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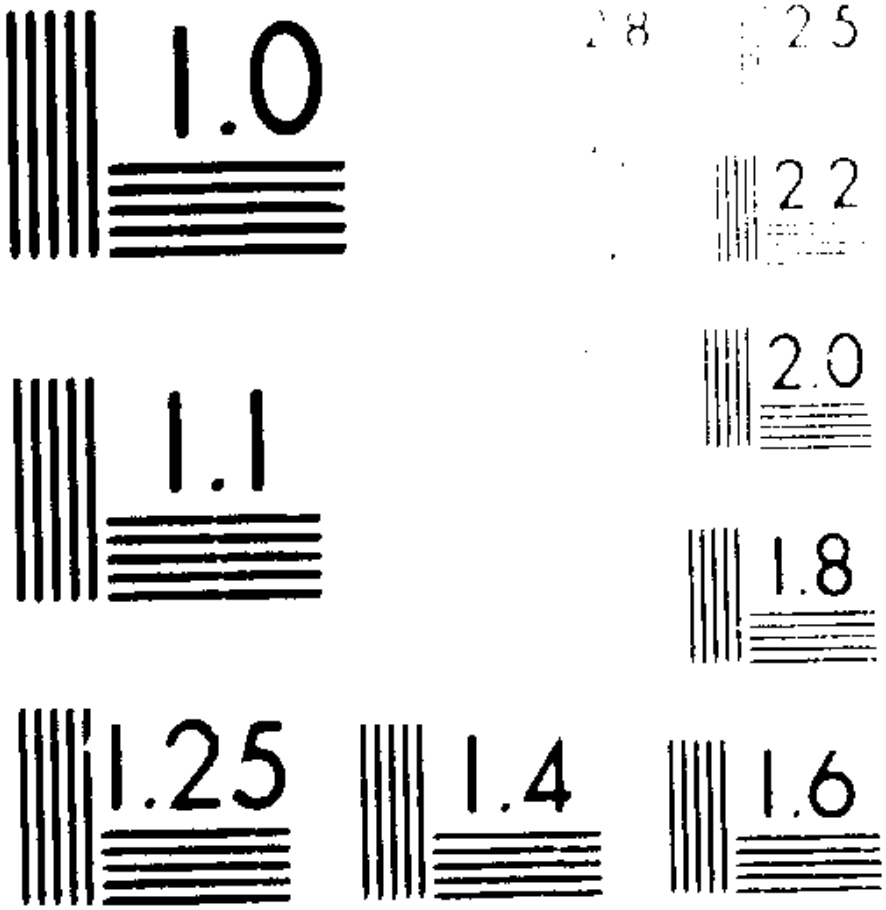
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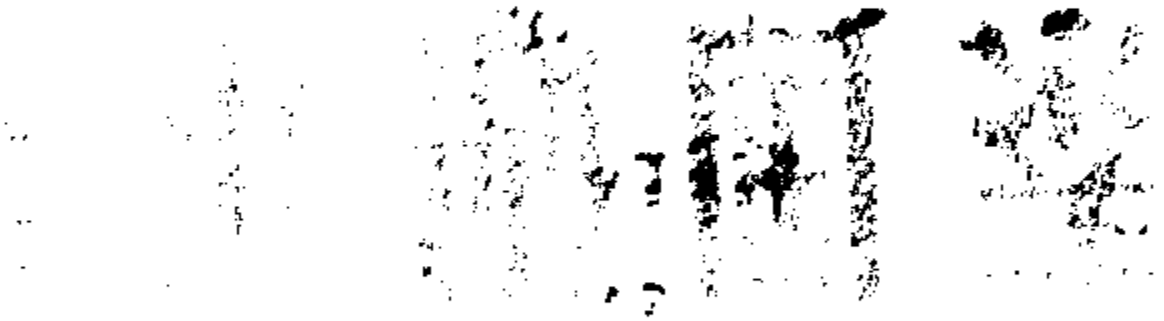

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# 联合国工业发展组织
# 泰王国建设碾米厂的可行性

# 考 察 报 告

THE UNITED NATIONS INDUSTRIAL
DEVELOPMENT ORGANIZATION
REPORT ON TNE FEASIBILITY STUDY
OF ESTABLISHING A RICE MILL IN
THE KINGDOM OF THAILAND

中国成套设备出口公司碾米厂考察组

一九八〇年九月十日·于北京

The Study Team on the Rice Mill of the China
National Complete Plant Export Corporation
Beijing· september 10 1980

# 目　录

# 前　言

根据中华人民共和国驻奥地利大使、常驻联合国工业发展组织（以下简称“工发组织”）代表俞沛文先生和工发组织执行主任阿卜杜勒·凯恩先生一九七八年五月八日在维也纳签订的《关于使用中华人民共和国政府一九七八年向联合国工业发展基金提供的志愿捐款为一个发展中国家建设一个碾米厂的协议》，及中国成套设备出口公司（以下简称“承包人”）和工发组织一九八〇年四月三十日在维也纳签订的《对在泰国建设一个综合碾米厂进行技术和经济可行性考察》的服务合同（合同号79／52），承包人派出的碾米考察组（以下简称“考察组”）于一九八〇年五月二十九日到达泰国首都曼谷，就在泰国建设一个综合碾米厂进行了可行性考察。通过八周考察，在七月二十五日完成了考察工作，七月三十一日返抵中国首都北京。

考察期间，考察组在泰国农业局工程处官员齐娃女士

和梅曲利先生安排下，参观了曼谷市郊五个不同类型碾米厂和二个粮食机械制造厂，并由泰农业局稻谷处详细介绍、提供了泰国稻谷生产和大米产品规格、标准等情况，同时还收集了建设碾米厂所需部分设计基础资料。七月二十二日考察组与泰农业局就拟建一个碾米厂的规模要求和选定的厂址取得一致意见，并还就碾米厂项目建设过程中各方承担的分工交换了意见。七月二十五日泰农业局工程处处长萨姆努先生与考察组组长马秉铨先生签订了“实施本项目过程中分工的建议书”。

考察组在整个考察过程中，受到泰政府农业局局长普拉顿先生、副局长理克斯先生、专家萨默帕特先生和有关部门各级官员热情友好接待和大力支持合作，也得到了联合国计划开发署驻曼谷地区代表普拉特利先生、代表助理帕敦先生、高级顾问纽曼先生的支持和协助，使这次考察工作虽在事先未及时通知泰政府，因而延误了两个星期才开展工作的情况下，仍能按时顺利完成了考察工作，考察组愿借此机会谨向他们表示感谢。

这次考察由于时间关系，考察组未能有机会访问泰国北部和东北部产稻区，调查收集这些地区稻谷品种质量和

碾米厂情况，因此本考察报告在这方面所引用的资料可能不够全面，特此说明。

## 一、考察评价摘要

泰国是个主要生产稻米的国家，全年生产稻谷约一千六百万吨，折合大米约一千万吨，其中国内消费约八百万吨，出口约二百万吨。

泰国碾米工业现共有三万三千一百六十一个工厂，其中小型碾米厂和碾米作坊有三万二千六百七十六个单位，占百分之九十八点五，大部分碾米设备比较陈旧，如工艺效果低，加工的产品碎米多，得率少，加工损失大，因此有必要由政府制订实施碾米工业现代化规划，帮助全国碾米厂分批逐步实现技术改造。根据以上情况，考察组建议，在泰国援建一个碾米实验工厂是可行的。碾米实验工厂的建成将有助于推进实现泰国碾米工业现代化的技术改造。

援建碾米实验厂项目初步估算总投资费用六十一万九千五百美元，其中工发组织负责提供四十六万零五百美

元，泰政府负责十五万九千美元（以上估算投资金额未考虑价格上涨因素）。

## 二、综合考察情况

（一）原料

泰国位于北纬5°～21°，东经97°～106°，地处中南半岛中部，属湿热带气候，土地肥沃，自然条件优越，适宜水稻生长，种植水稻一年两熟，因此稻谷是泰国主要粮食作物。

泰国全国面积共约五十一万八千平方公里，行政区划为七十二个府，按地理位置分为北部、东北部、中部平原、南部四个地区，水稻种植面积共八百九十万公顷，平均产量为1.8吨／公顷·年，年产稻谷约一千六百万吨，种植的稻谷主要是籼谷和籼糯谷，全国现尚有三千多个品种，目前政府推广种植的为RD型品种稻谷。

泰国农民生产的稻谷，除留种子和自己食用外，其余均出售给私商。政府为保障农民的利益规定了稻谷最低收购价，并实施了对农民支助计划，通过农民销售组织（M

OF）和农业促进局，向农民直接收购，使农民在价格有保证的情况下出售自己的稻谷。

有关泰国稻谷的种植面积、产量、稻谷的品种质量、稻谷收购价等见附表1、2、3、4、5、6。

（二）产品

泰国是世界上大米主要出口国家之一，全年生产稻谷按平均出率百分之六十六点七五计算，生产大米约一千零六十八万吨，国内消费约八百万吨，出口约二百万吨，大米出口占出口贸易总额百分之二十。在泰国大米、玉米、木薯、糖、红麻、橡胶六种出口商品中居首位。

根据泰商业部大米检验委员会一九七八年公布施行的大米标准，普通机制白米分为十一个等级，白碎米分为七个等级，糯米分为二个等级，糯碎米分为三个等级，蒸谷米分为五个等级，蒸谷碎米分为二个等级。

有关各级白米、白碎米标准，大米出口数量，大米批发价，大米出口价等见附表7、8、9、10、11、12。

（三）碾米工业的现状

1、生产能力

泰国现有各类大米加工厂三万三千一百六十一个单

位，碾米厂的生产能力自二吨——六百五十吨不等，其中日处理稻谷六十吨以上的大型厂一百二十四个，日处理稻谷三十吨——六十吨的中型厂三百六十一个，日处理稻谷三十吨以下的小型厂和作坊三万二千六百七十六个，大型厂和中型厂都集中于城市郊区，小型厂和作坊则分散在农村各个村镇，大中型厂全年开工约二百天，这些碾米厂若按日夜三班生产估算，总的生产能力日处理稻谷约为二十万吨。

有关碾米厂分类统计见附表13

2、生产技术水平

泰国现有三万二千多个小型碾米厂和碾米作坊，不少的厂还在采用铁辊筒碾米机一类设备，直接将稻谷碾制成白米，因此，加工生产大米质量差，碎米多，得率低，损失大。中型厂和大型厂由于大都是为出口大米进行加工生产，因此，生产工艺比较完善，一般生产过程如下：

稻谷→除杂→脱壳→选糙→碾白→分级→产品

但是在生产技术上还存在如下一些问题：

（1）生产设备陈旧，设备工艺效率较差，加工所得

产品碎米多，得率低。泰国大、中型碾米厂采用的工艺设备都是泰国国内一些小型机器厂制造，质量较差，如采用的砂盘砻谷机，脱壳率一般只有百分之六十五左右，在脱壳过程中还产生大量的糙碎和糙粞。由于砻谷机脱壳率低，在工艺上产生了大量回砻，加重了脱壳设备和谷糙分离设备的流量负荷，也增加了糙米的含碎。由于糙米含碎较高，使碾制所得产品碎米多，并因糙碎在碾白过程中，使大量淀粉研磨混入米糠，不仅减少了加工得率，并且也影响了米糠的质量（含油率降低）。根据泰国京华银行调查资料，大、中型碾米厂加工生产百分之五等级大米的得率为百分之六十六点七五三，其中正品率百分之四十点一三九，碎米率百分之二十六点六一四，正品率只占整个产品的百分之六十。碎米率占百分之四十。（有关稻谷出米率见附表14。）

（2）安全卫生条件较差。泰国大、中型碾米厂生产设备所需动力，除个别厂采用电动机拖动外，大部份厂都是采用蒸汽机总轴拖动，传动装置复杂，也影响工艺设备的布置，使操作维修带来不便。此外，由于采用的除杂，谷糙分离等都为敞开式，生产时灰尘飞扬，故车间安全卫

生条件均比较差。

（3）车间生产所需配置的动力和所需建筑面积较大。由于碾米厂采用的设备机械效率和工艺效率较低，而工艺生产路线较长，因此车间生产所需配备的动力比较大，同时也需要有足够大的建筑面积和空间来安置这些设备和机械，故所需建筑面积也较大。按生产能力日处理每吨稻谷作为计算指标，碾米车间生产所需配备的动力指标，一般大型厂为1.5～2.5千瓦／吨（稻谷），中型厂2.0～3.0千瓦／吨（稻谷），如按用电计算，每吨稻谷耗电在40—60度。碾米车间所需建筑面积指标一般在8—10米$^2$／吨（稻谷）。

3、综合利用

碾米厂的综合利用在泰国个别大型碾米厂中已取得良好成果，如直接利用米糠榨油、糠饼和粞作为饲料饲喂猪、鸡，谷糠作燃料，提供工厂生产所需的蒸气和动力，利用燃烧后的谷糠灰与粘土混合后制作砖坯，并用谷糠烧制成砖等等。但大部分工厂由于生产的米糠和粞等付产品数量较少，工厂直接利用在规模和经营等方面存在一定矛盾，所以，大都还是将米糠、粞等付产品直接出售给油厂

和饲料厂作为原料。谷糠除一小部分作燃料利用外，剩余的任农民取用或堆放燃烧成灰，供农民作为肥料。对采取谷出白的小型碾米厂和碾米作坊生产的混合糠，在农村都直接作为饲料。

## 三、建厂可行性的分析

根据泰国目前碾米工业的情况，由于设备比较陈旧，工艺生产效果较差，虽泰实业部于一九七五年公布禁止创建采取谷出白小型碾米厂的规定，但要改变碾米工业的面貌使能适应今后稻米生产的发展（在提高单位面积产量的基础上增加稻谷产量）和扩大大米出口的需要，以及提高稻谷加工的得率，减少加工损失，政府有必要制订实施碾米工业现代化的规划，帮助全国碾米工厂分期逐步实行技术改造。制订规划时有关技术改造方面应考虑包括下列几点：

1、引进适合泰国实际情况的国外先进的工艺技术和设备。

2、建立具有一定规模和技术装备的粮食机械修配制

造厂。

3、合理经济地利用副产品，对谷糠作为能源利用方面，建议采用谷糠煤气发生炉——煤气机——发电机组和谷糠锅炉（蒸汽）以取代老式的谷糠锅炉和蒸汽机总轴传动。

泰国政府为了帮助碾米工业实现技术改造，故在一九七七年已建立了一个日处理稻谷二十吨的第一碾米实验工厂。几年来在培训、提高碾米专业人员技术水平方面取得一定成果，泰国目前新建的大、中型碾米厂的工艺基本上是按第一实验碾米厂的要求建设的，故生产工艺较完善，加工生产的出口大米质量较好。但因采用的工艺设备大部分还是泰国内一些小型机器厂制造的老式砂盘砻谷机和立式砂臼碾米机等，所以在生产效果上出现的、在以上“碾米工业现状、生产技术水平”一节中所论述的那些问题仍严重存在。为此，考察组认为，作为实验工厂，应该不断吸收国际碾米工艺最新成果来把原有设备更新，提高现有碾米厂的技术水平，为全国碾米工艺的改造作出示范，故考察组建议有必要引进国外先进技术和设备，建立第二实验碾米工厂。

根据上述要求，考察组与泰政府研究提出新建第二实验碾米工厂的目的要求如下：

（一）建厂目的

1、对碾米厂先进技术开展研究、学习和推广。

2、培训碾米技术人员。

3、对农业试验站培育改良的各种稻谷品种进行碾米试验。

4、加工的大米供应给低工资的政府官员。

（二）建厂要求

1、碾米厂的类型应属技术先进并能推动开展技术研究，使碾米工业取得不断发展和进步。

2、碾米厂的单机设备应较易掌握、使具有较少碾米知识的人亦容易学会操作。对清理、脱壳及碾白等工段能单独控制，全部设备用电机拖动。

3、研究项目：为了提高碾米技术水平建议就下列项目开展实验研究。

a、探讨研究实验碾米厂内各个工艺设备的机械结构、性能、工艺原理，测定加工不同品种稻谷和生产不同规格产品等不同状态条件下的工艺效果（单机效率），掌

握各个设备最佳工作点（工作状态）。

b 、研究分析各种品种稻谷的加工工艺特性，并通过碾米试验据以制订适合泰国具体条件的合理工艺操作制度。

c 、研究、探讨、推广、采用通风除尘技术，改善碾米厂的卫生条件。

d 、探讨、研究、推广利用碾米厂的废料——谷糠作为能源的新的技术和新的设备。

4、培训建议：

A、初级班：

a 、培训期：1—2月

b 、培训对象：具有高中文化水平的学生、私营米厂的操作工，拥有小型米厂的农民。

c 、培训课程：（1）工艺操作技术，（2）碾米设备维护保养技术，（3）稻谷、大米的检验。

B、高级班：

a 、培训期：1—2年

b 、培训对象：具有大专文化程度负责大米、稻谷管理工作的政府官员及为其它发展中国家来泰培训的技术人

员。

c 、培训课程：（1）碾米工艺学，（2）碾米机械设备，（3）碾米厂通风除尘工程，（4）碾米厂的经济及技术管理。

（三）碾米设备技术经济性能的选用

根据拟建实验碾米工厂的建厂要求，考察组分析了中国制造的三十吨碾米成套设备（日处理稻谷四十五吨）和五十吨碾米成套设备（日处理稻谷七十五吨）的工艺技术性能。由于三十吨碾米成套设备只适合加工生产一般中等精度规格的大米产品（农村作坊及小型厂采用三十吨成套设备因投资省、设备平面布置占地小，操作简易），五十吨碾米成套设备在工艺上适应范围较大，能加工生产高、中等级精度规格的大米产品，为此拟建第二实验碾米厂及今后对产品质量要求较高的大、中型碾米厂，考察组推荐采用五十吨碾米成套设备。

