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THE UPPER PADDIES IN NORTHEAST THAILAND: THE CURRENT SITUATION AND SOME IMPLICATIONS FOR DEVELOPMENT.

NORTHEAST REGIONAL OFFICE OF AGRICULTURE AND COOPERATIVES

TECHNICAL WORKING PAPER

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NOTES ON THE CURRENT SITUATION AND IMPLICATIONS FOR DEVELOPMENT

INTRODUCTION: Up to one third of the paddy land in Northeast Thailand remains unplanted to rice each year due mainly to insufficient water for transplanting (Table 1 and Figure 1). The unplanted area is mainly on the higher elevation paddy land or middle terrace where it is more difficult to accumulate water due to topographical and soil factors. Rice-transplanting will often continue into October if there is sufficient water and by this time, farmers are unwilling to plant an upland crop on the untransplanted area.

DEFINITION: The upper paddies are bunded fields generally on the middle or high terrace that are planted to rice wherever possible but which receive sufficient water for transplanting in not more than one year out of three.

AREA: An estimate of the area of upper paddy land, as defined here, is not possible from currently available physical or geographical survey data. However, an estimate can be obtained from time series data on the area planted to rice. This estimate is based on the assumption that, in the wettest year, all the upper paddy will be planted and in the driest year all the upper paddy will remain unplanted. This estimate was calculated for each Changwat to allow for the variability of rainfall in different parts of the Northeast within any one year but ideally amphur level data, if available, should be used. The estimate thus obtained (Table 2) gives a total upper paddy area of 9,416,000 rai or approximately 26% of the total paddy area for the region.

It is recognised that this upper paddy estimate is only approximate. However, if anything, this figure is probably an underestimate as rainfall variability (the primary determinant of rice-planted-area), even within a Changwat, can be extremely variable with the result that in dry years some upper paddies will still be planted and in a wet year some will remain unplanted. This estimate is, however, in general agreement with others which put the area of upper paddies in the Northeast somewhere between 7-14 million rai or 20-39 percent of all paddy land (NEROA, 1980; DOA, 1980). The upper paddies therefore, represent a large, underutilized land resource in the Northeast.

LOCATION : The relative distribution of the upper paddy land is presented in Figure 2. The upper paddies are generally found on the middle and upper terraces in the mini-watershed agro-ecosystem which occurs throughout the Northeast (Figures 3 and 4). The occurence and relative importance of upper paddy areas within this agro-ecosystem are related to often quite localised combinations of topography and soil type and to the more general characteristics of rainfall in the area. Topography and soil tend to determine the location within the given agro-ecosystem while the amount and variability of rainfall determine the relative proportion of total rice area which is upper paddy in different parts of the region.

(i) The influence of topography on location.

There is essentially no difference between the amount of rain received by the lower or upper terrace areas at a given site. The lower terraces usually accumulate sufficient moisture for puddling and transplanting before middle or upper areas because of the movement of water by surface and subsurface flow from the upper to lower parts of the topographical sequence. The influence of topography on the location of the upper paddies, is therefore, usually site specific and related to variables such as soil conductivity, permeability and depth of water table.

Taking the main period of rice transplanting to be between June and August, it is hardly surprising that there is a relationship between the amount of rain received during this period and the proportion of total paddy area which is planted in a given year. A lower than normal area planted with rice in a given year is generally associated with less than normal rainfall in one or more of the months from June to August.

While the amount of rainfall influences the the area of rice planted in any one year, variability over years tends to have a greater influence on the relative proportion of upper paddy to total paddy in a given area. Using Changwat data, Table 3 and Figure 5, show the relationship between rainfall variability over the period June to August and the variation in rice area planted.

Areas with more variable rainfall in the months June to August tend to have a greater proportion of upper paddy land. The greater "reserve" of potential rice production area is necessary to compensate for low rice production in dry years. The relative proportion of upper paddies is greatest in the western provinces (notably Chaiyaphum and Loei) in which early season rainfall is both lower and more variable (Figure 6).

