Water retaining in paddy field: in a case of China

ZHU Defeng

China National Rice Research Institute

1 Rice production

2 Rice growth environment

3 Rice water requirement

4 Rice water management practice

5 Ecological function of paddy field

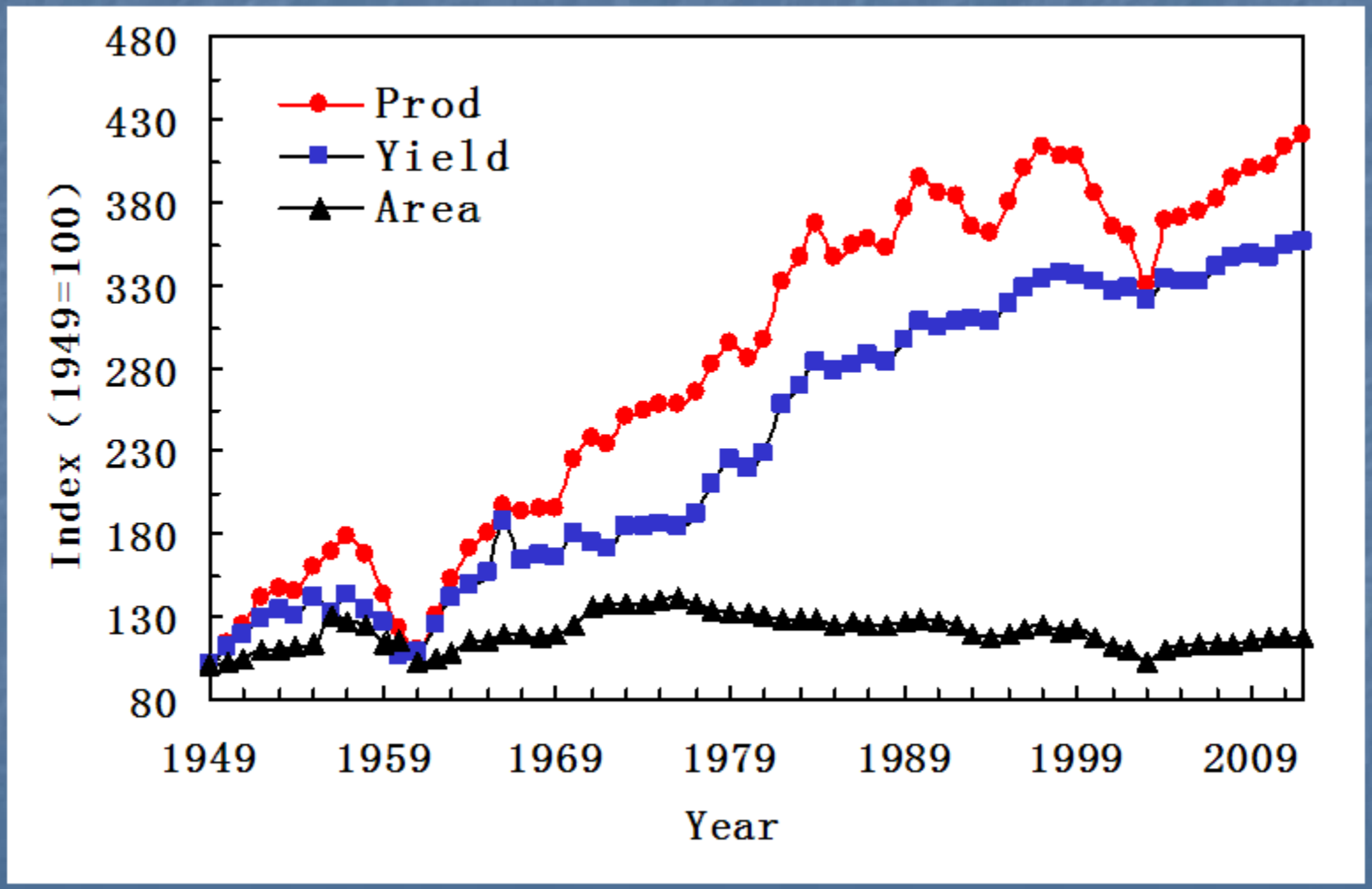
1 Rice production

Area, yield and prod of main food crop in China

Crop	Area（Mha)	Yield (t/ha)	Prod (Mt)
Food crop	110.5(100)	5.1(100)	571.2(100)
Rice	30.1(27)	6.6(129)	201.0(35)
Wheat	24.2(22)	4.8(94)	117.4(21)
Corn	33.5(30)	5.7(111)	192.7(34)

