PD-AAP-028
ISN: 33859

NORTHEAST RAINFED AGRICULTURAL DEVELOPMENT PROJECT

USAID Contract No. ASB-0308-C-00-2050-00

QUARTERLY REPORT NUMBER FIVE

July, August and September, 1983

UNIVERSITY OF KENTUCKY TECHNICAL ASSISTANCE TEAM

JOHN RAGLAND, Chief of Party

IAIN CRAIG, Cropping Systems Specialist

CRAIG INFANGER, Agricultural Economist

493-0308/53

PDAAP 028

QUARTERLY REPORT NUMBER FIVE

FOR

July, August and September 1983

USAID Contract No. ASB-0303-C-00-2052-00

Entitled "Northeast Rainfed Agricultural Development Project"

University of Kentucky Technical Assistance Team

John Ragland, Chief of Party

Iain Craig, Cropping Systems Specialist

Craig Infanger, Agricultural Economist

PROJECT INPUTS

Personnel - One of our two secretaries resigned. A replacement has been selected and DTEC approval has been requested. Four short-term technical consultants have been requested for the following areas: information management, village water resource development, village common lands management and a marketing specialist. Candidates for these positions are being identified.

Despite two of the four long-term technical assistance team being fluent in Thai, there is already a shortage of translator-interpretor services available in the staff. The arrival of short-term consultants will cause this problem to become a major constraint. Therefore, NERAD's project management is requesting that another interpreter/translator position be established. Please advise us of the steps necessary to make a formal request for this position.

Khun Pisarn, the training specialist, begins work October 1. A first draft list of roles for this specialist is included in this report as Appendix 1.

Equipment Acquisition - A microcomputer system has been purchased with delivery and training scheduled for the week of October 10. Out of four bids submitted only one company (Digital Data Co. Ltd. of Bangkok) met every specification. It was however, 40 percent over the lowest bidder who met every specification except the printer would only prin 131 characters per line, where 133 characters had been specified for some obscure reason. On the spot negotiations by DTEC procurement agents resulted in the bidder, reducing his bid to just under what was initially the lowest bid. The successful bidder will supply a Super-brain II Desktop Computer System consisting of the Model 30 VPU Compustar processing unit and 10 MB Winchester DSS hard disk storage unit. The system uses CPM 2.2 disk operating system and can operate stand-alone or be configured as a multi-user network when additional units are needed by the project or NEROAC. A second processing unit is scheduled for purchase in FY84. The system promised to be adequate for the database and management functions of the project.

Building Construction: Construction of the three houses began August 27. The contractor said they would be finished in 90 days from the beginning of construction. To date the foundations and structural steel have been mostly assembled.

Detailed blueprints for the project headquarters building are being prepared but no date for bid submission has been set. Construction of this building is badly needed because all NERAD personnel will be moved into the NEROAC Administration Building soon. The need to rush construction of the office building is illustrated by the fact that all four field managers are scheduled to share one office. The field managers' support staff will be officed in the hallway.

The vacated space is to be occupied by regional Department of Agriculture personnel.

PROJECT OUTPUTS

Introduction - The three interdepartmental workgroups established a year ago to implement and coordinate project components have been quite busy this quarter. There appears to be a willingness to move more and more of project planning and implementation into these interdepartmental workgroups. NERAD management is very pleased with this trend. For these reasons this report will focus largely on those parts of the project being handled by the workgroups.

Village Water Resources Management W.G. - The group held a four day study tour and one day planning session August 22 to 26. Weirs, submerged dams, storage tanks, modified shallow wells and fish ponds were visited in Changwats Khon Kaen, Chaiyaphum, Roi Et and Sri Saket. Potential sites for development of a natural spring and a small scale pump irrigation project were also included in the tour. A complete list of sites visited and summary of the workgroups discussions are shown in Appendix 2.

The main decisions coming out of our planning session, which was chaired by Khun Surachit of DLD, were to:

- Conduct a RAT Team assessment of village water needs in December 1983. This will be in combination with the Cropping Systems RAT team and confined to the four principal villages where cropping Systems trials and demonstrations are in progress
- Field managers will catalog existing water resources and their usage as background for the December assessment.
- A meeting would be sought with the engineering division of DLD to seek improvements in their responsiveness to the NERAD project. Several construction projects such as land leveling and swamp

rehabilitation have fallen behind schedule because the design and engineering planning has not been completed.

The workgroup met with DLD's engineering division on August 31; the day prior to NERAD's last National Committee meeting. The chief and his staff were extremely responsive to Dr. Utai's requests with the following assurances and decisions coming from the meeting:

- DLD thoroughly understands and accepts the project philosophy of "bottom-up" involvement of farmers and villagers.
- Ditto for interdepartmental planning and project implementation.
- All construction planned for FY82 and FY83 that has not been completed will be completed in FY84.
- All construction previously planned for FY84 or resulting from the December RAT teams would be constructed in FY84.
- Construction planned and/or sited in the NERAD project paper are subject to alterations or cancellation at the recommendation of the Village Water Resources Management Workgroup; assuming concurrence of NERAD project management.
- Construction contracts can be written with village groups specifically formed to rehabilitate a swamp, construct a weir or dig shallow wells.
- U of Ky Technical Assistance Team was asked to provide short-term assistance to the DLD Engineering Division to help with designs and organizing villages for construction projects. In the words of the assistant division chief "Sometimes we need an outsider's views because when you look at something every day, year after year, you may become blind to the opportunities".

Within the village water resources component, one of the most promising technological improvements in the water diversion weir developed by the KKU-New Zealand project. Their design improves on the traditional wood-mud weir built by villagers and concrete weirs built by various RTG departments. Villagers have long recognized that weirs can reduce the most important source of risk in rice production: water control. A well-designed and sited weir improves water availability and control in adjacent paddies and thereby improves yields and encourages the use of fertilizers and other inputs.

The economics of the KKU-New Zealand design is very attractive at the farmer level. Construction costs have averaged 50,000 ฿ (approx. 10,000 ฿/meter width) for weirs which will divert water into an average of 300 rai of adjacent paddy. These costs include all materials and construction supervision but no construction labor or consultant salaries. The average increase in production has been about 10% or 5 tang/rai in the Khon Kaen area. At 1982 prices of 30 ฿/tang, the gross annual benefits from rice production are about 45,000 ฿ (300 rai x 5 tang/rai x 30 ฿). There are additional possible benefits from fish production and gardening utilizing stored water during the dry season.

For NERAD, construction costs for the KKU-New Zealand weir will undoubtedly be higher than 10,000 ฿/meter width since NERAD operates in a different institutional setting. However, even at a 50% increase in construction costs, the economic feasibility is still favorable and the incentive for farmer participation is positive. What is needed now is a program to exploit this technology with the NERAD farming systems work.

Village Common Lands Management Working Group - This group held its first meeting separate from the departmental coordinators on September 7 - 8 at NEROAC. All members of the Working Group (RFD, DOLD, DOA, DLD, and DOAE)

were present and the session was chaired by Khun Amnat, RFD. Presentations were made on the pasture improvement programs conducted by the RTG Community Development Dept., the World Bank-DOLD pasture improvement project, and the KKU forage project. Following discussion of these related projects, the Working Group toured a DOLD Field Station to observe seed and forage improvement programs and a USAID sponsored demonstration project on intercropping eucalyptus, cassava, and hemata.

From previous experiences and the discussions/tour, most members of the Working Group recognize the importance of the common lands in the Northeastern farming system and is aware of the major productivity constraints and management problems. All commonly used resources will characteristically suffer from overuse and underinvestment. The common lands in the Northeast are typical of this type of common property resource. Thus, members of the Working Group repeatedly identified management and responsibility to be a key factor that must be addressed in any plans for NSRAD-sponsored common land research and education.

After a long day of discussion about common land problems and possible research efforts, the Working Group tentatively concluded that:

(1) FY84 common land improvement activities already included in the GIP (tree nurseries/woodlots, pasture improvement) should be carried out as planned;

(2) A preliminary assessment of the existing common lands in each tambon should be undertaken in October - November;

(3) Possible pilot projects for common land areas during FY84 should be identified before the next Working Group meeting; and

(4) The next Working Group meeting will be in December. The secretary to the Working Group, Dr. Sawat, and the

TA Team are presently drafting the questionnaire necessary to initiate efforts (2) and (3) through the respective Field Managers and cooperators.

If these initial activities and plans are completed as scheduled, the Working Group should be in a good position to benefit from the work of the consultants requested in the last fiscal period (Appendix 2, Quarterly Report Number Four).

Cropping Systems Working Group - The MOAC Departments concerned and individual members of this workgroup have continued with the implementation, monitoring and evaluation of the cropping system (C.S.) trials initiated earlier this year. The results (both economic and agronomic) of the pre-rice crops have now been collected and are being compiled in the respective Changwats prior to being sent to NEROAC for detailed analysis.

Anecdotal reports on the performance of both the DOA and the RAT (rapid assessment technique) trials would indicate extremely variable results both within, but more especially, across Project Tambons. This is as expected considering the extremely variable rainfall patterns experienced within the Region this year. Detailed results of the pre-rice crops along with results of the rainy season crops will be reported in the next Quarterly Report.

It was decided by the C.S. sub-group session at the last NERAD National Committee meeting to call a meeting of the Working Group to plan C.S. activities for FY84. This meeting was duly held on September 9 at NEROAC. The meeting was chaired by Khun Chalerm of DOA and four major objectives were tabled for consideration:

I Evaluate, from the process point of view, the C.S. trials and the RAT activities initiated in FY83.

II Plan and prepare an action plan for FY84 C.S. activities.

III Better define the 'Principal Village' concept as currently applied to C.S. activities.

IV Further develop a strategy to better integrate C.S. activities with other NERAD activities into the overall farming systems approach adopted within the Project.

I. Changwat presentations of both the DOA and the RAT C.S. trials were made with emphasis on the problems encountered and the lessons learned from the first crops in the systems. It was generally agreed that 1983 had been a problem year as regards the pre-rice crop due to the unusual rainfall patterns in the region. It was emphasised, however, that high rainfall variability characterises the crop production environment each year in the Northeast. For this reason, cropping systems which did not perform as expected this year should not be treated as failures but rather as valuable sources of information to identify which systems may have potential in future years under a different rainfall pattern and how current systems might be modified to overcome the problems encountered this year.

It was apparent during the C.S.trials presentation and discussion session that a significant proportion of the working group members felt somewhat constrained in their activities by the USAID policy on pesticide use within the Project. The meeting was informed that a USAID pest control consultant would shortly be visiting the Project and it was agreed that his work should include an assessment of this problem. Safe use of pesticides (human and environmental) was emphasised as the basis for the current pesticide use policy within NERAD and to this end further information, precautions and recommendations for chemicals approved for use in the Project were distributed. (An English language version of these appears in Appendix 3).