DESCRIPTION: A comparative description of the Upper and Lower/Middle paddies in Northeast Thailand :

FACTOR	UPPER PADDY	LOWER/MIDDLE PADDY
<u>SOILS</u>:		
GREAT GROUPS	Paleustult (Red-Yellow/ Gray Podzolic) or Paleaquult (Low Humic Gley)	Paleaquult (Low Humic Gley) Tropaquept
SERIES	Korat, Warin, Satuk Yasothorn, Roi Et and Tatum	Roi Et, Tatum, Ratchaburi, Pimai
NUTRIENT LEVELS	Correspondingly higher than lower paddies due to less frequent cropping (See Figure 5), however, pH and available P and N will remain lower longer until the soil becomes water saturated	Inherently lower nutrient levels but compensated for by earlier soil saturation
CLAY CONTENT	Lower	Higher
PHYSICAL STRUCTURE	Generally less developed plow-pan, more free-draining:	Generally well developed plow-pan and impeded drainage:
	1. Difficult to maintain standing water in wet season. 2. Capillary rise from the water table is enhanced. (basis for 'Surin Peanut	1. Run-off and drainage water accumulate in wet season. 2. Capillary rise from water table is impeded by plow-pan.
SOILS PROBLEMS	Selective erosion of clay and organic matter content.	

FACTOR	UPPER PADDY	LOWER/MIDDLE PADDY
CROP PRODUCTION		
WET SEASON	Rice in some years-often for sale (Khao bao)	Rice every year-mainly subsistence varieties (Khao nak)
PRE-RICE	-	Kenaf, sesame
POST-RICE	- N.B. Some cassava is planted in upper paddies when price is high	Vegetables, peanuts, mungbean, tobacco, water-melon
CROP PRODUCTION PROBLEMS:		
WATER	Insufficient water for transplanting/drought	Water-stress/flooding in rice. Water-logging and/or water-stress in upland crops.
	Deep water table makes it difficult to obtain water for off-season vegetable production	Water table close to surface. Shallow wells dug for dry season crop production.
WEEDS	Higher weed-seed burden due to less frequent cultivation and water-logging. Weed flora has a higher proportion of broad-leaved weeds.	Usually only a problem in dry years/or in upland crops. Weed flora composed mainly of grasses/aquatics.
LIVESTOCK:	Important grazing area in the wet season when unplanted.	Dry season grazing
	Early source of rice straw for forage when planted.	

CURRENT MANAGEMENT: The majority of farmers in the mini watershed agro-ecosystems of the Northeast, where most of the upper paddies are located, own both upper and lower paddy land and often some upland fields as well. They utilize these three different land-types in different ways but integrate their management in order to optimize the entire farm system. Current management strategies for the upper paddies appear to be more concerned with stabilizing rice production and reducing risk rather than maximising production. This is clearly illustrated by the following observations on utilization of the upper paddies:

(i) Many farmers cannot guarantee sufficient subsistence rice production from their more productive lower or middle paddies and compensate for this by planting rice in their upper paddies.

(ii) Although rice yields are unstable, the upper paddies represent a low risk system due to extremely low input levels applied. Virtually all fertilizer and other inputs currently used by farmers are applied to the lower or middle paddies.

(iii) In very wet years, some lower paddies are destroyed by flooding but in such a year production in the upper paddies is high and will compensate for the lower paddy area destroyed.

(iv) The upper paddies are planted after the lower paddies to early maturing rice varieties which are harvested earlier and therefore supply the farm family with rice at a time when stored rice is running out.

IMPLICATIONS AND STRATEGIES FOR DEVELOPMENT

1. Variability and Risk

The upper paddies represent a large, apparently under utilized, land resource in the Northeast region. That such areas cannot always be planted is related to the variability of rainfall; that they are rarely planted with other crops is due to the high priority given to rice production by farmers in the region.

Implications : Strategies for development of the upper paddies must take into account both enviromental and social factors which determine occurance of unplanted paddy areas and the fact that subsistence rice production is still an important objective of farmers in the region.

2. Integrated Development Approach

Farms with upper paddy areas are most commonly found in the mini-watershed agro-ecosystems. Due to the complex and inter-related way in which holdings with a mixture of land types are managed, development of upper paddy areas will require an integrated approach.

> Implications : Development of the upper paddies should not be considered in isolation from the rest of the farm system, nor can they be developed with a commodity approach. A "Farming Systems and Extension" approach may be an appropriate methodology for dealing with the complex relationships involved in development of the upper paddies.

3. Rice Improvement and Stabilisation

The current management strategies for the upper paddies are designed to reduce the risk and uncertainty associated with subsistance rice production in the Northeast. The development of cropping systems with the sole objective of maximising overall farm productivity may be difficult for farmers to accept.

> Implications : Programmes to diversify the use or increase productivity from the upper paddies are more likely to be acceptable if they include technologies for reducing the uncertainty of rice production. If rice production can be guaranteed from a reduced planted area then land, labour and other resources will be made available for other enterprises on the upper paddy. (The direct sown rice technology described in Appendix 1 is considered to be a potentially valuable method of reducing the uncertainty of rice production from upper paddies.)