Note: crop yield is relative yield to food crop

Change of rice area, yield and production in China



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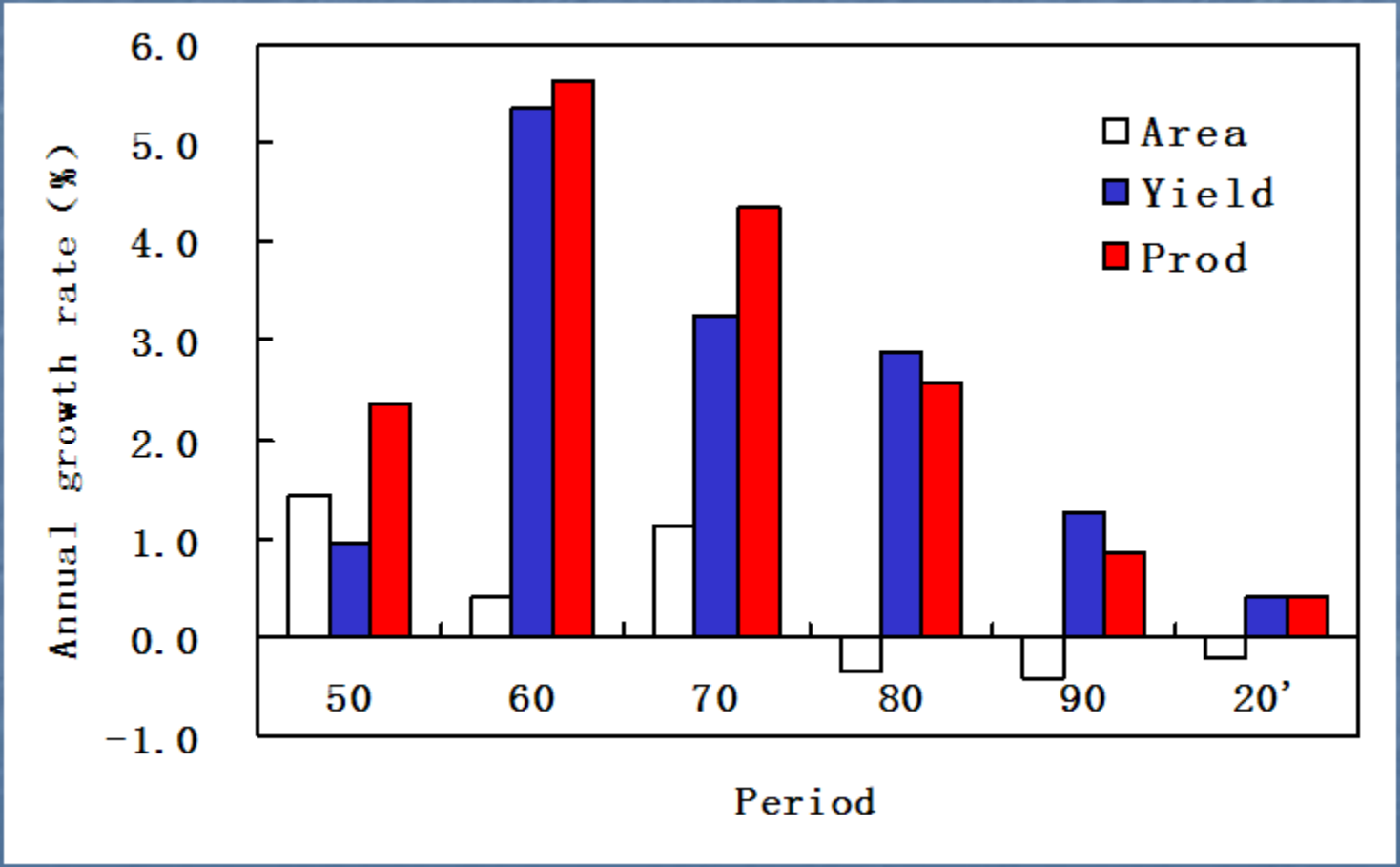
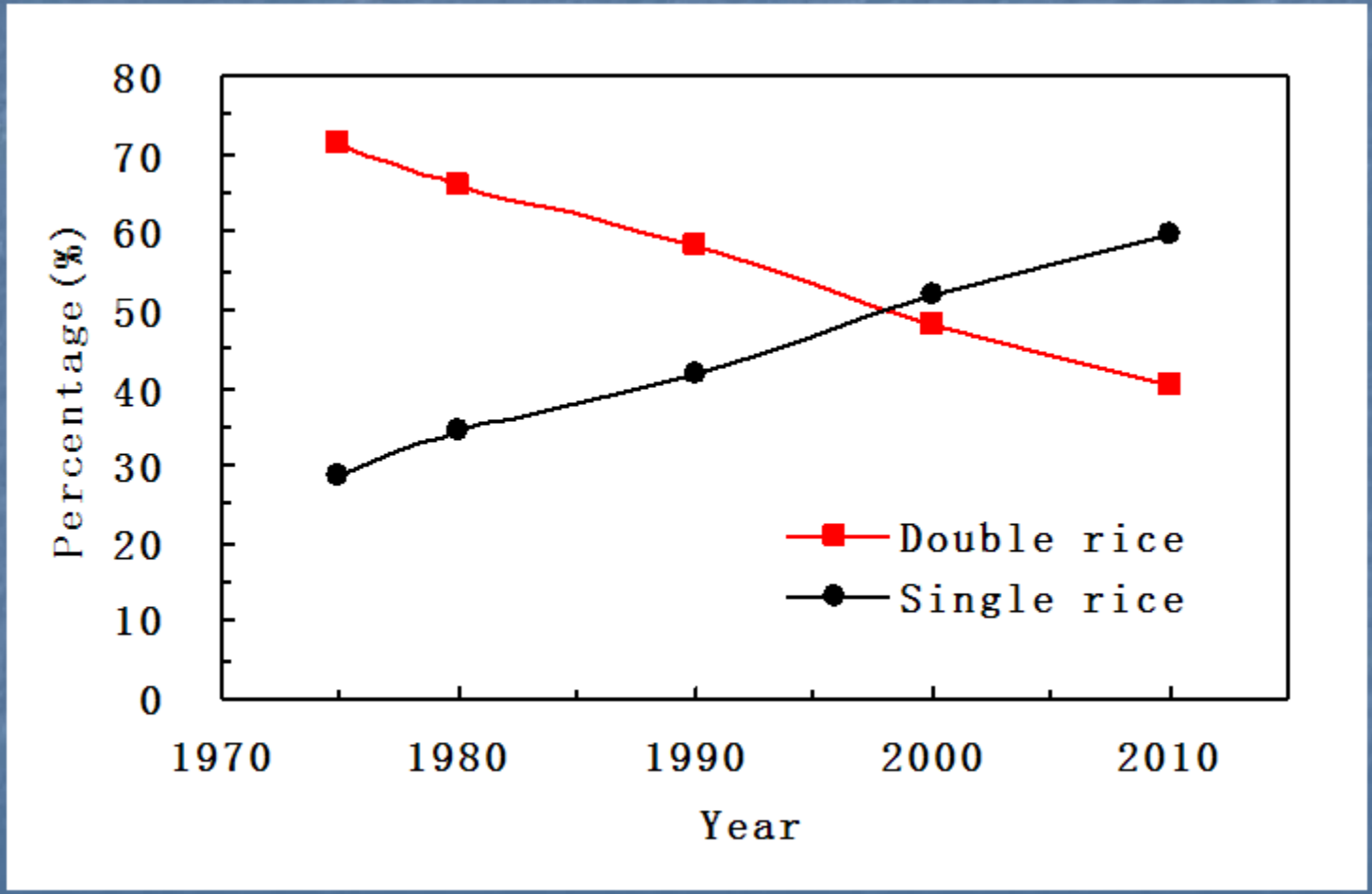
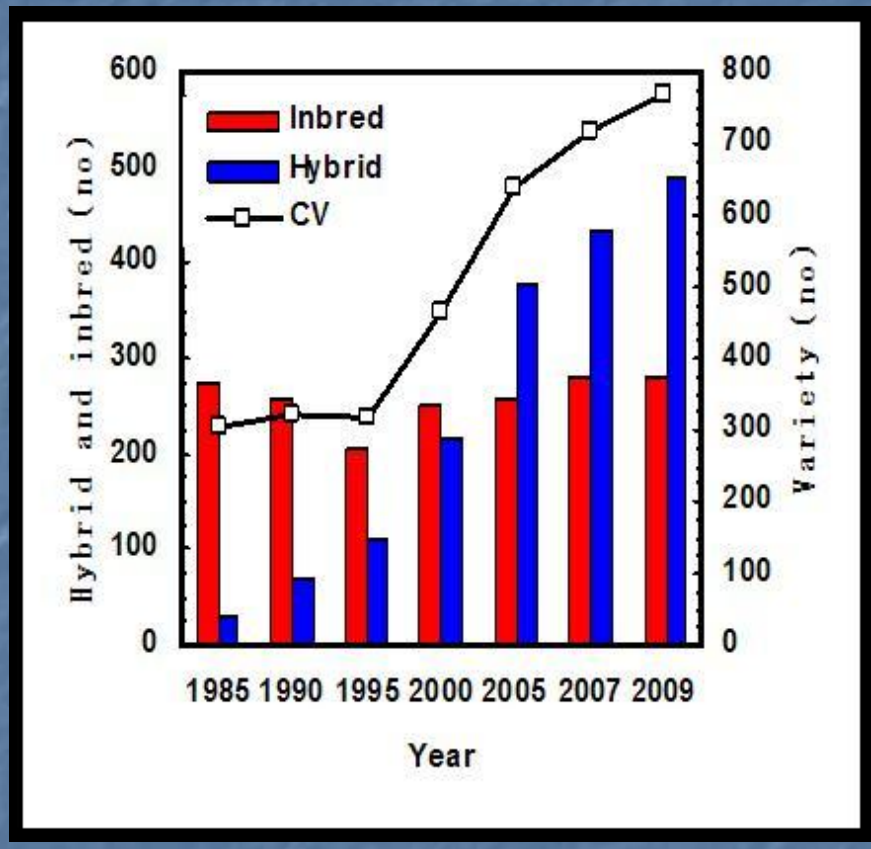
Annual growth rate of rice area, yield and production