1、五十吨碾米成套设备的工艺技术性能。采用五十吨碾米成套设备组合的碾米工艺，在工艺生产技术方面有如下特点：

（1）原粮清理采用风筛结合，除杂效率较高的振动

筛并配有专用去石设备，因而对加工混有并肩石子、泥块的稻谷也能取得良好的清理效果。

（2）脱壳工序采用具有快、慢辊可以调速并能自动紧辊的胶辊砻谷机，脱壳效率一般在百分之八十至九十，产生糙碎也较少。

（3）选糙采用了工艺效果较好、操作方便可靠的回转式选糙机。

（4）碾白采用横式砂辊碾米机并采取二机出白，制得产品碎米少，故得率较高。在加工中、低档精度规格的大米时也可采取一机出白，以提高产量降低生产费用。

（5）在成品打包前可根据需要通过白米分级设备的处理，以控制成品中的大米含碎。

（6）为确保设备的安全运行和防止产品中混入磁性物质在脱壳、碾白及产品打包前均配备有磁选装置。

（7）车间内设有七吨左右容量的毛谷仓，在去石、脱壳、碾白等工序前则设有储粮斗，以调节生产过程中流量的均衡。

（8）原粮、产品两头均配备有机械定量秤对加工稻谷直接计量和对产品（正品）进行定量灌包。

（9）生产过程中原粮、成品及中间产品均采用机械输送，对谷糠则结合脱壳后谷糠分离工艺采用气力输送直接吹送至谷糠仓或谷糠堆场。

(10) 对散发灰尘的作业设备配备有专用的吸风除尘设备以保障车间内的卫生，改善工厂劳动条件和保证产品——大米的清洁。

(11) 成品打包采用麻袋缝口机。

2、车间动力和建筑。由于采用的生产设备单机效率较高，生产工艺比较简短，因此车间需配备的动力负荷只要100千瓦，建筑面积也只需三百七十八平方米（一楼一阁），节约了动力和建筑费用。

3、第二实验碾米厂因属非营业性的单位，故在这里就不作经济分析，但按建成后的实际需要列支的加工费用来看，估计较一般生产性企业要低，因为五十吨碾米成套设备的电耗较原有工厂每吨稻谷要低二十度左右，出米率将提高百分之一左右，车间建筑面积小，因此固定资产投资省，成本项下的固定费用开支（折旧等）就相应减少，所以第二实验碾米工厂的成本要低而收益要高。

## 四、厂址选择

泰政府原来规划新建碾米实验工厂厂址选在克隆廊稻谷试验站内。经实地踏勘，这一厂址为一低洼水稻田，条件较差，建立新厂需要大量填土，厂房建筑和辅助建筑及公用设施均需要全部新建，投资较大，初步估算全部土建和公用设施等约需七十五万美元(不包括碾米工艺设备)。经考察组建议，将新建碾米实验工厂作为一个生产车间（名第二实验碾米工厂）建在老的实验碾米工厂内（名第一实验碾米工厂）。充分利用老实验工厂原有的辅助建筑和公用设施以节省投资。这一建议得到泰政府赞同。现选定的厂址比原选的厂址可节省投资费用约六十万美元。

实验碾米工厂厂址位置和工厂总平面见附图 2、3。

## 五、建厂建议

通过考察组与泰农业局工程处对建厂规模、选定的厂址等问题取得一致意见的基础上，议定如下各点，作为建

6、碾米厂的组成和用地。（见下表）。

| 名　称 | 占地面积 $m^2$ | 建筑面积 ($m^2$) | 估计土建造价 | | 备　注 |
|---|---|---|---|---|---|
| | | | 单位造价 美元/$m^2$ | 金　额 美元 | |
| 1、碾米车间 | 27×7=189 | 189×2=378 | 208 | 78,600 | 新　建 |
| 2、谷糠及副产品仓库 | 6×15=90 | 90 | 208 | 18,700 | 新　建 |
| 3、原粮仓库 | 10×10=100 | 100 | | | 利用原有建筑 |
| 4、成品仓库 | | | | | |
| 5、机修及物料间 | 12×24=288 | 288 | | | 利用原有建筑 |
| 6、检验室 | 10×10=100 | 100 | 347.5 | 34,800 | 新　建 |
| 7、备品物料间 | 6×10=60 | 60 | 208 | 12,500 | 新　建 |
| 8、办公室 | 6×10=60 | 60 | | | 利用原有建筑 |
| 合　计 | | 1,076 | | 144,600 | |

说明：工厂占地面积五千另八十八平方米，建筑面积一千另七十六平方米（不包括第一实验碾米车间建筑面积），其中利用原有建筑面积四百四十八平方米，新建筑面积六百二十八平方米。

7、生产工艺流程：

毛谷→计量→除杂→去石→脱壳→谷糙分选→碾白→

厂建议：

1、厂名：第二实验碾米工厂。

2、厂址：巴吞他尼府·克隆廊县。

3、生产规模：日产(二十四小时)普通大米五十吨。

4、产品方案：可实验生产各种规格大米。

5、生产方式和工作制度：采取连续生产方式。每天生产一班，每周工作五天，全年生产日按二百五十天考虑。

白米分级→打包计量→成品

8、生产设备：本项目提供的主要设备的名称数量如下：

（1）工艺生产设备：

| | | |
|---|---|---|
| 振动筛 | 1 | 台 |
| 去石机 | 1 | 台 |
| 胶辊砻谷机 | 1 | 台 |
| 谷糙分离设备 | 2 | 台 |
| 碾米机 | 2 | 台 |
| 白米分级设备 | 1 | 组 |

（2）辅助生产设备：

| | | |
|---|---|---|
| 麻袋缝口机 | 1 | 台 |
| 机械自动秤 | 2 | 台 |
| 斗式提升机 | 12 | 台 |
| 除尘设备(通风机刹克龙) | 4 | 组 |
| 手推小车 | 4 | 辆 |

（3）粮食检验设备

（4）备品（主机设备易损件备二年，砻谷机胶辊备一年）

9、主要技术指标：

| 项　目 | 单　位 | 指　标 |
|---|---|---|
| 大米产量 | 吨／年 | 4,200 |
| 原料耗用量（稻谷） | 吨／年 | 6,250 |
| 动力荷负 | 千　瓦 | 100 |
| 日处理1吨稻谷配置的动力负荷 | 千瓦／吨(稻谷) | 1.33 |
| 车间建筑面积 | 米$^2$ | 378 |
| 日处理1吨稻谷所需建筑面积 | 米$^2$／吨(稻谷) | 5 |

车间人员：

| 项　目 | 单　位 | 指　标 |
|---|---|---|
| 操作工 | 人 | 2 |
| 普通工 | 人 | 2—3 |
| 专业管理人员 | 人 | 1 |

注：（1）大米产量和原料耗用量，系按开工二百五十天每天生产八小时计算。

（2）人员配备，因原第一实验碾米工厂的碾米车间、仓库、机修等生产、辅助部门人员和管理部门人员

均已配备，新的第二实验碾米工厂的碾米车间建成后，可根据培训、研究工作的需要轮流开工，因此并不需要增加新的人员。

## 六、实施本项目过程中分工的建议

考察组与泰农业局工程处在商定建厂建议后，还就实施本项目各方承担义务的分工交换了意见，并拟就有关条款由泰农业局工程处处长萨姆努先生与考察组组长马秉铨先生签字认可。有关条款内容如下：

（一）联合国工发组织（使用中国捐款由中国承包）。

1、就碾米厂的建设进行可行性考察，编制考察报告（工作结束后返回中国后五十天内将考察报告一式二十份提交工发组织）。

2、联合国工发组织收到考察报告后，应不迟于九十天内将考察报告正式批复。

3、根据工发组织对考察报告的批复签订建设一个实验碾米工厂的服务合同。

4、承担工艺设计，在收到泰方提供的设计基础资料和签订项目建设服务合同后三个月提出工艺扩初设计请泰方审查，泰方应不迟于六十天内提出修改书面意见告中方。

5、中方收到修改书面意见后三个月内，提出工艺施工图设计。

6、向泰方提供原料、主要辅助材料和用电的数据。

7、提供实验碾米厂生产工艺成套设备和安装材料及二年设备易损件备品（砻谷机胶辊因易老化变质故提供一年备品。）

8、办理所提供的物资运抵泰国曼谷港口的运输和保险事宜。

9、派遣工程技术人员指导工艺设备安装和试生产并就地培训泰方人员学习使用所提供的设备。

10、负担上述（一）联合国工业发展组织方面项下各条所产生的费用。

（二）泰国方面：

1、提供实验碾米厂稻谷加工车间和有关辅助设施所需的场地。

2、提供有关设计资料（见附件），在工发组织批准碾米厂考察报告并送交泰方一个月以内提交中方。

3、中方在考察报告中提出碾米车间设计意图，并提出对土建的要求，在泰方批准建设项目后三个月内应提出土建扩初设计交中方核对是否符合工艺要求，中方在四十五天内提出修改意见邮寄泰方，泰方收到修改意见，即正式进行施工图设计。

4、承担全部工程的土建、材料和施工以及工艺设备的安装工作。

5、负责提供50赫芝，380伏的电源接至稻谷加工车间。

6、提供实验碾米厂所需原料仓库、成品仓库、机修和其它辅助设施。

7、提供在试生产期内质量符合标准的原料和其它辅助材料、用电、及包装材料，并提供在车间建成正常生产时的全部原料及流动资金，配备工人和管理人员。

8、负责中国所提供的物资到达曼谷港后的报关、提货和从港口到工地的运输和保管。

9、负担上述（二）泰国方面项下各条所产生的费

用见下表。

| 项目内容 | 说明 | 投资费用 | |
|---|---|---|---|
| | | 美元 | 折合人民币元 |
| 一、工发组织承担的费用 | | 460,500 | 657,800 |
| 1、可行性考察费 | 属：第一阶段工作，目前已完成 | 30,800 | 44,000 |
| 2、生产设备及安装材料 | | 210,000 | 300,000 |
| 3、备品 | | 35,000 | 50,000 |
| 4、运输保险费 | | 24,500 | 35,000 |
| 5、工艺设计费 | | 21,000 | 30,000 |
| 6、专家服务费 | 按24个人月，5800美元/人月计算 | 139,200 | 198,800 |
| 二、泰政府承担的费用 | | 159,000 | 227,200 |
| 1、土建费 | | 144,600 | 206,600 |
| 2、当地运杂费 | | 1,000 | 1,400 |
| 3、试生产费 | | 1,300 | 1,900 |
| 4、技术培训费 | | 4,500 | 6,400 |
| 5、不可预计费 | | 7,600 | 10,900 |
| 总计 | | 619,500 | 885,000 |

用。

（三）本项目初步估算总投资为美金六十一万九千五百元（折合人民币八十八万五千元），其中联合国工发组织负责一个碾米车间的考察及提供生产工艺成套设备、安装材料和指导安装及技术培训聘请中国专家等费用，共计投资美金四十六万零五百元（折合人民币六十五万七千八百元）；泰国政府投资美金十五万九千元（折合泰币三百一十八万铢，折合人民币二十二万七千二百元），分项费

说明：（1）工发组织承担费用系按人民币估算，泰政府承担的费用系按泰币估算，再折合美元，美元折换率按一美元折换人民币1.42856元，一美元折换泰币20铢计算。

（2）以上投资估算未考虑价格上涨因素。

附　件：

# 泰方应提供工艺设计基础资料

一、当地稻谷品种质量和检验项目内容：

1、总杂质：其中分列泥灰、砂石、草杂、种子等项。

2、瘪　谷：不实粒含量。

3、粒度大小：按子粒长度大、中、小所占比例。

4、适合加工大米的等级。

5、净谷出品率：即扣除杂质瘪谷后一千公斤净谷，收得、整米、各级碎米、米糠和谷壳的数量。

二、建厂所在地的气象资料：

（一）气温和湿度

1、年平均的绝对最高、绝对最低温度。

2、最热、最冷月份的平均温度、昼夜温差。

3、最热月份的最高干球和湿球温度。

4、最热月份13：00时的平均温度和相对湿度。

5、平均最大、最小相对湿度和绝对湿度。

（二）风：

1、年、季、月平均及最大风速。

2、年、季、月的风向和频率及风玫瑰图。

（三）降雨量：

1、当地采用的雨量公式。

2、历年和逐月的平均最大最小降雨量。

3、一昼夜、一小时、十分钟最大强度降雨量。

4、一次暴雨持续时间及其最大雨量。

（四）日照、气压、雷电：

1、全年晴天及阴天日数，日照角度。

2、历年最热三个月气压的平均值。

3、年雷电天数及雷电活动情况。

三、区域（厂区）位置图

比例1：5000—1：10000，内容包括地形标高、厂址位置、厂外交通运输路线、供电网走向。

四、厂区总平面：

比例1：500，内容包括厂区地形标高，厂区内已有建筑设施和拟建的建筑设施的位置，厂区面积，各建筑物的

用途。

五、厂区内已有建筑和拟建建筑的结构、面积、建筑造价。

六、厂区地下水位标高。

七、供电：

1、供电电源的位置及与厂区的距离。

2、供电部门允许的供电量、供电电压和电源回路数。

3、供电线路敷设的方式（架空或电缆）及其长度。

4、供电部门对最低功率因数，电源馈电线的短路容量及系统抗阻，单相短路，电容电流值，允许继电器最大动作时间（总开关跳闸时间）等要求。

5、用电的计费方式和电价。

6、供电部门同意供电的协议文件。

八、政府和有关部门对新建厂的法令规定：

1、劳动法。

2、环境保护法。

3、建筑（设计和施工）规范。

4、电力（设计和施工）规范。

九、交通运输：

工厂运输所经公路的等级、路面宽度、工厂原料、产品陆路运输每吨、每公里的运费。

十、其他：

1、对工艺设备要求采用的涂料颜色。

2、当地3mm厚平板玻璃的价格（每平方米）。

3、包装用麻袋尺寸规格。

附表一

# 泰国各地区稻谷种植面积及其比例

| 地　　区 | 耕地面积（公顷） | 稻田面积（公顷） | 比　例　% |
|---|---|---|---|
| 1. 北　　部 | 8,948,900 | 1,041,400 | 11.6 |
| 2. 东 北 部 | 17,022,400 | 2,670,470 | 15.7 |
| 3. 中部平原 | 27,410,400 | 2,591,289 | 9.4 |
| 4. 南　　部 | 7,018,000 | 547,171 | 7.8 |
| 合　　计 | 60,399,700 | 6,850,330 | 11.3 |

资料来源：泰国农业统计　　1 9 6 7 年

附表二

# 泰国1950——1967年各地区稻谷种植面积及产量

| 时间（年） | 北部 | | 东北部 | | 中部平原 | | 南部 | |
|---|---|---|---|---|---|---|---|---|
| | 种植面积（公顷） | 产量（千吨） | 种植面积（公顷） | 产量（千吨） | 种植面积（公顷） | 产量（千吨） | 种植面积（公顷） | 产量（千吨） |
| 1950 | 367,000 | 527 | 2,031,200 | 1,846 | 2,679,360 | 3,809 | 461,920 | 600 |
| 1951 | 373,760 | 556 | 2,363,680 | 2,335 | 2,758,280 | 3,837 | 463,680 | 597 |
| 1952 | 367,360 | 554 | 1,881,920 | 1,800 | 2,674,720 | 3,631 | 444,160 | 617 |
| 1953 | 379,360 | 679 | 2,538,240 | 2,705 | 2,777,920 | 4,172 | 476,320 | 683 |
| 1954 | 376,320 | 655 | 1,950,880 | 1,470 | 2,743,360 | 2,921 | 486,560 | 659 |
| 1955 | 387,520 | 745 | 2,322,880 | 2,150 | 2,631,680 | 3,769 | 427,520 | 670 |
| 1956 | 377,600 | 799 | 2,482,720 | 2,613 | 2,706,080 | 4,224 | 457,280 | 661 |
| 1957 | 387,360 | 822 | 1,658,560 | 1,572 | 2,600,000 | 2,654 | 430,240 | 522 |
| 1958 | 393,440 | 720 | 2,159,200 | 1,978 | 2,729,760 | 8,731 | 475,520 | 624 |
| 1959 | 410,240 | 796 | 2,467,360 | 2,020 | 2,732,320 | 3,307 | 455,520 | 647 |
| 1960 | 419,200 | 782 | 2,329,120 | 2,295 | 2,723,360 | 4,119 | 449,600 | 639 |
| 1961 | 411,520 | 894 | 2,465,280 | 2,323 | 2,822,240 | 4,273 | 479,040 | 707 |
| 1962 | 411,040 | 855 | 2,851,200 | 3,082 | 2,892,480 | 4,600 | 504,000 | 743 |
| 1963 | 418,560 | 909 | 2,707,200 | 3,026 | 2,952,800 | 5,348 | 525,760 | 886 |
| 1964 | 427,360 | 986 | 2,475,200 | 2,764 | 3,116,960 | 5,157 | 522,880 | 733 |
| 1965 | 428,640 | 1,057 | 2,429,280 | 2,222 | 3,102,560 | 5,066 | 518,240 | 874 |
| 1966 | 438,400 | 1,126 | 3,116,320 | 3,831 | 3,267,520 | 6,168 | 712,960 | 850 |
| 1967 | 1,438,000 | 2,755 | 2,255,200 | 2,177 | 2,165,440 | 3,932 | 551,520 | 729 |
| 平均面积 | 456,264 | 900 | 2,235,013 | 2,345 | 2,782,047 | 4,429 | 491,262 | 681 |
| 平均产量 | | 1.9726 | | 1.0492 | | 1.5920 | | 1.4066 |