4. Soil Improvement

Nutrient levels are often higher in the upper paddies (Figure 7) but these would be depleted by more intensified use of the land. Maintenance of organic matter is considered to be crucial if crop responses to chemical fertilizer and other inputs are to be obtained and maintained.

Implications : The management of crop residues, crop livestock interactions and the production of green manure for use in-situ or on other parts of the farm should be considered as possibly key components of programmes for development of the upper paddies.

5. Information Requirements

Only limited agro-ecological and socio-economic data are available for comparing the use and management of the upper paddy areas. The majority of surveys or research programmes make no distinction between upper, middle or lower paddies despite the fact that farmers make this distinction in virtually all of their management decisions.

> Implications : There is a need for more agronomic and socio-economic data specifically relating to use of the upper paddy areas. The establishment of a more complete data base for the upper paddies would be of great benefit to those formulating development programmes.

6. Research Requirements

Both rice and upland crop improvement will require considerable adaptation of currently recommended practices for these crops to be appropriate for conditions in the upper paddies.

> Implications : Rice varietal selection specifically for adaptation to moisture conditions in the upper paddies is required. Upland crop management practices for conditions in the upper paddies also need to be studied.

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TABLE 1 NORTHEAST THAILAND PADDY LAND UTILIZATION BY YEAR

CROP YEAR	PADDY LAND	PLANTED - AREA		HARVESTED - AREA	
	$(RAI \times 10^3)$	$(RAI \times 10^3)$	(%)	$(RAI \times 10^3)$	(%)
1975	31,07[illegible]	24,[illegible]0	73		
1976	34,59[illegible]	23,735	69		
1977	34,[illegible]	24,[illegible]46	71		
1978	35,55[illegible]	27,8[illegible]	78		
1979	35,54[illegible]	29,086	82		
1980	35,88[illegible]	28,22[illegible]	79	27,404	76
1981	36,19[illegible]	28,001	77	26,103	72
1982	36,2[illegible]	26,607	73	24,063	66
1983	36,57[illegible]	30,123	82	29,624	81
1984	36,57[illegible]	28,568	78	27,786	76

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Table 2. Planted area for wet season rice in Northeast Thailand, 1978-1983 (OAE, 1980, 82, 83)

Changwat	Rice area planted x 10^3 rai						Maximum Area (10^3 rai)	Minimum Area (10^3 rai)	Difference (10^3 rai)
	1978	1979	1980	1981	1982	1983			
Nakorn Phanom 1/	1082	1257	1120	1201	1041	1098	1257	1041	216
Loei	391	307	388	265	265	268	391	265	126
Sakone Nakorn	1667	1421	1621	1459	1584	1024	1667	1024	643
Nong Khai	1000	913	905	1083	1251	1276	1276	905	371
Udorn	2805	2585	2630	2538	1948	2799	2805	1948	857
Yasothorn	751	1178	986	973	710	999	1178	710	468
Ubol	3581	3537	3440	3570	3394	3352	3581	3352	229
Kalasin	1549	1246	1046	1265	538	869	1549	538	1011
Khon Kaen	1884	2231	1968	1952	1649	2228	2231	1649	579
Mahasarakam	1659	1388	1527	1790	1547	2196	2196	1388	808
Roi Et	2095	2342	2472	2261	2153	2560	2560	2095	465
Buri Ram	1729	2561	2463	2495	2298	2591	2591	1729	862
Sri Saket	1964	2003	1721	2144	2218	1787	2218	1721	497
Surin	2428	2364	2448	2561	3038	3112	3112	2364	748
Chaiyaphum	1361	1556	1429	563	1022	1615	1615	563	1052
Korat	1875	2196	2059	1880	1951	2359	2359	1875	484
Total									9416

1/ Includes Mukdaharn Province from 1982.

TABLE 3 : Changwat averages and variations in rice area planted and June to August rainfall.