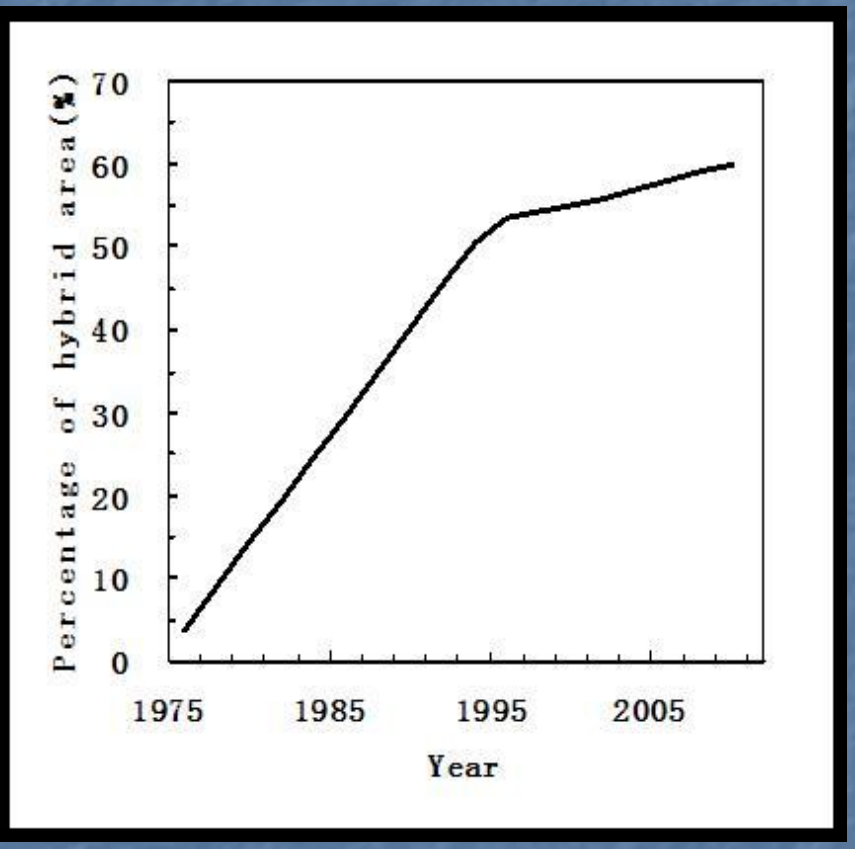


Shift from double rice to single rice



Change of rice variety type



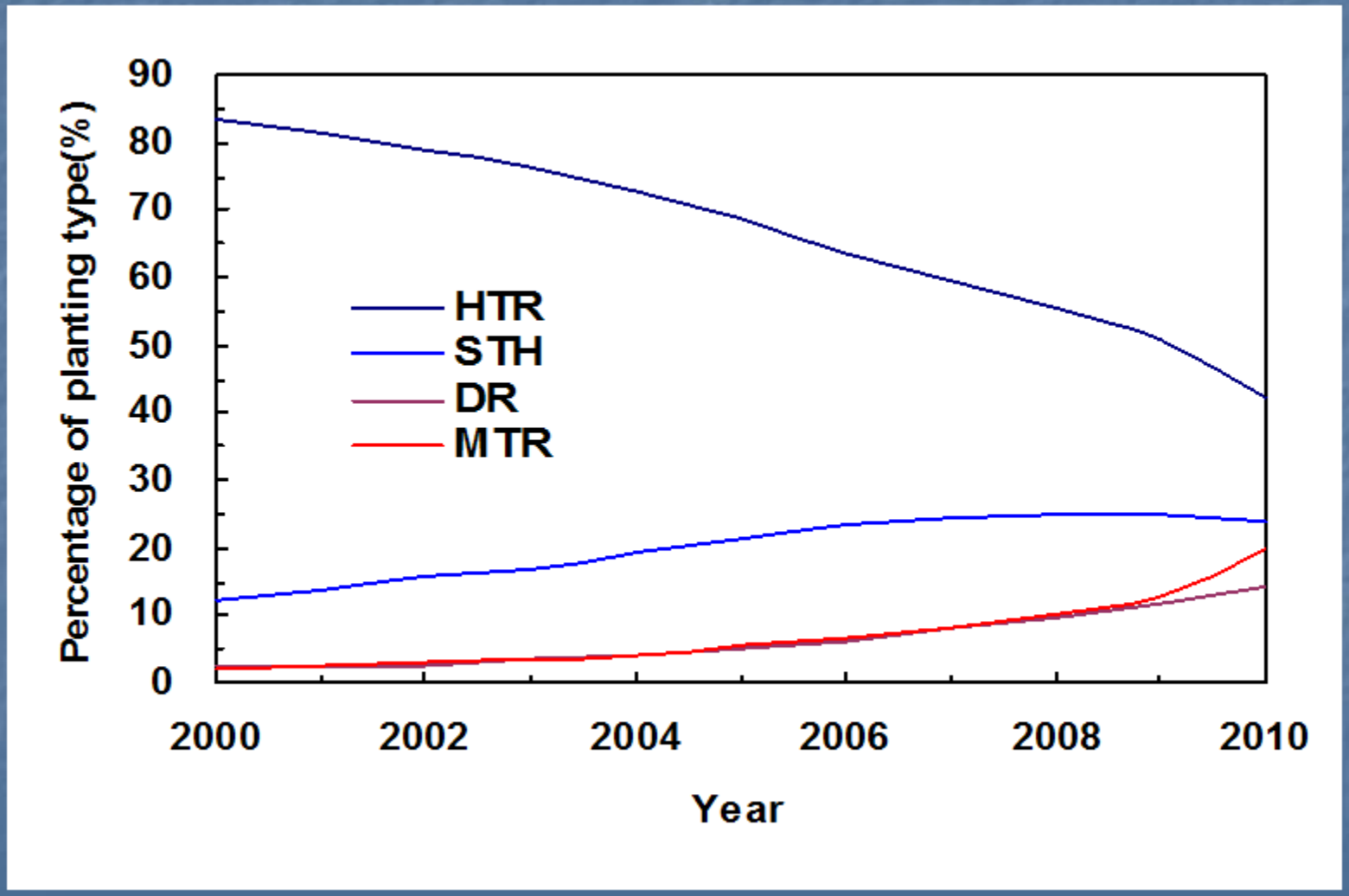


Rice variety number

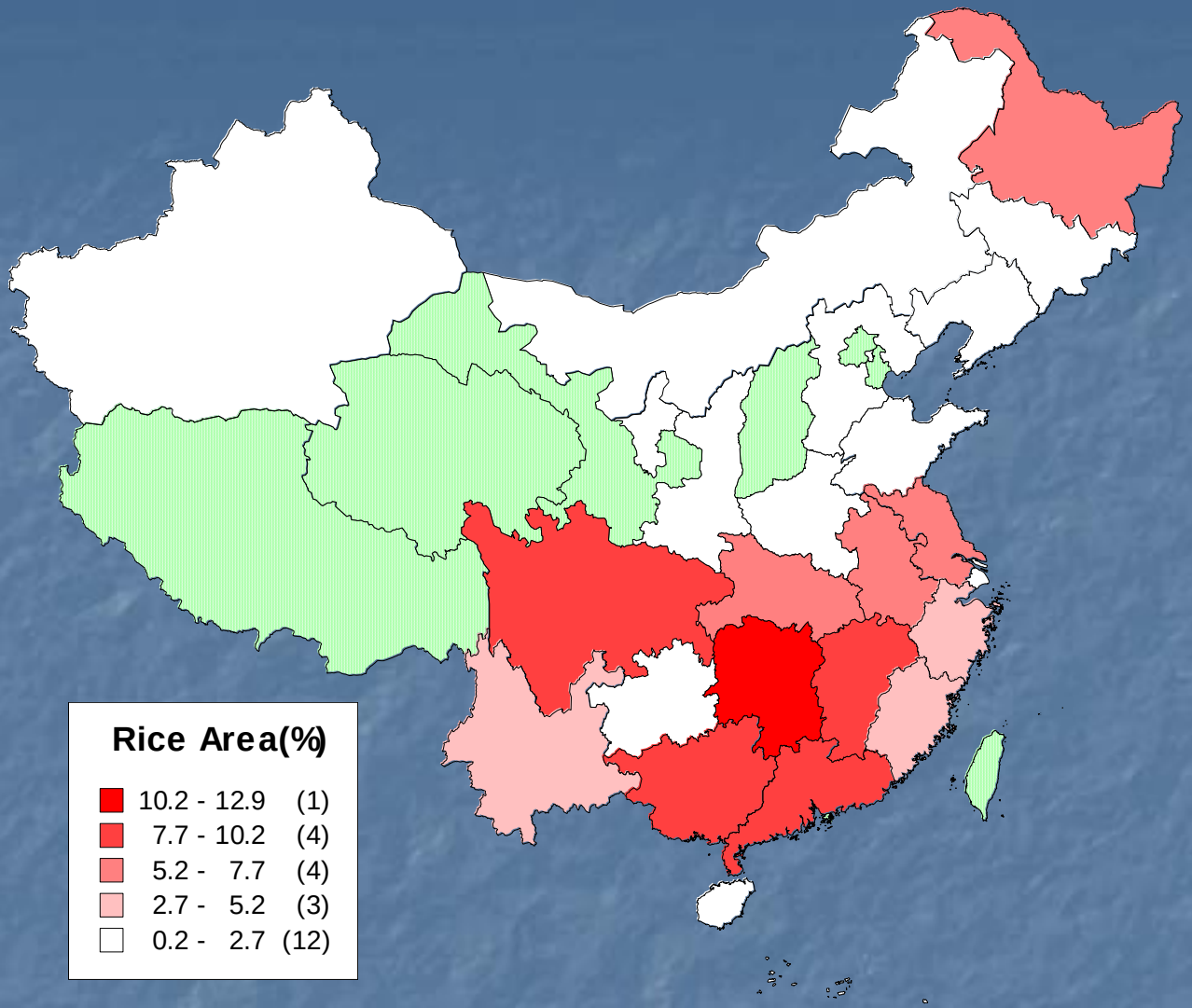
