Table 1 . A portion of the Rice Environment Geographic Information System Database, showing some rainfed areas in Solana, Cagayan (1987)

MUN	BRGY	RICE CUL-TURE	RAINFED LAND TYPE	AREA (Ha)	MU	LF	ST	TX	DR	SL	PH	OM	P	K	GFL	VAR	YIELD tons/ha	PRESENT CROPPING PATTERN
SOL	BANG	RFED	IV	179.4	1	AT	903	M	P	A	6.2	1.6	29.3	500	H	LV	2.0	R-F
SOL	BANG	RFED	IV	9.4	2	RRT	901	M	W	A	6.6	1.5	3.0	500	M	LV	2.0	R-F
SOL	BANG	RFED	IV	23.1	2	RRT	901	M	W	A	6.6	1.5	3.0	500	M	LV	2.0	R-F
SOL	BANG	RFED	V	47.5	2	RRT	901	M	W	A	6.6	1.5	3.0	500	M	LV	2.0	R-F
SOL	BANT	RFED	I	28.1	2	IMP	228	F	P	A	6.2	2.4	46.2	328	VH	HYV	2.5	R-F
SOL	BANT	RFED	I	18.1	3	IMP	228	F	P	A	6.2	2.4	46.2	328	VH	HYV	2.5	R-F
SOL	BANT	RFED	I	36.3	4	IMP	228	F	P	A	6.1	2.0	45.0	360	VH	HYV	2.5	R-F
SOL	BANT	RFED	I	4.3	5	IMP	228	F	P	A	6.1	2.0	45.0	360	VH	HYV	2.5	R-F
SOL	BANT	RFED	I	5.6	6	IMP	256	F	P	A	5.6	2.0	20.0	100	VH	HYV	2.5	R-F
SOL	BAUE	RFED	V	38.8	1	AT	903	M	P	A	6.2	1.6	29.3	500	H	LV	2.0	R-F
SOL	BAUE	RFED	IV	80.0	1	AT	903	M	P	A	6.2	1.6	29.3	500	H	LV	2.0	R-F
SOL	BAUE	RFED	V	19.4	2	AT	192	F	P	A	8.3	2.3	28.7	420	VH	LV	2.0	R-F
SOL	BAUE	RFED	V	5.0	2	AT	192	F	P	A	8.3	2.3	28.7	420	VH	LV	2.0	R-F
SOL	BAUW	RFED	VI	225.6	1	AT	192	F	P	A	8.3	2.3	28.7	420	VH	LV	2.0	R-F
SOL	IRAG	RFED	III	12.5	5	AT	262	M	MW	A	5.0	1.9	8.3	98	M	LV	2.0	R-F
SOL	PADU	RFED	III	19.4	7	IMP	262	M	MW	B	5.4	2.5	20.0	290	M	LV	2.5	R-F
SOL	SAMP	RFED	III	37.5	2	AT	262	M	MW	A	5.0	2.0	8.7	145	M	LV/HYV	2.2	R-F
SOL	SAMP	RFED	III	148.1	5	AT	262	M	MW	A	5.0	1.9	8.3	98	M	LV	2.2	R-F

CODES

MUN - MUNICIPALITY (Abbrev. name)
BRGY - BARANGAY (Abbrev. name)
RFED - RAINFED
MU - MAPPING UNIT
LF - LANDFORM TYPE

ST SOIL TYPE
GFL GENERAL FERTILITY LEVEL
TX SOIL TEXTURE
SL SLOPE CLASS
CP CROPPING PATTERN: R = RICE; F = FALLOW
VAR VARIETY: LV = LOCAL RICE VARIETY; HYV = MODERN VARIETY
DR DRAINAGE

Table 2. Physical characteristics, present and suggested cropping patterns for six Rainfed Land Types identified in the lowland rice growing areas, Cagayan.

ENVIRONMENTAL PARAMETERS	RAINFED LAND TYPES		
	I	II	III
Landform unit	Alluvial fan with large watershed; Interhill miniplain with large watershed	Interhill miniplain, land facet 2	Upper land facet of Interhill miniplain with small watershed; Interfluve
Representative location	Maguirig, Solana Talinganay, Tuao	Bayo, Iguig; Pengue, Tuguegarao	Bayo, Iguig; Pengue, Larion Alto, Tuguegarao
Drainage	Fair to poor internal drainage Good surface drainage	Poor internal drainage Poor surface drainage	Fair internal drainage Good surface drainge
Hydrological year	Long (Jul-Jan); extended by surface and interflow from the catchment	Jul-Dec; surface and sub-surface flow from facet 1 and upper catchment extends the hydrological year	Relatively short (Jul-Nov); Water regime depends on direct rainfall and limited surface and interflow
Submergence threat	No submergence threat; but flash floods may occur after heavy rains	Very short term (1-2 days crop submergence frequent	No submergence threat
Drought threat	Drought threat mild	Moderate in some years	Severe drought stress threat during the season
Soil types	Bigaa clay; Bago sandy clay loam; Isabela clay; Bantog clay	Bigaa clay; Isabela clay	Bago sandy clay loam
Current cropping pattern	Wet-seeded rice (WSR)-TPR (MV);	F-TPR(TV)	F-TPR(TV)
Suggested cropping pattern	WSR(MV)-TPR(MV)	WSR(MV)-TPR(MV)	Mg (rp)-TPR IV)

F = Fallow
TPR = Transplanted rice
WSR = Wet-seeded rice
DSR = Dry-seeded rice

TV = Traditional rice variety
MV = Modern rice cultivar, semidwarf, early maturing
IV = Improved rice cultivar, intermediate height, medium maturity

Table 2. (Continued). Physical characteristics, present and suggested cropping patterns for six Rainfed Land Types identified in the lowland rice growing areas, Cagayan.

ENVIRONMENTAL PARAMETERS	RAINFED LAND TYPES		
	IV	V	VI
Landform unit	Recent river terrace; Land facet 1 (or stratum 1) of Alluvial terrace;	Land facet 2 (or stratum 2) of Alluvial terrace	Backswamp (or land facet 3) of Alluvial terrace
Representative location	Andarayan, Solana Bauan, Solana;	Bauan, Solana	Bauan, Solana; Libag, Tuguegarao; Cordova, Amulung
Drainage	Fair to poor internal drainage; Poor surface drainage	Very poor internal and surface drainage	Very poor internal and surface drainage, medium deep (25-50 cm) to deep water (>50 cm)
Hydrological year	Relatively short (Jul-Oct); Water accumulation mainly from direct rainfall	Jul-Dec; surface and interflow from facet 1 extends the hydrological year	Very long
Submergence threat	Very short term (1-2 days) crop submergence during the growing season; severe flooding occurs 1 in 12 years	Frequent and severe crop submergence expected every growing season; major long term flooding every 3 years	Prolonged flooding, and several short submergence period expected annually
Drought threat	Severe drought stress during crop growing season	Moderate in some years	Slight
Soil types	Tagulod clay loam; Quingua silty clay loam	Bantog clay; Bigaa clay; Isabela clay	Bigaa clay
Current cropping pattern	Fallow (F)- Transplanted rice (TPR) using traditional rice cultivar (TV) in 80% of area, Mungbean (Mg) broadcast-TPR(TV) in 20% of area	F-TPR(TV)	F-DSR(TV) (Tall, photoperiod sensitive rice cultivars with 7-8 mos field duration
Suggested cropping pattern	Mg (ridge-planting (rp))-TPR (Improved cultivar (IV))	WSS(Sesbania)-TPR(IV)	No change

