiatan pengukuran parameter insitu, pengambilan sampel , pemasangan penangkap curah hujan dari berbagai sumber air disekitar Danau Toba dalam rangka mempelajari kesetimbangan air Danau Toba.

Insitu parameters measurements, sampling, rainwater trap installments from various water sources in water balance study of Lake Toba.

Produk hasil riset berupa pupuk bio-organik (PBO) yang dimanfaatkan untuk remediasi lahan yang tercemar.

Reseach product of bio-organic fertilizer for remediation of contaminated lands.

SISTEM MUTU
QUALITY SYSTEM

1. Sistem Manajemen MutuSB 001-SNI-9001 : 2012
   Ruang lingkup:

   Pelaksanaan pengembangan dan aplikasi isotop di bidang kebumian dan lingkungan, proses radiasi, pertanian dan layanan iradiasi, pengujian radiasi ionisasi dan kimia dan Uji Tak Merusak (NDT).

2. Sistem Mutu Pranata Penelitian dan Pengembangan, KNAPPP
   Ruang Lingkup:

   - Plant Improvement
   - Animal nutrition
   - Veterinary Science not elsewhere classified: Kesehatan dan reproduksi ternak
   - Other Medical and health sciences: sterilisasi/ pasteurisasi radiasi produk kesehatan dan pembuatan produk biomaterial
   - Food Processing
   - Other : Kesuburan tanah dan nutrisi tanaman
   - Plant Protection
   - Medical parasitology

3. Sistem Mutu Laboratorium Penguji SNI ISO/IEC 17025:2008, KAN
   Ruang Lingkup:

   - Radiasi Ionisasi (He, H2, N2, Ar dan CH4; Aktivitas tritium; Kandungan oksigen-18; Aktivitas karbon-14; Kandungan karbon-13; Aktivitas Pb-210)
   - Kimia (Ammonia; Klorida; Sulfat; Fluorida; pH)
   - Pestisida (Bahan aktif lamda sihalotrin; Bahan aktif sipermetrin)

1. *Quality Management System SB 001-SNI-9001 : 2012*
   Scope:

   Implementation of the development and isotope application in the field of earth sciences and environment, radiation processes, agriculture and services irradiation, ionizing radiation and chemical testing and Non -Destructive Testing (NDT).

2. *Quality System of "Pranata Penelitian dan Pengembangan", KNAPPP*
   Scope:

   - *Plant Improvement*
   - *Animal nutrition*
   - *Veterinary Science not elsewhere classified: Animal health and reproduction.*
   - *Other Medical and health sciences:irradiation sterilization/pasteurization of health care and biomaterial production.*
   - *Food Processing*
   - *Other : soil fertility and plant nutrition.*
   - *Plant Protection*
   - *Medical parasitology*

3. *Quality System for Testing Laboratory SNI ISO/IEC 17025:2008, KAN*
   Scope:

   - *Ionizing radiation (He, H2, N2, Ar and CH4; Activity of tritium; The content of oxygen-18; Activity of carbon-14; The content of carbon-13; Activity of Pb-210)*
   - *Chemicals Testing (Ammonia; Chloride; Sulfate; Fluoride; pH)*
   - *Pesticides (active substance of lambda cyhalothrin; active substance of sipermetrin*

PENGHARGAAN
AWARD/CERTIFICATE

2014

- Outstanding Achievement Award "Plant Breeding Group". Pemberi: Joint FAO/IAEA Programme.
  Outstanding Achievement Award "Plant Breeding Group". From: Joint FAO/IAEA Programme.
- 19 Karya Unggulan Teknologi Anak Bangsa Tahun 2014 di Bidang Pangan dan Material Maju. Pemberi: Kemenristek.
  19 Best creations of nation technology in the field of food and advance material Award. From: Ministry of Research and Technology.