Percent of Hybrid rice area

Rice planting type

Change of rice planting type

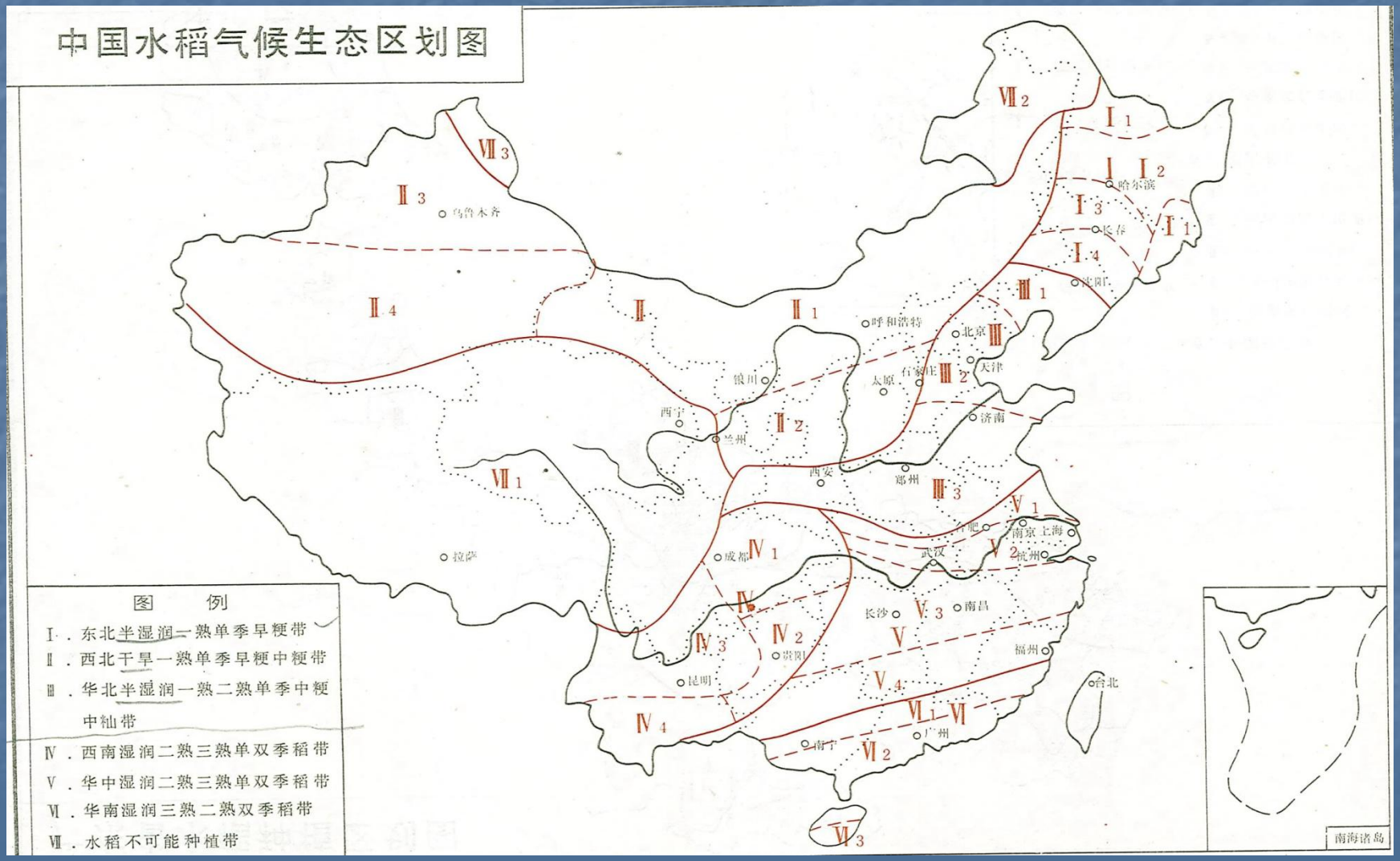


2 Rice growth environment



Percentage of provincial rice planting area over Chinese national rice area (2001)