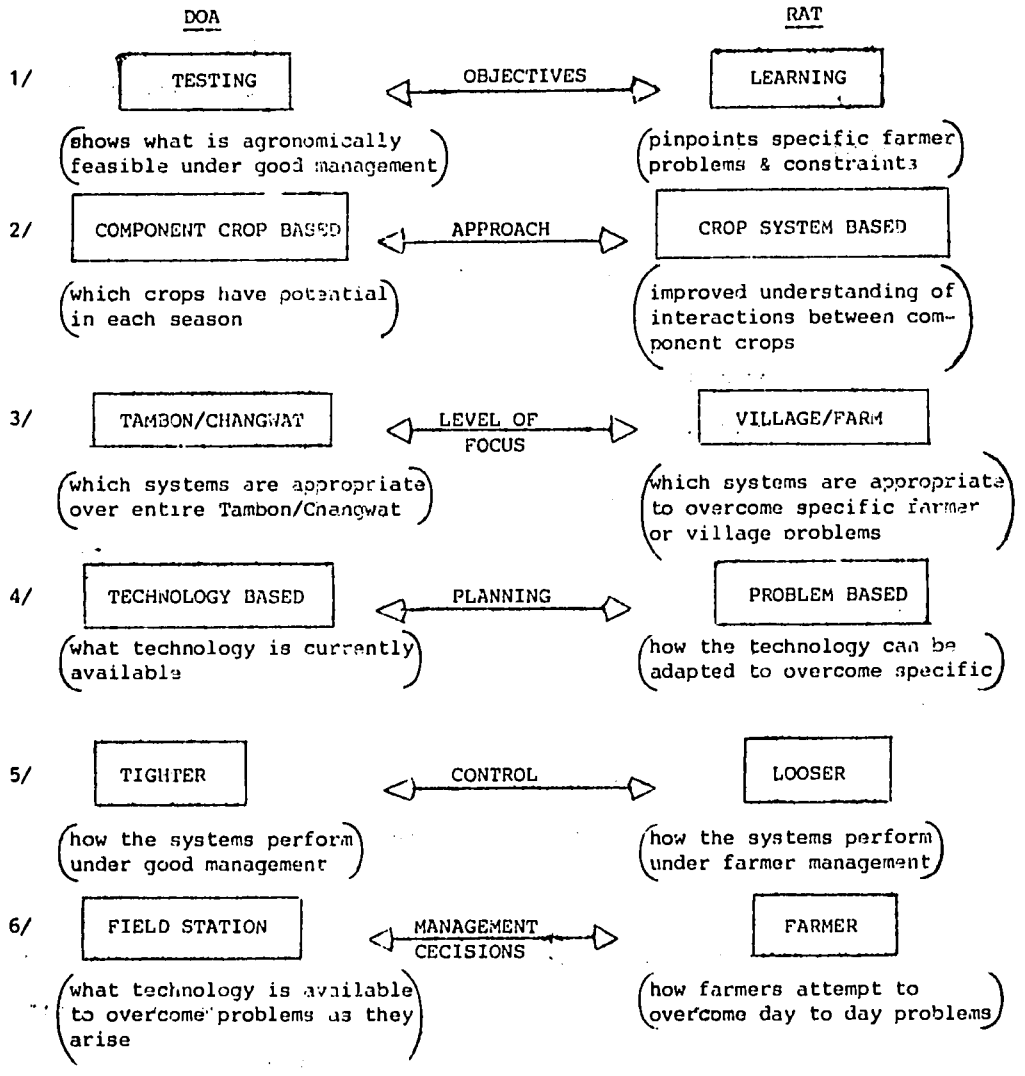
A brief summary of last years RAT process was also presented to the working group. The presentation focussed on the benefits and shortcomings

of the approach with a view to suggesting possible modifications for future iterations within the C.S. component of the Project. A more detailed report contained in a project working paper is presented in Appendix 4.

II. It was generally agreed by the working group to use the RAT approach in the implementation of C.S. trials for FY84. An important resolution of the meeting however, was that further effort should be placed on integrating the RAT and DOA approaches with the eventual goal of developing a single approach replicable throughout the entire region.

Discussion revolved around the principles presented in the following figure:

Difference in emphasis of the DOA and the RAT Cropping System Trials and the type of lessons learned from each approach.



In order to further aid integration of the two approaches it was tentatively decided to schedule another meeting to discuss detailed results of this year's trials once these are available.

III. It was decided that the principal village (PV) concept as currently applied to C.S. activities was useful. There was some problem, however, deciding how the tambon-wide trials of the DOA relate to the concept. It was decided to establish one PV per project tambon (total 9) as a 'pilot' area for integrating all Project activities.

It was also suggested that somewhat different strategies should be adopted for last years four PV's and the five new ones for FY84. A RAT assessment of last years trials including the partipipating farmers was proposed as a means of better defining:

- future policy for PV activities
- participating-farmer selection criteria
- role of the PV for C.S. activities
- means of better integrating the C.S. with other project activities

IV. All project working groups now have activities scheduled for FY84 and improved integration of these various activities will become a major determinant of the overall success of NERAD. It was suggested that the C.S. working group has a key role to play in this respect for the following reasons:

- The C.S. working group already has one year's experience of activities and is thus in a better position to begin thinking about integration.

- The C.S. working group has greater flexibility in the location of it's activities over both Water Resources which are limited by physical constraints and Common Lands which are long established and further constrained by socio-economic factors.

Budgetary flexibility of the C.S. working group is probably the greatest of all working groups.

C.S. work has for a long time made use of a systems approach to research and research workers are therefore probably better prepared to extend this approach to integrate other Project activities in a holistic manner.

The meeting resolved to initiate FY84 activities with a RAT training workshop to be held at NERDAC in the week beginning December 28th, 1983. This will be followed by RAT village assessments the following week.

Economic Studies Support - NERAD contains a large and vital economic component that should provide important support to the cropping systems work and other research and development activities. During this quarter considerable time has been spent by the TA Team Agricultural Economist reviewing and assessing the economic studies support. Responsibility for the economic studies is shared by the Office of Agricultural Economics (OAE) and the Department of Cooperatives Promotion (DCP).

Within OAE, the Research Division is conducting two kinds of economic studies: (1) Farm recordkeeping, planning, and decision making and (2) Analysis of improved farming systems. To date virtually all resources have been devoted to (1).

The OAE farm recordkeeping effort is an ambitious attempt to collect detailed farm budget data which will generate the coefficients for a linear programming model of Northeastern rainfed farms. The ultimate result of the linear program is anticipated to be a set of optimal farm plans and budgets by tambon for each NERAD Changwat.

The recordkeeping component involves 240 farmers (30 per tambon for the original 8 tambons) and a detailed "Monthly Farm Recordkeeping Book". This record book is nearly 80 pages long and calls for detailed

daily information on farm and family income, expenses, labor use, production, marketing, debt service, and investments. A 2-3 man team from OAE/Bangkok visits each changwat monthly and assists farmers in completing the record book. All record books are then collected and returned to Bangkok for tabulation, coding, card punching, and computer analysis.

As of September, OAE has completed the tabulation on record books for two of the eight tambons for the last crop year (April - March). For the current year, tabulation is approximately 20% complete through August.

OAE has forwarded several requests designed to expedite the tabulation and eventual computer analysis of farm records: (1) A programmer to design and write the analytical program needed to handle the farm record data; (2) A dumb terminal for OAE/Bangkhen intending to supply access to the MOAC Univac Computer through a proposed ASEAN multiplexer-modem; and (3) Overtime allowances for field team work on record tabulation.

It seems clear that if personnel and resources are ever going to be available within OAE for economic analysis of improved farming systems, some of the existing constraints must be overcome. Further discussions are planned with Dr. Supote, Director of the Research Division.

The OAE also contributes to economic studies support through the mini-evaluations conducted by Dr. Baantern's Division. At the last NERAD Progress Review Meeting, Dr. Baantern reported on mini-evaluations completed for improved rice varieties, compost production, and native poultry production. A summary of these is included as Appendix 5. Currently underway are mini-evaluations on fruit tree production and shallow well construction.

The OAE approach to the mini-evaluation is methodical and professional. The objectives are to isolate particular activities within the NERAD

project and attempt to evaluate performance, identify problems, and suggest recommendations for improved performance. To accomplish the mini-evaluation objectives, a small team of OAE personnel visits selected sites and administers a brief questionnaire to randomly selected participants. Field observations and discussions with agency representatives yield additional information. Analysis is completed in Bangkok and results are reported and discussed at NERAD Progress Review meetings.

Mini-evaluations are an innovative concept within NERAD and closely related to the more familiar monitoring characteristic of most other USAID and other donor projects. There are important differences and these are summarized below:

COMPARISON OF NERAD MINI-EVALUATION AND MONITORING ACTIVITIES

Item	Mini-Evaluation	Monitoring
OBJECTIVES	1. Evaluate performance	1. Monitor implementation
	2. Identify problems	2. Identify problems
	3. Make recommendations	3. Make recommendations
ORIENTATION	1. Technology package orientation	1. Program management orientation
	2. Qualitative:results VS expectations	2. Quantitative:planned VS actual
	3. Farmer participant orientation	3. Agency-program orientation
INFORMATION SOURCE	1. Farmer participants	1. Agency representatives
	2. Agency representatives	2. Farmer participants
	3. Selected tambons	3. All tambons
SUBJECT MATTER	1. Selected "technology packages" as identified by National Committee	1. All NERAD field activities
WHEN	1. As needs are identified by National Committee	1. After every Thai fiscal period

Item	Mini-Evaluation	Monitoring
CONDUCTED BY	1. OAE	1. NEROAC
METHODS USED	1. Questionnaire/Interview 2. Field observation	1. Interview 2. Field observation
REPORT TO	1. National Committee	1. National Committee
HOW RESULTS ARE USED	1. Research component re-design or modification	1. Program implementation modification

Mini-evaluations and monitoring both provide important information to project management. Since their objectives and orientation differ so markedly, they are not duplicative.

The third part of economic studies support is the marketing research being conducted by DCP. Surveys are underway or planned for several marketing areas: localized price trends, farmers' market feasibility, group procurement of inputs, and livestock marketing. The price data being collected by DCP are amphur-level observations and will be very useful for partial budget analysis of cropping system trials.

The marketing survey work can benefit from short-term consultant assistance on survey design (modification, analysis, and feasibility determinations). The current TA Team simply does not have the expertise necessary to competently assist DCP on several points. This consultant request is still pending.

Soil Fertility Status of the Northeast - In the last quarterly report (Apr. - June, 83) it was stated that "Collecting and organizing crop response and soil characterization data will continue as a high priority effort in the project. This is necessary in order to understand the factors accounting for the present fertility status and to predict future conditions and needs".

The previous quarterly report also stated that most soils in the Northeast were relatively fertile and high producing when first cleared of forest but declined rapidly, due to the loss of organic matter and removal of plant nutrients by crop production. The term "relatively fertile" can only be applied to the surface soil because the geology of the region (to be discussed later) precludes naturally rich soils in the Northeast except where deep-rooted trees concentrate plant nutrients in the top-soil through leaf and litter drop. The light sandy texture of Northeastern soils favors rapid organic matter and plant nutrient removal once the land is shifted from trees into cropping. Conversely, the utilization of nutrients added as manure or commercial fertilizer to annual crops tends to be very efficient. What is a disadvantage in one regard becomes an advantage in another.

How rapidly yields decline initially, where they plateau, and finally decrease to the point that the land is either abandoned or inputs of organic matter and plant nutrients begin, are major questions to be examined by this part of the Project. The patterns that emerge will differ for upland, paddy soils and among crops. A single example of the yield declines comes from the current Ley Farming Project of the MeKhong Committee and Khon Kaen University. To make way for the Ubolratana Dam in Khon Kaen province farmers were resettled to a forested uplands area (Korat Soil Series). Intensive clearing of uplands to grow cassava has occurred in the past ten years. Farmers commonly say that cassava yields on land just cleared from forest were 4 ton/rai, declining to 3 ton in the second year, 2 ton in the third year and 1 ton the fourth year. From this point yields seem to stabilize.[1/]

1/ T. Gibson, Notes for Field Day on 6th October 1983, Ley Farming Project/MeKong Committee Faculty of Agriculture Khon Kaen University.

Best Available Document

How much organic matter and soil fertility has been lost since clearing the trees will be estimated by comparing present soil test values of farmers' fields with soils still forested. The small packets of primary forest that still remains should provide enough locations to allow reasonably good estimates of what was once region-wide.

Sixty six soil samples were taken from farmer fields as part of the March 83 RAT assessment for cropping system trials. These contained the following organic matter and plant nutrients:

Changwat	pH 1:1 (water)	OM (%)	Available P (ppm)	Available K (ppm)	Sample No.
Nakorn Phanom	4.65	.66	6.1	15.7	11
Sri Saket	4.73	.28	11.1	11.3	16
Chaiyaphum	5.33	.36	12.3	37.6	21
Roi Et	5.07	.47	8.9	19.2	19

Details of these data are presented in Appendix 6 of the quarterly report for Jan.- March, 83.

Four 0 - 15 cm. soil samples were collected from forested areas in Nakhon Phanom and Sakon Nakhon as a measure of the stores of organic matter and available nitrogen nutrients that were present when the land was initially cleared. The results were:

Location	pH 1:1 (water)	Organic Matter (%)	Phosphorus (ppm)	Potassium (ppm)
1	5.2	4.18	1.0	100
2	5.1	4.33	1.0	73
3	6.2	4.10	3.5	135
4	5.1	2.35	5.0	33

The samples were tested by Khun Ladda of the NEROAC soil testing laboratory using standard DOA-Thailand procedures.

Location 1. Forest along Si Song Khram to Tha Uthen highway between Km. post 23 and 24, near Ban Lao, Ampore Si Song Khram, Changwat Nakon Phanom, West side of highway.

Location 2. Ditto except East side of highway.

Location 3. Forest along Ampore Pla Pak to Ban Kut Ta Kai road, Ampore Pla Pak, Changwat Nakon Phanom (a laterite soil).

Location 4. Forest along Sakon Nakhon to Galasin highway.