泰国平均产量（公顷）：1.505吨

资料来源：泰国曼谷农业部、次长办公室、农业经济处、泰国农业统计　　1967年

附表三

# 泰国１９７５年及１９８１年人口增长率、稻谷种植面积、出口及主要农产品产量计划

| 项　　目 | 一九七五年 | 一　九　八　一　年 | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | A | $B_1$ | $B_2$ | C | D | E | F |
| 1.人口增长率（%） | 3.2 | 2.1 | 2.5 | 2.5 | 2.8 | 2.1 | 2.1 | 2.1 |
| 2.稻谷种植面积（公顷） | 8,518,880 | 8,908,960 | 7,884,000 | 8,717,280 | 8,996,160 | 8,560,800 | 8,189,120 | 8,425,920 |
| 3.出口（百万吨） | | | | | | | | |
| 白米（稻谷） | 1.414 | 2.60 | 2.16 | 2.16 | 2.60 | 1.53 | 2.62 | 1.85 |
| 玉米 | 2.147 | 3.00 | 2.49 | 2.50 | 3.00 | 2.00 | 3.00 | 3.00 |
| 木薯（连根） | 6.786 | 6.57 | 5.48 | 5.48 | 0.57 | 4.43 | 6.57 | 6.57 |
| 糖 | | 0.75 | 0.55 | 0.55 | 0.75 | 0.35 | 0.75 | 0.75 |
| 红麻 | 0.157 | 0.10 | 0.08 | 0.08 | 0.10 | 0.05 | 0.10 | 0.10 |
| 橡胶 | 0.335 | 0.45 | 0.40 | 0.40 | 0.45 | 0.35 | 0.45 | 0.45 |
| 4.全国产量（百万吨） | | | | | | | | |
| 白米（稻谷） | 14.092 | 16.04 | 15.78 | 15.79 | 16.42 | 14.97 | 16.05 | 15.29 |
| 玉米 | 2.863 | 3.61 | 3.11 | 3.12 | 3.61 | 2.61 | 3.61 | 3.61 |
| 木薯（连根） | 7.052 | 7.10 | 6.03 | 6.02 | 7.21 | 4.95 | 7.10 | 7.10 |
| 甘蔗 | 19.099 | 16.30 | 13.73 | 13.72 | 16.48 | 10.97 | 16.30 | 16.30 |
| 红麻 | 0.308 | 0.32 | 0.30 | 0.30 | 0.33 | 0.27 | 0.32 | 0.32 |
| 橡胶 | 0.414 | 0.47 | 0.41 | 0.41 | 0.47 | 0.37 | 0.47 | 0.47 |

注：１、表中计划$B_1$是在计划A可能有某种意外而不能完成的情况下而提出的。

２、计划$B_2$为在$B_1$相同的条件下保证农民收入不低于１９７３年收入水平考虑的。

３、计划C为人口增长率高达2.8%考虑的。

４、计划D为六种主要农产品出口量减少的情况下考虑的。

５、计划E灌溉面积为计划A的50%考虑的。　　６、计划F灌溉面积与１９７５年相同。

资料来源：摘自泰国农业发展第四个五年计划（１９７７年——１９８１）。

附表四

## 泰国稻谷收购价

| 项目 | 等级 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 稻谷质量 | 100%一级稻 | 100%二级稻 | 100%三级稻 | 5%稻谷 | 10%稻谷 | 15%稻谷 | 短身糯谷 | 长身糯谷 |
| 稻谷收购价（铢/吨） | 3,800 | 3,700 | 3,600 | 3,500 | 3,400 | 3,300 | 3,200 | 3,400 |

资料来源：一九八〇年七月十六日公布（曼谷各大日报）

附表五

## 泰国稻谷品种及质量情况表

| 品种 | 颗粒度（毫米） | | | 糙米 | 白米 | 整米 | 谷壳 | 米糠 | 水份 | 容重 | 含杂 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 长 | 宽 | 厚 | % | % | % | % | % | % | 克/立升 | % |
| R·D·9 | 7.32 | 2.35 | 1.77 | 78.4 | 68.8 | 43.6 | 21.6 | 9.6 | 12.24 | 613.33 | 1.06 |
| R·D·11 | 7.63 | 2.28 | 1.80 | 77.6 | 68.8 | 56.0 | 22.4 | 8.8 | 10.84 | 594.44 | 2.14 |
| IR·38 | 6.82 | 2.17 | 1.72 | 77.6 | 67.6 | 52.0 | 22.4 | 10.0 | 11.88 | 643.33 | 1.13 |
| IR·42 | 6.25 | 2.22 | 1.67 | 78.4 | 72.0 | 51.6 | 21.6 | 7.2 | 12.48 | 632.73 | 2.37 |

资料来源：泰国农业合作部农业局提供。

附表六

# 泰国一九八〇年稻谷推广品种目录表

| 品种名称 | 收割期 | 类型 | 产量 公斤/莱 | 颗粒大小（毫米） 厚度 | 宽度 | 长度 | 稻瘟病 | 白叶枯病 | Y.O.L 病毒 | 胡稻 麻斑病 | 瘿蚊 | 褐色 作物虫 | 高度 （厘米） | 推广年 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| 北部 | | | | | | | | | | | | | | |
| 1.木良62M | 11月20日 | 糯性 | 539 | 2.0 | 2.9 | 6.6 | S | S | S | MR | R | S | 150 | 1959 |
| 2.卡道克马立105 | 11月25日 | 粳性 | 363 | 1.8 | 2.1 | 7.5 | | MS | S | MS | S | S | 138 | 1959 |
| 3.尼奥善巴道 | 11月26日 | 糯性 | 526 | 1.8 | 2.0 | 7.2 | MS | MS | S | MR | S | S | 150 | 1962 |
| 4.力旺也 | 11月25日 | 粳性 | 548 | 1.8 | 2.6 | 7.8 | S | MS | S | MS | S | S | 160 | 1968 |
| 5.R·D·6 | 11月21日 | 糯性 | 666 | 1.77 | 2.28 | 7.24 | MS | MS | S | MR | S | S | 133 | 1978 |
| 东北部 | | | | | | | | | | | | | | |
| 1.卡道克马立105 | 11月20日 | 粳性 | 512 | 1.8 | 2.4 | 7.6 | S | MS | S | MS | S | S | 150 | 1959 |
| 2.尼奥巴道 | 11月26日 | 糯性 | 572 | 1.8 | 2.2 | 7.3 | MS | MS | S | MR | S | S | 160 | 1962 |
| 3.卡巴克矛148 | 12月3日 | 粳性 | 415 | 1.9 | 2.3 | 7.6 | MS | MS | S | MS | S | S | 140 | 1965 |
| 4.伪沙盖伊19 | 11月4日 | 粳性 | 489 | 1.8 | 2.2 | 7.7 | MS | S | S | MS | S | S | 120 | 1968 |
| 5.杭伊71 | 11月4日 | 糯性 | 506 | 1.8 | 2.1 | 7.1 | R | S | S | MS | S | S | 133 | 1968 |
| 6.R·D·6 | 11月21日 | 糯性 | 666 | 1.77 | 2.28 | 7.24 | MS | S | S | MR | S | S | 133 | 1977 |
| 7.R·D·8 | 11月23日 | 糯性 | 585 | 1.92 | 2.52 | 7.11 | MS | MS | S | MR | S | S | 151 | 1978 |
| 8.R·D·15 | 11月10日 | 粳性 | 556 | 1.72 | 2.14 | 7.41 | MS | S | S | MR | S | S | 130 | 1978 |
| 中部 | | | | | | | | | | | | | | |
| 1.伪蒙S—4 | 11月26日 | 粳性 | 436 | 1.8 | 2.4 | 7.7 | MS | MS | S | MS | S | S | 140 | 1956 |
| 2.格伦88 | 11月21日 | 粳性 | 421 | 1.7 | 2.2 | 7.3 | S | MS | S | MS | S | S | 140 | 1962 |
| 3.卡巴克矛148 | 12月3日 | 粳性 | 415 | 1.9 | 2.3 | 7.6 | MS | MS | S | MS | S | S | 140 | 1965 |
| 4.力旺应帕都123 | 12月19日 | 粳性 | 414 | 1.8 | 2.3 | 7.6 | S | MS | MS | MS | S | S | 150 | 1965 |

附表六

# 泰国一九八〇年稻谷推广品种目录表（续）

| 品种名称 | 收割期 | 类型 | 产量 公斤/莱 | 颗粒大小（毫米） 厚度 | 宽度 | 长度 | 稻瘟病 | 白叶枯病 | Y.O.L病毒 | 胡稻麻斑病 | 瘿蚊 | 褐色作物虫 | 高度（厘米） | 推广年 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| 南部 | | | | | | | | | | | | | | |
| 1.襄帕哈也132 | 2月16日 | 粳性 | 486 | 1.7 | 2.2 | 7.6 | S | MS | S | MR | S | S | 178 | 1962 |
| 2.帕行哈埃2 | 2月6日 | 粳性 | 437 | 1.9 | 2.3 | 7.5 | S | S | S | MS | S | S | 171 | 1968 |
| 3.帕牙立良43 | 2月22日 | 粳性 | 450 | 1.7 | 2.1 | 7.6 | S | MS | S | MR | S | S | 166 | 1968 |
| 4.R·D·13 | 2月26日 | 粳性 | 446 | 1.7 | 2.2 | 6.8 | R | S | S | MR | S | S | 160 | 1978 |
| 非光敏品种——该品种能在不同地区的灌溉区生长。 | | | | | | | | | | | | | | |
| 1.R·D·1 | 130天 | 粳性 | 742 | 1.8 | 2.2 | 7.0 | S | S | S | MR | S | S | 115 | 1969 |
| 2.R·D·2 | 130天 | 糯性 | 766 | 1.9 | 2.6 | 7.2 | S | S | MS | R | S | S | 115 | 1969 |
| 3.R·D·3 | 128天 | 粳性 | 667 | 1.8 | 2.2 | 7.2 | S | S | S | MS | S | S | 100 | 1969 |
| 4.R·D·4 | 127天 | 糯性 | 573 | 1.8 | 2.4 | 7.2 | S | S | MS | R | R | S | 177 | 1973 |
| 5.R·D·5 | 140天 | 粳性 | 576 | 1.8 | 2.2 | 7.15 | MR | MR | MS | MS | S | S | 146 | 1973 |
| 6.R·D·7 | 120/130天 | 粳性 | 672 | 1.8 | 2.3 | 7.3 | MR | R | MS | MS | S | S | 108 | 1975 |
| 7.R·D·9 | 115/125天 | 粳性 | 657 | 1.8 | 2.3 | 7.3 | S | VS | S | MR | MR | | 110 | 1975 |
| 8.R·D·11 | 135天 | 粳性 | 698 | 1.82 | 3.36 | 7.52 | MS | S | S | MR | S | S | 110 | 1977 |
| 浮水稻 | | | | | | | | | | | | | | |
| 1.塔皮盖奇161 | 12月9日 | 粳性 | 350 | 1.7 | 2.5 | 7.2 | S | S | S | MS | S | S | — | 1959 |
| 2.雷莫襄111 | 12月19日 | 粳性 | 328 | 1.7 | 2.3 | 7.1 | MS | MS | S | MR | S | S | — | 1959 |
| 3.井盖伊56 | 12月29日 | 粳性 | 362 | 1.7 | 2.2 | 7.4 | S | MS | S | MS | S | S | — | 1959 |
| 4.襄下劳 | 11月30日 | 糯性 | 394 | 1.9 | 2.9 | 6.3 | MR | S | S | MS | S | S | — | 1969 |

说明：1.R：具有抗性　S：易受影响　MR：抗性中等　MS：影响中等

2.资料来源：泰农业合作部农业局

附表七

# 泰国各级白米标准

+不少于　　±多于或少于
-不超过或少于（视情况而定）

| 白米等级 | 粒型组成 | | | | 整碎组成 | | | | | 最大含杂允许量 | | | | | | | | | | | | 精度 | 水份不高于 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 颗粒长度 | | | 短型 | 碎粒大小 | 整粒 | 平头大碎粒 | 碎粒 | 小碎 | 红线粒 | 红粒 | 白垩粒 | 损坏粒 | 黄粒 | 皱缩粒 | 不熟粒 | 胶裂粒 | 杂质 | 种籽 | 糯米 | 含谷粒/公斤 | | |
| | 特长型 7.0 mm % | 长型 6.6—7.0 mm % | 中型 6.2—6.6 mm % | 6.2mm以下 % | | % | % | % | C.1 % | % | % | % | % | % | % | % | % | % | % | % | | | |
| 100% A | +70 (70-100) | ±25 (0—30) | -5 (0—5) | — | -8.0 +5.0 | +60 | ±36 | -4 | | | | 0.5 | | | | | | | | 0.5 | 5 | 超级精碾 | 14% |
| 100% B | ±50 (45—55) | ±35 (30—40) | ±10 (0—25) | -5 (0—5) | -8.0 +5.0 | +60 | ±35.5 | -4.5 | | | | 0.5 | | | | | | | | 0.5 | 10 | 〃 | 〃 |
| 100% C | ±35 (30—40) | ±45 (40—50) | ±15 (5—30) | -5 (0—5) | -8.0 +5.0 | +60 | ±35 | -5 | | | | 0.5 | | | | | | | | 0.5 | 15 | 〃 | 〃 |
| 5% | +20 (20—25) | ±35 (30—40) | ±35 (25—50) | -10 (0—10) | -7.0 +3.0 | +60 | ±33 | -7 (3—7) | | 2 | | 2.5 | 0.25 | 0.5 | | | 0.5 | 0.1 | | 0.5 | 15 | 精碾 | 〃 |
| 10% | +10 (10—15) | ±30 (25—35) | ±45 (35—55) | 10—15 (10—15) | -7.0 +3.5 | +55 | ±33 | -12 (8—12) | | 2 | | 3 | 0.5 | 1 | | | 0.75 | 0.2 | | 0.5 | 20 | 〃 | 〃 |
| 15% | +5 (5—10) | -20 (0—20) | -40 (20—40) | 35—50 (35—50) | -6.5 +3.0 | +55 | ±28 | -17 (13—17) | | 4 | 1 | 3 | 1 | 1 | | | 0.75 | 0.2 | | 0.5 | 25 | 适度精碾 | 〃 |
| 20% | +0 (0—10) | -15 (0—15) | -30 (10—30) | 55—65 (55—65) | -6.0 +3.0 | +50 | ±27 | +22 (18—23) | -1 | 5 | 2 | 5 | 2 | 1 | 0.5 | 0.5 | 0.75 | 0.25 | | 0.5 | 25 | 〃 | 〃 |
| 25%上 | +0 (0—8) | -35 (17—35) | 65—75 (65—75) | | -5.0 +3.0 | +40 | ±32 | +27 (23—28) | -1 | 4 | 1 | 3 | 1 | 1 | | | 0.75 | 0.2 | | 0.5 | 30 | 〃 | 〃 |
| 25% | +0 (0—8) | -35 (17—35) | 65—75 (65—75) | | -5.0 +3.0 | +40 | ±32 | ±26 (23—28) | -2 | 6 | 4 | 8 | 2 | 1 | 1 | 1 | 0.75 | 0.5 | 0.5 | 0.5 | 30 | 普通碾磨 | 〃 |
| 35% | +0 (0—8) | -35 (17—35) | 65—75 (65—75) | | -5.0 +3.0 | +32 | ±28 | ±38 (33—40) | -2 | 7 | 4 | 10 | 2 | 1 | 1 | 1 | 0.75 | 1 | 0.5 | 0.5 | 30 | 〃 | 〃 |
| 45% | +0 (0—8) | -35 (17—35) | 65—75 (65—75) | | -5.0 +3.0 | +28 | ±22 | ±47 (42—50) | -3 | 8 | 4 | 10 | 2 | 1 | 1 | 1 | 0.75 | 1 | 0.5 | 0.5 | 30 | 〃 | 〃 |