Changwat	RICE AREA PLANTED 1973-1982				JUNE TO AUGUST RAINFALL		
	Average (000's)	Variation (cv%)	Minimum (000's)	Greatest Unplanted Area (%)	Average (mm)	Variability (cv%)	Minimum (mm)
NAKHON PHANOM	1071	9	960	24	1472	25	995
SAKHON NAKHON	1465	8	1317	21	866	22	570
NONG KHAI	902	19	691	45	857	23	582
UDORN THANI	2411	11	1948	31	720	25	456
LOEI	302	24	163	60	549	37	229
YASOTHON	869	17	688	42	799	16	639
UBON RATCHATHANI	3127	13	2537	29	886	15	595
KALASIN	1139	25	538	65	730	34	548
KHON KAEN	1705	23	764	66	526	19	391
MAHASARAKHAM	1499	14	1021	43	529	10	444
ROI ET	2054	14	1631	34	639	18	440
BURIRAM	2090	18	1455	43	495	32	334
SRI SI KET	1690	25	934	58	678	26	456
SURIN	2202	24	1099	64	569	24	340
CHAIYAPHUM	1111	36	336	78	395	41	195
NAKHON RATCHASIMA	1960	11	1480	36	385	46	206

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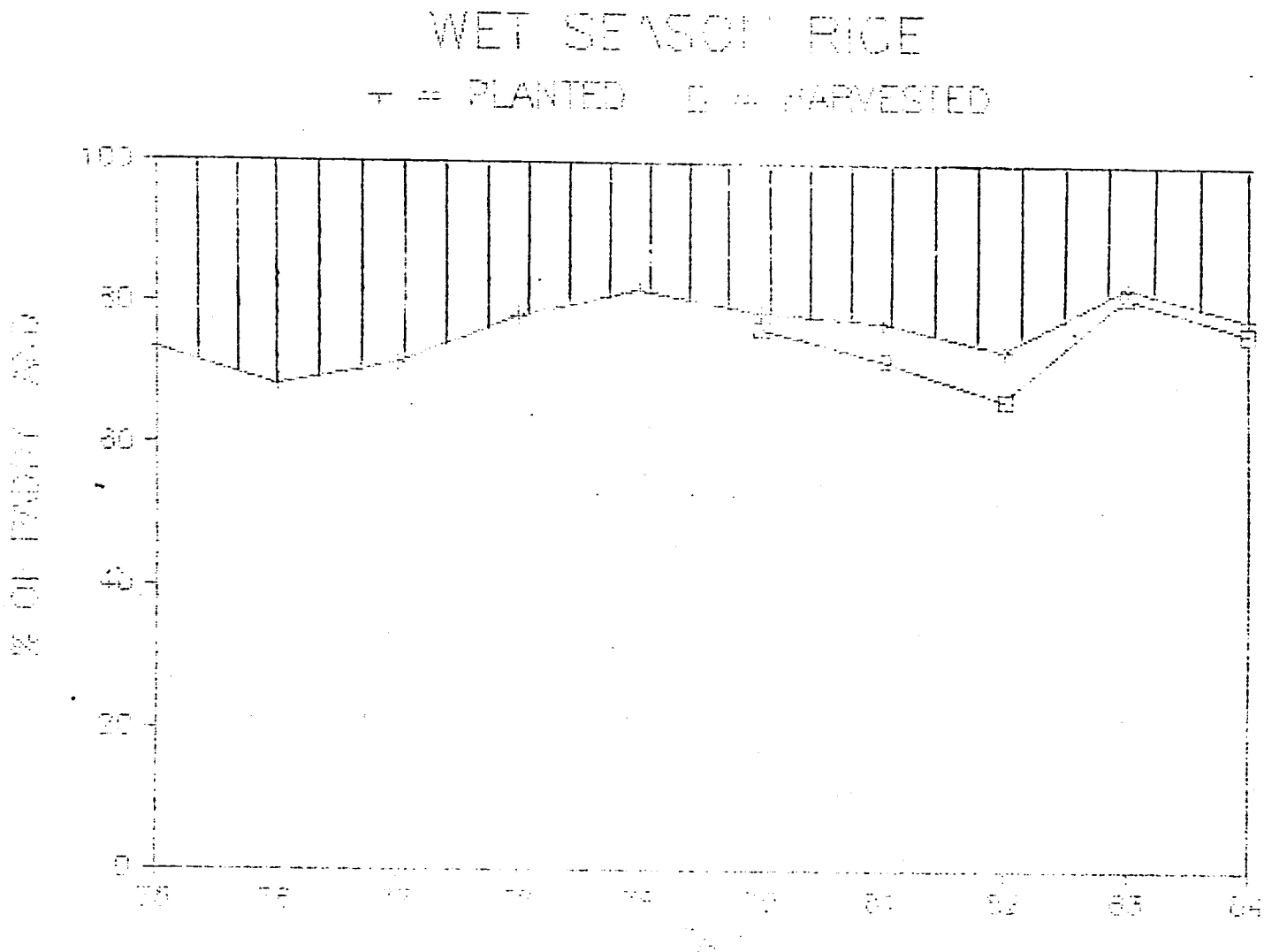
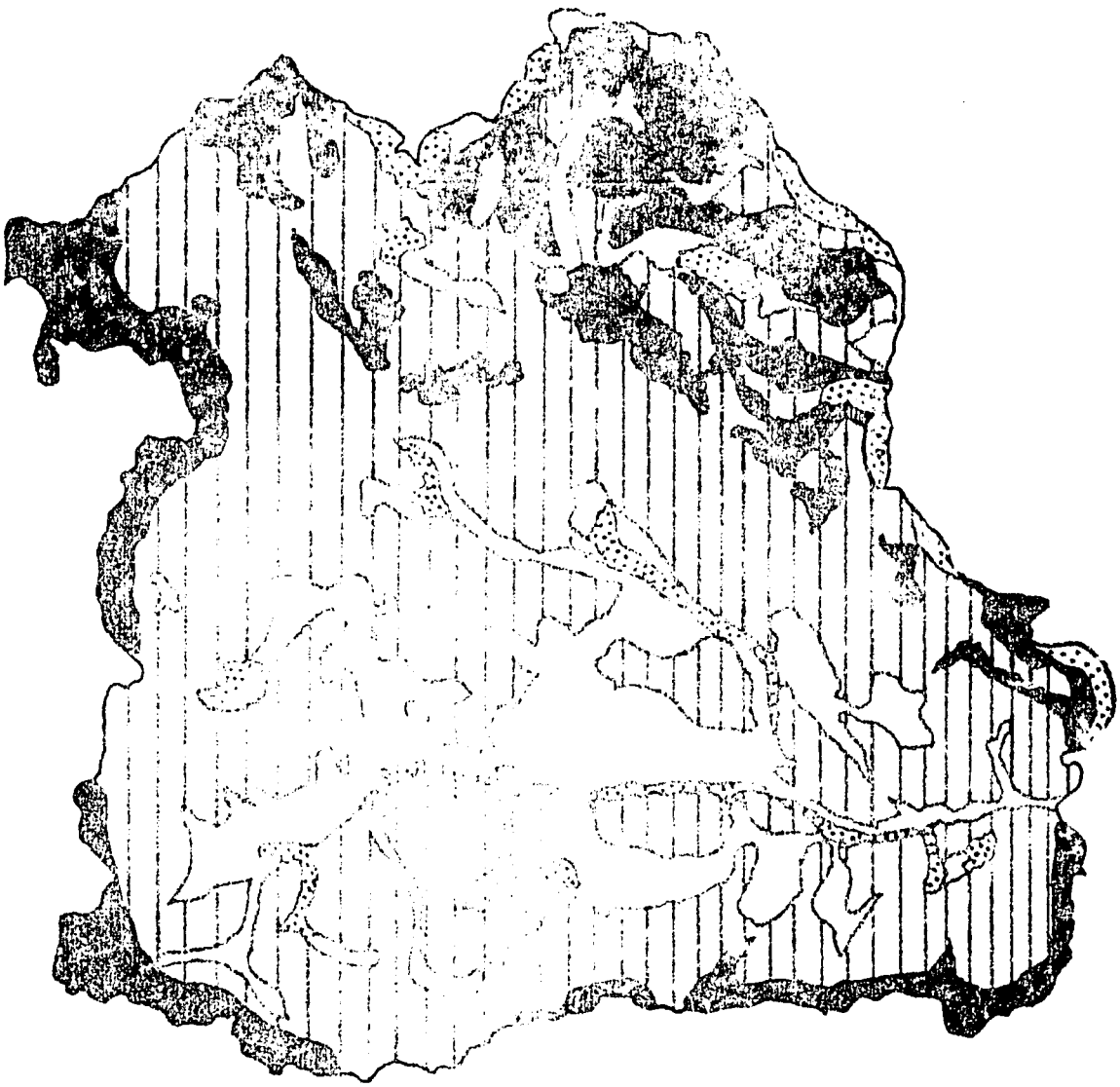


Figure 1. Wet Season Rice Planted Area in Northeast Thailand

Figure 2 : Total area of upper paddy estimated for each Changwat. (Darker shading represents a greater total area of upper paddy - 1 dot = 5,000 Rai).