Many more forested soil samples must be examined before the working hypothesis will be adequately tested. When that is completed, estimates of the quantities and value of organic matter and plant nutrients removed from soils of the Northeast will be made. If possible, the value of the crops produced, since the land was cleared, will be compared with the value of organic matter and plant nutrients lost. From this information it should be possible to predict the quantities and cost of organic matter and plant nutrient replacement programs that would:

1. Maintain crop yields at current levels
2. Improve yields without regard to rebuilding the soil
3. Improve yields and rebuild stores of organic matter and plant nutrients to some fraction of their original level when the land was cleared of forest.

Presently, most farmers are just trying to maintain current yield levels and no more. My experience (one year in Thailand) is that generally rice and field crops are grown on the same land year after year with little or no inputs of organic matter or fertilizer until yields become so low that they are unacceptable. For rice this seems to be around 200 Kg/rai. When this happens the farmer begins buying fertilizer and sometimes manure. Increasingly they are making compost to add to the soil. Glutinous rice, which is everyones main subsistence crop, gets first priority for any inputs of soil enrichment. At first only the poorest yielding spots are treated but a sizable minority, especially in the Sri Saket Tambons, are beginning to add fertilizer to the entire field.

(Fertilizer seems to be regarded as a medicine rather than a production input.)

Ask any farmer in the Northeast, who uses little or no fertilizer, the question "why" and he will either say "I have no money" or "I can't afford it". Yet when his subsistence is threatened he can then afford it. An investigation of this decision-making process would be very interesting and potentially valuable in finding the key to improving crop yields in the Northeast.

It appears that the mind-set of "crops for subsistence" versus "crops for sale" is so ingrained that fertilizer demonstrations, training or appeals to increased yield through more production inputs are not heard. Only when the family's food supply is threatened does the teachable moment exist for learning how to increase yields. This suggests that people who want to see higher yields through greater use of fertilizer and green manures should target those farmers whose yields have fallen below acceptable levels and encourage enrichments large enough, not only to halt declining yields, but to take advantage of the steepest part of the response curve.

Let no one think this will be an easy task, as illustrated by a statement taken from a 1958 end-of-tour report by a USOM sponsored soils specialist [2/], "The need for commercial fertilizer is a result of aging agriculture. In Thailand, the adoption of fertilizer practices has trailed the plow by many generations. The efficient use of the manures and fertilizers is one of the most important technical factors in food production. Much of the land is impoverished and restorative measures are long overdue. The use of commercial fertilizers alone is not the answer to the problem; timing, green manuring and proper soil and water

---

2/ Ernest V. Staker, Soils Advisor, Soil and Soil Improvement work in Thailand. USOM April 1958.

management must be taken into consideration. It is inconceivable that thousands upon thousands of farmers in Thailand can continue raising crops with such low yields when by using small amounts of fertilizer and other practices, they can increase their yields from 50 to 200 percent. Such low production is incompatible with modernization in non-agricultural fields. To leave the farmer behind would be disastrous to the Kingdom".

The point is that Stoker said it perfectly, yet 25 years later after thousands of DOA soil fertility experiments, FAO-sponsored on farm fertilizer demonstrations in every tambon and many foreign assistance fertilizer programs the farmers are still growing crops with inconceivably low yields by Western norms. It appears that farmers have a fairly good appreciation of how much fertilizer will increase yields but are convinced they cannot afford its cost unless their food supply is threatened.

It is true that fertilizer costs in Thailand, and particularly in the Northeast, are higher than in the West. A comparison of the retail cost of 16-20-0 in Lexington, Kentucky and Khon Kaen, Thailand revealed the cost here to be approximately 15% higher. With international rice prices set mainly in the USA, where fertilizer costs are less, perhaps the Northeast farmer is making a wise economic judgment in not buying fertilizer unless the family food supply is at stake. However, I am convince that the resistance to fertilizer use is much more complicated than price alone.

The higher price of fertilizer in Thailand is usually attributed to all fertilizer ingredients having to be imported. It is encouraging to follow the present government's efforts to organize a National Fertilizer Corporation for the production of the basic fertilizer ingredients required for mixed fertilizers. Plans call for annual production of at least 200,000 tons of nitrogen, 200,000 tons of phosphate and 100,000 tons of potassium (See Appendix 6). The projected use of all fertilizers in Thailand for 1983 is 965,000 tons and is growing at about 7 percent

annually (Appendix 7). The National Fertilizer Corporation plant will be located near Rayong and is scheduled to begin production in late 1987 (Appendix 6). The location was selected to use the natural gas from the Gulf which will supply the hydrogen for production of ammonia. Ammonia is the basic ingredient for the formulation of all commercial fertilizers containing nitrogen.

If this facility comes on stream as scheduled it should be a benefit by reducing the price disadvantage Northeast farmers now face. It is worth noting, however that a 1966 report of the Mekhong Committee[3/] states, "At the moment there is no productive manufacture of chemical fertilizers in either Laos or Thailand. However, Thailand has under construction its first nitrogen plant which is scheduled to be in production for the 1966 crop year. It is located in a northern province (Lampang) at Mae Mon and near a large supply of lignite. The capacity of the plant is planned for 100 tons per day of ammonia, from which 60,000 tons of ammonium sulfate and 20,000 tons of urea can be produced annually." This plant was never successful and was eventually shut down (Appendix 7.). The manufacturing technology to be used by the Rayong plant should not be a problem because they appear to be the standard manufacturing procedures used worldwide.

By way of summary it is true that fertilizer use in Thailand is increasing; 9,349 tons in 1950, 96,000 tons in 1964 and 965,000 tons in 1983. This, however, appears to be miniscule compared with what is needed for general yield increases. In the Northeast, farmers use fertilizer as a "medicine" to prevent yields from falling below subsistence requirments. Each year more and more land declines to the point that medicine (fertilizer) has to be administered. In the Northeast the growth in fertilizer use is mainly due to this factor, rather than using

---

3/ Pa Mong Project, Phase I Report Volume 4, Appendix IV March 1966, Prepared for the Mekong Committee by Bureau of Reclaimation U.S. Department of the Interior.

fertilizer to capture part of the high yield potential that exists.

It may seem inconsistant to enumerate so many soil factors limiting yield and then talk of the region's potential for high yields. Nevertheless, the potential is very high in the North. This is true because of a near perfect set of sunlight, temperature and humidity conditions for rice, cassava and kenaf production. Given such a large expense of near level land as the Korat Plateau, farmers in the West would invest in lime, fertilizers and green manures to correct the soil fertility problems, supplement rainfall to remove the main barrier to high yields of rice, and provide the drainage needed to prevent losses to upland crops from water-logged soils[4/] (currently a major problem to upland crop production).

However, what is possible may be neither feasible nor wise. Certainly many farmers in the West are questioning the wisdom of agriculture with such high production inputs that a couple adverse years due to drought or low prices leads to bankruptcy. Perhaps the issue comes down to what is good for the nation's economy versus what is best for the individual farmer. For Thailand as a nation whose exports are mainly agricultural, higher yields are greatly desired. As a farm family whose food supply (existence) depends on a land holding to produce subsistence crops, avoiding the risk of losing that land must be the first priority. In the opinion of this reporter, significantly higher yields by the Northeast region are not possible without the application of a lot of fertilizer, particularly phosphorus and potassium. It is possible to grow legumes that can produce much of the nitrogen required, however, most soils require additions of phosphorus and potassium before the legume that will fix the nitrogen can grow. So general are the dificiencies of P and K and perhaps sulphur, that Trevor Gibson[1/] states

---

[4/] This rosy scenerios does not take into account the soil salinity problems that limit yields in parts of the Northeast and may grow to be an even larger problem as irrigated agriculture spreads in the region.

that there is no point to sowing legumes in the Northeast unless phosphorus, potassium and sulphur are applied as well.

Data from FAO rainfed agriculture workshop proceedings[5/] support such a generalization, as shown by the following:

Soil Test Levels of Plant Nutrients

Region	N	P_2O_5	K_2O
Central	35	16	256
North	51	18	126
South	45	20	100
Northeast	13	7	56

The inherent fertility deficiencies are obvious. Not shown, but perhaps equally limiting are the low soil contents of soil organic matter (This will be developed further in a later report)

With 1988 being the earliest prospect for real improvements in fertilizer supplies and costs, what are the implications for NERAD? I suggest the following:

1. There will be no dramatic improvements in rice yields from the region as a whole because only large applications of commercial fertilizer to these infertile soils will make this possible. Such is not foreseen in the near future.

2. Carry-over of residual fertility to following crops in a sequential cropping system is a well established fact that is readily understood by the farmers. Although reluctant to apply fertilizer to their rice, farmers do fertilize cash crops which generate capital to pay for this input. Consequently C.S. development may be a feasible way of improving soil fertility and increasing subsistence rice yields through the residual

---

5/ Proceedings on FAO/Thailand National Workshops on Research and Development of Rainfed Crop Production Jan 9-14, 1979, pg. 120-121

fertility from cash cropping before or after rice. The limitation here is that only a small parcel of the total farm is used to grow cash crops in any single year. However, the areas where cash crops are grown are usually rotated about the farm in order to eventually extend the benifits of residual fertilizer to all the rice land.

3. The risk of drought in the Northeast is often given as the reason for such low fertilizer use. Therefore, improvements in water management must be a high priority for NERAD.

4. Continuing the on-farm fertilizer and green manure trials is important in order to educate both farmers and agriculture advisors to the yield improvements possible. If and when better supplies of low cost fertilizers become available, more people will be ready to take advantage of them. Alternatively the government may have to subsidize fertilizer applications as were once done on a massive basis in the USA.

5. Although a lot more work is needed on growing green manures to enrich the soil, a word of caution is in order. In the 1950's and early 60's US Agriculture placed great emphasis on growing green manure crops as a way to increase yields. The practice worked fine in maintaining the fertility of already fertile soils but did little for infertile soils since the green manure crop grew so poorly that there was very little growth to plow into the soil.

A different outcome is possible here, however, because there are some very aggressive legumes that may out perform any of the green manure crops that were available to the US farmer. Some of these, particularly crotaleria, grow so big that farmers have great difficulty plowing it into the soil, using their Buffalo drawn blows. A tool that the farmer can afford is needed to solve this problem.

6. Somehow the farmer needs to be convinced of the value to plowing a green manure crop into the soil versus harvesting and eating or selling it.

Best Available Document

7. The emphasis of NERAD on interdepartmental collaboration and "bottom up" planning holds a lot of promise for better governmental service to the farmers whether or not they ever get lower cost fertilizer supplies.

8. Finally, the cropping systems, village water resource development and village common land work being done through NERAD can do much to prevent further declines in crop production whether the Northeast ever gets lower cost fertilizer supplies or not. To stabilize crop yields in the face of steadily declining stores of soil organic matter and plant nutrients would be a major accomplishment, although not very dramatic in terms of improved farm incomes.

Plan of Work for Next Quarter - The technical assistance team expects the following project areas to occupy much of its time in the October-November-December quarter:

1. Preparations for the Twentieth Anniversary celebration of NEROAC. A picture - narrative booklet, slide show and illustrated talk are being prepared on the NERAD project. The Director Generals of the eight cooperating departments and the US Ambassador to Thailand are the intended audience for these.

2. Assist the conduct of needs assessments by RAT teams for cropping systems and village water management in nine principal villages.

3. Assist in compilation of village common lands preliminary assessment and finalize plans for pilot projects.

4. Get the microcomputer up-and-running, train NERAD staff and adopt software for NERAD use.

5. Assist in the harvest and summarizing of the first year's cropping systems trials.

6. Continue work to characterise the nutrient status of Northeast soils including a review of the regions geology.

7. Harvest and summarise a replicated lime on peanuts and rice experiment.

8. Initiate no-tillage trials with grain sorghum and mung beans.

9. Assist OAE in finding solutions to the current backlog and delays in the farm recordkeeping part of the project.

10. With the assistance of a USAID pest control consultant who will be with the Project for 3 weeks, conduct an environmental assessment for pesticide use within NERAD and set strategy aid guidelines for pest control practices within the C.S. component.

Appendix 1

Training Specialist's Roles
(Tentative)

A. General

Assist project in attaining purposes of NERAD at the village level.

B. Specific (but not detailed)

1. Informal and formal training of village groups in project areas to better understand their development needs and to increase their capacity to manage their individual and group resources
   - emphasis on decision-making
   - emphasis on villager self-confidence and self-reliance
   - emphasis on using NERAD Project and the MOAC's research and extension services offered by it as a resource to the community.
2. Informal and formal training with TEAs, asst TEAs, SMSs and other extension personnel to better understand and assess needs of villagers and to better understand MOAC agencies' resources to meet these needs.
3. Informal orientation of other departmental representatives to village needs assessment and fulfillment.

