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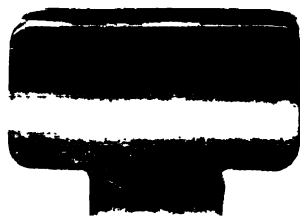
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Consultant Final Report
IICA/EMBRAPA-PROCENSUL II

SOYBEAN PROCESSING
TRIP REPORT TO BRAZIL

ESCRITÓRIO NO BRASIL



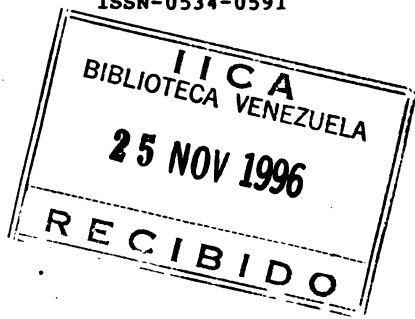
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Série Publicações Miscelâneas No.A4/BR-87-005
ISSN-0534-0591



SOYBEAN PROCESSING. TRIP REPORT TO BRAZIL

Consultant Final Report
IICA/EMBRAPA-PROCENSUL II

Lun-Shin Wei

Brasília, novembro 1987

INSTITUTO INTERAMERICANO DE COOPERAÇÃO PARA A AGRICULTURA
EMPRESA BRASILEIRA DE PESQUISA AGROPECUÁRIA

IICA
MIS A4/BR-87-005 Wei, Lun-Shin

Soybean processing. Trip report to
Brazil. Brasília, Brasil. Instituto Intera-
mericano de Cooperação para a Agricultura.
1987.

10 p. (IICA - Publicações Miscelâ-
neas, A4/BR-87-005)

ISSN-0534-0591

1. Pesquisa - Soja - Processamento.
I. Título. II. Série.

AGRIS 0336
Q02

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APRESENTAÇÃO

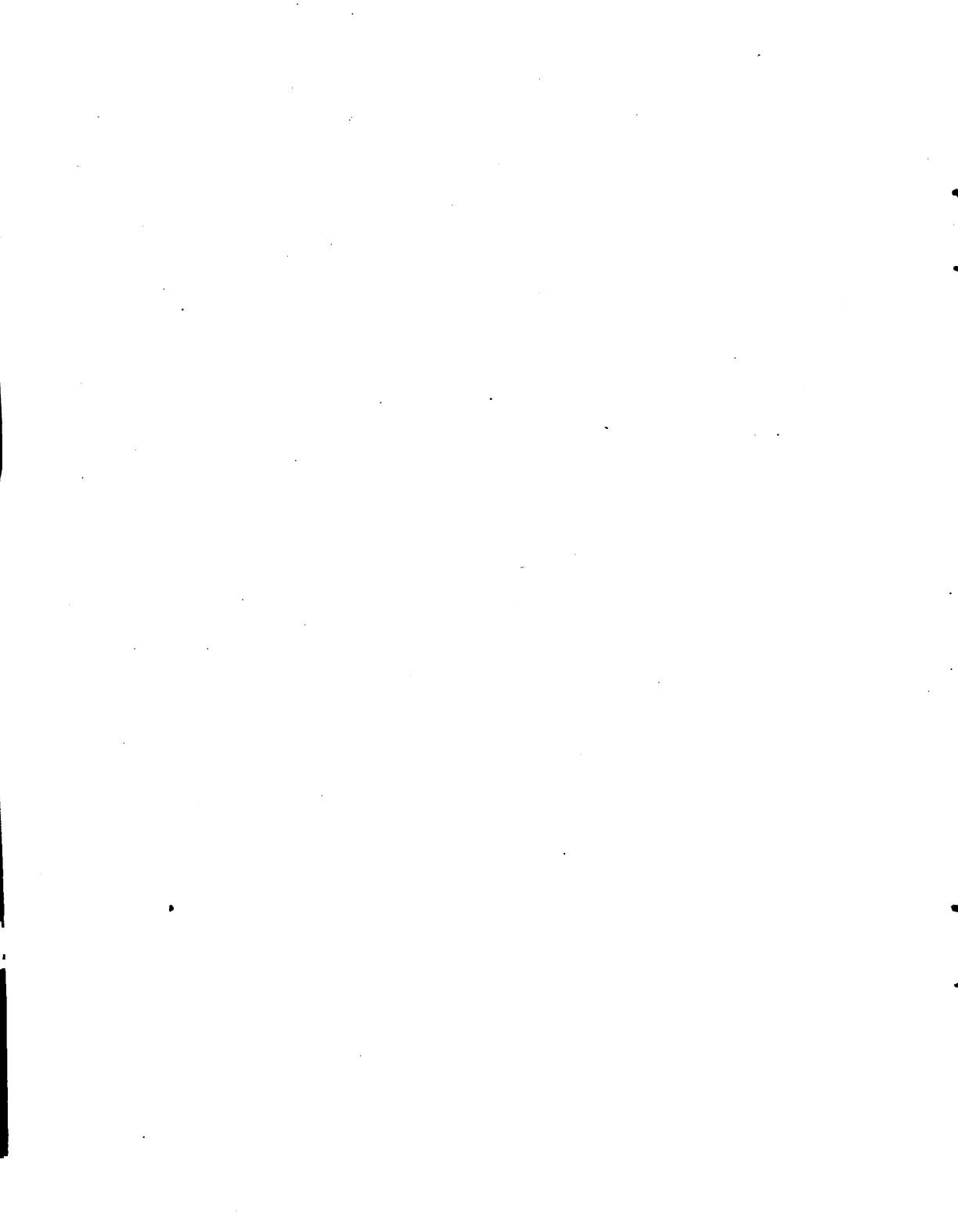
A reprodução e difusão dos Relatórios de Consultores, no âmbito restrito das Diretorias das Unidades do Sistema Nacional de Pesquisa Agropecuária, vinculado à EMBRAPA, tem como objetivo principal o de divulgar as atividades desenvolvidas pelos consultores e as opiniões e recomendações geradas sobre os problemas de interesse para a pesquisa agropecuária.