Figure 3: Major agro-ecosystems of Northeast Thailand



Mini watershed system

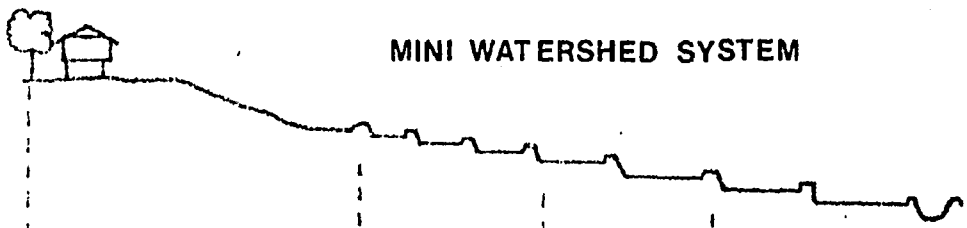
Hill system

Flood / non flood plain systems

Irrigation systems

Source: After KKU, 1982 and AIT, 1978

Figure 4 : Characteristics of the major agro-ecosystems of Northeast Thailand



	UPLAND		UPPER PADDY	MIDDLE PADDY	LOWER PADDY
SOILS		Paleustult	Paleustult/ Paleaquult	Paleaquult	Paleaquult
CROPS	Vegetable gardens, mulberry	Cassava, kenaf, sugar cane, water melon	Rice (short-duration)	Rice (long-duration)	Rice (long-duration)
PROBLEMS		Low O.M. content, selective-erosion, marketing	Insufficient water, weeds, drought	Low soil-fertility	Low soil-fertility, occasional flooding
LOCATION	Throughout the Northeast in areas between the hills and the flood and and non-flood plains				