C. Assist NEROAC staff as do other TA Team

1. Project Director & Deputy Director.
2. Field Managers.

CTA:9/30/03

Appendix 2

Summary of Minutes of Meeting

Village Water Resources Management Working Group

NEROAC Meeting Room: 26 August 1983

The meeting was chaired by the DLD representative Khun Surachit Chaisiri and presided over its opening by Khun Bunyasri on behalf of the project director. After the opening address the chairman has introduced the Village Water Resources Management Working Group that had just recently appointed, comprising:

DLD coordinator	Chairman
Dr. John Ragland, COP UKy TA Team	member
DOAE representative	member
DOF representative	member
DOA representative	member
KKU representative	member
Field Manager of Roi-Et	member & secretary

Dr. Charles Alton's statements given in response to the chairman's request include the followings:

VWRM Goal:

To assist villagers in NERAD tambon to develop their water resources so they can better manage them on a sustainable basis after the completion of the project.

VWRM RAT Team purpose:

1. To assess present village water resource use in the nine NERAD Principal Villages.

2. To indentify water resource constraints which limit present or future agricultural production.

3. To plan with villagers water resource activities for FY84 (27) in the 9 principal villages as a model for future village water resource management in NERAD.

4. To coordinate departments in implementing activities with villagers in an integrated fashion.

VWRM - WG decisions needed:

1. Future meetings of VWRM-WG

   - Action plan for FY84 (27)

   - Budget mostly set; determine flexibility

   - Set meetings for working group

   - Set guidelines for FY85 (28) budget ceilings

2. RAT Team orientation

   - Plan orientation of RAT Team

   - Composition of team: agencies, names, etc.

   - Agreement on village data needed before RAT Team goes out

- Tentative schedule for RAT Team visit to 9 principal villages

- Operating methods of RAT Team

3. Implementation of FY84 (27) water resource activities

- How to involve villagers in activities

  - planning and design
  - operations and maintenance
  - use

- How to focus on long-run village management of water resources

- Decide if any special demonstrations are needed

  - who will conduct them

- How to integrate water resource activities into general Farming System Approach

- Method of reporting, monitoring and evaluating results

Dr. John Ragland took chairman's place for a discussion period as requested by Dr. Waewchak. He proposed to the meeting that the discussion be around what was learned from field visits to various changwat water projects. Both successes and failures would be of a great help to consider NERAD water resources development plan. Everybody was asked to present some ideas regarding the projects visited on the study tour.

Dr. Waewchak began the discussion by presenting a detailed review of the projects visited as follows:.

August 22 tour sites - Khon Kaen:

Site 1 - KKU Faculty of Engineering, Water Resources Development Office in collaboration with New Zealand government-briefings of its program.

Site 2 - Khon Kaen DLD Center together with Land Reform Office and OAE presented briefings on their cooperative rainfed agricultural experiment project (ALRO area at Ban Kham Bon, T. Samran, A. Muang C. Khon Kaen).

- Field observation at the project site - this project is financed by the IBRD loan and jointly carried out by OAE, ALRO and DLD with a consultancy team. The characteristic of the project is of a land shaping type to manage surface water flow including establishment of roadbased furrow system for crop production and runoff collection in tanks. This water will be used for winter vegetable production. The first year operation will cover 210 rai.

Site 3 - Weir structure, Ban Dong Am, T. Khao Suan Kwang, A. Khao Suan Kwang: This weir is about 9 m. in length and about 3 m. in height. It was constructed by villagers under supports and supervision of NZ-KKU team, can serve over 500 rai paddy fields on a basis of gravity irrigation to supplement rainfall in the wet season as well as limited dry season cropping. This type of project needs high participation of villagers from planning, surveying, designing, constructing, operating, and maintaining.

28

Site 4 - Weir structure, B. Na Kho, A. Khao Suan Kwang: This is also a NZ-KKU supported project, a small structure about 5 m. in length and 2.5 m. in height but can serve the area over 400 rai of paddy fields.

August 23 tour sites: Chaiyaphum

Site 1 - Huai Ma Tai (Dead-dog-creek), B. Bua Phak Kwian, T. Kwang Chon, A. Pho Khieo: The old existing weir was constructed by villagers without any government assistance involved. The Field Manager of Chaiyaphum has proposed that this creek should be included in a small-scale water resource development project. It is feasible for construction of several checker weirs along the creek in order to reduce high gravity flows of water and to divert water into larger areas of paddy.

Site 2 - A NZ-government supported project, Amphoe Kaeng Khro, designed and supervised the construction works by a NZ-engineer Mr. Bryan Warboys. This new structure replaces the old weir constructed by villagers but broken down from time to time. The new weir is 8 m. in length, 4 m. in height, contracted cost of ฿197,000 (actual cost ฿120,000:฿100,000 for construction materials and ฿20,000 for labors).

Site 3 - A Kaw Saw Chaw FY1983 project, awarded top outstanding water development project in NE, constructed across Huai Sam Mo at T. Pho Chai, A. Mancha Khiri of Khon Kaen in adjacent to A. Kaeng Khro area of Chaiyaphum. The weir is 30 m. long, 2 m. wide, can serve the area of 1,800-2,000 rai, total construction cost of ฿791,445:฿550,000 for materials and ฿241,445 for labors. The labor rates were ฿50/day for general labors, ฿80/day for skilled labors, labor use of 35-40 man/day for a 75 day-construction duration.

August 24 tour sites: Roi-Et

Site 1 - Canal distribution, 3 kms long, constructed by villagers for second rice cultivation after severe damage by floods, located at Ban Khwang Noi, T. Na Muang A. Selaphum. An 8" water pump was initially loaned to this project by RID on a temporary assistance basis but farmers have not yet decided to purchase it for their own property despite their high affordability rate. Rice yields are considerably high: 900 kg/rai for second rice, 800 kg/rai for seasonal rice, and the maximum yield of 1,300 kg/rai was reported.

Site 2 - Nong Chok, small reservoir adjacent to the Chi river, initiated by the late chief abbot nearly 20 years ago. The recession of flood waters washes its embankment out almost every year. Assistance from NERAD for restructuring the dam was requested.

Site 3 - Natural spring, Ban Sok Muang T. Na Muang, A. Selaphum; the spring originated from the laterite pit and farmers had constructed an earth embankment about ½ km. below sometime ago but it had broken down. This site will be good for only domestic water resource.

Site 4 - Artesian well with electric centrifugal pump, Ban Don Hat, T. Tha Muang, A. Selaphum: Farmers use it as a supplementary water resource in wet season and vegetable production in the dry season.

August 25 tour sites: Si Sa Ket

Site 1 - Modified shallow well, B. Malat, T. Tae, A. Uthumphon Pisai. It is a combination of a shallow hand-dug well and a drilled artesian well. The 7 m. shallow well with concrete casing extended down to laterite layer which was so hard that the well had to be drilled from that point down. In this case the drilling extended 9 m. A strong artesian flow of water was coming up through the drill hole into the hand-dug shallow well part. The well serves over 10 rai of paddy field or dry season crops through pumping, either direct or storing in the nearby pond. It also serves as a domestic water resource for about 100 families in the dry season. Sixteen such wells have been planned in NERAD tambons of Sri Saket for next year.

Site 2 - Farmer's fish pond, B. Tae, A. Uthumphon Phisai. This farmer has put a fish stocking of about 1,000 pla taphian khao (silver common carp) fingerlings in his paddy field pond. The pond itself, at the time visited, is submerged in a waterlogged paddy field.

Site 3 - NERAD fish pond, Nong Lung, T. Tae - the pond was constructed under the Kaw Saw Chaw project encompassing the area of about 40 rai (actual water surface about 10 rai). NERAD has released a total of 84,000 fingerlings on 14 August 1983: 7,600 Nile Tilabia 38,200 indian carp and 38,200 silver common carp.

Site 4 - Public pond, B. Nong Lek, T. Ta Ket, A. Uthumphon Phisai. This pond covers an area of slightly over 10 rai and about 1.5 m. deep. A fish stocking was made last year and reported about 230 kg/rain fish production. The DLD has included this pond in its swamp rehabilitation progrem.

From group discussions which continued until 4 pm. the following conclusions were reached:

1. The VWRM-WG will serve as a core or a headquarters for the NERAD water resources development program.

2. The RAT Team for VWRM is required to be established which will comprise 2 teams i.e. technical and sociological.

3. RAT Team duties will be as follows:

   (1) Identify site, priority and utilization procedures.

   (2) Obtain data on resources required for construction works i.e. labour, skilled local labour, materials, etc.

   (3) Develop procedure and strategy for more inputs and participation from villagers.

   (4) Promote VWRM integration with other projects.

4. Composition of RAT Team for VWRM-WG:

   (1) DLD (engineers & technicians at field level)

   (2) DOAE

   (3) OAE

   (4) DOF

(5) DOA

(6) KKU: - Engineering

- Sociology

(7) Changwat representative

(8) NEROAC/NERAD Management Center

5. Next implementation steps:

(1) The RAT-VWRM will focus on the 4 old principal villages first and will follow the Cropping System RAT Team into the 5 new principal villages after learning from the old PVs' results.

(2) The RAT-VRWM orientation training has tentatively set with the RAT-CS as a result of limitation of time and a common interest on particular activities, the schedules are as follows:

	Activities	Time
1.	Orientation of RATs-VRWM & CS	Late Nov. '83
2.	Visit principal villages	December '83
3.	RAT Team operations in PVs	February '83

Appendix 3

Safe Use of Pesticides: general guidelines for field staff.

Use:

- Always follow manufacturers' directions for use exactly as stated.
- Never mix different types of pesticides except under instructions from the Field Manager.
- Read all instructions on the container with the farmer before issuing a new pesticide.
- Always attempt to be present when farmers are applying NERAD pesticides
- Always have soap and water (seperate from drinking water and never to be used for drinking) available in the field for washing after spraying or in case of accidental contact.
- Don't spray in high winds and always spray from up-wind.
- Never wash spraying eqipment in: public ponds, ditches, near wells or any other places that may cause a public hazard.
- Dispose of pesticide containers only when empty by burying but never close to water sources.

Storage:

- Store all pesticides in a clean, dry place that has no danger of flooding. The storage area should not be excessively hot and should not be near naked flames.
- Keep pesticides out of reach of children and pets and away from: food, drinking water, seeds and fertilizer.
- Never store pesticides in anything other than the manufacturers original container and never re-use empty pesticide containers for any purpose.

In case of accidental poisoning:

- Immediately remove the victim from the source of poisoning.
- Immediately summon qualified medical assistance.
- Follow any precautions in the Tables for that pesticide which caused the poisoning.
- Inform the Field Manager of the incident at the earliest opportunity.

INSECTICIDES

Common name (chemical type)	Commercial names	Acut- LD50* mg/kg. oral	Acut- LD50* mg/kg. dermal	WHO Toxicity class†	Directions for use	Storage recommendations	Toxicity symptoms	Antidotes/other precautions
CARBARYL (CARBAMATE)	SEVIN CARBONOX 85 SAFE 85D SINOVA	500 (rat)	4000 (rabbit)	Moderately hazardous II	Field crops +vegetables: 15-55 g/20 ltrs. of water Fruit crops: 15-30 g/20 ltrs. of water	Keep in safe place, out of children's reach, away from: food, pets, drinking-water and heat.	Sweating, dizziness, headaches involuntary muscle contraction, billiousness, blurred vision, chest pains, diarrhoea, shaking, frothing at mouth, muscle cramp, contracted pupils.	Body contact: immediatel wash with soap & water. Eyes contact: wash with clean water. Ingested: induce vomitti by drinking salty water by placing hand in the throat then take Atropin Sulphate 1/100 grains 2 tablet.
DIMETHOATE (ORGANO-PHOPHATE)	BOOK DITONE TWI DIMETH-OATE DIMETON	215 (rat)	<10,000 (rabbit)	Moderately hazardous II	Normal use: 10-20 cc/20 ltrs. of water Cotton: 50 cc/20 ltrs. of water	Keep in safe place, out of children's reach, away from: food, pets, drinking water and heat.	Drowsy, blurred-vision contracted belly, congested chest, nausea-vomitting, fatigue.	Eye contact: wash with clear water several tim Ingested: Remove patien from field and induce vomitting by drinking salty water or by placi hand in throat then tak pills; Atropine Sulphat 1/100 grains, 2 tablets
DICOFOL (ORGANOCHLORINE)	KELTHANE TWINCIDE M-2 TWINAKRAMITE KELTHAMITE M-77	575 (rat)	1870 (rabbit)	Moderately hazardous II	25-50 cc/20 ltrs. of water For fruit crops, vegetables and flowers. For control of red spider mite and, rust spider mite.	Keep in a safe place, out of children's reach, away from: food, pets, flames and drinking water.	Headache, nausea, vomitting, restlessness, pain at tongue-tip, upper lip and chin, stiff jaws, convulsions.	For doctor: inject Barbiturate (1 cc. 20% phenobarbitone) together with calcium (10 cc. solution 10%) or 10 cc. calcium bromide. Never treat wit morphine.