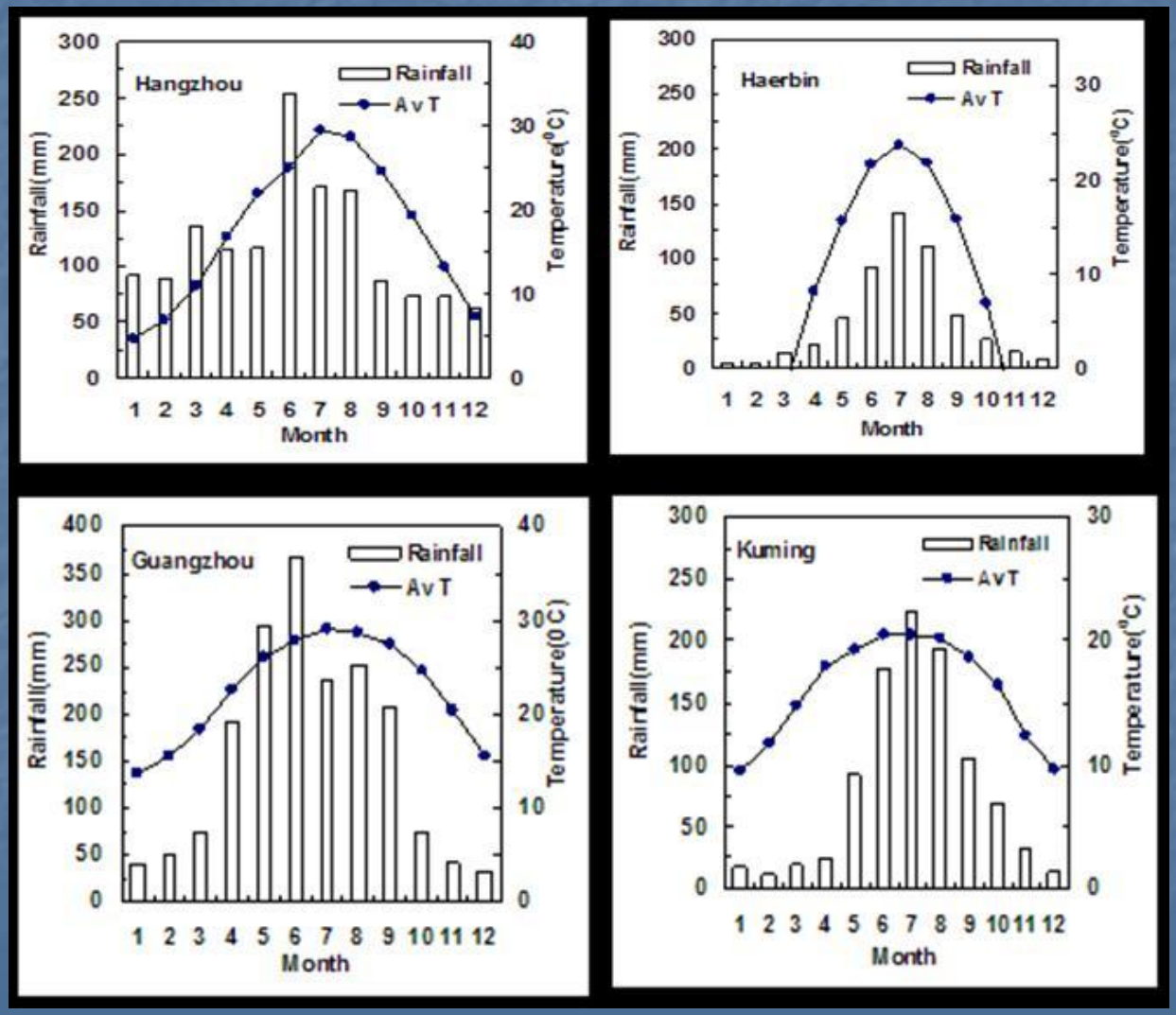
Rice ecological zones in China



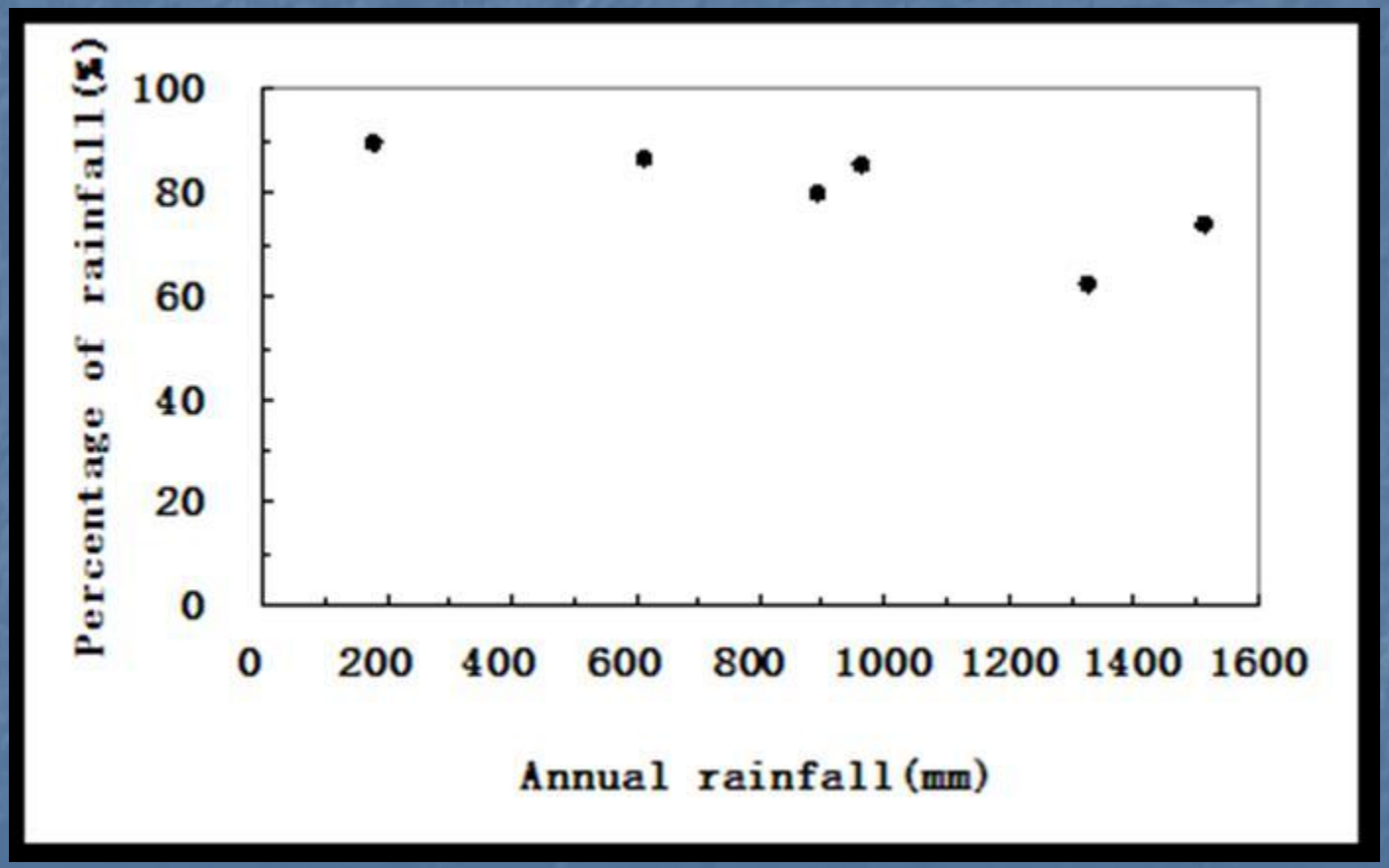
Character of rice ecological zone in China

Rice Zone	Rice growth season (d)	RAI	Type of rice
Northeast China	120-160	1.0-2.0	Japonica rice
Northwest China	120-180	＞2.0	Japonica & Indica rice
North China	160-180	1.0-2.0	Japonica rice & Indica
Yangtze river	200-260	≤1.0	Indica & Japanica rice
South China	260-365	≤1.0	Indica rice
Southwest China	200-240	≤1.0	Indica rice

Monthly rainfall and average temperature in main rice growing regions



Relation of annual rainfall to percentage of annual rainfall in rice growth season from May to October



3 Rice water requirement