F = Fallow
TPR = Transplanted rice
WSR = Wet-seeded rice
DSR = Dry-seeded rice

TV = Traditional rice variety
MV = Modern rice cultivar, semidwarf, early maturing
IV = Improved rice cultivar, intermediate height, medium maturity

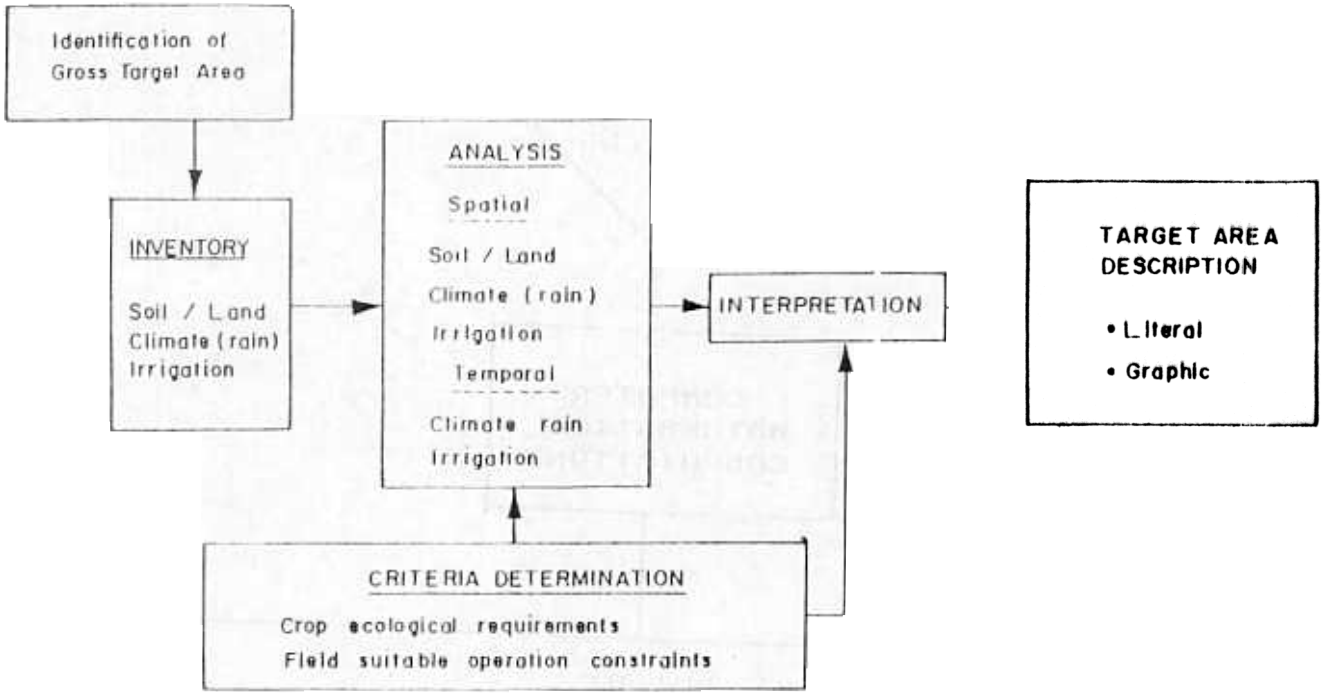


Fig 1 A routine for defining target areas for cropping systems projects. (From Magbanua and Morris, 1985).

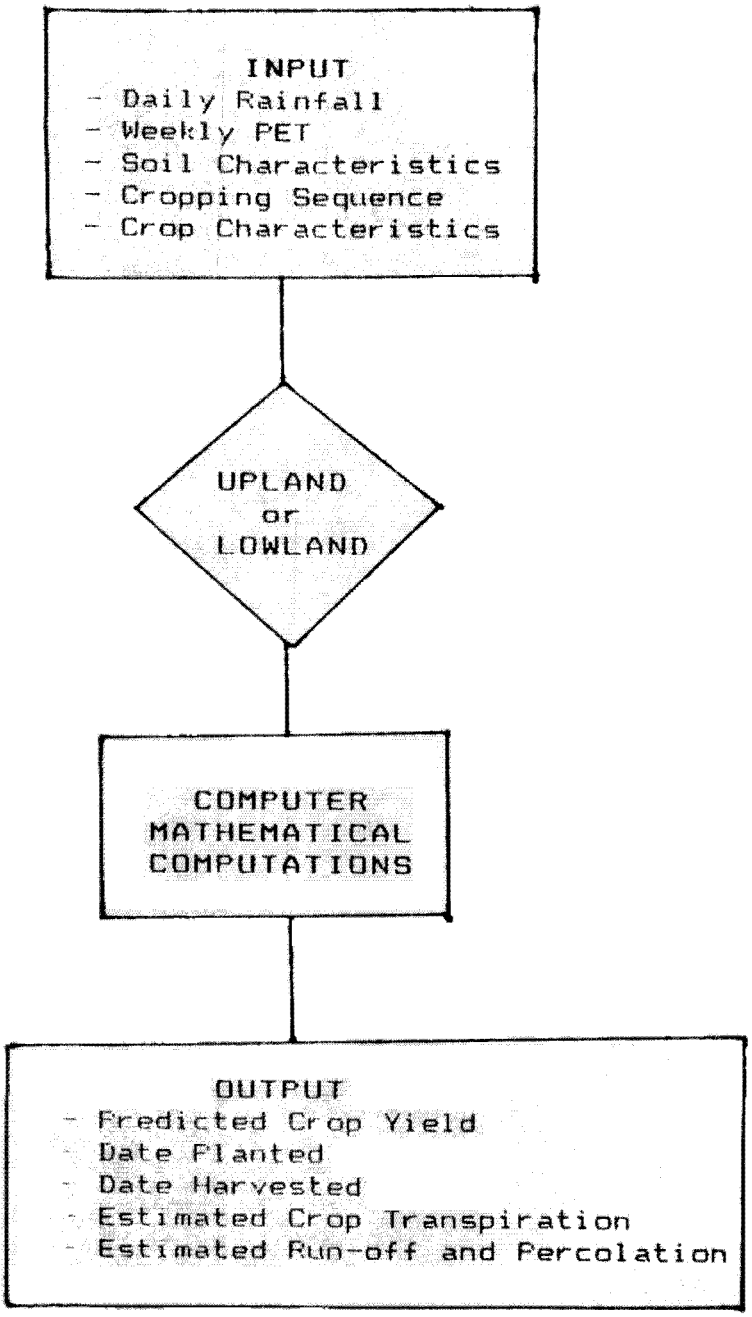


Fig 2 Schematic flow diagram of the soil water balance model (From Garcia, 1987).