INSECTICIDES (continued)

Common name (chemical type)	Commercial names	Acute-LD50*mg/kg		WHO Toxicity class +	Directions for use	Storage recommendations	Toxicity symptoms	Antidotes/other precautions
			dermal					
CARBOFURAN (CARBAMATE)	FURADAN CURRATERR	11 (rat)	2550 (rabbit)	Highly hazardous IB	Rice: 4 - 5 Kg./rai	Keep in a safe place out of children's reach, away from: food, pets, flames and drinking water	Headache, fatigue, frothing at mouth, sweating, contracted pupils, blurred vision, stomach pains, vomitting, breathing difficulty.	Eye contact: wash with clean water several times. Skin contact: wash with soap Remove patient from the field, bathe and change clothes Ingested: Induce vomitting by taking salty water or by placing hand in throat then take Atropine Sulphate 1/100 grains 2 tablets.
CYPERMETHRIN (PYRETHROID)	AMBUSH BOOG - 79 BOMBARD SUMICITHROID PYRETOX	4000 (rat)	>2000 (rabbit)	Slightly hazardous III	Normal use: 4-10cc./20 ltrs. of water at 3-7 day intervals Heavy infestation: use same rate at 3 days intervals. (Sticker recommended) Uses: onion, chili, grape, cotton, beans, fruit crops and flowers. Effective for all kinds of caterpillars.	Keep in a safe place out of children's reach, away from food. Bury empty containers	Rashes, itching, skin irritation, sneezing, respiration difficulties (especially in asthmatics), convulsions and paralysis.	Dermal contact: wash with soap and water and change clothes. Eye contact: wash with clean water Ingested: induce vomitting seek medical assistance.

HERBICIDES

Common name	Commercial names	Acute LD50* mg/kg. oral	Acute LD50* mg/kg. dermal	WHO Toxicity class†	directions for use	Storage recommendations	Toxicity symptoms	Antidotes/other precautions
GLYPHOSATE	ROUND UP COWBOY	4320 (rat)	7940 (rabbit)	Slightly hazardous III	Normal use: 200-250cc/20L. of water/0.2 rai should not be mixed with other herbicides.	Keep in a safe place, out of children's reach, away from food, pets and flames	Skin contact: irritation or itching Eyes: smarting and watering eyes.	Wash only with clean water - Sprayer should not be coated with zinc or steel - Should not mix with other kind of herbicide - Skin contact: wash with soap and clean water - Eyes: wash with clean water.
ALACHLOR	LASSO AROSAL ALACHLOR-C.T. ALANEX	1200 (rat)	2000 (rabbit)	Slightly hazardous III	Spraying to be conducted before crop germination: cotton, corn, sugarcane, cassava, peanut, soybean and some kind of vegetables. Sandy-loam: 500-600cc/rai Medium clay: 700-800cc/rai Heavy clay over 4% organic matter: 800-1000cc/rai	Keep away from: flames, seeds and food.	Skin contact: itching, irritation	- Flamable - Avoid skin, eyes and oral contact.
BUTACHLOR	MACHETE 5 G CHELETE	3,300 (rat)	>5000 (rabbit)	Slightly hazardous III	Transplanted rice: 3.2 kg/rai-immediately after transplanting. Broadcast rice (Progerminated seed - technique: 3.2 kg/rai-4 days before broadcashing pre-germinated need.	Keep in a dry place, avoid moisture.	Skin contact: itching and irritation	Skin contact wash with soap and water. Ingested: induce vomitting

* LD50* is a measure of the toxicity of pesticides to mammals. It is a measure of the dose (measured in mg. of active ingredient per kg. of test animal weight) necessary to kill 50% of the test animals, usually rats or rabbits. The lower the LD50 the more toxic is the pesticide

† WHO (The World Health Organisation) has classified pesticides according to the potential hazard that they represent to human health as follows: Class Ia extremely hazardous, Class Ib highly hazardous, Class II moderately hazardous, Class III slight hazardous.

Common name	Commercial names	Acute LD50* mg/Kg oral	Acute LD50* mg/Kg dermal	WHO Toxicity class **	Directions for use	Storage recommendations	Toxicity symptoms	Antidotes/other precautions
DIURON	DIURON ABSF KARMAX 80 DIROX WATATAX VORON SUMMIRON	3400 (rat)	-	Slightly hazardous III	-Spray before emergence of grasses. -Immediately after planting & harvesting Pineapple: 400-500g/80 ltrs of water/1 rai Orange, cassava: 200 g/80L. of water per 1 rai also for cotton, coffee, rubber and banana.	Store in dry place away from direct sunlight and flames.	-	Do not use on other crops not recommended. Other crops can be planted after 1 year of application. Accidental poisoning: wash with clean water.
ATRAZINE	TWINTRAZINE	1780 (rat)	7500 (rabbit)	Slightly hazardous III	Sugercane: 450-1400g/50-100 L. of water/rai post planting or post harvest, before grass emergence 400-800g/50-100 L. of water/rai between rows after grass emergence. Pineapple: 1400g/50-100 L. of water/rai post planting before grass emergece. 350-700g/50-100 L. of water between rows, after grass emergance. Banana: 720-1400g/50-100 L. of water/rai Corn: 120-360g/50-100 L. of water/rai Cotton: 200-280g/50-100 L. of water/rai	Keep in a safe place, out of children's reach, away from food, pets and flames Keep in dry-cool place, away from fertilizers, seeds and other pesticides.	Skin contact: itching or irritation on skin	Eyes: wash with clean water Skin contact: wash with soap and water

* LD50 is a measure of the toxicity of pesticides to mammals. It is a measure of the dose (measured in mg. of active ingredient per kg. of test animal weight) necessary to kill 50% of the test animals, usually rats or rabbits. The lower the LD50 the more toxic is the pesticide.

** WHO (The World Health Organisation) has classified pesticides according to the potential hazards that they represent to human health as follows:

Class 1A extremely hazardous
Class 1B highly hazardous

FUNGICIDES

Common name	Commercial names	Acute LD50* mg/k oral	Acute LD50* mg/k dermal	WHO Toxicity class +	Direction for use	Storage recommendations	Toxicity symptoms	Antidotes/other precautions
BENOMYL	BENLATE FUNDAZOL	10,000 (rat)	-		Use for rice, tobacco beans. Normal use: 6 gr. product in 20L. of water.	Keep out of children's reach. No moisture allowed. Close container firmly after use. Burn the empty containers.		This product is toxic to fish. Keep out of lakes, streams or ponds. Do not apply when weather conditions favor drift from trated areas. Do not contaminate water by cleaning equipment or disposal of wastes.
CAPTAN	TWINCOCIDE 50 CARBICIDE ACARCIDE CAPT 50 CAPTACIDE ORTHOCIDE WATACIDE				Normal use: 5-10g/20 L. of water. Fruit trees: 10-15g/20 L. of water.	Keep in a safe place, out of children's reach, close the container firmly after use, bury empty container after use.	Dermal contact: itching and irritation.	Do not allow oral or dermal contact Do not inhale spray Dermal contact: wash with soap and water, change clothes.

* LD 50* is a measure of the toxicity of pesticides to mammals. It is a measure of the dose (measured in mg of active ingredient per kg. of test animal weight) necessary to kill 50% of the test animals, usually rats or rabbits. The lower the Ld 50 the more toxic is the pesticide

\+ WHO (The World Health Organisation) has classified pesticides according to the potential hazard that they represent to human health as follows:

Class 1A	extremely hazardous
Class 1B	highly hazardous
class II	moderately hazardous
Class III	slightly hazardous

NERAD Working Paper

Iain A. Craig, Cropping Systems Specialist, UKy TA Team, NERAD

Rapid Assessment Technique: The process, lessons learned and recommendations for the future.

The purpose of this paper is to review the Rapid Assessment Technique (RAT) conducted within the cropping systems (C.S.) component of the NERAD Project in February and March, 1983 and to document its successes, its shortcomings and the lessons learned in order to better understand the process and thus be able to make modifications for its future use, both within cropping systems and other components of the Project. To this end, tentative recommendations emerging from the discussion are referenced in the relevant portion of the text and presented as single section in Annexe 1.

RAT is a new technique, still undergoing development and refinement. It is essentially a semi-structured interviewing technique conducted by a small group of experienced personnel who follow up on leads, revise questions and probe some areas in more depth than would be possible with a formal questionnaire. The ability to submit the findings to rigorous statistical analysis is sacrificed to enable an in-depth, holistic understanding of the situation to be gained rapidly and economically. At the same time it allows the researchers to learn from the farmers themselves who have considerable technical knowledge valuable to the research and extension process.

RAT was employed as the most appropriate means within the resources of the Project to meet two major objectives. Firstly to determine the needs, problems and constraints facing farmers as regards C.S. development within the region. It was also considered to be an effective way of planning, implementing and analysing the trials that were to be run in an attempt to improve the performance of cropping systems in a manner appropriate to the needs identified. Secondly to further promote interdepartmental cooperation within MOAC thereby achieving a truly interdisciplinary approach to agricultural research and extension in the region.

In retrospect, RAT can be seen to have had a number of advantages. Firstly, it was economical in its use of both time and manpower and the information obtained was of such a form as to immediately specify relevant research and extension (R & E) priorities. Secondly, it promoted a highly effective interdisciplinary forum for problem identification and solving which resulted in a much clearer 'system' understanding than could have been achieved by the analysis of each component in isolation. This in itself should prove to be highly compatible with the farming systems approach to research and extension adopted within NERAD, hopefully producing a 'closer-knit' R & E system within the region. In addition, by being responsive to farmers' needs as articulated by the farmer himself, it establishes a dialogue between the R & E workers and the farmer. Finally the RAT process fostered participation of staff not only across a large number of Departments within MOAC but also the participation of staff throughout the entire Departmental structure from National, Provincial, Amphur and Tambon levels. In addition, everyone participated at each stage in the R & E process from planning through implementation to eventual analysis and evaluation of results as opposed to individuals working solely on one stage and never fully understanding how it relates to the entire process.

The process also had a number of shortcomings which, although by no means outweighing the advantages, do require attention to ensure that they are minimised in future iterations. Firstly the RAT process had a specific focus at the village or even individual farm level. As

disciplinary discussion where the seeds of true inter-departmental co-operation would be sown as an essential prerequisite to a successful farming systems research approach.

No attempt was made to standardise the RAT process or questionnaires over the four Changwats for three major reasons. Firstly, the questionnaires were seen merely as guidelines to aid questioning which should remain flexible enough to pursue individual farm-family problems and constraints and to take account of the very great ecological, economic and social diversity both within and between Project Tambons. Secondly, the main thrust of the RAT process was to develop a good understanding of the cropping system decision-making framework. The aim here was to enable locally relevant cropping system trials to be designed which specifically address the local key problems rather than producing a regionally based, statistically comparable series of trials. Finally, the variation in approaches to questionnaire development and interview techniques in the 4 Changwats would provide a rich and diverse test-bed for later identification of promising approaches and techniques.

The Department of Agricultural Extension's request that their Principal Villages be chosen as the sites for cropping system trials in the four project Changwats was duly accepted. RAT Teams spent three days in these villages conducting intensive interview sessions in small groups of 3 or 4 members with a limited sample of farmers. There were two major thrusts to the village assessment. First, interviews were conducted with individual farmers with the objective of gaining a farm-family-level understanding of cropping system practions and problems. Secondly, questioning the village headman and integration of the farm-level assessments during plenary discussion periods allowed a village-level picture of C.S. practices and problems to be developed.[4] A sample schedule for RAT activities in one of the villages is presented in Annexe 3.