As atividades de consultoria são realizadas no âmbito do Projeto de Desenvolvimento da Pesquisa Agropecuária e Difusão de Tecnologia na Região Centro-Sul do Brasil-PROCENSUL II, financiado parcialmente pelo Banco Interamericano de Desenvolvimento-BID e a EMBRAPA conforme os contratos de Empréstimo 139/IC-BR e 760/SF-BR, assinados em 14 de março de 1985 entre o Governo brasileiro e o BID.

As opiniões dos consultores são inteiramente pessoais e não refletem, necessariamente, o ponto de vista do IICA ou da EMBRAPA.

A coordenação dos Contratos IICA/EMBRAPA aguarda receber comentários sobre estes relatórios.

Horacio H. Stagno
Coordenador Contratos IICA/EMBRAPA



University of Illinois
at Urbana-Champaign

Department of Food Science
382D Agricultural Engineering 217 333-9328
Sciences Building
1304 West Pennsylvania Avenue
Urbana, IL 61801

August 12, 1987

Dr. Decio L. Gazzoni
Empresa Brasileira de Pesquisa
Agropecuaria - Embrapa
Centro Nacional de Pesquisa de Soja - CNPSo
Rod. Celso Garcia Cid, Km 375
Cx. Postal 1061 - 86001
Londrina - Parana
BRASIL

Dear Dr. Gazzoni:

Thank you so much for your invitation to Brazil in June and the hospitality shown to me while I was there during June/July 1987.

Enclosed is my report for my trip. Please give my best regards to everyone at EMBRAPA.