FIGURE 5. RAINFALL AND RICE AREA VARIABILTY

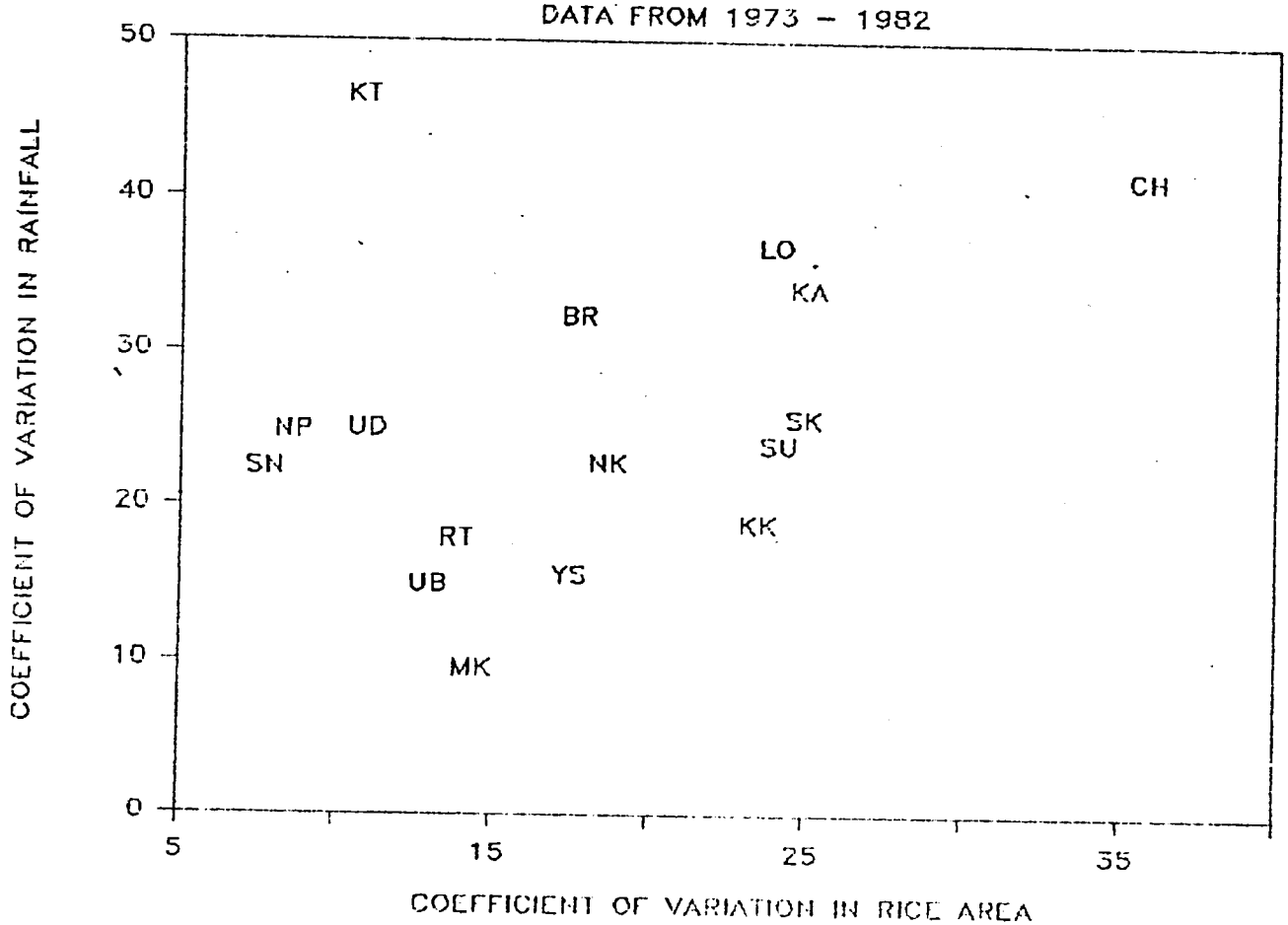


Figure 6. Coefficients of variation of rainfall over the period total June to August .