In at least two of the Changwats the village-level understanding thus obtained, revealed a marked skew in the initial farmer sample distribution toward the richer, larger-land-owner. In both instances this bias was corrected by increasing the sample to include farmers who had small land-holdings. In some instances farmers were interviewed who owned no land whatsoever and this greatly enhanced RAT group understanding of village level C.S. processes.

During the interview session, the value of maintaining a flexible questionnaire was soon apparent. The questionnaires were modified and refined throughout the RAT process, the end result being a somewhat less structured set of questions and RAT team members more willing to follow up unusual or interesting answers and less pre-occupied with obtaining precise answers to every section of the questionnaire.[5] Despite this marked improvement during the village assessment there was still a tendancy for some team members to regard the completed questionnaire as the end product rather than a helpful tool to achieve desired objectives. In addition questioning and recording responses tended to be dominated by one, often the most senior member, of the subgroup.[6]

There was a tendancy for the sub-groups to treat cropping activities as isolated elements rather than as an interacting set of components within an overall, highly-integrated farming system. This resulted in a rather limited understanding of how cropping systems are allocated to and rotated between individual plots within a field or even fields within the total farm holding. Some farmers follow very sophisticated rotational strategies on their farms, an understanding of which should be gained during the RAT process as a valuable aid to key problem identification.[7]

The village experience suggests that the RAT process produced a different level of understanding from that achieved by conventional agro-economic surveys. There was a tendancy, however, for rather a static picture to develop essentially that of the conditions pertaining last year which were most clear in the farmers memory.[8]

Other activities during the village assessment included collection of soil samples for analysis from the fields of sample farmers who mentioned specific soil-related corpping problems or who had unusually high or low yield levels in their current systems. Extremely useful information was gained during soil sampling as team members being able to relate questions to local conditions and topography were prompted to pose extremely pertinent questions which the farmer was better able to answer and expand on by using actual examples from the field.[9]

In addition, a simple village-map was drawn showing major topographical and natural features relevant to crop production and an attempt was made to plot sample farmers' land-holdings on the map. This helped in locating fields for soil analysis and enabled the information obtained from farmer-interviews to be related to topographical or other physical features at the village level.[10]

Following the village assessments, a two-day workshop was held at NEROAC with all four Changwat RAT Teams in order to discuss results, identify the key problem in each village and to plan cropping system trials for each Changwat. A number of key problems common to all Changwats emerged at this stage, however, one of the notable strengths of the RAT process was that solutions to these in the form of C.S. trials tended to be different in each province where they were tailored to individual conditions.

Proposals were later presented to the farmers in each village and changes and modifications to these were made according to farmers' suggestions. It was generally agreed that these modifications to suit farmers requirements as closely as possible were absolutely essential. This was in response to the recognition that it is the farmers who face the problems and must respond to them according to individual conditions which only they can fully understand.

Sites were chosen and trials implemented by the RAT Teams in response to the key problems identified. Although the trials were generally extremely relevant, it appears that sites for the various trials could have been chosen more appropriately possibly with increased farmer participation during this stage. Evidence would suggest that as the trials progressed, some farmers did not fully understand the objectives of the trials and in some cases did not appreciate their relevance to the problems they addressed. This made it difficult for the farmers to understand why certain recommendations as regards cultural practices were made and consequently these were not followed.[11]

40

Annexe 1

Tentative recommendations for future C.S. RAT iterations

1/ Further use could be made of the more macro-level data after the RAT village assessment has taken place. It is recommended that time is put aside during the trial planning session to specifically assess how RAT findings are reflected in other available data sets. This should both increase the appropriateness of R & E activities initiated by the RAT process and also greatly facilitate future replication of the technology to areas where formal-survey data are the only information available.

2/ A joint analysis of both RAT and the Tambon-level trials of the DOA should be made once results are available. Lessons learned from the DOA trials should help in the replicability of RAT generated technology to other areas and the experience of the RAT trials could be very useful in pinpointing possible modifications to the DOA systems in order to overcome local problems and constraints.

3/ It is recommended that Changwat RAT teams be reassembled at least once per crop to monitor results, assist in general implementation of the trials and agree on any modifications necessary.

4/ It is recommended that, following the RAT interviews, a discussion is scheduled with the entire farmer sample, village headman and possibly others. Discussion during this session should focus on presenting the key problems as perceived by the RAT Team and getting farmers' responses to these.

5/ Time should be allocated after an initial questionnaire-testing period for all sub-groups to meet together to suggest modifications to the questionnaire.

6/ It is recommended that during subgroup interviews one person is responsible for asking questions in the questionnaire while other sub-group members are responsible for asking follow up questions throughout the interview. These tasks should be rotated within the subgroup for each interview and every member should record farmer responses in his own words. In addition, sub-group discussions of findings after each interview should be encouraged and time allocated for this.

7/ Encourage sub-groups to construct a cropping system diagram (See model in Annexe 4) as a basic minimum level of understanding necessary and as a basis for stimulating futher questioning.

8/ RAT teams should possibly be encouraged to use Grandstaff's 'rule of three' and get information for the last 3 years. Alternatively the following type of questions might be encouraged:

- What happened the year before?
- What do you intend to do this coming year?
- Was the information just given low, average or high for the longer term?
- Was that: the same, more or less than your neighbours?
- etc.

9/ Soil sampling should become a standard part of the RAT interview and should be conducted by the entire sub-group with the farmer. Questioning should continue during sampling in the field where unusual topographical or soil features may prompt questions and where answers can be more easily related to actual land conditions.

10/ It is recommended that at some stage during the village assessment one or more subgroups be assigned to constructing a simple sketch map of the village and surrounding fields. Individual farmers' plots can then be added to this map which can be refined and added to in future visits to the village.

11. It is recommended that a brief description of all proposed trials including: problems addressed, objectives and recommended cultural practices is prepared and distributed to all participating farmers (See e.g. in Annexe 5). This will not only help the farmers but will ensure that all proposed trials are thoroughly thought through by the research personnel prior to their implementation. It is recommended that this should also be included as a RAT activity rather than the responsibility of only the Field Managers.

42

Annexe 2: Schedule of RAT activities - cropping systems, 1983.

January, 1983

10 - 11 C.S. Research/Extension Workgroup orientation session and planning RAT process. NEROAC

February, 1983

21 - 22 RAT Team Planning Workshop. NEROAC

21 Introduction/Cropping Systems Research/Presentations of available data:
- Socio Economic
- Soils
- Marketing
- Agroclimatology
- Pest Control

Analysis of available data - discussion

22 RAT methodology and objectives

Questionnaire development (Changwat sub-groups)

Subgroup presentations

Conclusion and assignment of responsibilities

March, 1983

2 - 4 RAT Team village assessment:

Ban Lao Non Than, Roi Et

Ban Duu, Sri Saket

7 - 10 Ban Bua Phak Kwian, Chaiyaphum

Ban Na Khoy, Nakhon Phanom

14 - 15 Village data analysis and planning of village trials. NEROAC
- Changwat presentations
- General discussions
- Changwat subgroups refine C.S. trials plans and implementation methodology
- Conclusions

21 - 24 Presentation of C.S. Trial proposals to villagers for comment and modification/choice of trial sites/assignment of responsibilities.

Annexe 2 (contd.)

March 1983

21 - 22	Ban Lao Non Than, Roi Et
	Ban Duu, Sri Sakat
22 - 24	Ban Bua Phak Kwian, Chaiyaphum
	Ban Na Khoy, Nakhon Phanom

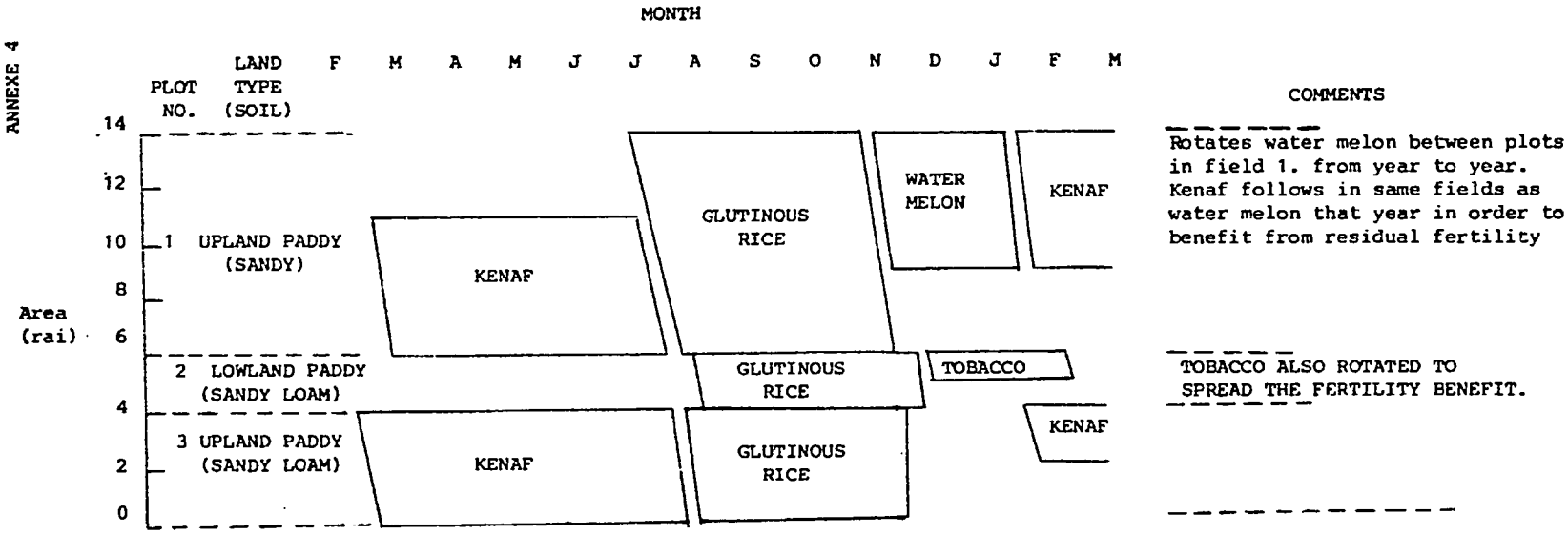
Annexe 3: RAT TEAM, VILLAGE ASSESSMENT - SAMPLE SCHEDULE

DAY 1	09.00 -112.00	- Kaset Amphur Office	
		- Introduction of RAT team members	- Field manager
		- Brief overview of RAT training workshop for those who did not participate	- Field manager
		- Objectives of RAT Village team/strategy	- Presentations
		- Selection/analysis of farmer sample	- Field manager
		- Selection of sub-groups	- Field manager
		- Village description	- TEA
		- Questionnaire analysis/desired changes	- Discussion
	13.30 - 16.30	- Village	
		- Introductions to villagers	- Field manager
		- Village level analysis - interview headman	- Sub-group
		- Questionnaire testing	- Sub-groups
		- Questionnaires begun	
		- Soil sampling	- Sub-group
DAY 2	09.00 - 10.30	- Kaset Amphur Office	
		- Partial sub-group presentations	- Sub-groups
		- Questionnaire analysis/suggested changes	- Discussion
		- Extend farmer sample	- Discussion with Headman
	12.00 - 12.00	- Village	
		- Farmer interviews	- Sub-groups
	13.30 - 16.30		
		- Farmer interviews/soil sampling cont.	- Sub-groups
DAY 3	09.00 - 12.00	- Kaset Amphur Office	
		- Sub-group presentations/discussions	
	13.00 - 15.00		
		- Sub-group presentations/discussions cont.	
	15.00 - 17.30		
		- Visit to Changwat Field Crop Station	- Director of Field Station

Annexe 3 (contd.)

DAY 4	09.00 - 12.30	- Kaset Amphur Office	
		- Determination of cropping system calendar	- Discussion
		- Determination of major problems	- Discussion
		- Interfacing problems with C.S. Calendar	- Discussion
		- Determination of crop priorities w.r.t. conceptual/calendar model of C.S.'s	- Discussion
	12.30	- Lunch and Departure	

ANNEXE 4



Model cropping calendar showing size of plots, area planted & cropping system practiced in each plot.

E.g. from farmer 5, Roi-Et.

Annexe 5

NERAD CROPPING SYSTEM TRIALS 1983

IMPLEMENTATION

SUMMARY

Ban Nong Bua Phak Kwian, Tambon Kwang Jon, Chaiyaphum

TRIAL: System 1 - Mungbean/Transplanted rice/Hamata.