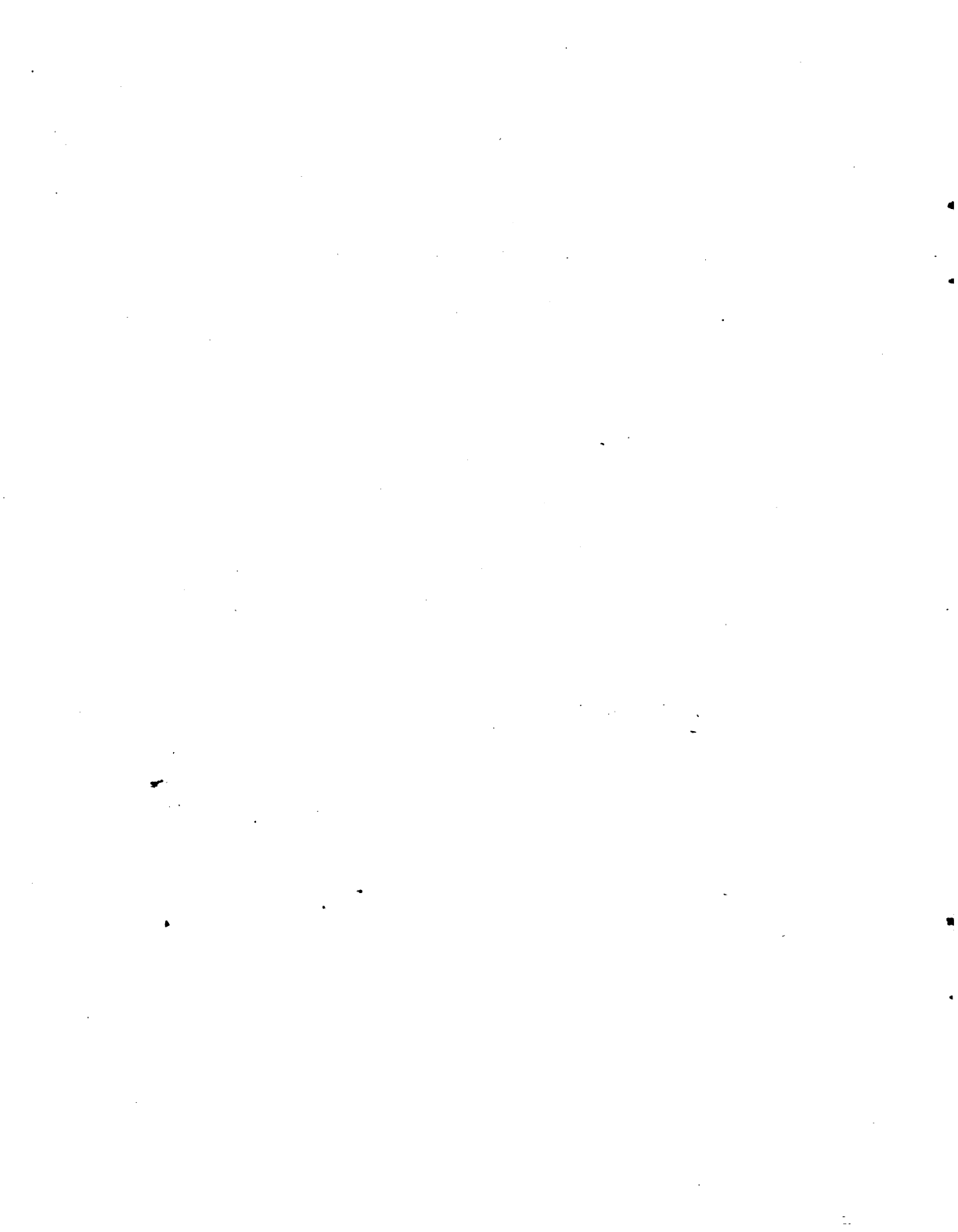
Yours very truly,



L. S. Wei
Professor of Food Science

LSW/bj

cc: Mercedes C. Carrao Panizzi
A. I. Nelson
A. J. Siedler
H. E. Kauffman



International Soybean Program
and
Department of Food Science
University of Illinois at Urbana-Champaign
Trip Report - Brazil
June 21 - July 12, 1987

Name: L. S. Wei

Fundings: by EMBRAPA and IICA

Purpose of Visit:

1. Give invited paper on "Present status of soybean products from the solvent extraction in the U.S.A." at III CISOJA.
2. Discuss and advise the soybean utilization projects with Food Technology Research Center (CTAA) and Soybean Research Center of EMBRAPA.
3. Lecture and demonstration of whole soybean utilization at ITAL, CTAA and Soybean Research Center.
4. Tour and consultation with some Brazilian soybean processing plants along with personnel from EMBRAPA.

Organizations/Persons Contacted:

EMBRAPA - Soybean Research Center (Londrina, Parana)

Dr. Decio L. Gazzoni, Director
Dr. Rubens Campo, Assoc. Director
Dr. Norman Newmaier, Assoc. Director
Dr. Romeu S. Kiihl
Dr. Clovis Manuel Bockert
Dr. Jose Tadashi Yorinori
Dr. Shin R. Wang
Dr. Antonio Panizzi
Mrs. Mercedes C. Carrao Panizzi
Mr. Paulo R. Galerani
Mrs. Marise Galerani

EMBRAPA - CTAA (Food Technology Center, Guaratiba, Rio de Janeiro)

Dr. Eduardo Paulo de Moraces Sarmiento, Director
Dr. Esdras Sundfeld, Head of Technical.
Dr. Lair Chaves Gabral, Food Technologist
Dr. David B. Arkcoll, Food Resources
Dr. Cyro Goncalves Teixeira, Executive Assistant
Dr. Ahmed A. El-Dash, Consultant, Prof. at Unicamp
Dr. Joao Fernando Marques, Economist
Dr. Servilho J. Gianetti, Economist
Dr. Yoon Kil Chang, Consultant, Assist. Prof., Unicamp
Dr. Leopold Hartman, Consultant

University of Londrina (Londrina, Parana)

Dr. Adelaide Beleia
 Dr. Raul J. H. Castro Gomez
 Dr. Maria V. Eiras Grossmann
 Dr. Oswaldo Calzavara

Unicamp (Campinas, Sao Paulo)

Dr. Cesar Francisco Ciacco, Director
 Dr. Theo Guentes Kieckbusch, Assoc. Director
 Prof. Ramon
 Prof. Park

University of Rural Rio de Janeiro (Itaguai, RJ)

Dr. Antonio Tavares da Silva, Food Science
 Dr. Paulo Costa Pereira, Prof. of Organic Chemistry
 also President of Uniao Fabril Exportadora S.A. (UFE)