• 除100%A等级外，政府允许高于规定的百分比含量。

资料来源：泰国商业部大米检验委员会“大米标准”1978年。

附表八

# 泰国各级白碎米标准

| 白碎米等级 | 粒型组成 | 整碎组成 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 从加工各级白米取得 | 整粒(10/10)% | 8/10—8/10% | 6.5/10—8/10% | 5/10—8/10% | 3/10—6.5/10% | 3/10—5/10% | 小白碎米B·1 | 小白碎米C·1 | 小白碎米C·3 | 杂质% |
| A·1特上 | 100% | (0—5) | (0—15) | | 90 (70—90) | — | 10 (0—10) | — | — | — | — |
| A·1上 | 100% 5% 10% | — | (0—5) | (0—15) | — | 100 (75—100) | — | — | (0—5) | — | 0.5 |
| A·1特 | 15% 20% 25%上 | — | (0—5) | (0—15) | — | 100 (74—100) | — | — | (0—6) | — | 1 |
| A·1普通 | 25% 35% 45% | — | — | (0—5) | — | 100 (69—100) | — | (0—10) | (0—12) | (0—4) | 3 |

| 小白碎米等级 | 粒型组成 | 整碎组成 | | | | | |
|---|---|---|---|---|---|---|---|
| | 从加工各级白米取得 | 不能通过8½号筛的% | (A·1)可通过 号筛，但不能通过 号的% | (C·1)可通过7号筛，但不能通过6½号筛的% | (C·3)可通过6½号筛的% | 杂质% | 种籽% |
| C·1特 | 100% 15% 10% 15% | — | (0—10) | 100 (70—100) | (0—20) | 1 | 1 |
| C·1普通 | 20% 25% 35% 45% | — | (0—10) | 100 (60—100) | (0—30) | 3 | 1 |
| C·3 | 各种等级 | — | — | (0—15) | 100 (85—100) | 3 | 1.5 |

资料来源：泰国商业部大米检验委员会，“大米标准”1978年公布。

附表九

## 泰国主要要农产品出口总量

单位：千吨

| 时间 | 大米 | 玉米 | 糖 | 木薯产品 | 橡胶 | 黄麻 |
|---|---|---|---|---|---|---|
| 1961年 | 1,576 | 569 | 1.53 | 443 | 184.59 | 143 |
| 62 | 1,271 | 484 | 43.01 | 400 | 194.18 | 237 |
| 63 | 1,417 | 767 | 52.82 | 427 | 186.88 | 125 |
| 64 | 1,896 | 1146 | 48.90 | 738 | 216.99 | 162 |
| 65 | 1,895 | 831 | 83.83 | 719 | 210.85 | 316 |
| 66 | 1,507 | 1,261 | 54.85 | 688 | 202.53 | 473 |
| 67 | 1,482 | 1,144 | 15.01 | 781 | 211.11 | 317 |
| 68 | 1,068 | 1,558 | 00.05 | 888 | 252.22 | 289 |
| 69 | 1,023 | 1,544 | 16.10 | 975 | 276.38 | 255 |
| 1970年 | 1,063 | 1,447 | 56.24 | 1,326 | 275.61 | 257 |
| 71 | 1,576 | 1,873 | 174.57 | 1,123 | 307.87 | 171 |
| 72 | 2,112 | 1,843 | 407.50 | 1,311 | 317.69 | 255 |
| 73 | 848 | 1,386 | 275.40 | 1,836 | 390.51 | 264 |
| 74 | 1,029 | 2,301 | 443.84 | 2,395 | 362.56 | 247 |
| 75 | 951 | 2,104 | 595.43 | 2,385 | 332.18 | 157 |
| 76 | 1,973 | 2,419 | 1122.39 | 3,720 | 373.45 | 138 |
| 77 | 2,932 | 1,541 | 1654.61 | 3,954 | 401.86 | 81 |
| 78年上半年 | 857 | 596 | 588.37 | 3,091 | 247.75 | 42 |

资料来源：摘自海关。

附表十

## 泰国大米批发价

铢/吨

| 品种 | 一九七八年 | | 差价% |
|---|---|---|---|
| | 七月 | 八月 | |
| 一级稻谷 | 2,550(箩) | 2,559(箩) | +0.35 |
| 100%白米 | 4,725 | 4,725 | --- |
| 5%白米 | 4,350 | 4,350 | --- |
| 5%蒸谷米 | 4,316 | 4,447 | +3.04 |
| A I超级碎米 | 2,708 | 2,729 | +0.78 |
| 10%白米 | 3,918 | 3,816 | -2.60 |
| 15%白米 | 3,836 | 3,724 | -29.2 |

资料来源：泰国银行一九七八年年度公报。

附表十一

## 大米出口价（曼谷离岸价）

美元/吨

| 品种 | 一九七八年 | | 差价% |
|---|---|---|---|
| | 七月 | 八月 | |
| 100%白米 | 400.97 | 381.45 | -4.87 |
| 5%白米 | 386.52 | 366.45 | -5.19 |
| 10%白米 | 366.94 | 346.45 | -5.58 |
| 15%白米 | 358.10 | 341.45 | 4.65 |
| A I超级碎米 | 210.97 | 185.00 | -12.31 |
| 5%蒸谷米 | 383.77 | 70.16 | -3.55 |

资料来源：泰国银行一九七八年月度公报。

附表十二

## 泰国一九七九年大米批发及出口价

| 品　　种 | 一九七九年 | | 差　价　% |
|---|---|---|---|
| | 十　　月 | 十　一　月 | |
| 批发价（铢/吨） | | | |
| 一级稻谷 | 3,048 | 2,959 | -2.92 |
| 5%白米 | 5,246 | 5,139 | -2.27 |
| 5%蒸谷米 | 4,446 | 4,169 | -6.23 |
| 出口价（离岸价美/元吨） | | | |
| 100%白米 | 377.5 | 378.3 | +0.21 |
| 5%白米 | 362.5 | 363.3 | +0.22 |

资料来源：泰国银行一九七九年月度公报。

附表十三

## 泰国碾米厂统计表

| 地　区 | 产　量　吨/天 | | | | 机器马力（匹） | | | |
|---|---|---|---|---|---|---|---|---|
| | 0—30 | 31—36 | 60以上 | 小　计 | 0—30 | 31—30 | 60以上 | 小　计 |
| 东北部 | 15,641 | 89 | 41 | 15,771 | 15,240 | 355 | 176 | 15,771 |
| 东　部 | 8,275 | 115 | 22 | 8,412 | 7,695 | 393 | 324 | 8,412 |
| 中　部 | 4,322 | 153 | 60 | 4,535 | 3,499 | 627 | 409 | 4,535 |
| 南　部 | 4,438 | 4 | 1 | 4,443 | 4,329 | 75 | 39 | 4,443 |
| 合　计 | 32,676 | 361 | 124 | 33,161 | 30,763 | 1,450 | 948 | 33,161 |

资料来源：泰国农业合作部农业局提供。

附表十四

# 泰国稻谷出米率

A 泰国第一实验碾米厂平均出米率

| 品种 | 整粒米% | 一号碎米% | 二号碎米% | 得率% | 米糠% | 谷糠% | 备注 |
|---|---|---|---|---|---|---|---|
| 卡奥马里 | 54.78 | 4.18 | 8.58 | 66.08 | 4.96 | 28.78 | 稻谷平均 |
| 卡塔行 | 57.60 | 1.04 | 6.75 | 68.50 | 4.76 | 26.81 | 含杂1.68% |
| 卡良帕耶 | 58.26 | 4.63 | 5.66 | 68.56 | 4.23 | 27.20 | |
| 卡山梯 | 59.15 | 3.67 | 7.00 | 68.60 | 5.88 | 25.60 | |
| 卡通 | 54.98 | 4.92 | 7.84 | 67.60 | 5.68 | 26.76 | |
| R·D·1 | 51.30 | 8.85 | 5.35 | 65.16 | 4.68 | 30.15 | |
| R·D·5 | 52.66 | 4.20 | 10.40 | 67.26 | 4.83 | 27.95 | |

资料来源：泰国农业合作部农业局提供。

B 泰国碾米厂平均出米率

| 规格 | | 出率% |
|---|---|---|
| 5%白米 | | 40.139 |
| A 1 特级碎米 | | 18.829 |
| C 1 碎米 | | 6.649 |
| C 3 碎米 | | 1.136 |
| 稻谷出米率 | | 66.753 |
| 付产品 | | |
| | 白米糠 | 6.746 |
| | 糙米糠 | 2.985 |
| | 谷壳及混合物 | 23.516 |
| 计 | 总 | 100.00 |

资料来源：摘自泰京华银行行讯。

附表十四

C　泰国顺和成碾米厂平均出米率

| 规　　格 | 出　　率　　% |
|---|---|
| 100%整米 | 36.00 |
| 大碎米 | 6.00 |
| 中碎米 | 6.00 |
| 小碎米 | 18.00 |
| 稻谷出米率 | 66.00 |
| 付产品 | |
| 细　糠 | 8.40 |
| 粗　糠 | 3.60 |
| 谷　壳 | 22.00 |
| 总　　计 | 100.00 |

资料来源：顺和碾米厂提供。

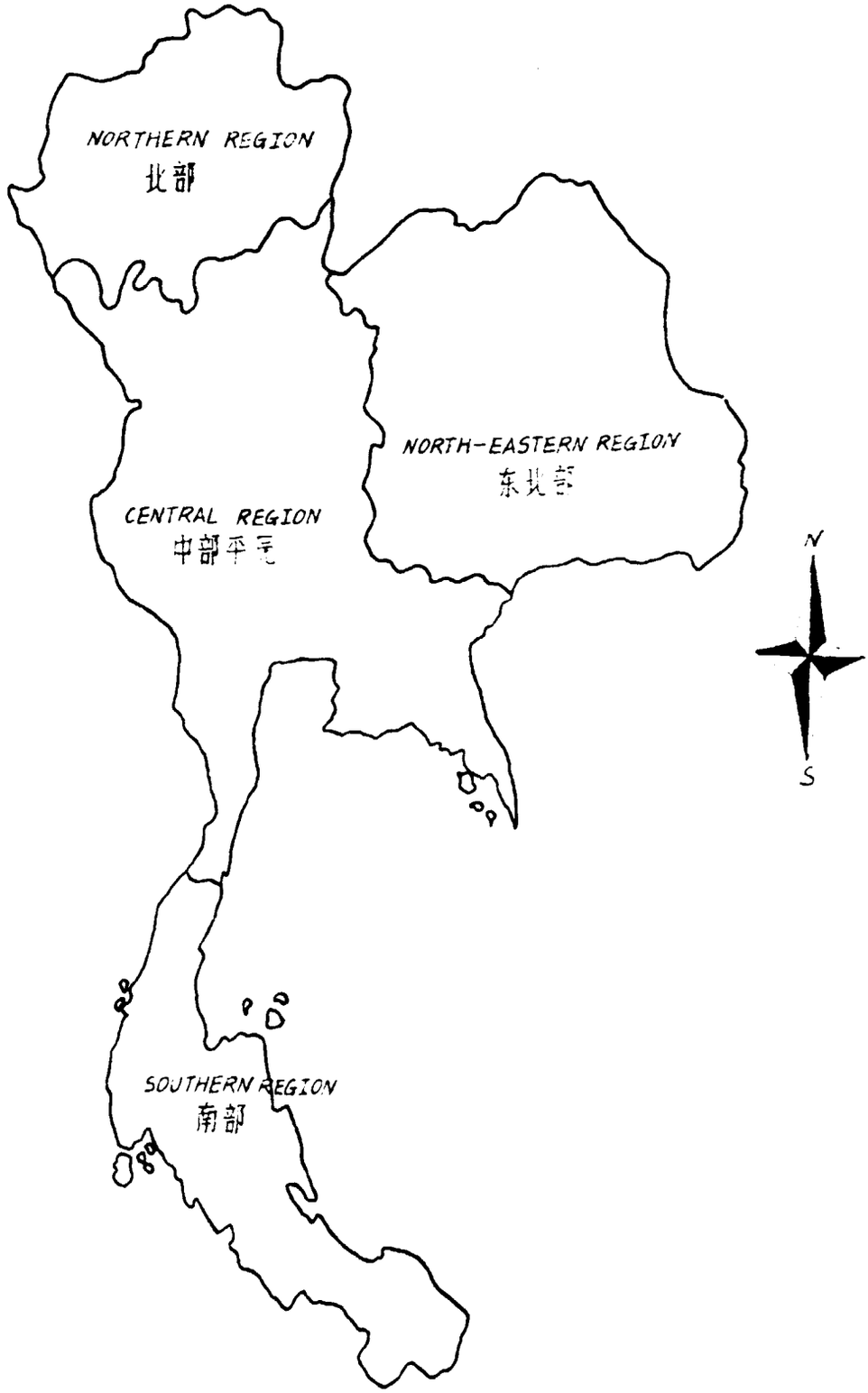
D　泰国北柳合作社碾米厂出米率

| 规　　格 | 出　　率　　% |
|---|---|
| 5%白米 | 48.00 |
| 大碎米 | 4.00 |
| 中碎米 | 10.00 |
| 小碎米 | 4.00 |
| 稻谷平均出米率 | 66 |
| 付产品 | |
| 细米糠 | 7.00 |
| 粗米糠 | 3.30 |
| 谷　壳 | 23.70 |
| 总　　计 | 100.00 |