NUMBER OF TRIALS: 6

TOTAL AREA: 6 rai (*For location see attached map)

PARTICIPATING FARMERS:
1. Nai Phun
2. Nai Samat
3. Nai Chamroon
4. Nai Noodaeng
5. Nai Kan
6. Nai Sao

LAND TYPE: Lower paddy land

KEY PROBLEMS ADDRESSED:
1. Low cash income
2. Forage problems
3. Low soil fertility
4. Varietal needs

OBJECTIVES:

1. To increase farm-family income by the introduction of a cash-crop (mungbean) into a rice-based cropping system.

2. To help overcome fodder shortages in the dry season by the introduction of a legume fodder crop into the system.

3. To improve soil fertility by the incorporation of mungbean and Hamata crop residues and by the deposition of cattle manure during the grazing of Hamata. It is anticipated that the improvement in soil: organic matter, nitrogen and other nutrient levels thus obtained will exhibit a residual effect on the yield of the rainy season rice crop.

4. To increase subsistence rice yields by the introduction of improved rice verieties on a scale sufficient to enable seed multiplication for sowing in future years. It is further expected that the improved varieties are better adapted to benefit from the soil fertility improvements brought about by the preceeding modifications to the cropping system.

RECOMMENDED PRACTICES

MUNGBEAN

VARIETY: Uthong 1 (M7A), determinate type.

LAND PREPARATION: Plough twice with buffalo an soon as rainfall permits, and prepare furrow for planting.

PLANTING: Plant 3 seeds/hill at 10 cm. spacing in furrows 50 cm. apart as soon as land preparation is complete and cover by hand.

THINNING: Thin to one plant per hill after first true leaf emergence.

FERTILIZING:	Double super phosphate in furrow at planting at rate recommended by soil analysis.
WEEDING:	As necessary by buffalo-drawn plough.
PEST CONTROL:	Dimethoate at one week post emergence and at flowering stage.
HARVEST:	Single harvest when mature-appox. 75 days.

RICE

VARIETY:	RD 6/RD 15 - depending on farmer choice.
LAND PREPARATION:	Plough in mungbean crop residue followed one week later by another ploughing followed immediately by puddling
PLANTING:	Plant three twenty-day old seedlings per hill at 25 cm. x 25 cm. immediately after puddling.
WEEDING: SPRAYING:	As per farmer's normal practice.
FERTILIZING:	According to soil tests
WATER CONTROL:	As per farmer's normal practices but if standing water remains drain 3 weeks prior to harvest.

HAMATA

LAND PREPARATION:	None
PLANTING:	Broadcast seed (3 kg/rai) in the rice approx. 3 weeks prior to rice harvest depending on soil moisture.
GRAZING MANAGEMENT:	No grazing for 2 months post-sowing, then control as necessary.
CROP RESIDUE MANAGEMENT:	Plough in crop residue in April as soon as soil moisture permits.

MONITORING

DATA TO BE COLLECTED FOR MUNGBEAN:

- Date, method and labour requirement for land preparation
- Date, method, density and labour requirement for planting
- Date of 50% emergence
- Date of thinning and replanting and labour requirement
- Satifactory modulation
- Actual plant density
- Date, method and labour requirements for weeding spraying and fertilizing.

- Pest monitoring: date and scale of infestation for: beanfly/cutworm/aphid/semi-looper/leaf roller/pod borer

- Weed monitoring - scale and composition of weed infestation.

- Date of 50% flowering

- Date(s) of harvesting and labour requirement

- Crop yield

- Harvest index

- Yield components

- Post harvest soil sample.

DATA TO BE COLLECTED FOR RICE:

- Date, method and labour requirement for land preparation

- Date, method and labour requirement for transplanting

- Actual plant density

- Plant height recording (every three weeks)

- Tiller recording (every three weeks)

- Amount of standing water in paddy (at least weekly)

- pH of paddy (every three weeks)

- Date, method and labour requirement for weeding, spraying and dertilizing

- Pest monitoring: Date and scale of infestation for: stem borer (dead hearts, white-heads count); leafhopper; planthopper; gall midge; whorl maggot; leaf folder

- Weed monitoring: scale and composition of weed flora infestation.

- Date of 50% flowering

- Date of harvesting and labour requirement

- Crop yield

- Harvest index

- Yield components

- Post harvest soil sample

DATA TO BE COLLECTED FOR HAMATA:

- Date and labour requirement for sowing

- Actual plant density

- Pest and weed monitoring

- Date of first grazing

Appendix 5

EDITED TRANSLATION

From Minutes of Progress Review Meeting

Mini-Evaluation Report

The Mini-Evaluation was carried out by Dr. Bantherng's staff, Office of Agricultural Economics and had covered 3 NERAD activities i.e. rice varieties, compost and poultry.

Three different groups of farmers were interviewed:

1.	Farmer Specialists	84 persons
2.	Farmers involved in NERAD trials	80 persons
3.	Other farmers	180 persons

Results in summary for all 4 changwats are as follows;

1. Rice variety trials

- For farmers who obtained improved rice seeds, the yield of the new varieties:

  For Non-glutious rice increased 50%

  For Glutinous rice increased 91%

- Chemicals application: No differences were evident between general farmers and the ones who obtained improved rice seeds. Only 32% of all farmers used chemicals, the rest did not use chemicals at all.

- Transfer of technology:

  - Farmers received instructions from officials 3 times/crop season.

  - 21% of farmer specialists did not tranfer knowledg to neighbours, whereas 79% did.

  - Farmers were most in favor of rice variety RD 105 (97% preferred this variety, Khao Dok Mali)

  - Dissemination of trial rice seeds

    14% saved seed for on-farm use
    15% exchanged with neighbours
    71% sold

2. Compost Making

- 55% were willing to have training, 45% were not.

- 2-day training: 64% - about right
  34% - too short
  2% - too long

- After training: 92% - made compost
  8% - did not

- Average amount: 1.6 tons/farmer with B20.-input.

- Use of compost:- rice crop and nursery beds 67%
  - field crops and fruit trees 9%

- vegetables 42%

- Problems:
  - 18% - lack of material
  - 24% - lack of water
  - 56% - lack of starter

- Transfer of technology: 1 to 8 but only 3 followed.

- 30% of general farmers made compost

- More trained farmers made compost then general farmers.

- Reasons why farmers did not make compost:

  42% not know how to make it
  13% not interested
  22% lack of starter
  22% no one instructed

- Farmers who made compost had received instructions from:

  Officials - 62%
  Neighbours - 33%
  Self-acquired - 9%

- Will continue to make compost next year:

  98% - will
  2% - won't

3. Poultry

- Before training stock inventories were

		Duck	Chicken
Ave. for all chgwt.:	early in the yr.	7 heads	20
	late in the yr.	3	35

- Member farmers' ave. in all chgwt.

	early in the yr.	3	24
	late in the yr.	4	28
- General farmers	early	4	23
	late	3	22

- Before training, raising method was:

  natural way - 46%
  keep in a pen at night - 52%
  keep in a pen during the day - 2%

- Feed:
  - Paddy - 60%
  - broken rice - 26%
  - milled rice - 4%
  - cooked rice - 10%

- Vaccination service:

  86% did not receive service
  14% had received

52

- Diseases control: 15% self-practiced
  85% had never practiced vaccination before

- 2-day training course: 34% too short
  62% about right
  1% too long

- Improvement of raising method:

  20% no improvement
  8% improved by purchasing new breeds
  28% feeding according to instructions
  45% pens constructed

- Reasons why having no improvement:

  13% lack of skills
  87% lack of time

- Technology transfer: 1 : 12

- Trained farmers as transfer agent

  95% transferred well
  5% not interested among group members

- After technology transferred:

  77% followed
  23% not followed

- Reasons for not following the instructions:

  19% believed that the trained farmers were not well versed on the relevant subject.
  18% not interested

- General farmers: 70% received services from officials
  30% did not receive

- Vaccination: 95% trainees gave instructions to other farmers
  5% did not

- For 7 members whc know the vaccination methods

  69% followed the instructions
  31% not followed
  12% not transferred

Bangkok Post Sept. 19, 83
บางกอกโพสต์ วันจันทร์ ที่ ๑๙ กันยายน พ.ศ. ๒๕๒๖ 19

67 firms plan to bid for fertiliser project

ABOUT 67 local and international firms have so far bought documents to participate in pre-qualification bids for the engineering, procurement and construction of Thailand's multi-billion baht national fertiliser complex, Deputy Industry Minister Chirayu Isarangkura na Ayutthaya said at the weekend.

He said more firms are expected to buy the documents from the National Fertiliser Corp — a Thai-owned company — as the deadline for sales of the documents on October 30, approaches.

He also expressed optimism that quite a large number of firms will be submitting their tenders to participate in the pre-qualification bids.

The deputy industry minister disclosed that the National Fertiliser Corp's administrative committee chaired by himself, has decided to select Foster Wheelers, a US industrial concern, to serve as project management consultant.

Foster Wheeler, he said, will be responsible in screening the pre-qualification tenders submitted by bidders, preparing the paperwork during the bidding for construction of the complex, and supervising the construction itself.

Dr Chirayu disclosed that the final cost of this fertiliser complex project is estimated at about 14,000 million baht. "But I believe that negotiations with the successful bidder would bring down the final cost to about 10,000 million baht," he added.

The corporation will announce the name of the successful bidder next February, he said, adding that construction of the complex is expected to begin by the end of next year and be completed in late 1987.

It is certain that this complex will be located on an area of 600 rai in the Eastern Development Seaboard in Rayong Province, he said.

Apart from transporting the fertiliser by road and railway, this complex will also have its own port to accommodate lighters for transporting part of the fertiliser to Bangkok for distribution, he added.

According to Dr Chirayu, this complex will be able to produce more than 200,000 tons of nitrogen, more than 200,000 tons of phosphate and more than 100,000 tons of potassium annually.

He noted however, that the result of a recent survey showed that the total fertiliser production would be far less than the local demand which is about 1.5 million tons a year.

"But we have a plan to expand the plant in the future," he stated.

He also expected that everything would be alright when considering the reaction of the interested firms.

"We believe that this national fertiliser complex is no longer merely a dream; it is, in fact, another step closer to reality," he stated.

Bk Post 9/26/83

Foster Wheeler selected for fertiliser plan

FOSTER Wheeler, a US industrial concern, received the National Fertiliser Corp's approval to serve as the project management consultant for Thailand's US$777.4-million national fertiliser complex.

The green light came on Friday following an NFC board meeting.

The contract value was not disclosed, but an NFC director said Foster Wheeler's technical and financial proposals are better than those of its only rival, Stone and Webster Engineering, also a US firm.

Basically, Foster Wheeler's jobs are drawing designs, preparing bid documents, helping select contractors and supervising the construction of the project.

The NFC director said a letter of intent would be given to Foster Wheeler soon so that work could start to meet the relative tight schedule.

Meanwhile, more than 90 local and international companies have bought documents to participate in the pre-qualification process to be eligible for submitting construction bids for the project.

By the end of next month, a short list of qualified contractors will be ready and the preparation of tender documents will begin. By early next year, a contractor is expected to be named.

Set to start operation in late 1987, the project, to be located in Rayong Province under the Eastern Seaboard Development Plan, will enable the country to be almost self-sufficient in its fertiliser consumption.

Best Available Document

Fertilisers

An idea for cultivation

THE large and growing overseas sales of farm commodities, particularly rice, have made Thailand the world's fourth-largest net food exporter. Exports of products such as rice and tapioca are among the world's highest, while sales of maize, beans, sugar, frozen food and fishery products are also very large.

Ironically, the country has been very slow to adopt modern technology in developing agriculture, particularly in the use of fertiliser. Thailand has the lowest rate of chemical fertiliser use among developing countries in the region, except Burma

The National Economic and Social Development Board conducted a study and reported: "Fertiliser application in Thailand averages 1.9 kilogrammes per rai, as compared with an average rate of at least five kilogrammes per rai in other countries in Asia. The United Nations Food and Agriculture Organisation meanwhile found that Thailand's rate of fertiliser use "is 2.5 kilogrammes per rai, as compared with five kilogrammes per rai on an average in other Asian countries." Though the figures from the two sources differ, they show clearly how much the country can and ought to improve itself in making use of one of the most important aids to agricultural production.

It is recognised that Thailand can no longer achieve significant progress in agriculture by increasing the amount of arable land, as land that remains uncultivated is either very poor or lies within preserved forestry areas. The only means of increasing farm production is to increase output per rai. This essentially implies the introduction of modern farm technology.