ITAL (Campinas, SP)

Dr. Rodrigo Otavio Teixeira Nato, Director
 Dr. Louiz Carlos dos Santos
 Dr. Wilson Leite do Canto
 Dr. Genevaldo de Souza

Private Industries:

- Mr. Arturo Jose Furlong, President of Samrig S.A., Porto Alegre - RS
 and President of Brazilian Vegetable Association
- Mr. Dilson Dos Santos Moreira, Sanbra S.A.
- Mr. Stefan Gracza, Gracza Industrial Tech. Consultation Ltd. (Vila Velha,
 ES)
- Mr. Ruy Barreto, Jr., Director Bhering Food Products S.A., Rio de
 Janeiro - RJ
- Mr. Ruy Barreto, President, Cafe Soluvel Brasilia S.A., Rio de Janeiro -
 RJ
- Eng. Valentinio C. Signorelli, Samrig S.A., Esteio - RS
- Mr. Osman Masson, Sec. General, Brazilian Veg. Oil Assoc., Sao Paulo
- Mr. Alvaro C. C. do Amarante, Tech. Manager, Nutrimental S.A., Sao Jose
 dos Pinhais - PR
- Ms. Marileusa d. Chiarello, Nutrimental S.A., PR

Ms. Marileusa d. Chiarello, Nutritional S.A., PR

Mr. David J. Arrabasa, President, Ind. e Comercio de Alimentos Ltda., Londrina, Parana (Maker of Prote Milk)

Mr. Edeval Lopes Borges, Jr., Quality Technical Manager, SOL, Mecbrazil Industria, Comercio Representacoes E. Service Ltda., Pompeia, SP

Mr. Sheun Ming Lin, President, Olvebra Group, Porto Alegre - RS

Mr. Juarez Mayer, Industrial Director, Olvebra Industrial S.A., Porto Alegre - RS

Mr. Chi Zen Lee, Technical Director, Olvebra Group, Porto Alegre - RS

Mr. V. Katunori Moriguchi, Chemical Engineer, Olvebra Industrial S.A., Porto Alegre - RS

Mr. Izumi Watanabe, Director, Braswey S.A., Cambe - PR

Mr. Chang, Cheng-Chung, Director Braswey S.A., Londrina, PR

Mr. Paulo Roberto Reschetti, Chem. Engineer, Braswey S.A., Cambe - PR

Mr. Joao Roberto Zamboni, Cargill Agricola S.A., Santo Amaro - SP

Schedule:

- June 22 Meeting with Dr. Gazzoni, Dr. Lair Gabral and Mrs. Mercedes Panizzi on my tour objectives and schedule.
- June 23 Attending III CISOJA meeting and gave seminar on the present status of soy foods from the U.S. solvent extraction industries and gave press conference at the Convention Center.
- June 24 Attending meeting of III CISOJA and visit facilities of Sanbra S.A. at Centro Empresarial de Sao Paulo. Left Sao Paulo for Londrina - PR.
- June 25
1. Visit Braswey S.A. solvent extraction plant and Dept. of Food Science, University of Londrina.
 - 2.. Visit "prote" milk plant using SOL, mechanical cow to make soymilk.
- June 26
1. Discuss and demonstrate tempeh, soymilk, silken tofu and tofu manufacture with personnel at EMBRAPA, Soy Research Center.

U.S. soy products samples, and yogurt-tempeh freeze dried cultures and GDL (glucono delta lactone).

- June 27 Inspection tour of operation at Braswey S.A., solvent extracting 1,800 m.t. of soybean per day and making purified lecithin.
- June 28 Attending annual picnic gathering of Londrina Agronomic Society; met many former U. of I. and U.S.A. university alumni.
- June 29
1. Meeting with Dr. Gazzoni, Dr. Campo, Dr. Neumaier and Mrs. Panizzi on the cooperation with INTSOY.
 - a. To give future utilization short course at EMBRAPA (1989).
 - b. Exchange of personnel.
 - c. Exchange of information.
 2. Meet with press.
 3. Lecture to Soy Res. Center and University of Londrina Soymilk (Oriental and Japanese processes, U. of I. patented process and improvement of process used in mechanical cow).
 4. Meet EMBRAPA-Soy Res. Center - Press Secretary, Sandra, on the general question regarding soy utilization for the press release.
- June 30
1. Travel from Londrina to Porto Alegre via Curitiba.
 2. Meeting with the technical personnel (about 8 to 10 persons) from Olvebra at their soymilk, TVP, oil refining and packaging plant.