2013

- Gelar Teknologi Tepat Guna Nasional XV Tahun 2013 atas penemuan Kedelai "Super Genjah" Varietas Gamasugen-1 dan Gamasugen-2. Pemberi: Kemenristek.
  National effective and efficient technology exhibition XV year 2013 Award for "Very Early Maturity" soybean Variety Gamasugen 1 and Gamasugen 2. From: Ministry of Research and Technology.
- Lembaga Penelitian dan Pengembangan yang akan dikembangkan menjadi Pusat Unggulan Iptek Tahun 2014. Pemberi: Kemenristek.
  R&D Institution Prospective for Leading Science and Technology Center 2014 Award. From: Ministry of Research and Technology.
- Sertifikat Sistem Manajemen Mutu SB 001-SNI-9001-2012. Pemberi: BATAN.
  SB 001-SNI-9001-2012 Quality Management System Certificate From: BATAN.
- Hakteknas Ke-18 Karya Unggulan Benih Padi "Bestari". Pmberi: Kemenristek.
  18th National Technology Awake Day Best Work Award for "Bestari" Rice Variety. From: Ministry of Research and Technology.
- Anugerah Iptek "Pranata Penelitian dan Pengembangan (Prayogasala)". Pemberi: Kemenristek.
  "Ethics of R&D" in Science and Technology Award. From: Ministry of Research and Technology.

2012

- SNI 7764.1.2012 Pangan Iradiasi. Pemberi: Kepala BSN.
  Irradiated Food (SNI 7764.1.2012). From: Director of BSN.
- 104 Inovasi Indonesia Prospektif 2012 untuk 4 Hasil Penelitian. Pemberi: Kemenristek.
  104 Indonesian Innovation Prospectives 2012 for 4 R&D Results. From: Ministry of Research and Technology.
- Hak Perlindungan Varietas Tanaman Padi "Bestari". Pemberi: Kementan.
  "Bestari" rice variety protection rights. From: Ministry of Agriculture.

PELEPASAN VARIETAS
RELEASED VARIETIES

1982 - 2012

PADI

Atomita 1 - 4
Situgintung
Cilosari
Meraoke
Woyla
Kahayan
Winongo
Diah Suci
Yuwono
Mayang
Mira 1
Bestari
Pandan Putri
Inpari Sidenuk
Inpari Mugibat
Suluttan Unsrat 1 dan 2