There was an attempt about two decades ago by the Government to set up a chemical fertiliser plant, the Chemical Fertiliser Co at Mae Moh, Lampang. Granted Boi promotional privileges, Chemical Fertiliser was set up to produce ammonium nitrate (21% nitrogen) and urea (46% nitrogen), using lignite as its raw material. For a number of reasons, including mismanagement, it suffered a string of losses, which forced it to close.

To meet the domestic demand for fertilisers, private fertiliser-mixing plants were encouraged in 1975 and have grown into the country's main suppliers of fertilisers today. The largest of these concerns is Thai Central Chemical Co Ltd, which is Boi-promoted and opened in January 1975. Besides Thai Central Chemical, there are 14 or 15 other manufacturers of ready-mixed fertilisers. These are small, however, their production capacities ranging from 4,000 to 24,000 tons a year; Thai Central Chemical is 300,000 tons a year. The small fertiliser-mixing concerns include Asia Chemical Fertiliser Industrial Co Ltd, G.C. Co Ltd, Liang Hong Co Ltd and Pholdee Industrial Co Ltd.

TABLE 1: IMPORTS OF CHEMICAL FERTILISERS

Year	Volume (tons)	Value (million baht)
1979	861,396	2,814
1980	674,276	2,837
1981	757,000	3,614
1982*	890,000	3,916
1983**	965,000	4,250

*Sources: Custom Department and Business Economics Department. * estimated ** projected*

The combined output of these fertiliser mixers and manufacturers is estimated at about 400,000 tons a year, which accounts for almost 40% of total domestic demand for chemical fertilisers here. The rest is accounted for by importers of finished products.

Of these, the oldest concerns are Bara Winsor & Co Ltd, East Asiatic Co Ltd and Yip In Tsoi Co Ltd, which began to import fertilisers before World War Two. The Plant and Agricultural Material Control Division estimates that there are about 130 to 150 importers of fertilisers. Large importing concerns are Sri Krung Wattana, Yip In Tsoi, Bara Winsor, Chia Kwang Seng and Chia Tai. They account for about half of the imports by the group.

Since Thailand still does not have a factory to produce fertiliser ingredients, it has to import them. It is estimated that fertiliser imports are costing the country between 3,000 and 4,000 million baht annually. However, this outflow of currency is expected to grow because demand for fertilisers is rising by more than 7% annually. As shown in Table 1, 861,396 tons of fertilisers worth 2,814 million baht were imported into the country in 1979. The imports have increased to an estimated 890,000 tons worth 3,916 million baht in this year. The Business Economics Department predicts an increase to 965,000 tons worth 4,250 million baht next year. This represents a drain on the foreign currency reserves which Thailand can ill afford.

With the discovery of natural gas in the Gulf of Thailand hopes were raised that a chemical fertiliser plant might be set up here. Several years ago, a national committee was appointed by the Cabinet to plan the development of the industry, but it was four years before any real action was undertaken. In 1978 with technical assistance from the Japanese Government, a pre-feasibility study on setting up a chemical fertiliser plant was conducted by the Engineering Consulting Firms Association. In the following year another study on strategy for developing the industry was carried out by the International Fertiliser Development Centre in cooperation with the International Bank for Reconstruction and Development (IBRD).

Both studies produced reports which emphasised the need for a chemical fertiliser plant to meet the demand from agriculture which is expected to be increased by the Fifth Five-Year Development Plan. A reason for the emphasis in the studies was the expected availability of raw materials when the natural gas separation plant opens in 1984.

To hasten the day when Thailand will have its own fertiliser factories as well as to lay down a clear policy for investors, the Special Committee on Chemical Fertiliser met several times and in its fourth session on June 26 1981 it laid down the following principles for the setting up of a chemical fertiliser plant: —Investment capital

a) Investors are responsible for providing the total amount of investment capital required for the whole project.

b) Investors will issue fully-paid common stock to the credit of the Government amounting to 10% of the total volume of common stocks issued. The Government is not obliged to pay

Continued Page 94

Fertiliser application in Thailand is the lowest in the region, except for Burma. Its use needs to be increased if the country is to step up agricultural productivity, but fertiliser imports are already proving a drain on valuable foreign exchange. The answer is a fertiliser plant here — a project bedevilled by delays and problems.

Best Available Document

55

Local demand for fertilisers is growing and will be encouraged to grow even faster. Meanwhile prices of fertilisers are rising and will increase sharply if prices of oil do so. With no factories to produce fertiliser here, Thai farmers would be left at the mercy of foreign suppliers.

From Page 93

for the stocks issued in its favour at the date issued. The Government has the commitment to transfer the dividend received for the full payment of the value of stocks issued in favour of the Government at no interest charged. Only after payment for the stock has been completed shall the Government retain its exclusive rights over the dividend received.

c) Investors shall submit all documents and statements to the Government to prove their technical expertise and financial ability to carry out the project effectively and efficiently.

— Type of chemical fertiliser to be produced.

a) Fertilisers to be produced will include urea, diammonium phosphate (DAP), mono-ammonium phosphate (MAP) and nitrophosphates.

b) If there is a need, the Government will negotiate with the investor for the production of other types of chemical fertilisers.

— Price determination

Prices for fertilisers produced locally shall not exceed the CIF Bangkok prices of the same type and quality of products imported from an appropriate port of origin, together with a 15% discount.

— The import and export of chemical fertilisers.

a) The Government will protect the investor against unfair competition from similar foreign products.

b) If the investors cannot meet domestic demand, the Government will consider permitting the temporary import of fertilisers.

c) If production exceeds domestic demand, the Government will permit investors to export the surplus.

— Production.

a) Investors must produce chemical fertilisers that can later be mixed by farmers.

b) Mixing of fertilisers must be carried out by the bulk-blending technique but the investor is allowed to use the chemical synthesis compound technique if necessary.

c) The amount of fertiliser produced and mixed must be in proportions that allow the extension of bulk-blending to other regions

— The production of phosphoric acid

a) Production of phosphoric acid is prohibited unless pollution can be prevented and production cost is considered reasonable.

b) If phosphoric acid is required as a raw material for fertiliser production and must be imported, ASEAN producers should be given first consideration

c) Production of phosphoric acid for industrial use cannot serve as a condition for the extension of the investor's promotional privileges.

— Plant location.

The plant will be located at Ban Mab Ta Pud or at an adjoining site

— Production techniques, transfer of technology and duration of project.

a) The production technique must be efficient and involve minimum costs

b) Investors must submit plans for the systematic transfer of technology, which will be carried out from the beginning of the project.

c) Construction of plant and production have to begin as soon as possible.

Encouraged by the assurance from PTT that natural gas could be supplied to the industry at a rate of 60-60 million cubic feet a day, and the Government's repeated call for greater participation by private business in large industrial projects, 10 companies submitted investment proposals. These were short-listed, and a Scandinavian consortium, comprising Haldor Topsoe of Denmark, Swedyard Development of Sweden and Norsk Hydro A/S of Norway was given official approval and BOI promotional privileges. However, a disagreement about the price of methane gas, an important raw material for the fertiliser industry, caused the project to be delayed and later dropped.

Though the Scandinavian consortium's project was stillborn, it does not mean that the Government has given up on the establishment of fertiliser manufacturing plant here. It is determined to push ahead for two main reasons.

First, the chemical fertiliser project is part of the master plan to develop the Eastern Seaboard, which is being given priority by the Government. The Government has been investing huge sums in infrastructure for the area and it hopes that industries will develop there following completion of the gas separation plant.

Second, local demand for fertilisers is growing and will be encouraged to grow even faster. Meanwhile, prices of fertilisers are increasing and will increase sharply if prices of oil do so. With no fertiliser factories here, Thai farmers will be left at the mercy of foreign suppliers. The availability of our own natural gas is seen by the Government as an opportunity to break away from this dependence, so the Government will try its best to exploit the natural gas and establish a chemical fertiliser plant here.

Reflecting this determination, was the decision last July by the Eastern Seaboard Development Committee, chaired by Prime Minister Prem Tinsulanonda, to set up a national fertiliser company. This project was proposed by a working group comprising Minister of the Prime Minister's Office Sulee Mahasanthana, Deputy Industry Minister Dr Chirayu Isarangkura na Ayutthaya and NESDB Secretary General Dr Snob Unakul. Under the proposal, the initial registered capital of the company is 50 [illegible] baht, while investment requir[illegible] are expected to total US$500 mi[illegible]

The working group was instr[illegible] persuade interested parties [illegible] shares, and it reported in late [illegible] ber that the National Fertili[illegible] shares had been over-subscri[illegible] Chirayu said the Government [illegible] have to allocate shares to the fi[illegible]

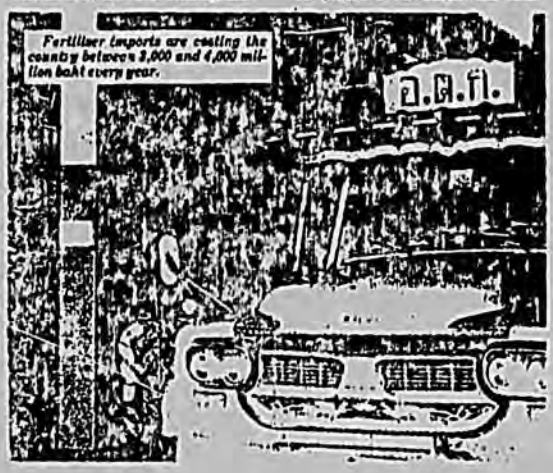
A month later, visiting Ro[illegible] Deputy Industry Minister Nic[illegible] stantin offered to Industry [illegible] Chatichai Choonhavan to com[illegible] a feasibility study on the [illegible] national fertiliser project, the [illegible] which may pave the way for [illegible] Romanian participation. The st[illegible] costs of which will be paid by R[illegible] will be divided into three stag[illegible] materials for fertiliser product[illegible] use of natural gas in the proce[illegible] market conditions for fertiliser[illegible] In addition, Thai officials [illegible] trained in Romania.

Maj-Gen Chatichai asked [illegible] Romania team to consider [illegible] number of plants, productio[illegible] and locations which will be in li[illegible] the best use of natural gas f[illegible] land and offshore.

A source in the Industry [illegible] explained: "This is because we [illegible] unable to decide whether we [illegible] build a large fertiliser plant in [illegible] and use natural gas piped fro[illegible] Oil's Erawan field, or build sm[illegible] in the provinces which may [illegible] shore gas." Gen Chatichai [illegible] minded the Romanian team [illegible] into account the ammonium [illegible] (used as fertiliser) which wi[illegible] from the planned ASEAN rock [illegible] soda ash project to be establishe[illegible]

TABLE 2: SHAREHOLDERS OF THE NATIONAL CHEMICAL FERTILISER COMPANY

I. The public sector	45%
– PTT	25%
– Finance Ministry	10%
– Marketing Organization for Farmers	10%
II. The Thai Central Chemical Group	22.5[illegible]
III. Thai Bankers Association	10%
IV. Fertilizer trader group	21.1[illegible]
– Chia Tai Seeds & Agriculture Co.	2.69
Rojana Kasikit Ltd. Part.	2.69
– Bara Winsor & Co.	2.69
– Seri Agricultural Chemical Co.	2.69
– Economics Chemical Co.	2.69
– Songserm Kaset Thai Co.	2.69
– Chi Soon Chan Co.	1.3[illegible]
– Siriwat (Chiangmai) Co.	1.3[illegible]
– Yip In Tsoi & Jack	0.8[illegible]
– Bangkok Tanakij Co.	0.8[illegible]
– Sirm Siri Kasikam Co.	0.2[illegible]
Thai fertilizer Co.	0.2[illegible]
– Charoen Kasikam Co.	0.2[illegible]
Sahai Kaset Ltd. Part.	0.2[illegible]
Chia Hah Lee Ltd. Part.	0.1[illegible]
– Tocy Kim Heng	0.1[illegible]
– Prida Karn Kaset	0.1[illegible]
– Chiankul	0.0[illegible]
– Sap Anan Co.	0.0[illegible]
– Chia Kwang Seng	0.0[illegible]
V. Fertilizer producer group	1.3[illegible]
– Asia Chemical Fertilizer Industrial Co.	0.6[illegible]
– Phermphol Kaset Co.	0.3[illegible]
– Chemical Fertilizer Industry Co.	0.1[illegible]
– Anan Songserm Kaset Co.	0.1[illegible]
– Burapha Fertilizer Co.	0.1[illegible]
– Asia Kasikam Co.	0.1[illegible]
– Chiankul	0.0[illegible]



Fertiliser imports are costing the country between 3,000 and 4,000 million baht every year.

Best Available Document

56