Discuss soymilk processing in general on the question and answer basis.
- July 1
1. Discussion with the technical team from Olvebra at their plant on soymilk, solvent extraction, concentrate and isolated soy protein and protein texturization.
 2. Tour of soymilk powder plant (60 tons per day capacity), oil bottling and TSP plant under expansion (using 2 Wenger X-200 extruders).
 3. Evaluate Olvebiak soy products - TVP dinner, TVP paté, soymilk of various flavors.
- July 2
- Travel from Porto Alegre to Sao Paulo by air then by bus to Campinas.

- July 2 Travel from Porto Alegre to Sao Paulo by air then by bus to Campinas.
- July 3
1. Visit ITAL and Unicamp facilities and personnel.
 2. Informal discussion with ITAL and Unicamp professors on soy utilization.
 3. Lunch at Unicamp in a student cafeteria.
 4. Meet with the Director of ITAL.
 5. Lecture on soy foods from the solvent extraction and importance of soymilk and off-flavor problem - mechanical cow and some processes.
 6. Meet with Mr. Genevoldo to discuss research with tofu at evening along with Dr. Lair Gabral.
- July 4
1. Travel from Campinas to Rio de Janeiro by air.
 2. Sight-seeing Corcovado mountain with Dr. Lair.
- July 5 Sunday, free time, took guided bus tour of sugar loaf mountain and Niteroy City.
- July 6
1. Whole day at EMBRAPA-CTAA.
 2. Visit administrative and research personnel.
 3. Tour CTAA pilot plant facilities.
 4. Soak whole soybean for the experiments.
 5. Gave CTAA tempeh and yogurt freeze dried cultures and GDL (glucono delta lactone).
- July 7
1. Demonstrated at CTAA, soymilk processed from overnight or 4 hours water soaked whole beans, following 90 seconds blanching in a metal basket at microbiology lab.
 2. Start yogurt culture from freeze dried.
 3. Demonstrate and explain multiplication and maintenance of yogurt and tempeh cultures.
 4. Mrs. Mercedes Panizzi join us at CTAA.
 5. Discuss with Dr. Lair and Mrs. Panizzi on their joint project of home and village soy utilization and variety screening.
- July 8
1. Demonstrated again the preparation of soymilk and dairy analogs using 90 second blanching of soaked whole beans at their pilot plant.

2. Prepared yogurt after sweeten soymilk with 2% sucrose and 2% glucose; plain and sundae style with pineapple preserves.
 3. Prepared soymilk plain and flavored with bottled coconut milk with the addition of 0.05% NaHCO_3 , 4% sugar and 0.2% NaCl .
 4. Prepared tofu with 0.25% $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$.
 5. Prepared silken tofu (soybean custard) after flavored with coconut milk with 0.25% glucono delta lactone on heated soymilk (95°C).
 6. Discuss with visitors from Nutrimental SA on fermented soybean products.
 7. Discuss with Dr. Lair Gabral, Mrs. Mercedes Panizzi and Dr. David Arkcoll with regard to funding for the cooperation with INTSOY and the area of cooperation.
- July 9
1. Prepared soymilk, yogurt, custard and tempeh for press conference.
 2. Press conference.
 3. Evaluation of all product made at CTAA by CTAA personnel.
 4. Meet with Dr. (Prof.) Antonio Tavares da Silva from Rural RJ. University.
 5. Meet with Dr. Paulo Costa Pereira who manufactures laundry soap bar with soyoil hydrogenated to I.D. No. 1 or 2.
- July 10
1. Meet Mr. Ruy Barreto, Jr. (Director of Bhering Food Products S.A.) with Dr. Gabral, Mr. Panizzi and Dr. Silva.
 2. Discuss processing with Mr. Ruy Barreto (president) and Ruy Barreto, Jr., and their technical members of soymilk and extrusion processes; tour their manufacturing of dry gruel mix flavored with coconut soy-corn-milk-egg blended dry mix plant.
 3. Preparation for departure to U.S.A.

Observation/Conclusion and Recommendations:

1. There are many companies with more than a few solvent extraction plants. These plants range in size from 500 to over 2,000 m. tons per day soybean crushing capacity. However, a great number of plants are not in opera-

tion. Therefore, there is a great need to increase usage in order for these plants to operate at better than 50% capacity.

2. Solvent extraction facilities are excellent and some companies showed great success in modifying DT (desolventizer-toaster), etc. to produce meal of low residual oil at high capacity. Desolventizer-toaster is also operated in some plants at reduced pressure to produce defatted meal with high nitrogen solubility.
3. Both isolated soy protein and TSP (textured soy protein) as well as soy protein concentrate (hot water washed type) are made in Brazil. Some of isolated soy protein, TSP soymilk powder, and pelletized defatted soybean meal are being exported abroad from Brazil.
4. Fully purified soybean oil is available in all supermarkets and grocery stores. Hydrogenated soy oil and food grade lecithin are also manufactured in Brazil for salad dressing and margarine industry.
5. One of the largest dry soymilk powder plants producing fairly good acceptable (locally) plain soymilk powder and strawberry and banana powder flavored dry soymilk are produced.
6. If solubility problem of the spray dried soymilk powders can be solved, little effort is needed to improve flavor for increased domestic usage.
7. Project to expanding home level use at EMBRAPA-Soy Res. Center is very encouraging. However, facilities, equipment and additional personnel are needed at the new Soy Res. Center of EMBRAPA.