资料来源：北柳合作社碾米厂提供。

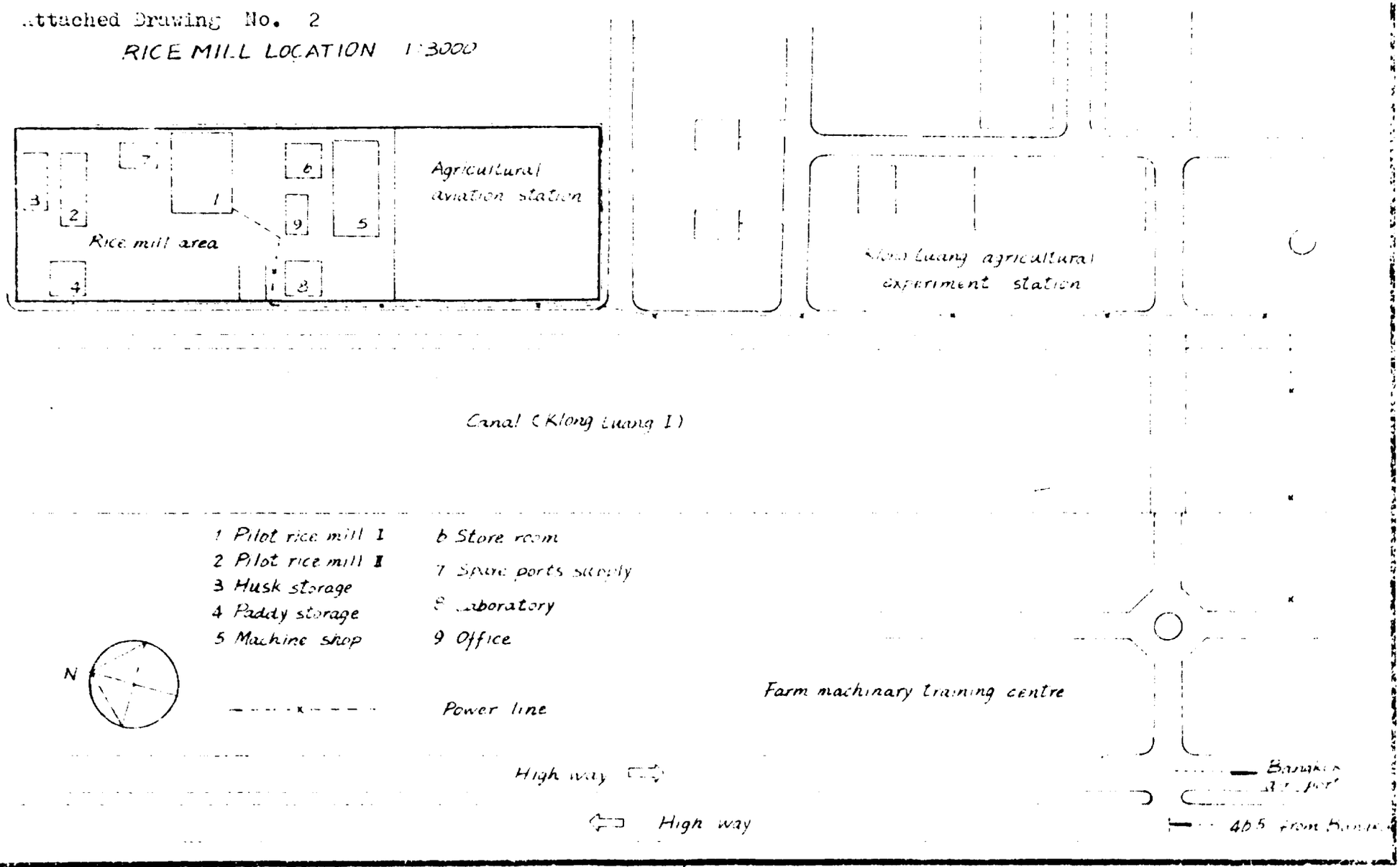
Attached Drawing
No. 1

THE MAP OF THAILAND BY REGIONS
泰国分区地图

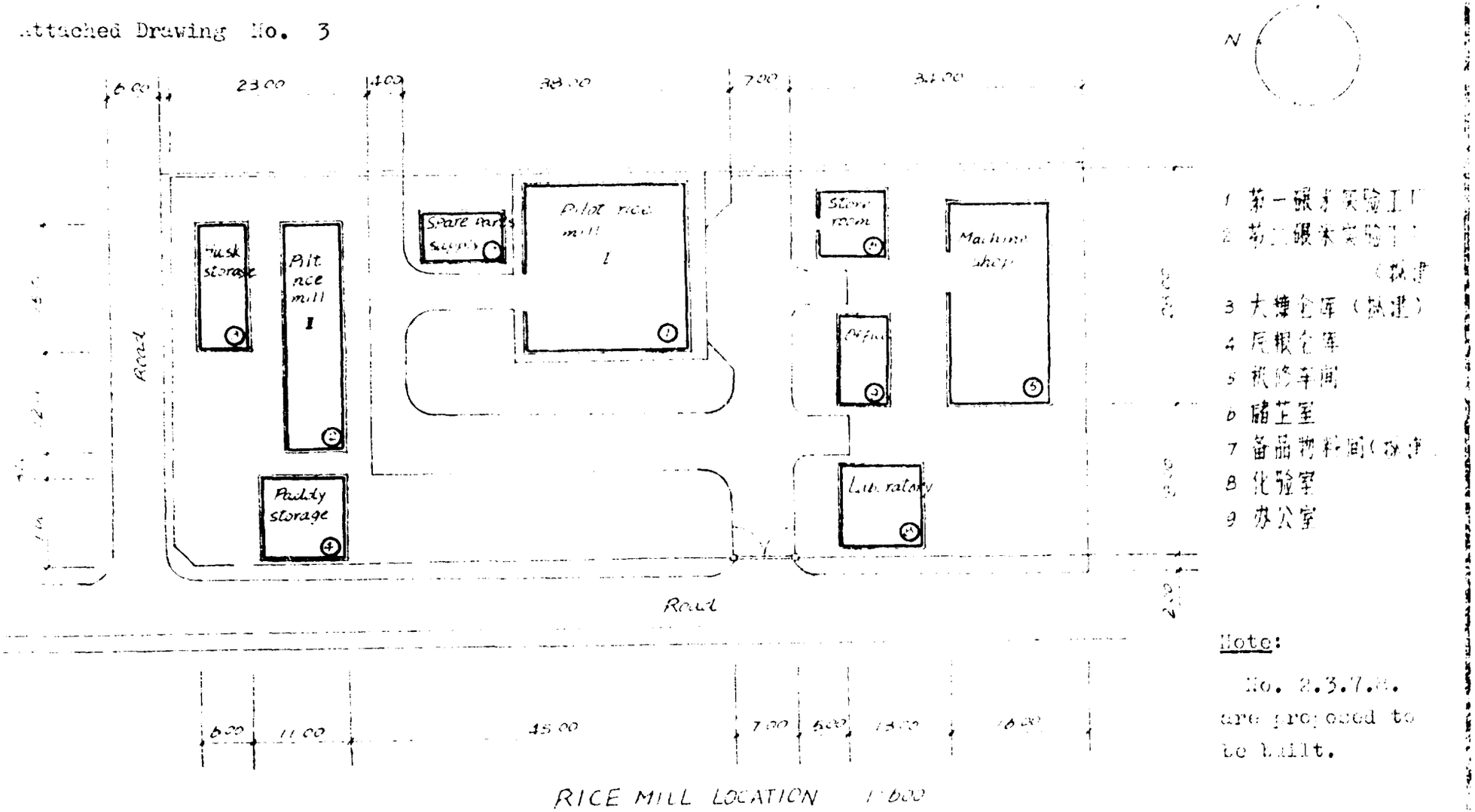


Attached Drawing No. 2

# RICE MILL LOCATION 1:3000



Attached Drawing No. 3




RICE MILL LOCATION 1/600

1 第一碾米实验工厂
2 第二碾米实验工厂（拟建）
3 大糠仓库（拟建）
4 原粮仓库
5 机修车间
6 储藏室
7 备品物料间（拟建）
8 化验室
9 办公室

Note:

No. 2.3.7.8. are proposed to be built.

# THE UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
# REPORT ON THE FEASIBILITY STUDY OF ESTABLISHING A RICE MILL IN THE KINGDOM OF THAILAND

The Study Team on the Rice Mill of
the China National Complete
Plant Export Corporation

Beijing, September 10, 1980

CONTENTS

## Introduction

On 8 May 1978, Mr. Hu Jeerwen, Ambassador of the People's Republic of China to Austria and Permanent Representative to UNIDO, and Dr. A. Khan, Executive Director of UNIDO signed in Vienna the "Agreement on the Utilization of the Voluntary Contribution made by the Government of the People's Republic of China to the United Nations Industrial Development Fund (UNIDF) in 1978 for the Establishment of a Rice Mill in a Developing Country." On 30 April 1980, the China National Complete Plant Export Corporation (hereinafter referred to as the Contractor) and the United Nations Industrial Development Organization signed in Vienna the Contract for the Provision of Services Relating to Conducting a Technical and Economic Feasibility Study for the Establishment of a Combined Rice Mill in Thailand(UNIDO Contract No. 79/52). In accordance with the above-mentioned Agreement and Contract, a Feasibility Study Team for the Establishment of a Combined Rice Mill (hereinafter referred to as the Study Team) dispatched by the Contractor arrived in Bangkok, the capital of Thailand, on 29 May 1980 and from then on, conducted a feasibility study for the establishment of a combined rice mill in Thailand for

eight weeks. The Study Team completed its study on 25 July and returned to Beijing, the capital of China, on 31 July.

In the course of the study, with the arrangements made by Mrs. Sriwai and Mr. Maitrie, officials from the Division of Agricultural Engineering of the Agricultural Department , the Study Team visited 5 rice mills of varied types located at both the urban and suburban areas of Bangkok, and also 2 rice-milling machinery manufacturers. At the same time, the Study Team collected some basic data for technological design which was considered essential to the establishment of a rice mill. The Rice Division of Agricultural Department also gave the Study Team some introduction in detail about paddy production and standards of rice in Thailand. On 22 July the Study Team and Department of Agriculture reached unanimity of views on the size and location of the proposed rice mill, and exchanged views on the work division in the execution of the proposed rice mill project. On 25 July Mr. Samnao, Director of Agricultural Engineering Division and Mr. Ma Bingquan, Leader of the Study Team signed " Recommendation on the Division of Work in the Execution of the Project".

During its stay in Bangkok, the Study Team was accorded cordial and friendly reception as well as effective support and cooperation by Mr. Praderm, Director-General of the Agricultural Department, Mr. Riksh, Deputy Director-General of the Agricultural Department, Mr. Somphot, Agricultural Expert and other officials at all levels in concerned departments, also support and cooperation given by Mr. Prattley, Regional Representative of UNDP in Bangkok. Mr. Patten, Assistant Regional Representative and Mr. Newman, Senior Industrial Adviser, UNDP. In result, the Study Team smoothly completed its study on time though study activity had been delayed 2 weeks owing to failing to inform Thai Government of the Study Team's arrival in advance. So the Study Team would like to take this opportunity to express its thanks to all of them.

Because of time limitation the Study Team could not find a chance to visit the rice-growing areas in the Northern and Northeastern parts of Thailand, and to collect informations on paddy varieties planted, paddy quality and rice mills in the said areas so that it should be stated in particular that the data quoted in the Report might be somewhat incomprehensive.

## I. Evaluation Summary

Thailand is a rice-producing country with an annually white rice production of 10,000,000 tons (16,000,000 tons for paddy), approximately, 8,000,000 tons for domestic consumption and 2,000,000 tons for export.

There are now existing 33,161 rice mills in Thailand, including 32,676 small scale rice mills and workshops, occupying 98.5% of the total. The rice-milling equipment used in most of those mills are comparatively obsolete, showing poor technological effectiveness, i.e. much brokens in processing, low milling yield and heavy processing loss. Therefore the Government should consider it necessary to work out and put into effect the program of modernizing Thai rice-milling industry to assist all the rice mills throughout the country in realizing technical transformation in batches step by step. The Study Team suggests, on the basis of above-mentioned conditions, that the establishment of an additional pilot rice mill in Thailand will be feasible, which would be of help to technical transformation to realize the modernization of Thai rice-milling industry.

The total capital investment for the Pilot Rice Mill

Project preliminarily estimated would be 619,500 US Dollars, including 460,500 US Dollars provided by UNIDO and 159,000 US Dollars paid by Thai Government.
( The factor of price-rising has not been taken into consideration in the above capital investment estimation)

## II. Comprehensive Survey

### 1. Raw Material

Thailand, with a fertile land and a wet tropical climate, is situated at the centre of Peninsula of Indo-China at a geographical location of 5°-21° North Latitude and 97°-106° East Longitude. Natural conditions are favourable for growing paddy. Consequently, paddy is the major grain plant, two crops a year , in Thailand.

Thailand has a total territory of 518,000 sq.km, divided into 72 provinces in 4 geographical regions, namely, the North, Northeast, Central Plain and South. Paddy-planted area covers totally 8,900,000 hectares, producing about 16,000,000 tons of paddy and averaging 1.8 ton/ha. per year.

Paddy varieties planted are mainly nonglutinous and glutinous. There still exist in this country more than 3,000 paddy varieties among which RD variety has been at present recommending by the Government.

Thai farmers sell all paddy to the middlemen except that reserved for seeds and family consumption. In the interest of farmers the Government has fixed minimum purchasing price of paddy and put into practice the aid program for farmers. The Government purchases paddy directly from the farmers by the Market of Farmer (MOF) and the Department of Agricultural Promotion. In this way farmers may sell out paddy at the guaranteed price.

References to paddy planted area, production, varieties. quality and purchasing price are shown in Attached Table 1,2,3,4,5,6.

2. Finished Product

Thailand is one of major rice-export countries in the world. It produces 10,680,000 tons of white rice calculated at average milling yield of 66.75%. Approximately, 8,000,000 tons are domestically consumed and 2,000,000 tons exported. Rice trade keeps the first place among the exports of six agricultural products (rice, maize, cassava, sugar, kenaf and rubber), amounting to 20% of total value of Thailand's overseas trade.

According to the standards of white rice published by the Rice Inspection Committee, Board of Trade of Thailand in 1978, white rice processed by conventional mill-

ing machines was divided into 11 grades, white brokens into 7 grades, glutinous rice into 2 grades, glutinous brokens into 3 grades, parboiled rice into 5 grades and parboiled brokens into 2 grades.

References to the standards of white rice, white brokens, rice export, wholesale price, export price are given in Attached Table 7, 8, 9, 10, 11, 12.

3. Current Situation of Thai Rice-Milling Industry

1) Productive Capacity

There are now 33,161 rice mills of various types in Thailand. Their producing capacity ranges from 2 tons to 650 tons. Of all these are 124 large scale rice mills with daily capacity over 60 ton paddy, 361 medium scale rice mills with daily capacity from 30 to 60 tons, and 32,676 small scale rice mills and workshops with daily capacity less than 30 tons. Large- and medium-scale rice mills are concentrated on the outskirts of the city while small-scale mills and workshops are scattered in villages and small towns in the countryside. Generally speaking, large- and medium-scale mills would go into operation about 200 days per year. The total daily capacity of processing paddy in all those mills is estimated about 200,000 tons calculated on the basis of 24-hours operation in three shifts.

Reference to number of milling units of various types is indicated in Table 13.

2) Technical level of Rice Mill

Thailand has 32,000 small-scale rice mills and workshops. A great number of them are still using hullers that process paddy directly into white rice With inferior quality, much brokens, low milling yield and heavy processing loss. For the sake of export medium or large rice mills have to apply a comparatively perfect technological process, generally show as follows: Paddy-Cleaning -Husking-Paddy separation-whitening-Grading-Finished product.

But some problems concerning productive technology still remain as follows:

a. Obsolete production equipment with a relatively low efficiency. The finished product contains more brokens, and milling yield is comparatively low. The facilities used in large-or medium -scale rice mills were made in poor quality by some small machinery manufacturers, for instance, disc sheller, with a husking efficiency only about 65%, would produce a lot of husk, brokens and small brokens during operation. Due to low husking efficiency a great deal of unhusked rice returns to husker

again in process. With the result that load of flowing material both on the husking equipment and paddy separator has to become heavier and brokens contained in husked rice has to increase, too. Much brokens contained in husked rice cause much brokens in milled rice. Furthermore, husked brokens make lots of starch mixed with bran in the whitening process. This results in not only lower milling yield, but also effects bran quality (reduction of oil content). According to data investigated by Bangkok Metropolitan Bank, in large and medium scale rice mills milling yield in processing 5 % white rice is 66.753%, including quality product 40.139%, brokens 26.614%. The percentage of quality product covers only 60% of the total, and 40% brokens.

Reference to milling yield of paddy is given in Attached Table 14.

b. Unsatisfactory conditions for safe operation and poor sanitation. For driving force needed by facilities in large and medium scale rice mills, except a few rice mills that use electric motor, all rice mills are still using steam engine to drive all equipment by main shaft transmission. The device is usually structured quite complicated, hence affecting arrangement of facilities and bringing about inconvenience in maintenance and repairing.

In addition, the facilities such as cleaner, paddy separator were designed and made in uncovered style. Cloud of dust were flying up in operation. Things are still going on like this up to now.

c. A bit too larger power needed in operation and building area. With a comparatively low mechanical efficiency and technological efficiency the production line has to extend longer. Consequantly, the production sections have to be equipped with more power and required larger floor space to cover all these facilities and machines. Taking capacity of processing one ton of paddy as a calculation unit the power provided in rice-milling sections requires 1.5-2.5 kw/ton in large-scale mills and 2.0-3.0 kw/ton (paddy) in medium scale mills. If calculating electric consumption, to process one ton of paddy would consume 40-60°. The building area required for rice -milling section would be in general 8-10m²/ton(paddy).

3) Multipurpose Uses of By-product of Rice Mill

Satisfactory results have been obtained upon multipurpose utilization of rice mill's by-product in few large-scale mills in Thailand, for example, extracting edible oil from rice bran; using defatted bran meal and small brokens to feed poultry and pig; burning husk as

fuel to produce steam as driving force in operation; making unfired brick by mixing husk-burnt ash with clay, then baking it by burning husk, etc. But by-products such as bran and small brokens in most of the rice mills are produced in small amount, there must be some contradiction on management and size if rice mills directly make use of them. Therefore most rice mills sell by-products as raw material straight to vegetable oil plant or feed mill, And husk is burnt to ash by farmers at will for making fertilizer except a small amount utilized as fuel. Mixed bran come from small-scale rice mills and workshops which process paddy immediately into white rice with one pass, has been utilizing as animal feeds in the rural areas.

## III. Analysis on the Feasibility of Establishing a Rice Mill

Thai rice-milling industry at present is characterized by obsolete facilities and low technological efficiency though the Ministry of Industry published in 1975 the regulation that small rice mills, which process paddy immediately into white rice with one pass, were prohibited from setting up. The Government, in order to change the face of Thai rice-milling industry and meet the needs of

expanding rice export and developing production (gaining more paddy by increasing unit yield) as well as to improve milling yield and minimize processing loss, should further formulate the program of modernizing rice-miling industry and assist all rice mills to go in for technical transformation in batches step by step. Following points relating to technical transformation should be taken into consideration for program-making :

1. Introduce advanced technology and facilities from abroad that suits Thailand's actual condition.
2. Erect several rice-milling machinery plants equipped with advanced facilities and skilled workers. and with a considerable capacity.
3. Utilize by-products economically and reasonably. With respect to taking husk for energy -utilization the Study Team suggests that the old husk-burnt boiler and shaft-driven steam engin would be replaced with an unit of husk-burnt gas generator-gas engine-electric generating set and husk-burnt boiler(steam).

In order to assist rice-milling industry in realizing technical transformation, Thai Government established in 1977 Pilot Rice Mill No.1 with a daily capacity of 20 ton paddy . Some achievements have been made in training

and improving technical competence of professional personnel since then. At present the technological process used in newly-built large or medium scale rice mills in Thailand is on the whole to follow Pilot Rice Mill No.1. That is the reason why those newly-built mills have a more effective technological process and process white rice in better quality. But unfortunately, most of those rice mills are still operating the same old facilities as disc sheller and vertical emery polisher made by small rice-milling machinery manufacturers. Therefore, the problems occurred on productive efficiency , which discribed in "Technical level of Rice Mill" Paragraph 2 , Chapter III, are still seriously existing. To solve these problems, the Study Team thinks that, as a pilot rice mill,it should adapt itself continuously with new achievements in international rice-milling technology by renewing old facilities, and to further raise rice-mill's technical level and set an example in technical transformation for Thai rice-milling industry. So the Study Team suggests that it should be quite necessary to introduce advanced technology and facilities from abroad and to establish Pilot Rice Mill No.2.