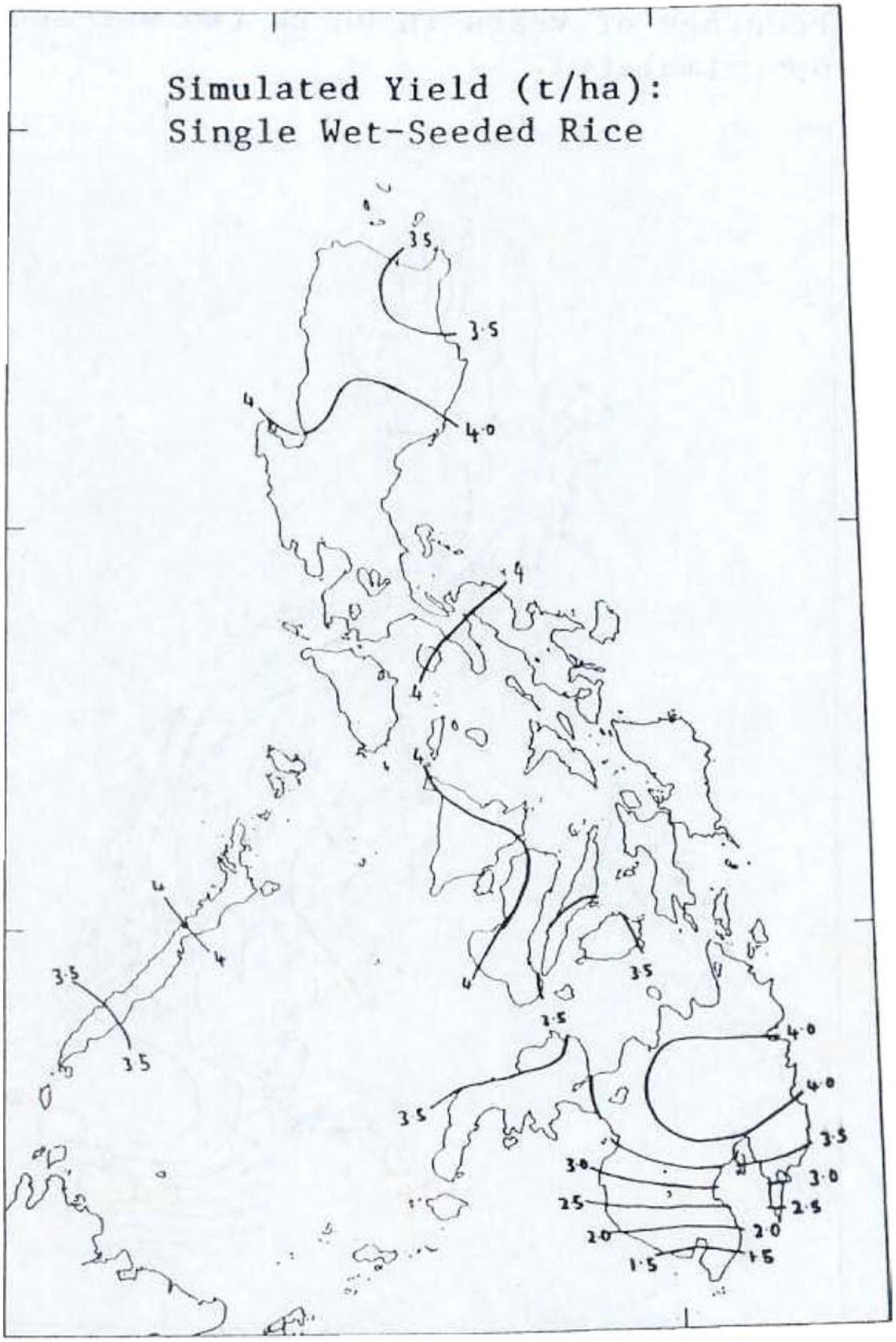


Fig. 3 Simulated yields of a single wet-seeded rice crop growing on a rainfed plain, based on simulations on weather data at 103 stations. (From Angus, 1987)

Percentage of years in which two wet-seeded crops simulated.

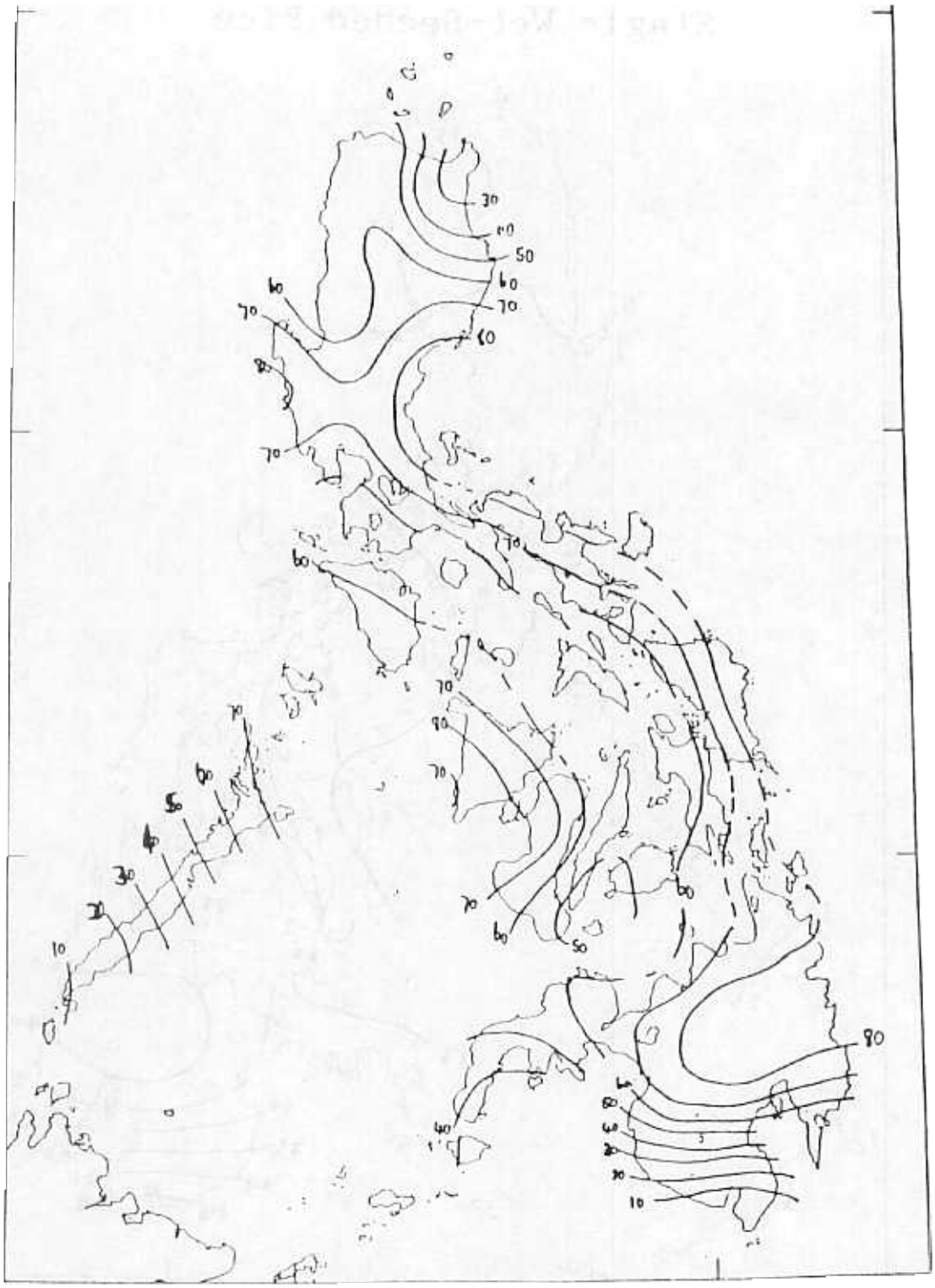


Fig 4 Percentage of years when the model simulated two wet-seeded rice crops on a rainfed plain, based on simulations on weather data at 103 locations. (From Angus, 1989).