Recommend strongly that some joint projects be formed between the Soy Res. Center and CTAA on utilization with fundings for some training and equipment addition.

8. While EMBRAPA-CTAA is equipped with many commercial size equipment, it is lacking in the equipment for small scale pilot operation. Small size equipment are badly needed in CTAA. Some of these for CTAA and Soy Res. Center can be listed in 9 and 10 below.
9. Equipment needed for CTAA:
 - 1) Jacketed kettle - 5 gallon size.
 - 2) Plate heat exchanger - for heating and cooling of liquid food.
 - 3) A small two-stage homogenizer capable of operating at pressures up to 5000 psi.
 - 4) A test kitchen capable of initiating home level processing.
10. Needs of Soybean Res. Center - EMBRAPA at Londrina (new building at the permanent location) for utilization research. At the present location,

carry research on utilization, there should be all of the following facilities independent of CTAA.

- 1) A completed equipped test kitchen.
 - 2) Cold storage facility.
 - 3) An equipped pilot plant with small scale machinery and high pressure steam.
 - 4) Should ask SOL to donate mechanical cow machine for experimental use and training use.
 - 5) Additional full-time researcher (2 researchers) and technician (2 technicians) for the food lab and pilot plant to assist and work with Mrs. Mercedes Panizzi.
11. "Mechanical Cow" by SOL - Excellent compact machine, appeared to be capable of converting soybean into soymilk and is available at reasonable cost (\$18,000 US), according to Mr. Edeval Lopes Borges, Jr. of SOL. The process as used presently is a modified hot water extraction of pre-ground dry soybeans. It still processes strong off-flavor, some of this off-flavor is not necessarily associated with lipoxxygenase activity. The product as it is produced is poor in shelf-life even under refrigeration.

Recommend the following for improvement:

- 1) Better sanitation - Training of workers and operators and plant inspection.
- 2) Raw material - Soya quality control; use undamaged sound soybean with high nitrogen solubility (NSI) Index.
- 3) Once dehulled and ground into powder, use immediately.
- 4) Clean hammer mill after grinding soybeans everyday with compressed air or vacuum cleaner.
- 5) Don't water rinse hang-up of the soy powder already moistened in the feed hopper adjoining the hot water grinder.
- 6) Raise grinding hot water temperature from 90°C to 95°C or even better to temperature as near to boiling as possible.
- 7) Increase soybean slurry circulation temperature from 80°C to 95°C or above, with direct steam injection or heater.
- 8) Increase holding time, 7 above, from 3 minutes to 10 minutes. (As this will lower T1 content and reduce total microbial count before pasteurization.)

- 8) Increase holding time, 7 above, from 3 minutes to 10 minutes. (As this will lower T1 content and reduce total microbial count before pasteurization.)
- 9) Accurate control of pasteurization temperature (121°C) and holding time before cooling to 4°C for pouch fill. Two minutes holding at 121°C gave only F_0 value (sterilization value) of 2 which is lower than 2.7 required for clostridium botulinum. Recommended increase holding time to 3 minutes which will give sterilization value, F_0 of 3.2.
- 10) Refrigerate immediately after packaging.

The above changes can be made without any additional equipment. Further improvement can be made according to the following:

- 1) Adapt pre-blanching step on soaked whole soybean before grinding with the present grinder. (Require addition of a blanching tank.)
 - 2) Grinding temperature and heating should increase as above.
 - 3) Add flavor before packaging, even just with sugar and salt.
12. A simple home or lab process demonstrated by L. S. Wei at EMBRAPA-Soy Res. Center and CTAA for soymilk, silken tofu (soybean custard), tofu and yogurt.

Whole soybean

↓

Placed in Wire Basket

↓

Rinse and wash with cold tap water

↓

Soak in tap water for 4 h. to overnight
until beans double in weight.
(Place the wire basket into bucket
filled with cold water.)

↓

Drain and fresh water rinse (lift basket
from bucket and water rinse from top to
the basket).

↓

not be less than 95°C) - lift and lower the basket up and down for 3 times. (So no cold spot in the beans at the center of the basket); blanch for total of 90 seconds.

↓

Cool the basket of beans in a bucket of cold water thoroughly, so center is not warm to touch.

↓

Grind in Waring blender with boiling water (8 parts water to 1 part dry beans) at high speed for 3 minutes.

↓

Filter

→

Sludge can be used as pan fried pattie with wheat flour as binder and garnished with onions, etc.