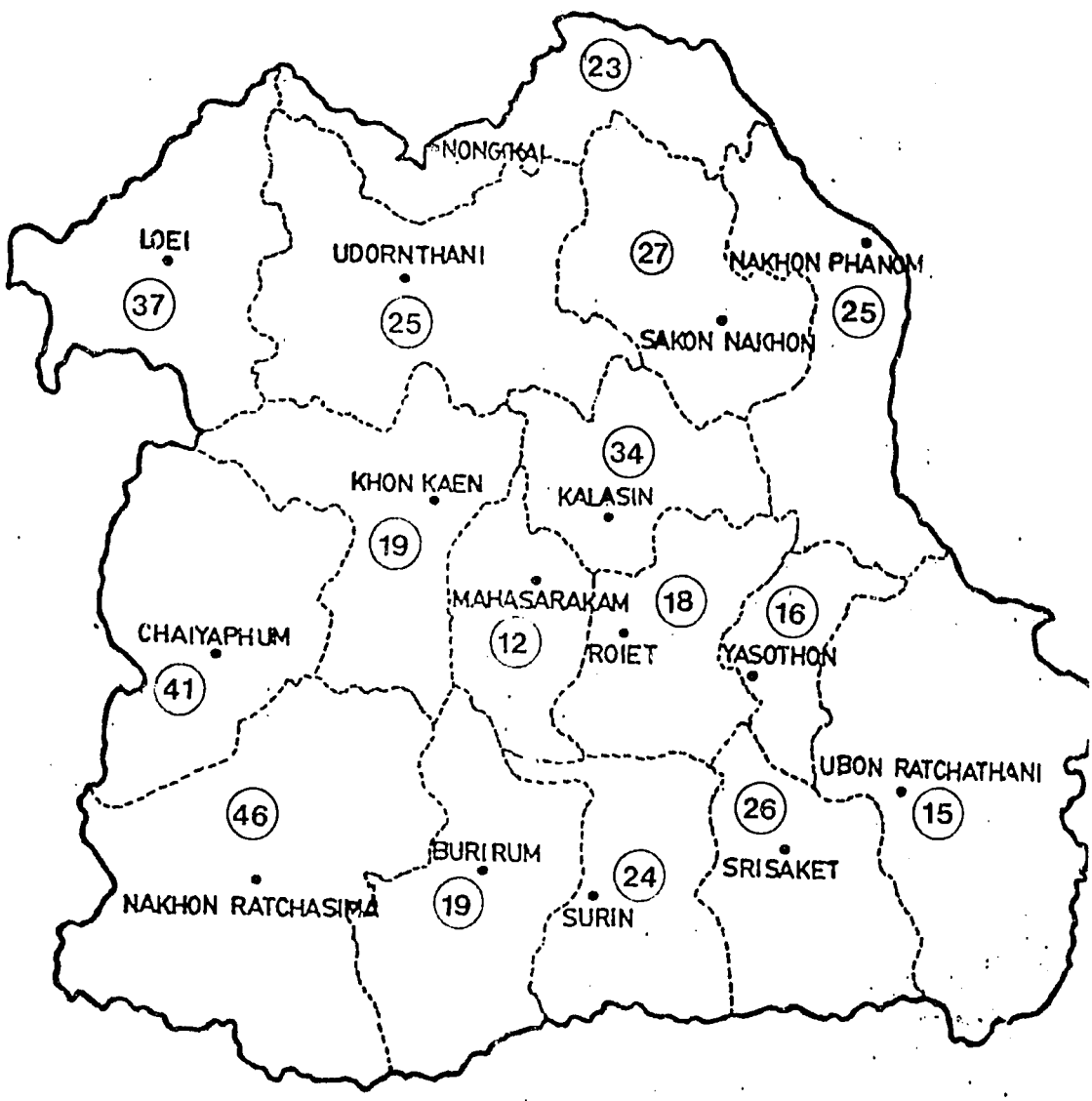
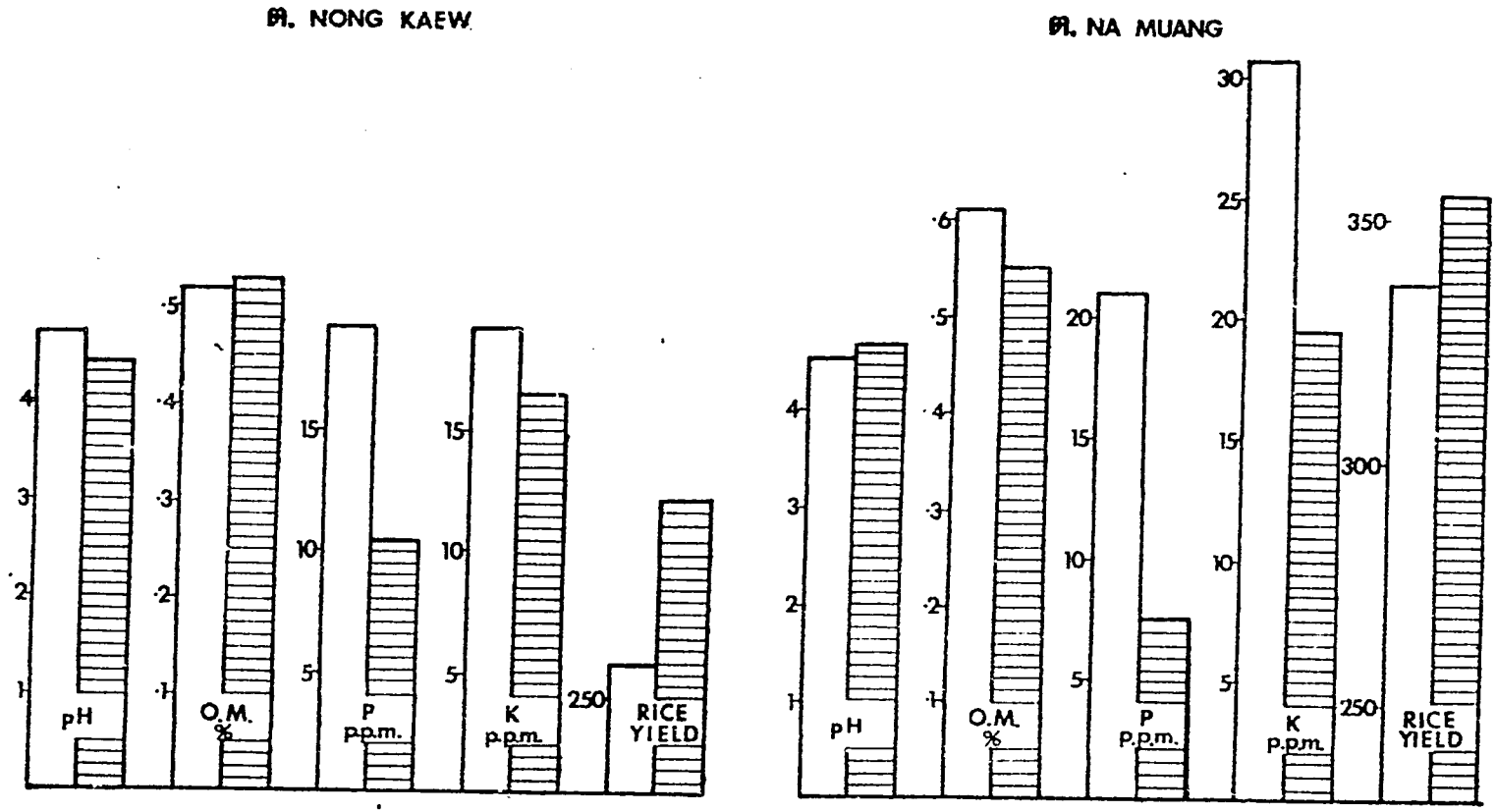


Figure 7 : Comparative soil test data for upper and lower paddies in NERAD project tambons, Roi Et.



Source: NERAD Cropping Systems Trials Data, Roi Et, 1984.
(mean values from 45 samples per tambon)

Lower paddy

Upper paddy