1987 - 2010

KEDELAI

Muria
Tengger
Meratus
Rajabasa
Mitani
Mutiara 1

2014

TROPIKO

Padi
- Potensi hasil 10,57 ton/ha
- Tahan hama penyakit utama

Rice
- High yield and quality 10,57 ton/ha
- Resistant to main pes and disease

MUTIARA 2

Kedelei Hitam
Potensi hasil 3,0 ton/ha

Black Soybean
Yield potential 3,0 ton/ha

MUTIARA 3

Kedelei Hitam
Potensi hasil 3,2 ton/ha

Black Soybean
Yield potential 3,2 ton/ha

SAMURAI 1

Sorgum
- Kadar nira 12,0 %
- Tinggi biomassa
- Produksi etanol: 1,148 L/ha

Sorghum
- Brix content 12,0%
- High biomass
- Ethanol productivity: 1,148 L/ha

SAMURAI 2

Sorgum
- Potensi hasil 8,5 ton/ha
- Sesuai untuk pangan

Sorghum
- Yield potential 8,5 ton/ha
- Suitable for food

2013

MURI

Kacang Hijau
- Potensi hasil 3,3 ton/ha
- Toleran kekeringan

Mung Bean
- Yield potential 3,3 ton/ha
- Drought tolerant

GANESHA

Gandum
- Potensi hasil 6,4 ton/ha
- Adaptif pada ketinggian >1000 m dpl

Wheat
- Yield potential 6,4 ton/ha
- Adaptif to altitude >1000 m dpl

PAHAT

Sorgum
- Umur genjah
- Rendah tanin
- Protein tinggi

Sorghum
- Early maturity
- Low tanin 0,012%
- High protein 12,8%

GAMASUGEN 1

Mutan Kedelei
- Umur super genjah (65 hari)
- Potensi hasil 2,6 ton/ha

Mutant Soybean
- Early maturity (65 days)
- Yield potential 2,6 ton/ha

GAMASUGEN 2

Mutan Kedelei
- Umur super genjah (68 hari)
- Potensi hasil 2,6 ton/ha

Mutant Soybean
- Early maturity (68 days)
- Yield potential 2,6 ton/ha

PATEN
PATENT

Judul | Title	Masa Berlaku Period of Validity	Inventor
Proses Pembuatan Bahan Perekat Pengalengan yang Tahan Pelarut. *Fabrication process of solvent resistant adhesive material for canning activities.*	20 Tahun *20 Years*	Prof. R. Marga Utama, APU, Daud Soetrisna
Proses Pembuatan Kondom dari Lateks Pekat Pravulkanisasi Radiasi Bebas Nitrosamin dan Rendah Protein. *Fabrication Process of condom from irradiated prevulcanized concentrated rubber Latex, Nitrosamine free and low protein.*	20 Tahun *20 Years*	Prof. Dr. Marga Utama, APU, Ir. Prayitno, B.Sc, Drs. Sastra Viqiya, Dr. Siswanto, DEA, Drs. Yoharmus Syamsu, M.Si, dr. Heru Sundaru, SpPD-KAI, Ir. Herwinarni S,Ir. Suharyanto, M.Si, Bambang Handoko, S.Si dr. Teguh H.K, SpPD
Sarung Tangan Tahan Listrik dari Kopolimer Lateks Alam Stiren Iradiasi. *Electricity resistant gloves from irradiated natural rubber latex styrene co-polymer.*	20 Tahun *20 Years*	Prof. Dr. Marga Utama, APU, Made Sumarti Kardha, B.Sc

2011

Sarung Tangan Higienis Rendah Nitrosamin dan Rendah Protein dari Lateks Pekat Pravulkanisasi. *Hygienic, low nitrosamine and protein gloves from prevulcanized concentrated latex.*	20 Tahun *20 Years*	Prof. Dr. Marga Utama, APU, Ir. Tjutju Rahayu Liusman, MM, Dr. Siswanto, DEA, Drs. Yoharmus Syamsu, M.Si, dr. Heru Sundaru, SpPD-KAI, Ir. Herwinarni S, Ir. Suharyanto, M.Si, Bambang Handoko, S.Si, Dr. Teguh H.K, SpPD

2009

Proses Pembuatan Lateks Pekat Pravulkanisasi. *Fabrication process prevulcanized concentrated latex.*	20 Tahun *20 Years*	Prof. Dr. Marga Utama, APU, Dr. Siswanto, DEA,Drs. Yoharnus Syamsu, M.Si, Ir. Herwinarni S,Ir. Suharyanto, M.Si Bambang Handoko, S.Si
Proses Pembuatan Lignoselulosa Plastik dan Produk Barang Jadinya dengan Teknik Polimerisasi Radiasi. *Fabrication process of lignocellulose plastics and other products using radiation polymerization technique.*	20 Tahun *20 Years*	Marga Utama, Yusuf Sidohadi, Bambang Kusranto
Campuran Limbah Industri asil Pengolahan Lateks yang Ditambah Pengisi untuk Pembuatan Tembikar tanpa Pembakaran. *Industrial waste mixture from Latex processing added with filler for the making of potteries without furnishing.*	20 Tahun *20 Years*	Drs. Endrawanto, Nana Mulyana, Zulhema Dadang Sudrajat

LAMPIRAN
APPENDICES

Dua orang Myanmar yang disponsori oleh IAEA sedang mengikuti pelatihan pemuliaan mutasi tanaman di PAIR-BATAN selama 2 bulan.

Two IAEA fellows from Myanmar attending training course on Plant Mutation Breeding at CIRA-BATAN for the duration of 2 months.

Perwakilan dari IAEA meninjau evaluasi galur mutan sorgum di lahan masam di Bogor (IAEA CRP Project No.16947).

IAEA representatives visited the evaluation of sorghum mutant lines in acid soil in Bogor (IAEA CRP Project No.16947).

Penjelasan kepada peneliti dari Burkina Faso (Afrika Barat) tentang bagaimana cara kerja iradiator gamma.

Explanation to IAEA fellow from Burkina Faso (West Africa) about how gamma irradiator is working.

Pengantar kesehatan dan keselamatan di tempat kerja untuk rekan-rekan dari Myanmar.

Introduction to health and safety at work for fellows from Myanmar .