Based on above reasons the Study Team and the Depart-

ment of Agriculture consulted on the purposes and requirement of Pilot Rice Mill No.2 as follows:

1. Purposes

(1) Studying, researching and popularizing advanced rice-milling technology.

(2) Training rice milling technicians

(3) To do milling tests of different varieties of paddy cultivated and improved by agricultural experiment stations

(4) To mill rice for low salary government officials.

2. Requirements

(1) The type of this mill should be of advanced technique. It will give an impetus to carrying out technical research, and as well, enable Thai rice-milling industry to improve and develop continuously.

(2) Each unit of the milling machines should be comparatively easy to be operated and not so difficult to be mastered by a person who has a few knowledge in rice milling. Each operation step,e.g. cleaning, husking, whitening etc.should be controlled separately. All units are driven by electric motors.

(3) Subjects of Research: On purpose to improve rice-milling technology, followings are suggested as research

subjects:

a. To probe, study and test the mechanical structure, properties, and technological principles on each one of milling technological processes and facilities; determine technological efficiency of unit machine at varied working conditions e.g. processing various varieties of paddy and milling different standards of white rice; know well the optimal operation point of each equipment (in operation).

b. To study and analyze characteristics of various varieties of paddy technological process in processing; work out reasonable operation system which suits Thailand's actual condition through rice milling experiments.

c. To study, approach, adopt and popularize the technique of ventilation and dust-removing, and do a better job in rice mill's sanitation.

d. To probe , study, popularize and utilize new technique and facilities in making use of husk (waste product) as one possible source of energy.

**4. Proposals on Training Course**

**A. For Primary Training Class**

**a. Period of training: 1-2 month/course**

b. Trainee: Those who graduated from high school; operator of private rice mill; farmer who owns small rice mill

c. Training course;

(1) Technological operation;

(2) Maintenance and repairing of rice-milling facilities;

(3) Testing of paddy and rice;

B. For Higher Training Class

a. Period of training: 1-2 year/course

b. Trainee: Those who graduated from university or college; government officials whose duty concerns with rice and paddy ; persons sent by other developing countries for rice-milling training in Thailand.

c. Training Course:

(1) Rice milling technology;

(2) Rice milling facilities and installations;

(3) Ventilation and dusting in rice mill;

(4) Economical and technical management of rice mill

3. Alternative of rice milling facilities based on economy and capability

In accordance with requirement of the proposed rice

mi[illegible] the Study Team made an analysis by comparison on Model 30, a complete set of equipment (daily capacity o[illegible] processing 45 ton paddy)and Model 50, a complete set of equipment (daily capacity of processing 75 ton paddy), both made in China. The Model 30 is considered only suitable to processing rice in intermediate milling degrede(The rural milling workshop and small rice mills prefeprto use it because of less capital investment, less floor space to arrange all facilities and easier operation). The Model 50 , having a larger technological suitability, is considered able to process rice both in high or intermediate milling degrees. In consideration that the proposed rice mill as well as all large-and medium-scale rice mills in the future will command higher requirement on quality control, the Study Team recommends Model 50, a complete set of equipment.

1. Model 50's Technological Properties

Model 50 has the following advantages in production and technology :

(1) Paddy cleaning is carried out through aspiration integrated with separation. The vibrating screen, which has a high efficiency in removing impurity, is coupled with a stoner, hence satisactory result may be achieved

in processing paddy mixed with stone or mud identical to size of kernel.

(2) Husking process is equipped with a rubber roll husker which can adjust speed and narrow the gap between two rolls automatically. Husking efficiency usually ranges 80%-90%, producing less husked brokens.

(3) Rotary paddy separator is used in separation of paddy from husked rice to obtain better efficiency and easier operation.

(4) Horizontal emery polisher is adopted in whitening process with two passes so that milled rice contains less brokens and obtains high milling yield. In the case of processing rice in low or intermediate milling degree, this machine also can be operated with one pass in this way, production cost reduces and capacity increases.

(5) To control broken content of fininshed product, a whitened rice grader is accordingly arranged prior to bagging.

(6) To ensure safe operation and prevention of mixing metal into the flow, some magnetic device is arranged in the course of husking, whitening and bagging.

(7) A paddy bin with a storage capacity of 7 ton is

installed in the section. Some holding hoppers are also arranged in process of husking and whitening to adjust the flowing rate of throughput during operation

(8) The mechanical fixed-quantity weigher is arrange at both ends to weigh paddy and finished product at constant quantity.

(9) During operation all the raw material , semi-finished product and finished product are moved by conveyers. In combination of paddy separation husk is blo straight to husk-storeroom or husk storing ground.

(10) There is an air duct and dust remover specially arranged at the machine that emits a great deal of dus With a result sanitation within the section is realize worker's operating conditions are improved and cleanli ness of finished produc (milled rice) is ensured.

(11) The packing of finished product is done by bagging-sewing machine.

2. Power Required and Construction of the Section

Because Model 50 has a higher efficiency in unit machine and simplified technological process, the power provided in the section would be only 100 kw and build ing area about 378m$^2$ (two storeys building with a pla form), saving much power and building cost required.

3. Owing to the reason that Pilot Rice Mill No. 2 will not be built for commercial purpose, the economic analysis is unnecessary to be made here , but on the whole, the actual production cost estimated would be much lower compared with that of ordinary profit-making rice mill. The Model 50's electric consumption in processing one ton of paddy would be 20 kw lower and its milling yield may be about 1% higher than that of ordinary rice mill and building area is less. Therefore investment on fixed assets would be saved a lot. The fixed expenses (depreciation, etc.) in production cost would be comparatively reduced. In a word, Pilot Rice Mill No.2 enjoys cheaper production cost and more benefit.

## IV. Selection of the Location of Pilot Rice Mill No. 2

The location of the proposed rice mill was previously selected by the Government within the area of the Klong Luang Rice Experimental Station, Pathum Thani province. After on-the -spot survey the Study Team found that the selected site was a piece of low-lying paddy field in poor condition. In the case of setting up a new rice mill there, a large quantity of landfilling would be re-

quired, and auxiliary buildings and public installations have to be built again. The capital investment involved would be much. It was preliminarily estimated that total capital investment only for construction (including public installations) might be 750,000 US Dollar approximately (exclusive of cost of a set of rice milling equipment). So the Study Team suggested that the new pilot rice mill should be regarded as a production section(named as Pilot Rice Mill No. 2) to be erected in the inside of the existing pilot rice mill (named as Pilot Rice Mill No. 1), making full use of existing auxiliary buildings and public installations to save investment cost. This suggestion was appreciated by the Government . Now the capital investment on decided site would be saved by about 600,000 US Dollar.

The location of Pilot Rice Mill No. 2 and general layout is indicated in Attached Drawing 2,3.

## V. Recommendation of Establishing Pilot Rice Mill No. 2

Based on the unanimity of views on the size and location of Pilot Rice Mill No. 2, the Study Team and the Division of Agricultural Engineering, Department of Agriculture, have consulted following points as the

recommendation of establishing a rice mill:

1. Name of the rice mill

   Pilot Rice Mill No. 2

2. Location of the rice mill

   Storage and Processing Section, Division of Agricultural Engineering, Klong Luang District, Pathumtanee Province

3. Productive capacity

   50 ton of white rice per day (24 hours)

4. Product scheme

   Trial-producing different grades of rice

5. Operation type and work system

   Pilot Rice Mill No. 2 will be operated on one shift (8 hours per shift a day, 5 working days per week) and for 250 working days per year

   Operation type should be continuous.

6. Composition of the rice mill and land occupied by it

| Section | Occupied land ($m^2$) | Building area ($m^2$) | Estimated Construction cost | | Remarks |
|---|---|---|---|---|---|
| | | | US \$/$m^2$ | US \$ in total | |
| 1.Rice milling section | 27x7=189 | 189x2=378 | 208 | 78,600 | to be built |
| 2.Husk and by-product warehouse | 6x15=90 | 90 | 208 | 18,700 | to be built |
| 3.Paddy warehouse | | | | | existing |
| 4.Milled rice warehouse | 10x10=100 | 100 | | | existing |
| 5.Machinery maintenance workshop | 12x24=288 | 288 | | | existing |

| | | | | | |
|---|---|---|---|---|---|
| 6.Laboratory | 10x10=100 | 100 | 347.5 | 34,800 | to be built |
| 7.Spare parts storeroom | 6x10=60 | 60 | 208 | 12,500 | to be built |
| 8.Office building | 6x10=60 | 60 | | | existing |
| Total | | 1,076 | | 144,600 | |

Notes: Total occupied land 5,088 $m^2$

Total building area 1,076 $m^2$

(exclusive of building area of existing pilot rice mill)

including: existing building area 448 $m^2$

proposed building area 628 $m^2$

7. Technological process of the rice mill

Paddy → Weighing → Cleaning → Stoning → Husking → Paddy separation → Whitening → Grading → Weighing & Bagging → Finished product

8. Production facilities

The name and number of major facilities provided in the Project are listed as follows:

(1) Operation machinery

| | |
|---|---|
| Vibrating screen | 1 |
| Stoner | 1 |
| Rubber roll husker | 1 |
| Paddy separator | 2 |
| Rice polisher | 2 |
| White rice grader | 1 (set) |

(2) Auxiliary operation machinery

| | |
|---|---|
| Sack sewing machine | 1 |
| Mechanical automatic weigher | 2 |
| Bucket elevator | 12 |
| Dust remover (blower & cyclone) | 4 (set) |
| Wheel barrow | 4 |

(3) Testing instrument for paddy and rice

(4) Spare parts (two-year supply of quick-wearing parts of operation machinery, and one-year supply of rubber roll)

9. Main Technological Indexes

| Item | Unit | Index |
|---|---|---|
| White rice yield | ton/year | 4,200 |
| Raw material consumption (paddy) | ton/year | 6,250 |
| Power load | kw | 100 |
| Power load required for processing one ton of paddy | kw/ton(paddy) | 1.33 |
| Building area of production section | $m^2$ | 378 |
| Building area required for processing one ton of paddy | $m^2$/ton (paddy) | 5 |
| Staff required | | |
| Skilled operator | man | 2 |
| Unskilled worker | man | 2-3 |
| Professional administrator | man | 1 |

Notes: (1) White rice yield and paddy consumption are calculated on 8-hour operation per day and 250-day operation per year.

(2) In Pilot Rice Mill No.1 all personnel has already been assigned in the production section, auxiliary sections and office .No more personnel would be added if Pilot Rice Mill

No. 1 and No. 2 may go into operation in turn according to the needs of training and research after the establishment of Pilot Rice Mill No. 2.

## VI. Recommendation on the Divion of Work in the Execution of the Project

Soon after consultations on the Recommendation of Establishing a Rice Mill in Bangkok the Study Team and the Division of Agricultural Engineering, Department of Agriculture exchanged views upon the division of work by two sides in the execution of the Project. Following provisions were signed and approved by Mr. Samnao, Director of Division of Agricultural Engineering, Department of Agriculture and Mr. Ma Bingquan, Leader of the Study Team.

No.1 UNIDO side (Using China's voluntary contribution and designating it as the Contractor)

a. Conduct a feasibility study for the establishment of a rice mill; prepare a report on the study which shall be submitted to UNIDO with 20 copies not later than 50 days after the termination of services in the Project area and returning to China.

b. UNIDO should formally approve the Report not later than 90 days after receiving of the Report.

c. Sign a service contract for the establishment of a pilot rice mill upon UNIDO's approval of the Report.

d. Undertake designs of technological process; deliver the preliminary designs to Thai side for examination three months after receiving basic data for designing to be provided by Thai side and signing the Service Contract on the Project. Thai side should put forward their views on the modification of preliminary designs in writing to Chinese side not later than 60 days.

e. Chinese side should offer design of working drawings on technological process not later than three months after receiving Thai views on the modification in writing.

f. Inform Thai side of the required amount of raw material, main auxiliary materials and electric consumption .

g. Provide a complete set of production equipments used in a pilot rice mill, installation materials and quick-wearing spare parts enough for two year's use (rubber roll only for one year's use because of being aged easily)

h. Effect transportation and insurance of the said equipment and materials to Bangkok port in Thailand.

i. Send technical personnel to give guidance in equipment installation and trial-production , and give on-the-spot training to Thai personnel in the operation of the said equipment.

j. Bear all the expenses incurred in the discharge of its responsibility as set out in the present Paragraph No. 1.

No. 2 Thai side

a. Provide the space for the erection of a pilot rice mill and auxiliary installation.

b. Provide the basic data for designing (see Appendix 1) which should be delivered to Chinese side within one month after UNIDO approves the Report on the Study and transmits it to Thai si

c. Chinese side in the Report will explain their ideas on designs of rice milling section and put forward the requirement on construction work. Thai side should deliver preliminary designs of construction to Chinese side for examination from a technologecal view not later than three months after Thai Government approves the Project; Chinese side should deliver their views on the modification to Thai side by mail within 45 days. Thai side will formally commence to design work-

ing drawings of construction upon receiving Chinese views on the modification.

d. Provide all the building materials in civil engineering and carry out all the work in actual construction and equipment installation.

e. Undertake to connect the power source (50 cycles , 380 voltage) with new rice milling section.

f. Provide Pilot Rice Mill No. 2 with the service of paddy warehouse, milled rice warehouse, machinery maintenance and other facilities now available in Pilot Rice Mill No. 1.

g. Provide the raw material of standarded quality, auxiliary material, electric source and packaging material in the trial-production; supply all raw material and working capital required in the normal operation after the establishment of the rice milling section, and staff it with workers and managerial personnel.

h. Secure the Customs clearance for and take delivery of the equipment and materials supplied by China on their arrival in Bangkok port, transport them from Bangkok port onto the construction site and place them under good care.

i. Bear all the expense incurred in the discharge of its

responsibility as set out in the present Paragraph No. 2.

No. 3 Total capital investment estimated preliminarily on the Project will be 619,500 US $ (in RMB 885,000 Yuan) including: 460,500 US $ paid by UNIDO (in RMB 657,800 Yuan) covering a feasibility study on the establishment of a rice mill; a complete set of production equipment and installation materials; payment for Chinese experts giving guidance in equipment installation and technical training ; etc. and 159,000 US $ paid by Thailand (in RMB 227,200 Yuan or Thai Currency 3,180,000 Baht)

List of Capital Investment

| Item | Discription | Capital investment | |
|---|---|---|---|
| | | US $ | in RMB Yuan |
| A. Investment made by UNIDO | | 460,500 | 657,800 |
| 1. a feasibility study | completed | 30,800 | 44,000 |
| 2. Production equipment and installation materials | | 210,000 | 300,000 |
| 3. Spare parts | | 35,000 | 50,000 |
| 4. Transportation and insurance | | 24,500 | 35,000 |
| 5. Technological designs | | 21,000 | 30,000 |
| 6. Expert service | calculated as 24 man/month, 5,800 US $/man/month | 139,200 | 198,800 |
| B, Investment made by Thai Government | | 159,000 | 227,200 |

| | | | |
|---|---|---|---|
| 1. construction | | 144,500 | 205,600 |
| 2. Local miscellaneous expense | | 1,000 | 1,400 |
| 3. Trial-production | | 1,300 | 1,900 |
| 4. Technical training | | 4,500 | 6,400 |
| 5. Inestimable expense | | 7,600 | 10,900 |
| Total | | 619,500 | 885,000 |

Notes: (1) The investment paid by UNIDO is first estimated with RMB Yuan , then with US $, and the investment paid by Thai Government is first estimated with Thai currency, Baht, then with US $.

Rates of exchange: 1 US $ = 1.42856 RMB Yuan

1 US $ = 20 Baht (Thai currency)

(2) The factor of price rising has not been taken into consideration in the above capital investment estimation.

Appendix I.