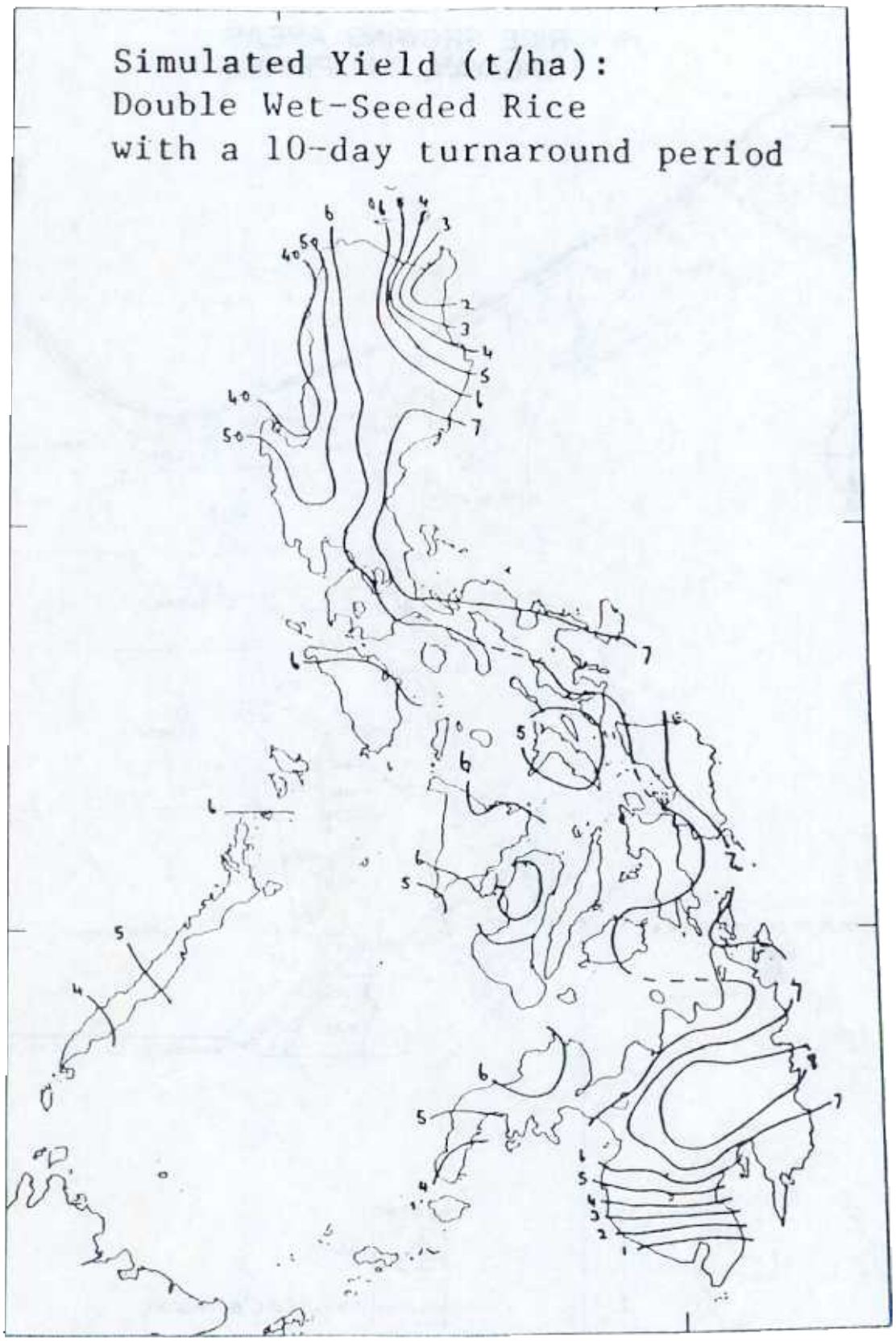
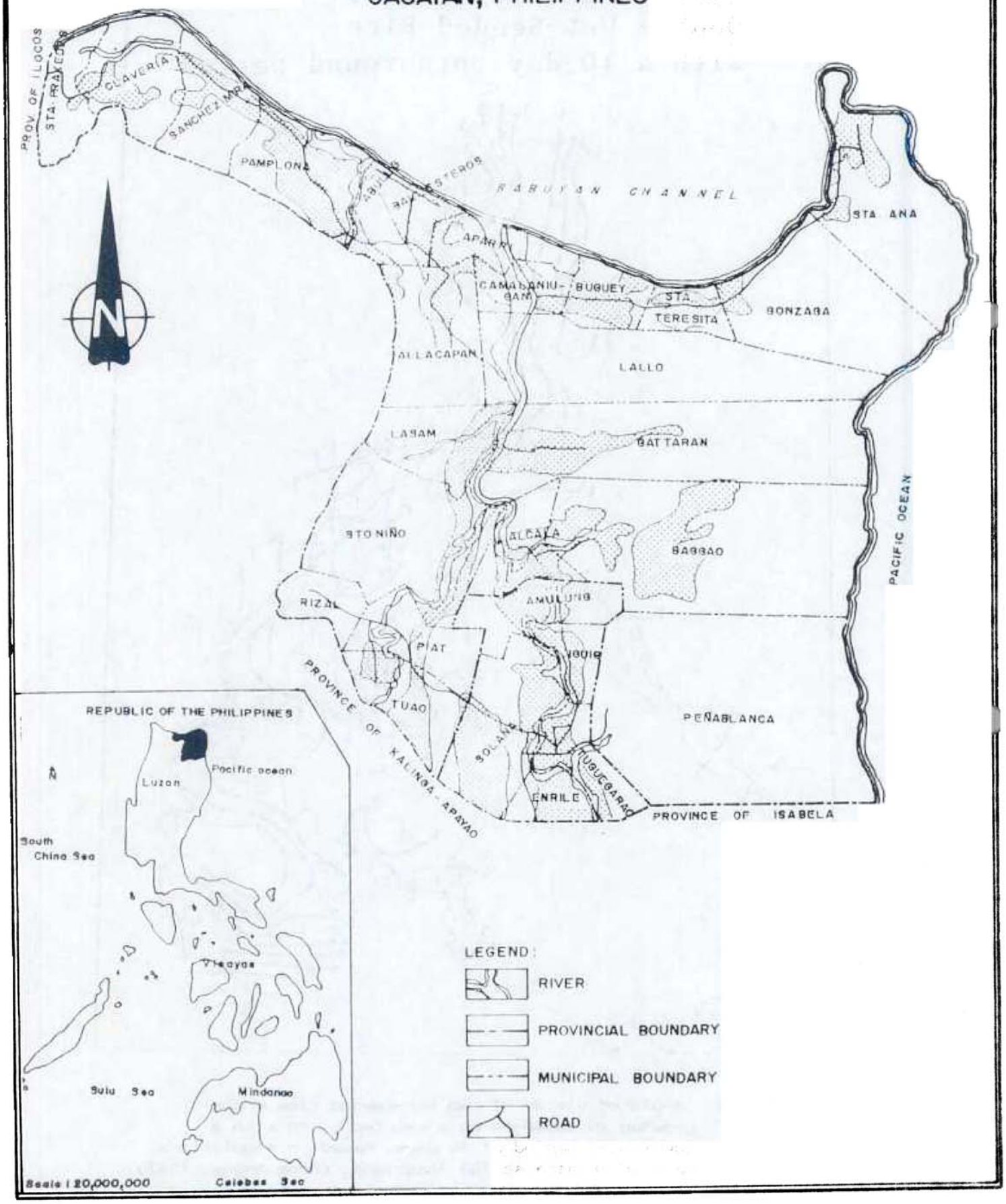


Fig. 5 Simulated yields of two wet-seeded rice crops growing in sequence on a rainfed plain with a turnaround period of 10 days, based on simulations on weather data at 103 locations. (From Angus, 1987).