↓

Filtrate - Soy milk

↓

Add following: →

Heat to boil and simmer for 10 minutes.

1. 0.05% NaHCO₃

2. 0.2% NaCl

3. 4% sugar

4. Flavoring:

a) cocoa at 0.6%
(increase
sugar to 7%)

or

b) coconut milk -
enough to flavor

Cool to room temperature with running water before bottling

↓

Refrigerate

13. Soymilk for yogurt or silken tofu or tofu should be flavored differently. Addition of NaHCO₃ or NaCl may delay gel formation by GDL, CaSO₄.2H₂O or MgCl₂.6H₂O and prolong time required for lactic fermentation.

Esta publicação foi reproduzida na Gráfica do Escritório do IICA no Brasil, em Brasília, em novembro de 1987, numa tiragem de 200 exemplares.

Responsáveis pela reprodução: Jadir José dos Santos e Murillo Sodré da Silva.

Programa II. Geração e Transferência de Tecnologia

O Programa de Geração e Transferência de Tecnologia é a resposta do IICA a dois aspectos fundamentais: (i) o reconhecimento, por parte dos países e da comunidade técnico-financeira internacional, da importância da tecnologia para o desenvolvimento produtivo do setor agropecuário; (ii) a convicção generalizada de que, para aproveitar plenamente o potencial da ciência e da tecnologia, é necessário que existam infra-estruturas institucionais capazes de desenvolver as respostas tecnológicas adequadas às condições específicas de cada país, bem como um lineamento de políticas que promova e possibilite que tais infra-estruturas sejam incorporadas aos processos produtivos.

Nesse contexto, o Programa II visa a promover e apoiar as ações dos Estados membros destinadas a aprimorar a configuração de suas políticas tecnológicas, fortalecer a organização e administração de seus sistemas de geração e transferência de tecnologia e facilitar a transferência tecnológica internacional. Desse modo será possível fazer melhor aproveitamento de todos os recursos disponíveis e uma contribuição mais eficiente e efetiva para a solução dos problemas tecnológicos da produção agropecuária, num âmbito de igualdade na distribuição dos benefícios e de conservação dos recursos naturais.

INSTITUTO INTERAMERICANO DE COOPERAÇÃO PARA A AGRICULTURA

O Instituto Interamericano de Cooperação para a Agricultura (IICA) é o organismo especializado em agricultura do Sistema Interamericano. Suas origens datam de 7 outubro de 1942, quando o Conselho Diretor da União Pan-Americana aprovou a criação do Instituto Interamericano de Ciências Agrícolas.

Fundado como uma instituição de pesquisa agrônômica e de ensino; de pós-graduação para os trópicos, o IICA, respondendo às mudanças e novas necessidades do Hemisfério, converteu-se progressivamente em um organismo de cooperação técnica e fortalecimento institucional no campo da agropecuária. Essas transformações foram reconhecidas oficialmente com a ratificação, em 8 de dezembro de 1980, de uma nova convenção, que estabeleceu como fins do IICA estimular, promover e apoiar os laços de cooperação entre seus 31 Estados membros para a obtenção do desenvolvimento agrícola e do bem-estar rural.