Water requirement for rice production in rice season and regions

Region	Early rice(mm)	Late rice(mm）	Single rice （mm）
South China	350-500	350-600	--
Southwest China	--	--	600-800
Yangtze river	350-450	350-500	550-780
Northeast	--	--	400-700

Water balance in paddy field in different water management condition

Item	Traditional water management	Water saving management
Land preparation（m3）	126（18）	70（15）
Seepage（m3）	154（22）	112（24）
Evaporation（m3）	210（30）	70（15）
Transpiration（m3）	210（30）	210（45）
Water requirement（m3）	700（100）	462（100）
Rice yield (t/ha)	7.50（100）	8.02（110）
Water productivity（kg/m3）	0.71（100）	1.19（168）

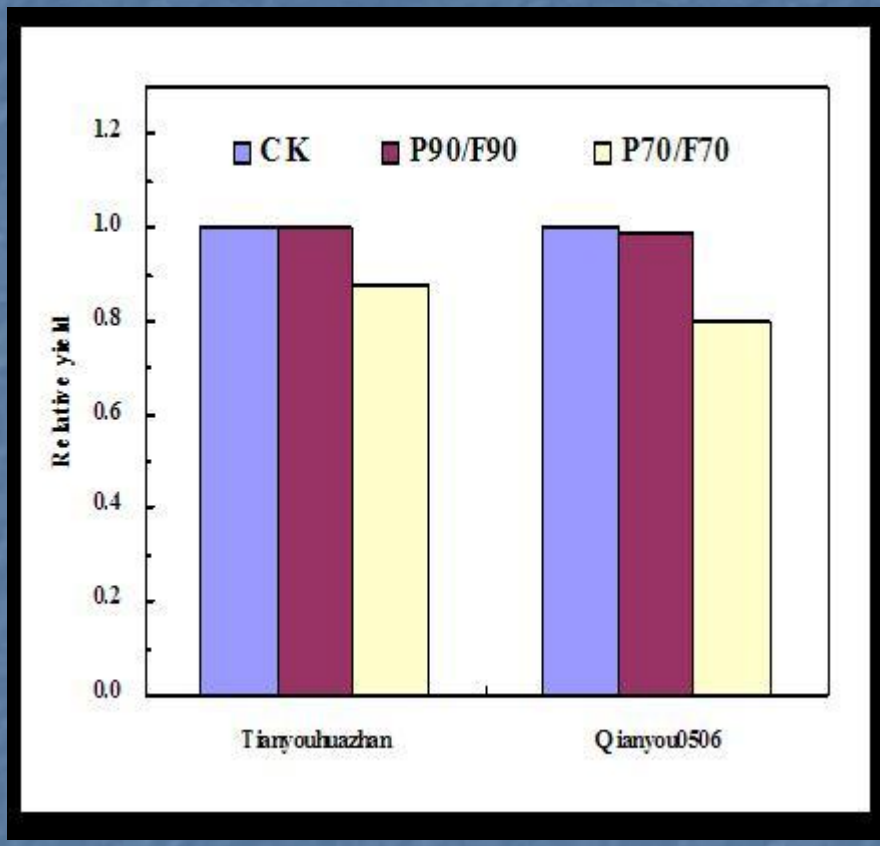
Rainfall (mm) in rice growth duration in early rice and late rice in South China