Fig. 6. RICE GROWING AREAS
CAGAYAN, PHILIPPINES



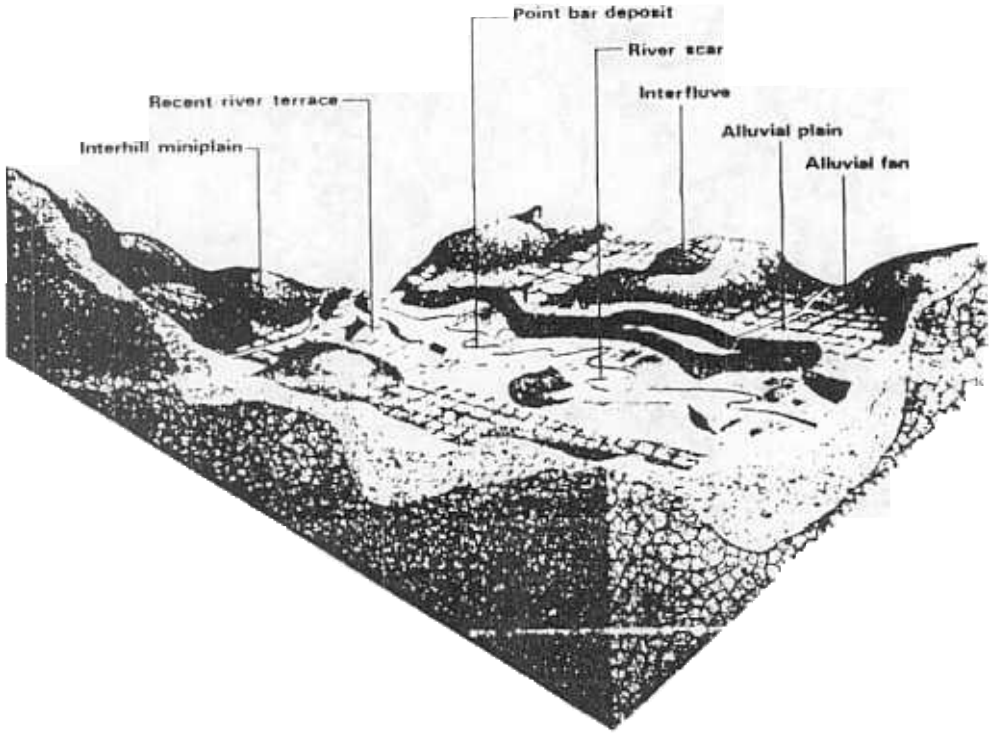
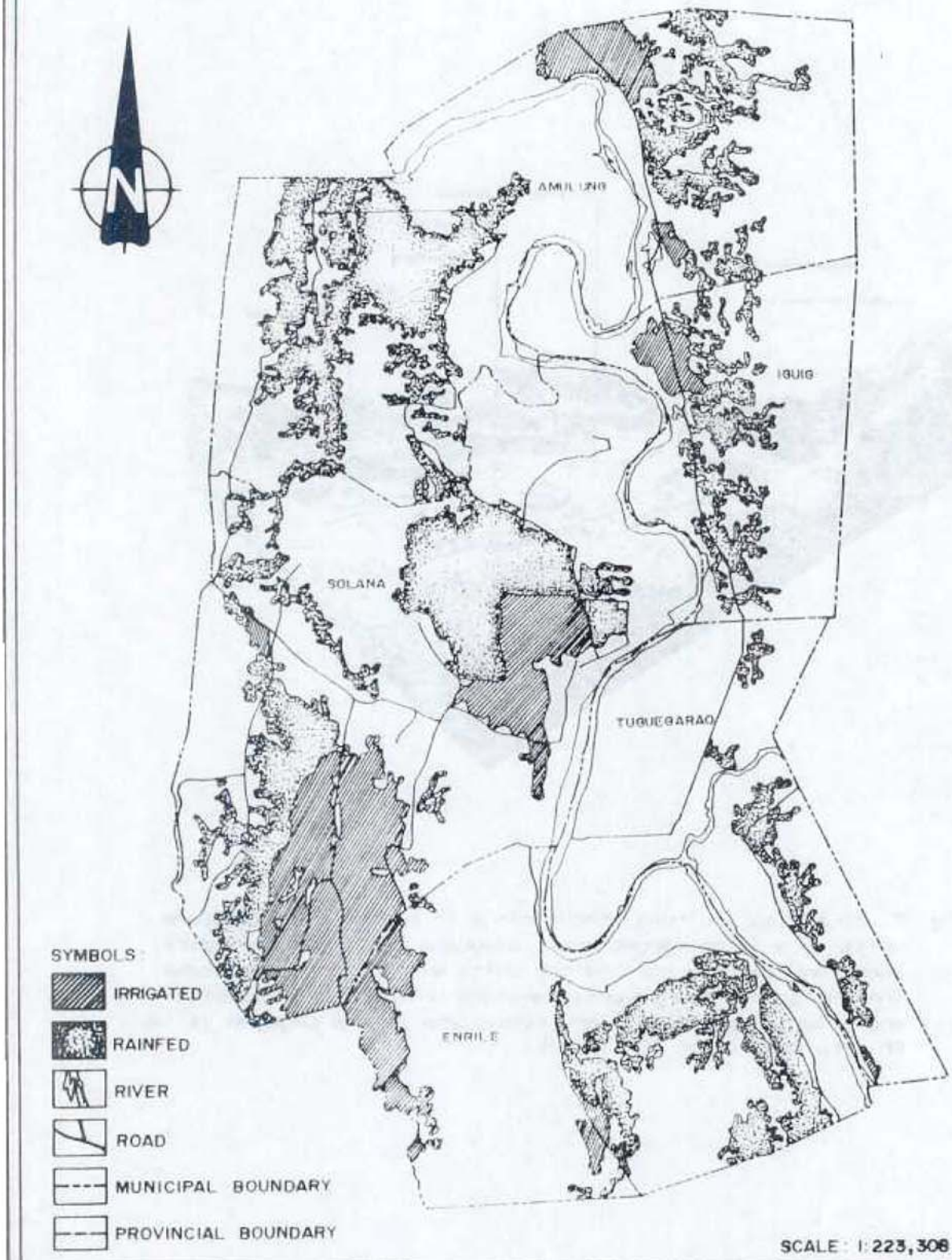


Fig 7 To aid agricultural technicians in recognizing landform units in a large target area, diagrams can show the typical recurrent pattern of landform units within land subsystems. This diagram shows several landform units within alluvial and alluvial-colluvial land sybsystems in the Cagayan Valley Philippines. (From IRRI, 1980).

Fig. 8. STUDY AREA OF 5 MUNICIPALITIES IN THE PROVINCE OF CAGAYAN, PHILIPPINES



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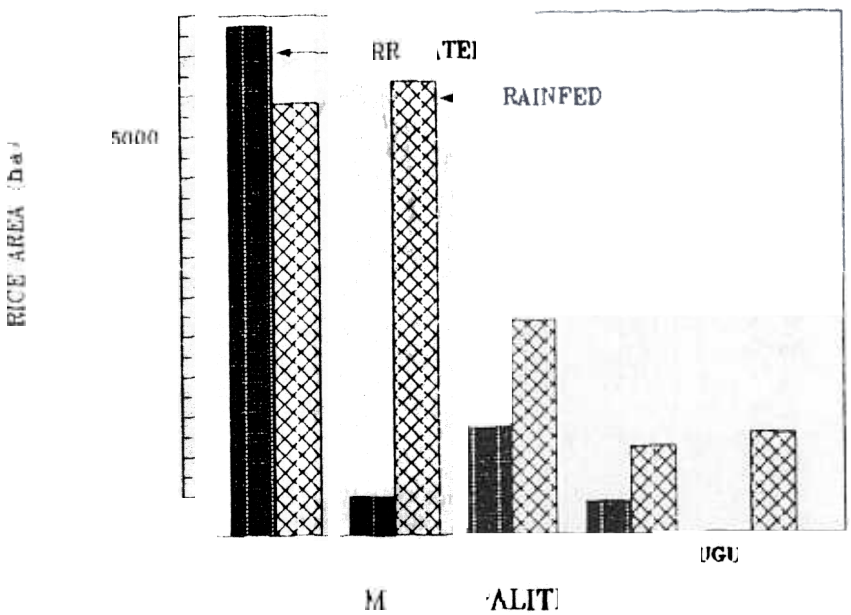