Basic Data for Technological Design

Offered by Thai Side

1. Local paddy variety and quality, items of test and analysis

   a. Total impurity: percentage of dust, sand, stone and weed seeds

   b. Unripe grains: percentage of shrivelled kernel

   c. Grain size : ratio of long, medium and short grains

   d. Rice grade suitable for processing

   e. Milling yield of purified paddy : exclusive of impurity and unripe grains the quantity of head rice, varied brokens, bran and husk obtained from 1,000 kg. of purified paddy

2. Metecrological data in the location of the rice mill

   a. Temperature and humidity

   (1) Annual average of absolute maximum and minimum temperature

   (2) Mean temperature in the hotest and coldest months, temperature difference between day and night

   (3) Maximum temperature of wet bulb and dry bulb in

the hotest month

(4) Mean temperature and relative humidity at 14 o'clock in the hotest months

b. Wind

(1) Mean and maximum wind velocity in a year, a season and a month

(2) Wind direction and frequency in a year, a season and a month, Annexing wind rose

c. Rainfall

(1) Preciptitation formula locally used

(2) Average, maximum and minimum rainfall for years or each month in a year

(3) Heaviest rainfall per day, per hour and per ten minutes

(4) Lasting time and maximum rainfall of a storm

d. Sunshine , barometric pressure, thunder and lightening

(1) Numbers of fine days or rainy days, angle of incidence of sunshine

(2) Average value of the barometric pressure in three hotest months for years

(3) Numbers of days occurring thunder and lightening, and their activity in a year

3. Rice mill location map

Proportion: 1:5,000-----1: 10,000

Including: topographic height, rice mill location, communication and transportation ways of rice mill, direction of transmission network

4. General plan of rice mill area

Proportion: 1 : 500 ------1 : 1,000

including: topographic height of rice mill area, existing buildings and installations, position of proposed buildings and installations, area occupied by the rice mill, use of each existing building

5. The structure, area and building cost of existing or proposed building in the rice mill area

6. Height of underground water

7. Electric supply

a. Position of electric source, and its distance to the rice mill

b. Allowed capacity of power supply, voltage and circuit numbers

c. Wire laying way (aerial or cable) and length

d. Requirements made by the power supply department such

as minimum efficacy factor, minimum capacity of short line in transmission lines, systematic resistance, single-phase capacitance value, allowed maximun time for relay (time for main switch to cut off)

e. Calculating method of electric fee, and price

f. Agreement documents signed by the power supply department

8. The rule and regulation worked out by the Government and concerned departments on the newly-built factory

a. Labour law

b. Regulation on environmental sanitation

c. Standards on building design & construction

d. Standards on electric design and installation

9. Communication and transportation

Conditions and grades of nearby highway on which trucks in the rice mill must pass every day, width of highway surface, transportion fee for per ton/per km.by truck

10. Others

a. Colour preferred on the production equipments

b. Local price of ordinary glass with thickness 3mm (per $m^2$ )

c. Size of jute bag for package

Attached Tables;

Table 1. Area and Percentage of Rice Land by Region in Hectares

| Region | Area | Rice land | Percent |
|---|---|---|---|
| 1. Northern | 8,948,900 | 1,041,400 | 11.6 |
| 2. Northeastern | 17,022,400 | 2,670,470 | 15.7 |
| 3. Central Plain | 27,410,400 | 2,591,289 | 9.4 |
| 4. Southern | 7,018,000 | 547,171 | 7.8 |
| Total | 60,399,700 | 6,850,330 | 11.3 |

Source; Agricultural Statistics of Thailand, 1967 P. 28

Table 2. Area Planted and Paddy Production by Geographical Regions 1950—1967

| year | Northern | | Northeastern | | Central Plain | | Southern | |
|---|---|---|---|---|---|---|---|---|
| | area Planted in ha. | Production 1,000 tons | area Planted in ha. | Production 1,000 tons | area Planted in ha. | Production 1,000 tons | area Planted in ha. | Production 1,000 tons |
| 1950 | 367,000 | 527 | 2,031,200 | 1,846 | 2,679,360 | 3,809 | 461,920 | 600 |
| 1951 | 373,760 | 556 | 2,363,680 | 2,335 | 2,758,280 | 3,837 | 463,680 | 597 |
| 1952 | 367,360 | 554 | 1,881,920 | 1,800 | 2,674,720 | 3,631 | 444,160 | 617 |
| 1953 | 379,360 | 679 | 2,538,240 | 2,705 | 2,777,920 | 4,172 | 476,320 | 683 |
| 1954 | 376,320 | 655 | 1,950,880 | 1,470 | 2,743,360 | 2,927 | 486,560 | 659 |
| 1955 | 387,520 | 745 | 2,322,880 | 2,150 | 2,631,680 | 3,769 | 427,520 | 670 |
| 1956 | 377,600 | 799 | 2,482,720 | 2,613 | 2,706,080 | 4,224 | 457,280 | 661 |
| 1957 | 387,360 | 822 | 1,658,560 | 1,572 | 2,600,000 | 2,654 | 430,240 | 522 |
| 1958 | 393,440 | 720 | 2,159,200 | 1,978 | 2,729,760 | 8,731 | 475,520 | 624 |
| 1959 | 410,240 | 796 | 2,467,360 | 2,020 | 2,732,320 | 3,307 | 455,520 | 642 |
| 1960 | 419,200 | 782 | 2,329,120 | 2,295 | 2,723,360 | 4,119 | 449,600 | 639 |
| 1961 | 411,520 | 894 | 2,465,280 | 2,323 | 2,822,240 | 4,273 | 479,040 | 707 |
| 1962 | 411,040 | 855 | 2,851,200 | 3,082 | 2,892,480 | 4,600 | 504,000 | 743 |
| 1963 | 418,560 | 909 | 2,707,200 | 3,026 | 2,952,800 | 5,348 | 525,760 | 886 |
| 1964 | 427,360 | 986 | 2,475,200 | 2,764 | 3,116,960 | 5,157 | 522,880 | 733 |
| 1965 | 428,640 | 1,057 | 2,429,280 | 2,222 | 3,102,560 | 5,066 | 518,240 | 874 |
| 1966 | 438,400 | 1,126 | 3,116,320 | 3,831 | 3,267,520 | 6,168 | 712,960 | 850 |
| 1967 | 1,438,080 | 2,755 | 2,255,200 | 2,177 | 2,165,440 | 3,932 | 551,520 | 729 |
| average area | 456,264 | 900 | 2,235,013 | 2,345 | 2,782,047 | 4,429 | 491,262 | 681 |
| average yield/ha. | | 1.9726 | | 1.0492 | | 1.5920 | | 1.4066 |

Note; Thailand's average yield/ha. =1.5051 ton

Source; Agricultural Statistics of Thailand 1967 P.48
Division of Agricultural Economy, Office of the Under—Secretary of State,
Ministry of Agriculture, Bangkok, Thailand.

Table 3. Population Growth Rate, Comparative Area Planted, Production and Exports of Major Crops in 1975 and 1978 by Alternative Plans

| Type of Statistics | 1975 | 1981 | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | A | $B_1$ | $B_2$ | C | D | E | F |
| 1.Population growthrate (Percent) | 3.2 | 2.1 | 2.5 | 2.5 | 2.8 | 2.1 | 2.1 | 2.1 |
| 2.Paddy Planted area (ha.) | 8,518,880 | 8,908,960 | 7,884,000 | 8,717,280 | 8,996,160 | 8,560.800 | 8,189,120 | 8,425,920 |
| 3.Exports (million tons) | | | | | | | | |
| Rice (Paddy) | 1.414 | 2.60 | 2.16 | 2.16 | 2.60 | 1.53 | 2.62 | 1.85 |
| Maize | 2.147 | 3.00 | 2.49 | 2.50 | 3.00 | 2.00 | 3.00 | 3.00 |
| Cassava (roots) | 6.786 | 6.57 | 5.48 | 5.48 | 6.57 | 4.43 | 6.57 | 6.57 |
| Sugar | | 0.75 | 0.55 | 0.55 | 0.75 | 0.35 | 0.75 | 0.75 |
| Kenaf | 0.157 | 0.10 | 0.08 | 0.08 | 0.10 | 0.05 | 0.10 | 0.10 |
| Rubber | 0.335 | 0.45 | 0.40 | 0.40 | 0.45 | 0.35 | 0.45 | 0.45 |
| 4.Total Production | | | | | | | | |
| Rice (Paddy) | 14.092 | 16.04 | 15.78 | 15.79 | 16.42 | 14.97 | 16.05 | 15.29 |
| Maize | 2.863 | 3.61 | 3.11 | 3.12 | 3.61 | 2.61 | 3.61 | 3.61 |
| Cassava (roots) | 7.052 | 7.10 | 6.03 | 6.02 | 7.21 | 4.95 | 7.10 | 7.10 |
| Sugarcane | 19.099 | 16.30 | 13.73 | 13.72 | 16.48 | 10.97 | 16.30 | 16.30 |
| Kenaf | 0.308 | 0.32 | 0.30 | 0.30 | 0.33 | 0.27 | 0.32 | 0.32 |
| Rubber | 0.414 | 0.47 | 0.41 | 0.41 | 0.47 | 0.37 | 0.47 | 0.47 |

Notes:

1. Plan B1 is specified under the hypothesis that some events or obstacles might occur so that the Plan A goals cannot be fully achieved.
2. Conditions in Plan B2 are all the same as in Plan B1 except that the Plan B2 requires a minimum level of farmer income at the level of not less than the income level in 1973.
3. In the Plan C, population growth rate is estimated at 2.8 percent per annum.
4. In the Plan D,exports of six agricultural products are estimated at "low" level.
5. In the Plan E, irrigated area is not changed from the area at present time which is an irrigated area 50 percent less than in the Plan A.
6. In the Plan F, irrigated area is not changed from the area in 1975.

Source:

Thailand's Fourth Five-Year Agricultural Development Plan 1977--1981

Table 4. Purchase of Paddy in Thailand

| Types of paddy | 100% first grade paddy | 100% second grade paddy | 100% third grade paddy | 5% paddy | 10% paddy | 15% paddy | short glutinous | long glutinous |
|---|---|---|---|---|---|---|---|---|
| purchasing price (Baht/ton) | 3,800 | 3,700 | 3,600 | 3,500 | 3,400 | 3,300 | 3,200 | 3,400 |

Source: Published on 16 July, 1980 in all the newspaper in Bangkok

Table 5. Local Paddy Variety and Quality

| variety | grain size | | | brown rice | milled rice | head rice | hull | bran | moisture content | wt. | impurity |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | L mm. | W mm. | Th mm. | % | % | % | % | % | % | gm/li | % |
| R. D. 9 | 7.32 | 2.35 | 1.77 | 78.4 | 68.8 | 43.6 | 21.6 | 9.6 | 12.24 | 613.33 | 1.06 |
| R. D. 11 | 7.63 | 2.28 | 1.80 | 77.6 | 68.8 | 56.0 | 22.4 | 8.8 | 10.84 | 594.44 | 2.14 |
| IR. 38 | 6.82 | 2.17 | 1.72 | 77.6 | 67.6 | 52.0 | 22.4 | 10.0 | 11.88 | 643.33 | 1.13 |
| IR. 42 | 6.25 | 2.22 | 1.67 | 78.4 | 72.0 | 51.6 | 21.6 | 7.2 | 12.48 | 632.73 | 2.37 |

Source: Offered by Department of Agriculture, Ministry of Agriculture and Cooperatives, Bangkok, Thailand

Table 6. List of Recommended Rice Varieties in 1978

| No. | Variety name | Harvesting date | * Type | Yield ** kg/rai | Kernel size (mm.) *** T | W | L | Blast reaction | Bacterial leaf blight | Y.O.L virus (tungro) | Reaction to Brown Spot | Call Midge | Brown plant Hopper | Height (cm.) | Year of release |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| | Northern Region | | | | | | | | | | | | | | |
| 1 | Muey Nawng 62 M | Nov.20 | G | 539 | 2.0 | 2.9 | 6.6 | S | S | S | MR | R | S | 150 | 1959 |
| 2 | Khao Dawk Mali 105 | Nov.25 | NG | 363 | 1.8 | 2.1 | 7.5 | | MS | S | MS | S | S | 138 | 1959 |
| 3 | Niaw San-Pah -tawng | Nov.26 | G | 526 | 1.8 | 2.0 | 7.2 | MS | MS | S | MR | S | S | 150 | 1962 |
| 4 | Leuang Yai 148 | Nov.25 | NG | 548 | 1.8 | 2.6 | 7.8 | S | MS | S | MS | S | S | 160 | 1968 |
| 5 | RD 6 | Nov.21 | G | 666 | 1.77 | 2.28 | 7.24 | MS | MS | S | MR | S | S | 133 | 1978 |
| | Northeastern Region | | | | | | | | | | | | | | |
| 1 | Khao Dawk Mali 105 | Nov.20 | NG | 512 | 1.8 | 2.4 | 7.6 | S | MS | S | MS | S | S | 150 | 1959 |
| 2 | Niaw San-pah -tawng | Nov.26 | G | 572 | 1.8 | 2.2 | 7.3 | MS | MS | S | MR | S | S | 160 | 1962 |
| 3 | Khao Pahk Maw 148 | Dec.3 | NG | 415 | 1.9 | 2.3 | 7.6 | MS | MS | S | MS | S | S | 140 | 1965 |
| 4 | Nam Sa Gui 19 | Nov.4 | NG | 489 | 1.8 | 2.2 | 7.7 | MS | S | S | MS | S | S | 120 | 1968 |
| 5 | Hahng Yi 71 | Nov.4 | G | 506 | 1.8 | 2.1 | 7.1 | R | S | S | MS | S | S | 133 | 1968 |
| 6 | RD 6 | Nov.21 | G | 666 | 1.77 | 2.28 | 7.24 | MS | S | | MR | S | S | 133 | 1977 |
| 7 | RD 8 | Nov.23 | G | 585 | 1.92 | 2.52 | 7.11 | MS | MS | S | MR | S | S | 151 | 1978 |
| 8 | RD 15 | Nov.10 | NG | 556 | 1.72 | 2.14 | 7.41 | MS | S | S | MR | S | S | 130 | 1978 |

(continued)

| NO. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Central Region | | | | | | | | | | | | | | |
| 1 | Nahng Mon S-4 | Nov.26 | NG | 436 | 1.8 | 2.4 | 7.7 | MS | MS | S | MS | S | S | 140 | 1956 |
| 2 | Gow Ruang 88 | Nov.21 | NG | 421 | 1.7 | 2.2 | 7.3 | S | MS | S | MS | S | S | 140 | 1962 |
| 3 | Khao Pahk Maw 148 | Dec. 3 | NG | 415 | 1.9 | 2.3 | 7.6 | MS | MS | S | MS | S | S | 140 | 1965 |
| 4 | Leuang Pra-tew 123 | Fec.19 | NG | 414 | 1.8 | 2.3 | 7.6 | S | S | MS | MS | S | S | 150 | 1965 |
| | Southern Region | | | | | | | | | | | | | | |
| 1 | Nahng Prayah 132 | Feb.16 | NG | 486 | 1.7 | 2.2 | 7.6 | S | MS | S | MR | S | S | 178 | 1962 |
| 2 | Puang Rai 2 | Dec. 6 | NG | 437 | 1.9 | 2.3 | 7.5 | S | S | S | MR | S | S | 171 | 1968 |
| 3 | Peuak Nam 43 | Feb.22 | NG | 450 | 1.7 | 2.1 | 7.6 | S | MS | S | MS | S | S | 166 | 1968 |
| 4 | RD 13 | Feb.26 | NG | 446 | 1.7 | 2.2 | 6.8 | R | S | S | MR | S | S | 160 | 1978 |
| | Non-Photosensitive Variety can be grown in irrigated area in different regions | | | | | | | | | | | | | | |
| 1 | RD 1 | 130 days | NG | 742 | 1.8 | 2.2 | 7.0 | S | S | S | MR | S | S | 115 | 1969 |
| 2 | RD 2 | 130 days | G | 766 | 1.9 | 2.6 | 7.2 | S | S | MS | R | S | S | 115 | 1969 |
| 3 | RD 3 | 128 days | NG | 667 | 1.8 | 2.2 | 7.2 | S | S | S | MS | S | S | 100 | 1969 |
| 4 | RD 4 | 127 days | G | 573 | 1.8 | 2.4 | 7.2 | S | S | MS | R | R | R | 177 | 1973 |
| 5 | RD 5 | 140 days | NG | 576 | 1.8 | 2.2 | 7.15 | MR | MR | MS | MS | S | S | 146 | 1973 |
| 6 | RD 7 | 120-130 days | NG | 672 | 1.8 | 2.3 | 7.3 | MR | R | MS | MS | S | S | 108 | 1975 |
| 7 | RD 9 | 115-125 days | NG | 657 | 1.8 | 2.3 | 7.3 | S | VS | S | MR | MR | | 110 | 1975 |
| 8 | RD 11 | 135 days | NG | 698 | 1.82 | 2.36 | 7.52 | MS | S | S | MR | S | S | 110 | 1977 |
| | Floating Rice | | | | | | | | | | | | | | |
| 1 | Ta-Pow-gaew | Dec. 9 | NG | 350 | 1.7 | 2.5 | 7.2 | S | S | S | MS | S | S | - | 1959 |
| 2 | Leb Mue Nahng 111 | Dec.19 | NG | 328 | 1.7 | 2.3 | 7.1 | MS | MS | S | MR | S | S | - | 1959 |
| 3 | Pin Gaew 56 | Dec.29 | NG | 362 | 1.7 | 2.2 | 7.4 | S | MS | S | MS | S | S | - | 1959 |
| 4 | Nahng Cha-lawng | Nov.30 | G | 394 | 1.9 | 2.9 | 6.3 | MR | S | S | MS | S | S | - | 1969 |

Notes: *Type: G = Glutinous, NG = Non-glutinous **Rai: 6.25 rai = 1 hectare

***Kernel Size: T = Thickness, W = Width, L = Length, R = Resistance, S = Susceptible,
MR = Moderately Resistance, MS = Moderately Susceptible

Source: Offered by Department of Agriculture, Ministry of Agriculture and Cooperatives

Table 7. Standards of White Rice + Not less than. - Not more than or less than (as the case may be). ± More or less than.