KERJA SAMA
COLLABORATION

Kerjasama Nasional
National Collaboration

- Pertanian dengan Pemerintah Kabupaten Musi Rawas
- Industri Kayu Cetak dengan PT. Tirta Marta
- Industri Oligokhitosan dengan PT. MB Plus Agro
- Eksplorasi dan Eksploitasi Panas Bumi dengan Fakultas Teknik, Universitas Gadjah Mada
- Pertanian dengan Fakultas Pertanian, Universitas Hasanuddin
- Industri Plastik Ramah Lingkungan dengan PT. Sarana Tunggal Optima
- Biomaterial dan Bank Jaringan dengan RSU. Fatmawati
- Biomaterial dan Bank Jaringan dengan Fak. Kedokteran, UNPAD
- Pertanian dan Peternakan dengan PEMDA Klaten
- Pertanian dengan Dinas Pertanian Kab. Kotabaru dan Pascasarjana Univ. Lambung Mangkurat
- Kelautan dan Perikanan dengan Badan Penelitian dan Pengembangan Kelautan dan Perikanan
- Biomaterial dan Bank Jaringan dengan RSU. Fatmawati
- Pertanian dengan Badan Perencanaan Pembangunan Daerah Kab. Kerinci
- Pertanian dengan PT. Kebon Agung, Surabaya
- Kesehatan dengan Balai Besar Penelitian dan Pengembangan Vektor dan Reservoir Penyakit, Badan Litbang Kesehatan, Kemenkes
- Pengawetan Pangan dengan Pemerintah Kota Serang
- Kesehatan dengan PT. Pharma Medica Sejahtera
- Kesehatan dengan Dinas Kesehatan Kota Semarang, Fakultas Kesehatan Masyarakat, UNDIP, Balai Penelitian dan Pengembangan Pengendalian Penyakit Bersumber Binatang, Banjarnegara
- Pertanian dan Peternakan dengan Fakultas Pertanian, Universitas Gadjah Mada
- Pertanian dengan Kementerian Pertanian
- Geologi dan Hidrologi dengan Fak. Teknik Geologi, UNPAD

2009 **2010** **2011** **2012** **2013** **2014** **2015** **2016** **2017** **2018** **2019**

Kerjasama Internasional
International Collaboration

- FNCA
  About Radiation Processing of Natural Polymers
  NPC : Darmawan
- CRP
  AboutDevelopment of Safe Ethnic Foods
  NPC : Zubaidah Irawati
- TC
  About Climate Change
  NPC : Ali Arman Lubis
- RAS
  About Climate Change Anticipation in Rice Plant
  NPC : Ishak
- RAS
  About Climate Change for Sustainable Management
  NPC : Ali Arman
- RAS
  About Soil Fertility and Land Productivity
  NPC : Barokah Aliyanta
- RAS
  About Advanced Non-Destructive Examination for Enhanced Industrial
  NPC : Sigit Budi Santoso
- RAS
  About Process Dynamics in Complex Industrial Systems
  NPC : Sugiharto
- RAS
  About Best Practices of Food Irradiation
  NPC : Zubaidah Irawati
- RAS
  About Groundwater Dynamics and Recharge Rate
  NPC : Paston Sidauruk
- TC
  About Enhancing Food Crop Production
  NPC : Sobrizal
- FNCA
  About Breeding of Rice Variety(s)
  NPC : Sobrizal
- UNDP
  About Electron Beam Application for Value Addition
  NPC : Darmawan
- RAS
  About Development of Advanced Grafted Materials Preservation
  NPC : Meri Suhartini
- RAS
  About New Crop Varieties Adaptable to Climate Change
  NPC : Soeranto Human
- RAS
  About Food Traceability and Food Safety Control Systems
  NPC : Agustin Sumarsono
- APEC
  About Bioenergy Crops as Renewable Energy
  NPC : Soeranto Human
- CRP
  About Climate-Smart Agriculture
  NPC : Setiyo Hadi W
- CRP
  About Quarantine Treatment of Mangosteen Insect Pests
  NPC : Murni Indarwatmi
- CRP
  About Sorghum Mutant Lines and Variety
  NPC : Soeranto Human
- RAS
  About the Control of Aedes Mosquitoes
  NPC : Ali Rahayu
- RAS
  About Flood Risk Mitigation and Post-Flood Rehabilitation
  NPC : Paston Sidauruk
- RAS
  About Food Irradiation for Immunocompromised Patients
  NPC : Zubaidah Irawati
- RAS
  About Hamrful Algae Toxin on Seafood Safety
  NPC : Agustin Sumartono
- TC
  About Advanced Non-Destructive Testing
  NPC : Sigit Budi Santoso
- RAS
  About Preventing Overweight and Obesity
  NPC : Ermin Katrin H
- RAS
  About Infant and Young Child Nutrition
  NPC : Ermin Katrin H
- TC
  About Isotope Tracer Study on Children Nutrition Status
  NPC : Hendig Winarno

TC = IAEA TC Project
RAS = IAEA Regional Project
CRP = IAEA Coordinated Research Programme
UNDP = UNDP funded project
FNCA = JAEA funded project
APEC = APEC funded project

PETA PAIR

MAP OF CIRA