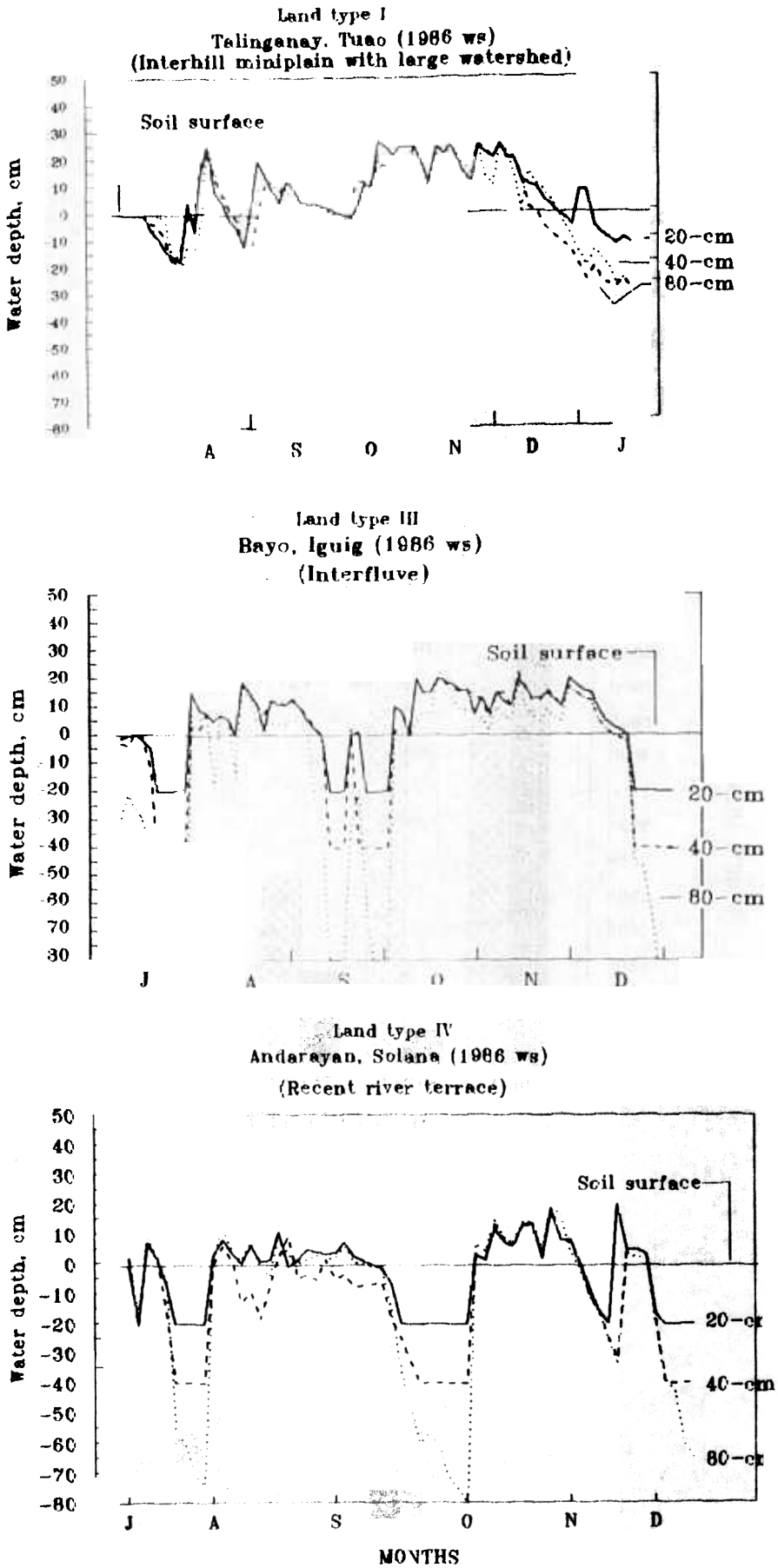
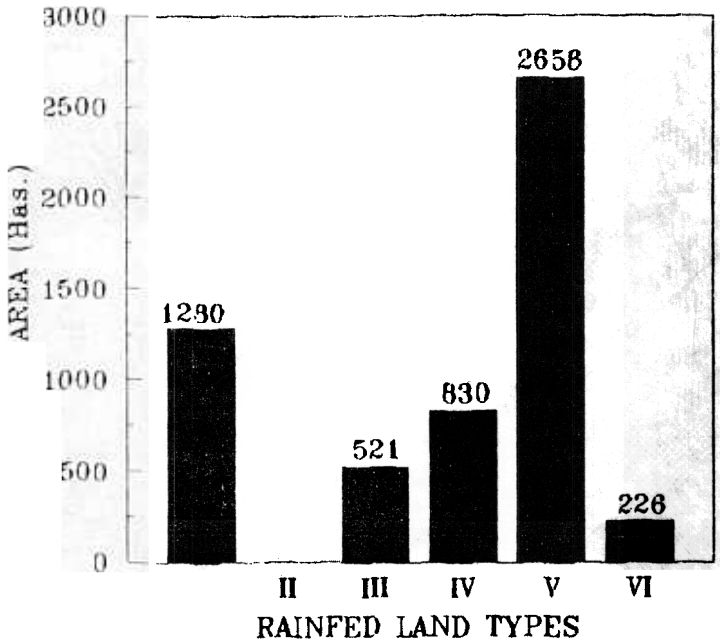


Fig. 10 Hydrographs of different rainfed land types, Cagayan, Philippines.

Fig Area distribution of different rainfed land types in Solana, Cagayan.



(See Table 2 and Fig. 12 for rainfed land type description and distribution, respectively)