| Crades of White Rice | Grain classification | | | | Grain composition | | | | | Maximum allowance of the following mixtures, | | | | | | | | | | | | Milling Degree | Moisture not higher than |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Length of Grain | | | Short Grain less than 6.2 mm. % | Size of Brokens | % Whole grain | % Head Rice Big Brokens | % Brokens | % Small white Brokens C.1 | % Red streaked kernels | % Red kernels | % • Chalky kernels | % Damaged kernels | % Yellow kernels | % Shrivelled kernels | % Immature kernels | % Split kernels | % Foreign matters | % Seeds | % Glutinous rice | Paddy per 1 kg. | | |
| | Extra Long 7 mm. % | Long 6.6 - 7.0 mm. % | Medium 6.2 - 6.6 mm. % | | | | | | | | | | | | | | | | | | | | |
| 100% Class A. | +70 (70 - 100) | ±25 (0 - 30) | - 5 (0 - 5) | - | - 8.0 + 5.0 | + 60 | ±36 | - 4 | - | - | - | 0.5 | - | - | - | - | - | - | - | 0.5 | 5 | Extra well milled | 14% |
| 100% Class B. | ±50 (45 - 55) | ±35 (30 - 40) | ±10 (0 - 25) | - 5 (0 - 5) | - 8.0 + 5.0 | + 60 | ±35.5 | - 4.5 | - | - | - | 0.5 | - | - | - | - | - | - | - | 0.5 | 10 | Extra well milled | 14% |
| 100% Class C. | ±35 (30 - 40) | ±45 (40 - 50) | ±15 (5 - 30) | - 5 (0 - 5) | - 8.0 + 5.0 | + 60 | ±35 | - 5 | - | - | - | 0.5 | - | - | - | - | - | - | - | 0.5 | 15 | Extra well milled | 41% |
| 5% | +20 (20 - 25) | ±35 (30 - 40) | ±35 (25 - 50) | - 10 (0 - 10) | - 7.0 + 3.5 | + 60 | ±33 | - 7 (3 - 7) | - | 2 | - | 2.5 | 0.25 | 0.5 | - | - | 0.5 | 0.1 | - | 0.5 | 15 | well milled | 14% |
| 10% | +10 (10 - 15) | ±30 (25 - 35) | ±45 (35 - 55) | 10 - 15 (10 - 15) | - 7.0 + 3.5 | + 55 | ±33 | - 12 (8 - 12) | - | 2 | - | 3 | 0.5 | 1 | - | - | 0.75 | 0.2 | - | 0.5 | 20 | well milled | 14% |
| 15% | + 5 (5 - 10) | - 20 (0 - 20) | - 40 (20 - 40) | 35 - 50 (35 - 50) | - 6.5 + 3.0 | + 55 | ±28 | - 17 (13 - 17) | - | 4 | 1 | 3 | 1 | 1 | - | - | 0.75 | 0.2 | - | 0.5 | 25 | Reasonably well milled | 14% |
| 20% | + 0 (0 - 10) | - 15 (0 - 15) | - 35 (10—30) | 55 - 65 (55 - 65) | - 6.0 + 3.0 | + 50 | ±27 | ±22 (18 - 23) | - 1 | 5 | 2 | 5 | 2 | 1 | 0.5 | 0.5 | 0.75 | 0.25 | - | 0.5 | 25 | Reasonably well milled | 14% |
| 25% (Super) | + 0 (0 - 8) | - 35 (17 - 35) | | 65 - 75 (65 - 75) | - 5.0 + 3.0 | + 40 | ±32 | ±27 (23 - 28) | - 1 | 4 | 1 | 3 | 1 | 1 | - | - | 0.75 | 0.2 | - | 0.5 | 30 | Reasonably well milled | 14% |
| 25% | + 0 (0 - 8) | - 35 (17 - 35) | | 65 - 75 (65 - 75) | - 5.0 + 3.0 | + 40 | ±32 | ±26 (23 - 28) | - 2 | 6 | 4 | 8 | 2 | 1 | 1 | 1 | 0.75 | 0.5 | 0.5 | 0.5 | 30 | Ordinarily milled | 14% |
| 35% | + 0 (0 - 8) | - 35 (17 - 35) | | 65 - 75 (65 - 75) | - 5.0 + 3.0 | + 32 | ±28 | ±38 (33 - 40) | - 2 | 7 | 4 | 10 | 2 | 1 | 1 | 1 | 0.75 | 1 | 0.5 | 0.5 | 30 | Ordinarily milled | 14% |
| 45% | + 0 (0 - 8) | - 35 (17 - 35) | | 65 - 75 (65 - 75) | - 5.0 + 3.0 | + 28 | ±22 | ±47 (42 - 50) | - 3 | 8 | 4 | 10 | 2 | 1 | 1 | 1 | 0.75 | 1 | 0.5 | 0.5 | 30 | Ordinarily milled | 14% |

Nate: • Except the grade 100% Class A, allowance of higher percentage than that specified above has been approved by the authority.

Source: "Standard of Rice" Rice Inspection Committee, Board of Trade of Thailand, 1978

Table 8. Standards of white Rice (Brokens and Small brokens)

| Grades of White Broken Rice | Grain Classification: To be obtained from the milling of white rice of the grades | Grain Composition: % whole grain (10th/10th) | % 8/10th to less than whole grain | % 6.5/10th to less than 8/10th | % 5/10th to less than 8/10th | % 3/10th to less than 6.5/10th | % 3/10th to less than 5/10th | % Small white Brokens B.1 | % Small white Brokens C.1 | % Small white Brokens C.3 | % Foreign Matters |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A.1 Super Special | 100% | (0 - 5) | (0 - 15) | - | 90 (70 - 90) | - | 10 (0 - 10) | - | - | - | - |
| A.1 Super | 100% 5% 10% | - | (0 - 5) | (0 - 15) | - | 100 (75 - 100) | - | - | (0 - 5) | - | 0.5 |
| A.1 Special | 15% 20% 25% (Super) | - | (0 - 5) | (0 - 15) | - | 100 (74 - 100) | - | - | (0 - 6) | - | 1 |
| A.1 Ordinary | 25% 35% 45% | - | - | (0 - 5) | - | 100 (69 - 100) | - | (0 - 10) | (0 - 12) | (0 - 4) | 3 |

| Grades of Small white Broken Rice | Grain Classification: To be obtained from the milling of white rice of the grades | Grain Composition: Not Passing through Sieve No. 8 ½ % | (A.1) Passing through sieve No but not through No. % | (C.1) Passing through Sieve No. 7 but not through No. 6 ½ % | (C.3) Passing through Sieve No. 6 ½ % | Foreign Matters % | Seeds % |
|---|---|---|---|---|---|---|---|
| C.1 Special | 100% 5% 10% 15% | - | (0 - 10) | 100 (70 - 100) | (0 - 20) | 1 | 1 |
| C.1 Ordinary | 20% 25% 35% 45% | - | (0 - 10) | 100 (60 - 100) | (0 - 30) | 3 | 1 |
| C.3 | Various grades | - | - | (0 - 15) | 100 (85 - 100) | 3 | 1.5 |

Source: "Standard of Rice", Rice Inspection Committee, Board of Trade of Thailand 1978

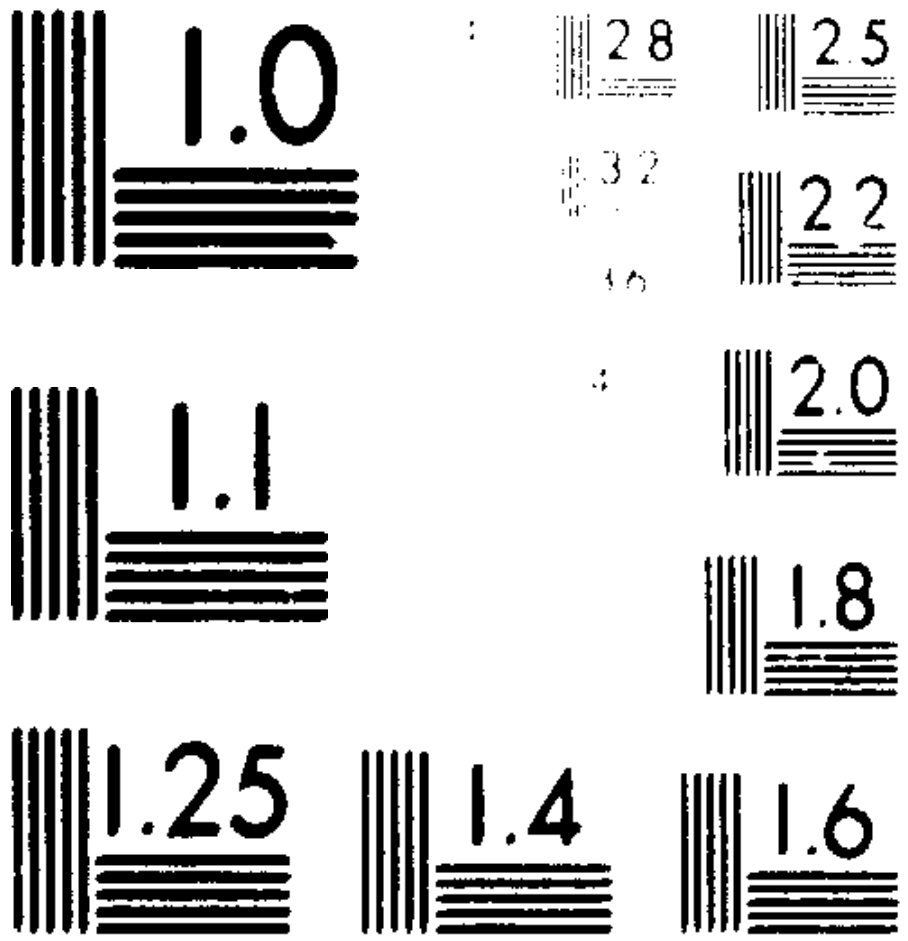


Table 9. Total Export of principal Agricultural Products in Thailand

Unit: one thousand tons

| Period | Rice | Maize | Sugar | Rapioca Product | Rubber | Jute |
|---|---|---|---|---|---|---|
| 1961 | 1,576 | 569 | 1.53 | 443 | 184.59 | 143 |
| 62 | 1,271 | 484 | 43.01 | 400 | 194.18 | 237 |
| 63 | 1,417 | 767 | 52.82 | 427 | 186.88 | 125 |
| 64 | 1,896 | 1,146 | 48.90 | 738 | 216.99 | 162 |
| 65 | 1,895 | 831 | 83.83 | 719 | 210.85 | 316 |
| 66 | 1,507 | 1,261 | 54.85 | 688 | 202.53 | 473 |
| 67 | 1,482 | 1,145 | 15.01 | 781 | 211.11 | 317 |
| 68 | 1,068 | 1,558 | 0.05 | 888 | 252.22 | 289 |
| 69 | 1,023 | 1,544 | 16.10 | 975 | 276.38 | 255 |
| 1970 | 1,063 | 1,447 | 56.24 | 1,326 | 275.61 | 257 |
| 71 | 1,576 | 1,873 | 174.57 | 1,123 | 307.87 | 271 |
| 72 | 2,112 | 1,843 | 407.50 | 1,311 | 317.69 | 255 |
| 73 | 848 | 1,386 | 275.40 | 1,836 | 390.51 | 264 |
| 74 | 1,029 | 2,301 | 443.84 | 2,395 | 362.56 | 247 |
| 75 | 951 | 2,104 | 595.43 | 2,385 | 332.18 | 157 |
| 76 | 1,973 | 2,419 | 1,122.39 | 3,720 | 373.45 | 138 |
| 77 | 2,932 | 1,541 | 1,654.61 | 3,954 | 401.86 | 81 |
| 1978 | | | | | | |
| First half | 857 | 596 | 588.37 | 3,091 | 247.75 | 42 |

Source: Department of Customs

Table 10: Wholesale Price of Rice

(Unit: Baht Per ton)

| Types of rice | 1978 | | % Change |
|---|---|---|---|
| | July | August | |
| First grade paddy rice | 2,550* | 2,559* | +0.35 |
| 100% milled rice | 4,725 | 4,725 | - |
| 5 % milled rice | 4,350 | 4,350 | - |
| 5 % Parboiled rice | 4,316 | 4,447 | +3.04 |
| A1 Super broken rice | 2,708 | 2,729 | +0.78 |
| 10% milled rice | 3,918 | 3,816 | -2.60 |
| 15% milled rice | 3,836 | 3,724 | -2.92 |

Note: * Baht Per Kwien

Source: Monthly Report, Bank of Thailand 1978

Table 11. Export Price of Rice (F.O.B.Bangkok)

(Unit: US$/ton)

| Types of rice | 1978 | | % Change |
|---|---|---|---|
| | July | August | |
| 100% milled rice | 400.97 | 381.45 | -4.87 |
| 5 % milled rice | 386.52 | 366.45 | -5.19 |
| 10% milled rice | 366.94 | 346.45 | -5.58 |
| 15% milled rice | 358.10 | 341.45 | -4.65 |
| A1 Super broken rice | 210.97 | 185.00 | -12.31 |
| 5 % Parboiled rice | 383.77 | 370.16 | -3.55 |

Source: Monthly Report, Bank of Thailand 1978

Table 12. Wholesale and Export Price of Rice

| Type of rice | 1979 | | % Change |
|---|---|---|---|
| | October | November | |
| Wholesale Price (B: ton) | | | |
| 1st grade paddy | 3,048 | 2,959 | -2.92 |
| 5% white rice | 5,246 | 5,139 | -2.27 |
| 5% parboiled rice | 4,446 | 4,169 | -6.23 |
| Export price, F.O.B. (US$: ton) | | | |
| 100% white rice | 377.5 | 378.3 | +0.21 |
| 5% white rice | 362.5 | 363.3 | +0.22 |

Source: Monthly Report, Bank of Thailand 1979

Table 13. Number of Milling Units Based on Total Production/Day and Machine Horsepower

| Part of Thailand | Tons/Day | | | | Machine Horsepower | | | |
|---|---|---|---|---|---|---|---|---|
| | 0 - 30 | 31 - 60 | over 60 | total | 0 - 30 | 31 - 60 | over 60 | total |
| The North Easthern | 15,641 | 89 | 41 | 15,771 | 15,240 | 355 | 176 | 15,771 |
| The Northern | 8,275 | 115 | 22 | 8,412 | 7,695 | 393 | 324 | 8,412 |
| The Central | 4,322 | 153 | 60 | 4,535 | 3,499 | 627 | 409 | 4,535 |
| The Southern | 4,438 | 4 | 1 | 4,443 | 4,329 | 75 | 39 | 4,443 |
| Total | 32,676 | 361 | 124 | 33,161 | 30,763 | 1,450 | 948 | 33,161 |

Source: Offered by Department of Agriculture, Ministry of Agriculture and Cooperatives. Bangkok, Thailand.

Table 14: Milling Yields of Paddy in Thailand

A. The Average Milling Yield of the Pilot Rice Mill

| Variety | Head Rice % | Broken No.1 % | Broken No.2 % | Recovery % | Bran % | Husk % |
|---|---|---|---|---|---|---|
| Khaomali | 54.78 | 4.18 | 8.58 | 66.08 | 4.96 | 28.78 |
| Khaotahang | 57.60 | 4.40 | 6.75 | 68.50 | 4.76 | 26.81 |
| Khaonangpraya | 58.26 | 4.63 | 5.66 | 68.56 | 4.23 | 27.20 |
| Khaosetthee | 59.15 | 3.67 | 7.00 | 68.60 | 5.88 | 25.60 |
| Khaotong | 54.98 | 4.92 | 7.84 | 67.60 | 5.68 | 26.76 |
| R. D. 1 | 51.30 | 8.85 | 5.35 | 65.16 | 4.68 | 30.15 |
| R. D. 5 | 52.66 | 4.20 | 10.40 | 67.26 | 4.83 | 27.95 |

Note: Average impurity 1.68%

Source: Offered by Department of Agriculture, Ministry of Agriculture and Cooperatives, Bangkok, Thailand.

B. The Average Milling Yield of Rice Mills in Thailand

| Grades of rice | Milling yield % |
|---|---|
| 5% white rice | 40.139 |
| A 1 super brokens | 18.829 |
| C 1 brokens | 6.649 |
| C 3 brokens | 1.13 |
| Milling yield | 66.753 |
| By-products | |
| Fine bran | 6.746 |
| Coarse bran | 2.985 |
| Husk | 23.516 |
| Total | 100.00 |

Source: Bangkok Metropolitan Bank

C. The Average Milling Yield of Soon Hua Seng Rice Mill

| Grades of rice | Milling yield % |
|---|---|
| 100% head rice | 36 |
| Big brokens | 6 |
| Medium brokens | 6 |
| Small brokens | 18 |
| Milling yield | 66 |
| | |
| By-products | |
| Fine bran | 8.4 |
| Coarse bran | 3.6 |
| Husk | 22 |
| Total | 100.0 |

Source: Offered by the Mill

D. The Milling Yield of Chachoengsao Co-operative's Rice Mill

| Grades of rice | Milling yield % |
|---|---|
| 5% White rice | 48 |
| Big brokens | 4 |
| Medium brokens | 10 |
| Small brokens | 4 |
| Average milling yield | 66 |
| | |
| By-products | |
| Fine bran | 7 |
| Coarse bran | 3.3 |
| Husk | 23.7 |
| Total | 100.0 |

Source: Offered by the Mill