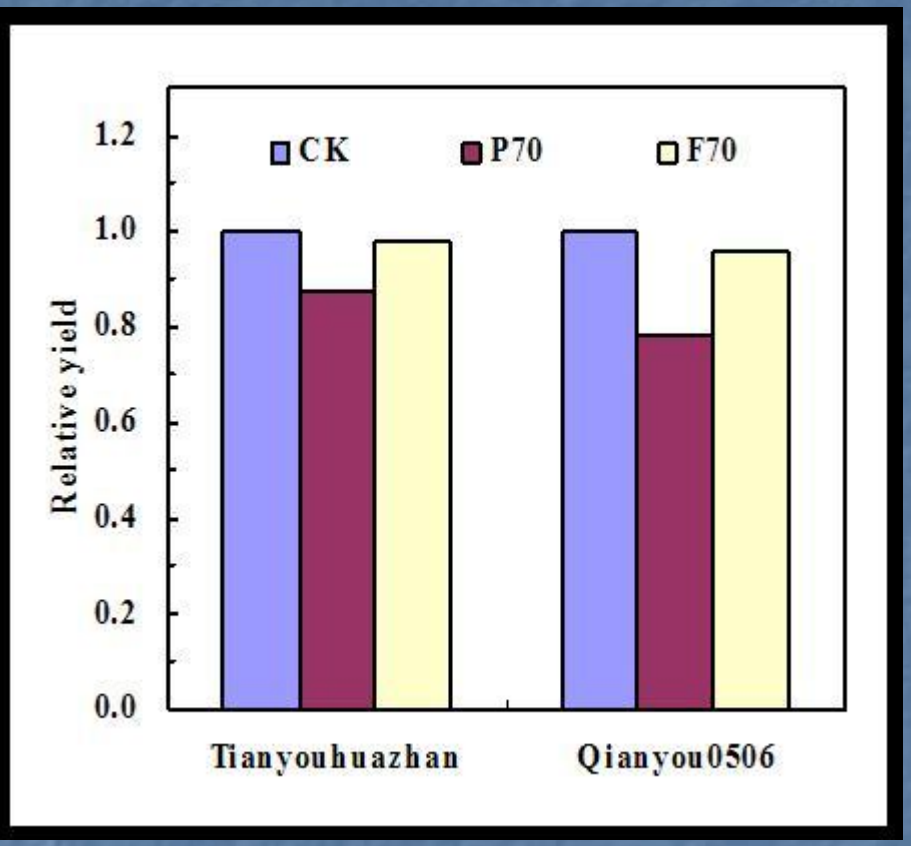
Rice zone	City	Early rice	Late rice
Yangtze river	Changsha	554.3	309.1
Yangtze river	Hangzhou	492.1	351.5
Yangtze river	Hefei	346.0	255.8
Yangtze river	Nanchang	700.1	292.1
South China	Fuzhou	606.5	367.6
South China	Guangzhou	888.6	613.5
South China	Nanning	572.7	396.7
Average		594.3	369.5

Temperature and rainfall in single rice season in rice zones in China

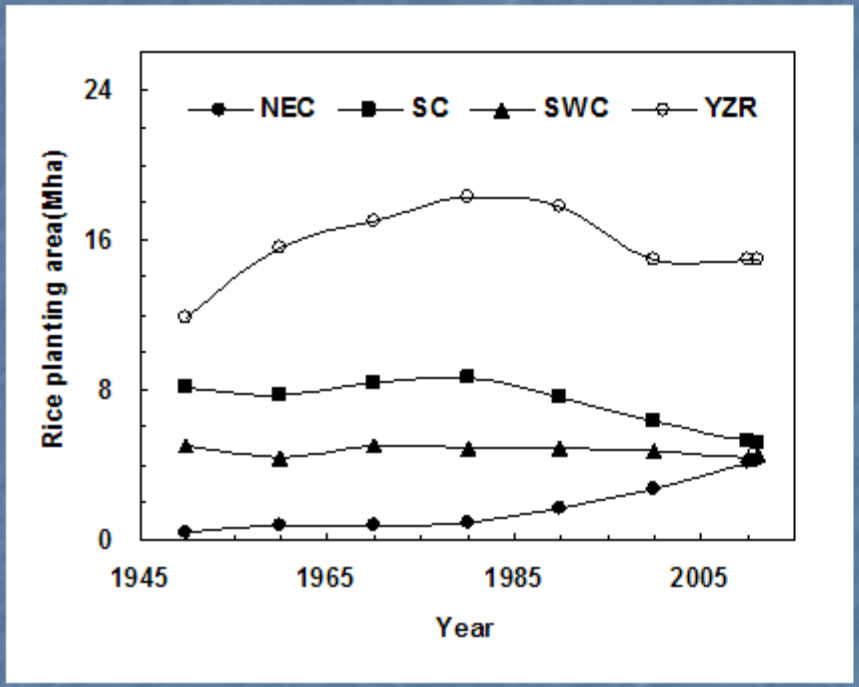
Rice zone	Average T(^{0}C)	Rainfall(mm)	Rain day	Daily rainfall(mm)
South China	28.4	591.4	41.0	14.4
Southwest China	21.9	658.1	68.0	9.7
Yangtz river	27.2	581.6	41.6	14.1
Northeast China	22.0	440.0	44.5	10.0
North China	23.3	522.2	41.5	12.6
Northwest China	21.4	141.2	27.0	5.2