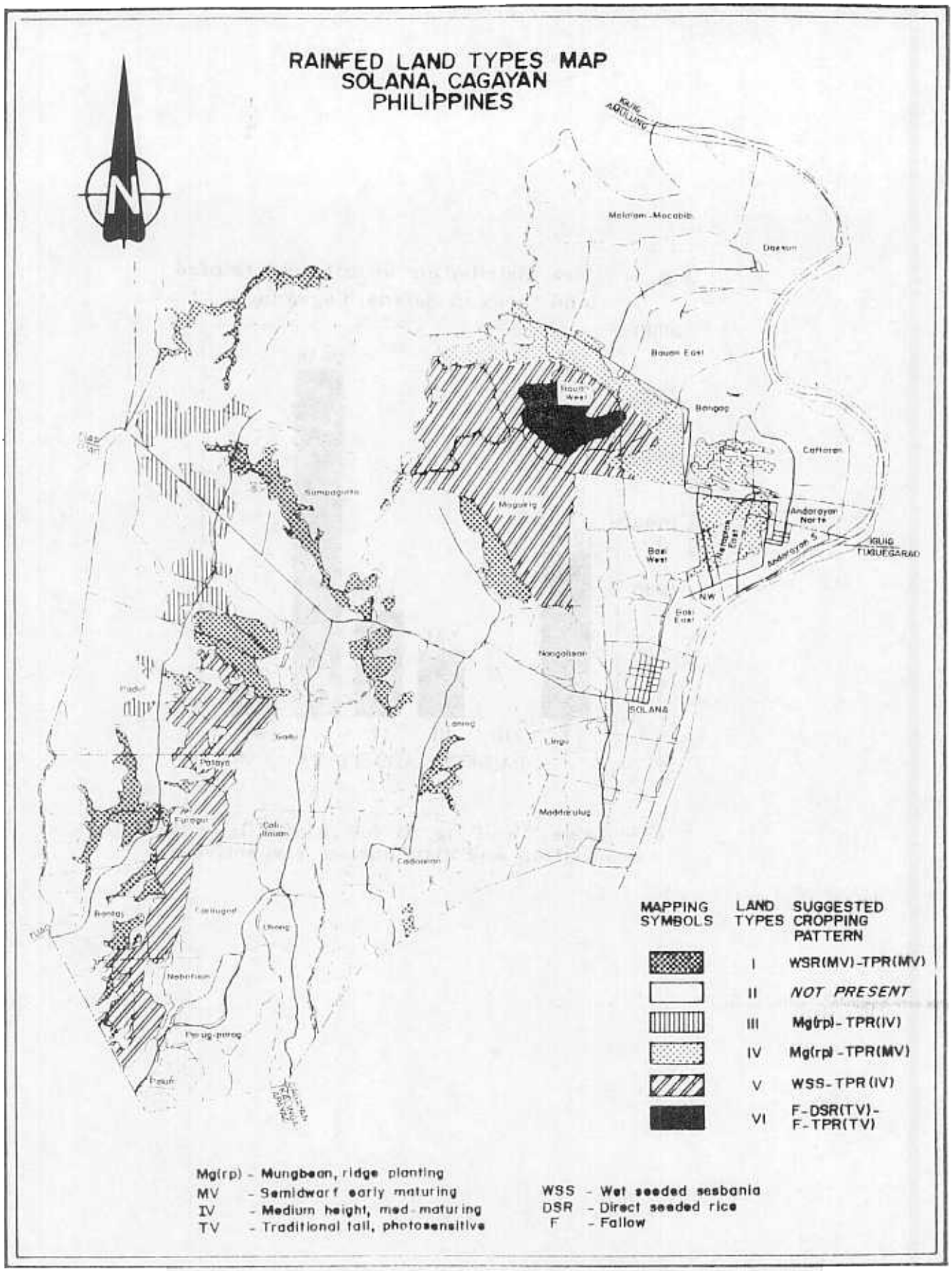


Fig. 12 Distribution of six rainfed land types and suggested cropping pattern, municipality of Solana, Cagayan, Philippines.

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MINISTRY OF AGRICULTURE, PHILIPPINES

P O L Y C R O P I

A COMPUTER PROGRAM TO CALCULATE THE POTENTIAL YIELD
OF RAINFED ANNUAL CROPS IN RELATION TO WATER BALANCE
THE PROGRAM SHOULD BE USED IN CONJUNCTION WITH THE
INSTRUCTION MANUAL

PREPARED BY JOHN ANGUS, ARNOLD GARCIA AND JOHN STEIN
CSIRO AUSTRALIA AND UPLB PHILIPPINES, 1985

BASED ON WEATHER DATA PROVIDED
BY W.P. DAVID, W.E. CABEZON, C.N. SERQUINA,
L.C. TIROL-LABIOS AND M.M. TAMISIN
FUNDING BY ACIAR

****

METEOROLOGICAL STATIONS WITH EVAPORATION DATA :

AMBKLO	AMBULG	APARRI	AURORA	BAGO	BAGUIO	BALARA	BALER	BALETE	BASCO
BOLNAO	BONTOC	BORONG	BRBAZA	BROOKS	BUTUAN	BYMBON	CALAPN	CALAYN	CASGRN
CATBLG	CATRMN	CAVNTI	CBNTUN	CDEORO	CEBU	CLARIN	CLRAYA	CLVRIA	CNTLAN
LOSBAN	CORON	COTABT	CSTILA	CULASI	CUYO	DAET	DAGHOY	DAGUPN	DAVAO
DIPOLO	DLGETE	DUMGTE	FRTICH	GENSAN	GNBTAN	HINATN	IBA	ILIGAN	ILOILO
IMPLTO	INFANT	IPO	ITOGON	JOLO	JORDAN	JUBAN	KBUGAO	KDPWAN	LAMESA
LADAG	LASAM	LCRLTA	LEGASP	LGRNJA	LMITAN	LUBANG	LUCENA	MAASIN	MABINI
MALITA	MALYBY	MANILA	MASBTE	MBINID	MDSYAP	MIA	MLGROS	MNLNLA	MNTLPA
MSALEP	NANENG	NGULAN	ORAS	PALNAS	PRTPCS	ROMBLN	ROXAS	SIATON	SILAY
SMINGO	SRSGON	STCRZL	SURGAO	TACLOB	TAGUM	TGBLRN	TUBGON	TUGARA	VCTRAS
VIGAN	VIRAC	VLDRMA	ZMBNGA	DAO					

FROM THIS LIST OF AVAILABLE EVAPORATION STATIONS, PLEASE ENTER THE NAME OF
YOUR STATION, OR THE STATION NEAREST TO YOUR RAINFALL LOCATION

ILOILO

PLEASE ENTER THE NAME OF STATION WHERE RAINFALL DATA WAS RECORDED
(EITHER FROM THE LIST ABOVE, OR YOUR OWN LOCATION)

ILOILO

EVAPORATION STATION = ILOILO
RAINFALL STATION = ILOILO
(ENTER YES IF CORRECT, OR NO IF NOT)

YES

HOW MANY DAYS OF MISSING RAINFALL DATA ARE TOLERATED IN A YEAR
BEFORE REJECTING THAT YEAR ?
(IF YOU ARE NOT SURE, AN APPROPRIATE NUMBER IS 20)

20

AVAILABLE YEARS FOR STATION ILOILO : 1904 978
IN WHICH YEAR WOULD YOU LIKE TO START ?

1976

IS YOUR FIELD LOWLAND OR UPLAND ?
(ENTER L FOR LOWLAND OR U FOR UPLAND)

LOWLAND

	SOIL TYPE		
	1 HEAVY (CLAY	2 MEDIUM (LOAM)	3 LIGHT (SAND)
% SOIL WATER CONTENT AT:			
SATURATION	52.0	49.0	46.0
FIELD CAPACITY	38.0	27.0	16.0
PERM. WILT. POINT	23.0	15.0	4.0
INFILTRATION RATE (mm/day)	3.0	8.0	12.0
SEEPAGE RATE THRU BUND (mm/day)	3.0	6.0	9.0

WHAT IS YOUR SOIL TYPE ?
(FOR SOILS LISTED ABOVE, ENTER APPROPRIATE NUMBER, ie. 1-3
FOR SOILS NOT LISTED, ENTER 4)

IN WHICH MONTH DOES THE CROP YEAR MOST OFTEN START ? (NUMBER PLEASE)
(APRIL=4 MAY=5 JUNE=6 JULY=7 AUGUST=8)

5

DO YOU WANT TO HAVE THE SAME CROPS EVERY YEAR ?
IF YES, ENTER THE NUMBER OF CROPS IN THE CROPPING PATTERN 1-3)
IF NO, ENTER 0

3

	CROP				
	1 DS IR36	2 WS IR36	3 TP IR36	4 MUNGBEAN	5 GREEN CORN
DAYS TO FLOWERING	75.	75.	60.	32.	40.
DAYS TO MATURITY	105.	105.	90.	65.	60.
% GROUND AREA UNDER LEAF CANOPY	100.	100.	100.	100.	100.
MAX. ROOT DEPTH (cm)	30.	30.	30.	60.	60.
WATER USE EFFICIENCY (g/m2/mm)	1.300	1.300	1.300	.800	1.400

WHAT IS YOUR FIRST CROP ?
FOR CROPS LISTED ABOVE, ENTER APPROPRIATE NUMBER, ie. 1-5
FOR CROPS NOT LISTED, ENTER 6 IF CROP NEEDS SATURATED SOIL TO COMMENCE,
OR 7 IF IT DOES NOT

1

HOW MANY DAYS BETWEEN FIRST MOIST SOIL AND ACTUAL DATE OF PLANTING ?