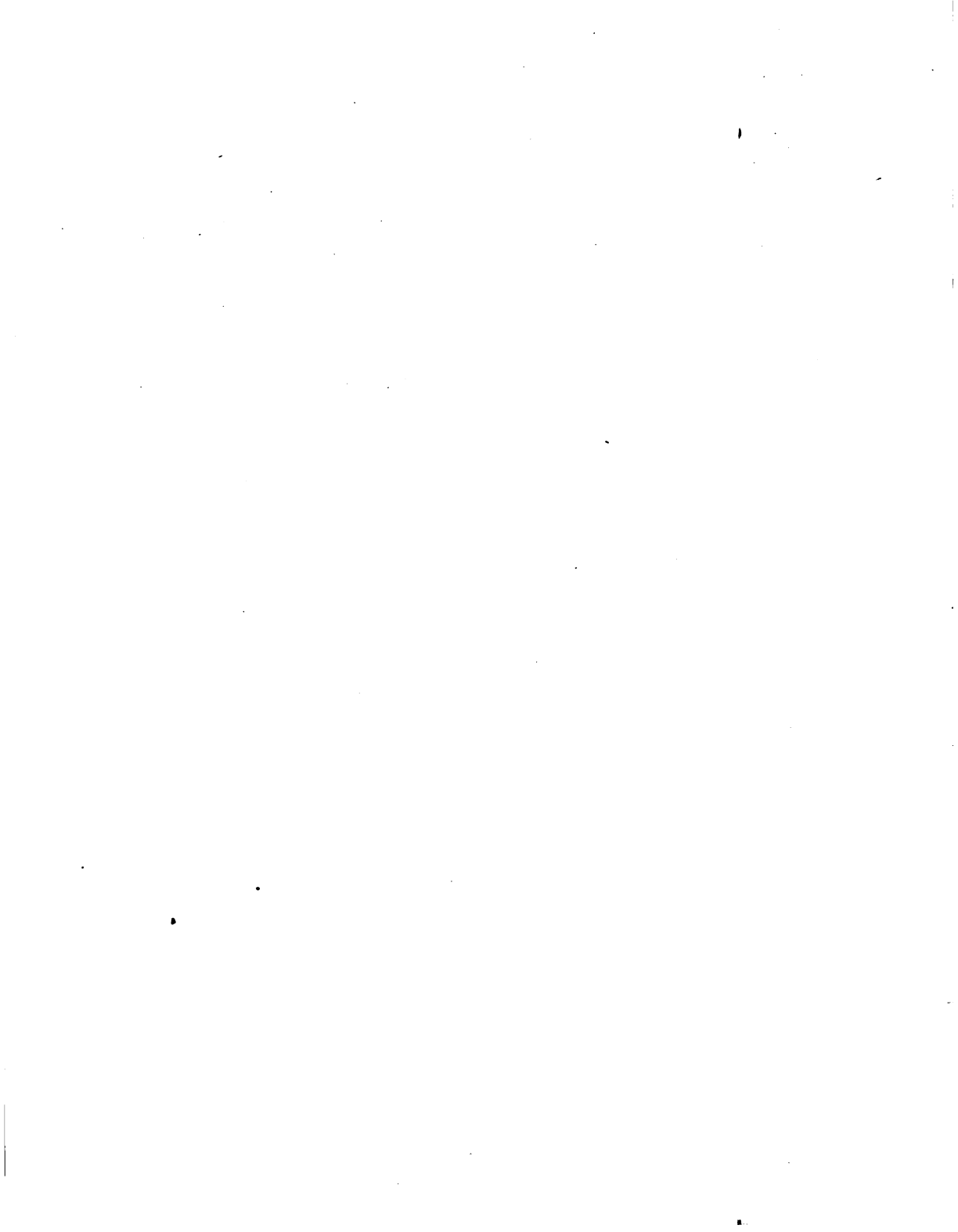
Com um mandato amplo e flexível e com uma estrutura que permite a participação direta dos Estados membros na Junta Interamericana de Agricultura e em seu Comitê Executivo, o IICA conta com ampla presença geográfica em todos os países membros para responder a suas necessidades de cooperação técnica.

As contribuições dos Estados membros e as relações que o IICA mantém com 12 Países Observadores, e com vários organismos internacionais, lhe permitem canalizar importantes recursos humanos e financeiros em prol do desenvolvimento agrícola do Hemisfério.

O Plano de Médio Prazo 1987-1991, documento normativo que assinala as prioridades do Instituto, enfatiza ações voltadas para a reativação do setor agropecuário como elemento central do crescimento econômico. Em vista disso, o Instituto atribui especial importância ao apoio e promoção de ações tendentes à modernização tecnológica do campo e ao fortalecimento dos processos de integração regional e sub-regional.

Para alcançar tais objetivos o IICA concentra suas atividades em cinco áreas fundamentais, a saber: Análise e Planejamento da Política Agrária; Geração e Transferência de Tecnologia; Organização e Administração para o Desenvolvimento Rural; Comercialização e Agroindústria, e Saúde Animal e Sanidade Vegetal.

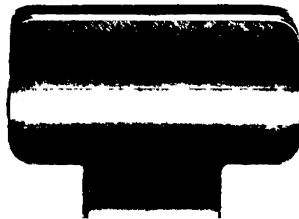
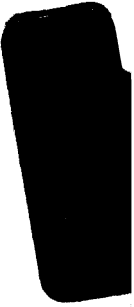
Essas áreas de ação expressam, simultaneamente, as necessidades e prioridades determinadas pelos próprios Estados membros e o âmbito de trabalho em que o IICA concentra seus esforços e sua capacidade técnica, tanto sob o ponto de vista de seus recursos humanos e financeiros, como de sua relação com outros organismos internacionais.



**Interessados em receber mais exemplares deste
e de outros Relatórios de Consultores poderão
solicitá-los a:**

**Coordenação dos Contratos IICA/EMBRAPA
Escritório do IICA no Brasil
Caixa Postal 09-1070
Brasília, DF. 71.600**

Tel. (061) 248-5477



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INSTITUTO INTERAMERICANO DE COOPERAÇÃO PARA A AGRICULTURA
SHIS QI 5 CONJ. 9 BL. D. COMERCIAL LOCAL CAIXA POSTAL 09-1070, BRASÍLIA, D.F. BRASIL
TEL. (061) 248-5477 - TELEX 611959 INAG-BR - CORREIO ELETRÔNICO 1536.