1

CROP

	1 DS IR36	2 WS IR36	3 TP IR36	4 MUNGBEAN	5 GREEN CORN
DAYS TO FLOWERING	75.	75.	60.	32.	40.
DAYS TO MATURITY	105.	105.	90.	65.	60.
% GROUND AREA UNDER LEAF CANOPY	100.	100.	100.	100.	100.
MAX. ROOT DEPTH (cm)	30.	30.	30.	60.	60.
WATER USE EFFICIENCY (g/m2/mm)	1.300	1.300	1.300	.800	1.400

WHAT IS YOUR SECOND CROP ?
FOR CROPS LISTED ABOVE, ENTER APPROPRIATE NUMBER, ie. 1-5
FOR CROPS NOT LISTED, ENTER 6 IF CROP NEEDS SATURATED SOIL TO COMMENCE,
OR 7 IF IT DOES NOT

HOW MANY DAYS IS THE MINIMUM TURN-AROUND TIME ?
(FROM HARVEST OF LAST CROP TO PLANTING OF THIS CROP)

14

CROP

	1 DS IR36	2 WS IR36	3 TP IR36	4 MUNGBEAN	5 GREEN CORN
DAYS TO FLOWERING	75.	75.	60.	32.	40.
DAYS TO MATURITY	105.	105.	90.	65.	60.
% GROUND AREA UNDER LEAF CANOPY	100.	100.	100.	100.	100.
MAX. ROOT DEPTH (cm)	30.	30.	30.	60.	60.
WATER USE EFFICIENCY (g/m2/mm)	1.300	1.300	1.300	.800	1.400

WHAT IS YOUR THIRD CROP ?
FOR CROPS LISTED ABOVE, ENTER APPROPRIATE NUMBER, ie. 1-5
FOR CROPS NOT LISTED, ENTER 6 IF CROP NEEDS SATURATED SOIL TO COMMENCE,
OR 7 IF IT DOES NOT

4

HOW MANY DAYS IS THE MINIMUM TURN-AROUND TIME ?
(FROM HARVEST OF LAST CROP TO PLANTING OF THIS CROP)
1

INPUT SUMMARY

EVAPORATION STATION	=	ILOILO		
RAINFALL STATION	=	ILOILO		
STARTING YEAR	=	1976		
FIELD LOCATION	=	LOWLAND		
% SOIL WATER AT: SATUR.	=	49.		
F.CAP.	=	27.		
P.W.PT.	=	15.		
INFILTRATION RATE	=	8.		
SEEPAGE RATE	=	6.0		
FIRST MONTH OF CROP YEAR	=	USUALLY MAY		
CROP	=	DS IR36	TP IR36	MUNGBEAN
DAYS TO FLOWERING	=	75.	60.	32.
DAYS TO MATURITY	=	105.	90.	65.
LEAF COVERAGE (%)	=	100.	100.	100.
ROOT DEPTH (cm)	=	30.0	30.0	60.0
WATER USE EFFICIENCY	=	1.3000	1.3000	.8000
MIN. TURN-AROUND (days)	=	1.	14.	1.

ARE THESE DATA CORRECT ?
(ENTER YES TO CONTINUE, OR NO TO MAKE CHANGES)
YES

CROP YEAR 1976/1977 IS ACCEPTABLE WITH LESS THAN 20. DAYS OF MISSING DATA

CROP 1 DS IR36
SOWING DATE: MAY 17
HARVEST DATE: AUG 29
ESTIMATED TOTAL CROP TRANSPIRATION: 312. mm
MAXIMUM POTENTIAL YIELD (LIMITED BY TRANSPIRATION ONLY): 4.1 t/ha
ESTIMATED EXCESS WATER FROM RUN-OFF AND PERCOLATION: 1139. mm

CROP 2 TP IR36
SOWING DATE: SEP 13
HARVEST DATE: DEC 11
ESTIMATED TOTAL CROP TRANSPIRATION: 245. mm
MAXIMUM POTENTIAL YIELD (LIMITED BY TRANSPIRATION ONLY): 3.2 t/ha
ESTIMATED EXCESS WATER FROM RUN-OFF AND PERCOLATION: 355. mm

CROP 3 MUNGBEAN
SOWING DATE: DEC 12
HARVEST DATE: FEB 14
ESTIMATED TOTAL CROP TRANSPIRATION: 156. mm
MAXIMUM POTENTIAL YIELD (LIMITED BY TRANSPIRATION ONLY): 1.2 t/ha
ESTIMATED EXCESS WATER FROM RUN-OFF AND PERCOLATION: 0. mm

CROP YEAR 1977/1978 IS ACCEPTABLE WITH ESS THAN 20. DAYS OF MISSING DATA

CROP 1 DS IR36
SOWING DATE: JUL 2
HARVEST DATE: OCT 14
ESTIMATED TOTAL CROP TRANSPIRATION: 290. mm
MAXIMUM POTENTIAL YIELD (LIMITED BY TRANSPIRATION ONLY): 3.8 t/ha
ESTIMATED EXCESS WATER FROM RUN-OFF AND PERCOLATION: 904. mm

CROP 2 TP IR36
NO SOWING DATE CROP WAS NOT SOWN BECAUSE IT WAS TOO DRY

CROP YEAR 1978/1979 IS ACCEPTABLE WITH LESS THAN 20. DAYS OF MISSING DATA

CROP 1 DS IR36
SOWING DATE: MAY 19
HARVEST DATE: AUG 31
ESTIMATED TOTAL CROP TRANSPIRATION: 298. mm
MAXIMUM POTENTIAL YIELD (LIMITED BY TRANSPIRATION ONLY): 3.9 t/ha
ESTIMATED EXCESS WATER FROM RUN-OFF AND PERCOLATION: 547. mm

CROP 2 TP IR36
SOWING DATE: SEP 26
HARVEST DATE: DEC 24
ESTIMATED TOTAL CROP TRANSPIRATION: 244. mm
MAXIMUM POTENTIAL YIELD (LIMITED BY TRANSPIRATION ONLY): 3.2 t/ha
ESTIMATED EXCESS WATER FROM RUN-OFF AND PERCOLATION: 643. mm

CROP 3 MUNGBEAN
SOWING DATE: JAN 2
HARVEST DATE: MAR 7
ESTIMATED TOTAL CROP TRANSPIRATION: 88. mm
MAXIMUM POTENTIAL YIELD (LIMITED BY TRANSPIRATION ONLY): .7 t/ha
ESTIMATED EXCESS WATER FROM RUN-OFF AND PERCOLATION: 0. mm

WHAT WOULD YOU LIKE TO DO NOW ?

ENTER :

0 TO FINISH
1 TO CHANGE CROPS ONLY
2 TO CHANGE SOIL ONLY
3 TO CHANGE LOCATION ONLY
4 TO MAKE MORE THAN ONE CHANGE

0
Stop Program terminated.