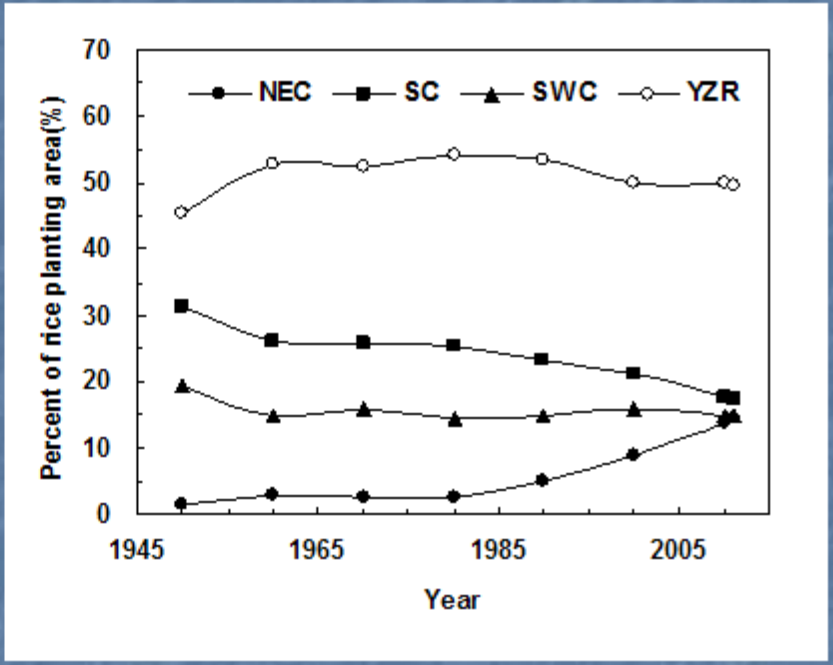
Effect of drought on rice yield





Transfer of rice planting area in main rice zone

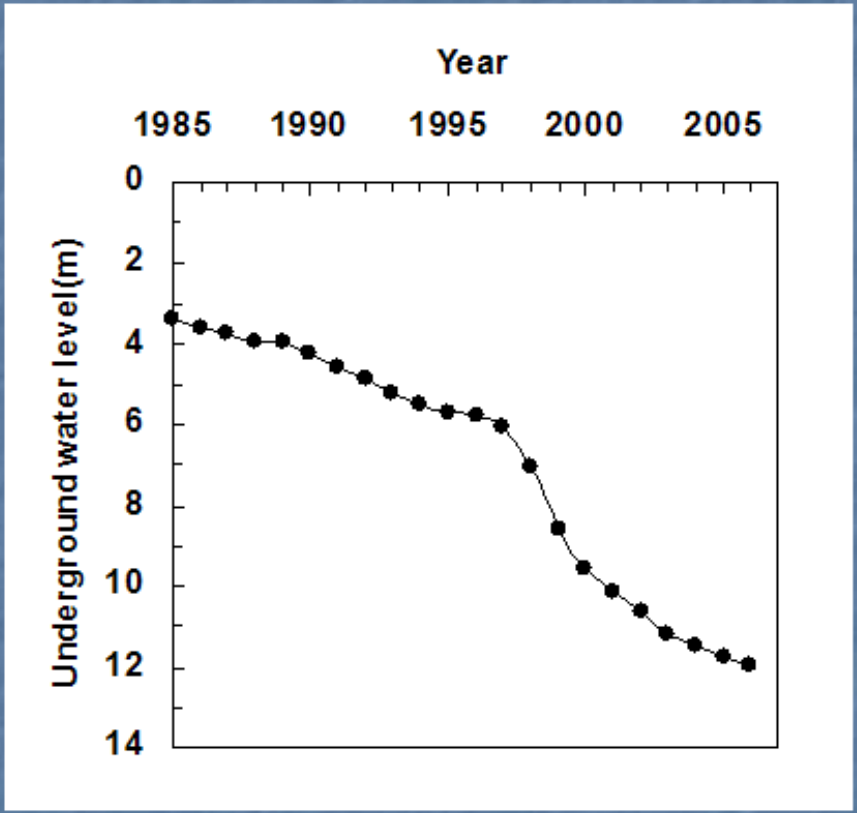


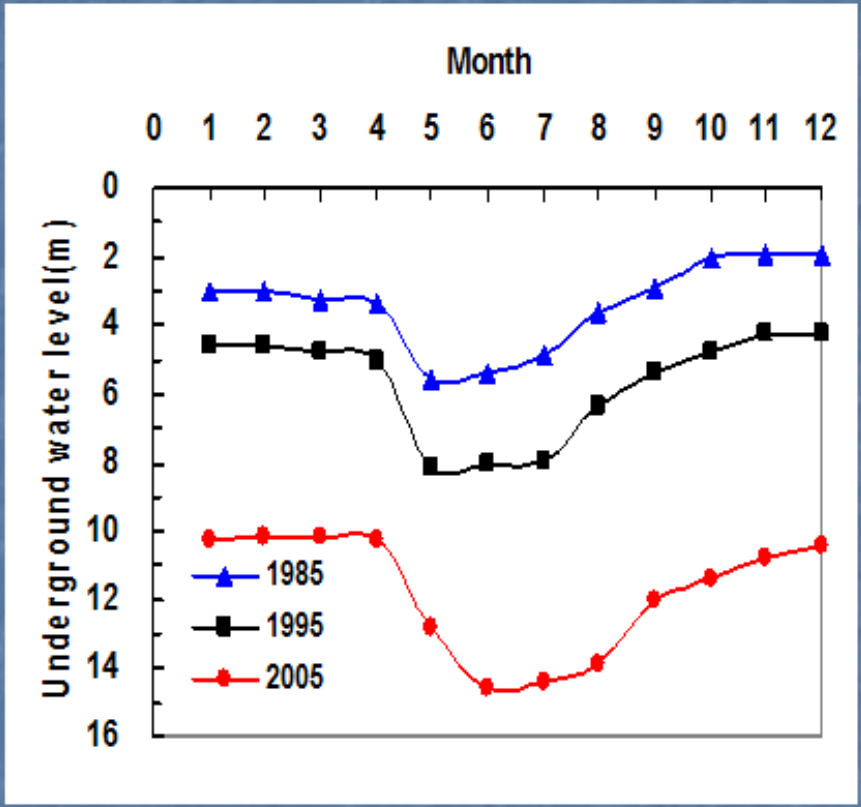


Rice area in main rice zones

Percent of rice area in main rice zones over national rice area

Change of underground water level in observation state of rice farm in Heilongjiang





4 Rice water management practice

Rice water management

- Shallow-wet-dry practice
- intermittent irrigation practice
- Aerobic irrigation practice
- Others
  - Upland rice
  - Drip irrigation under film mulch

Water standard in paddy field in Shallow-wet-dry practice

Stage	water status	water layer(mm)
Green turning	shallow	20 to 40
Early tillering	wet	90% moisture to 30
Late tillering	wet-dry	60% moisture to 30
Elongation to heading	shallow	10 to 50
Grain filling	wet	90% moisture to 20
Yellow maturity	dry	50% moisture to 0

Water standard in paddy field in intermittent irrigation practice

Stage	Day without water layer	Water layer(mm)
Green turning	0	10 to 20
Early tillering	3-5	90% moisture to 40
Late tillering	4-7	60% moisture to 40
Elongation to heading	1-3	90% moisture to 50
Grain filling	3-5	90% moisture to 20
Yellow maturity	all	65% moisture to 0

Water standard in paddy field in Aerobic irrigation practice

Stage	water status	water layer(mm)
Green turning	shallow	20 to 30
Early tillering	shallow-wet-dry	90% moisture to 30
Late tillering	dry	60% moisture to 0
PI to heading	shallow-wet	0 to 40
Grain filling	shallow-wet	90% moisture to 30
Yellow maturity	dry-wet	80% moisture to 30

Water management in irrigation rice field

Drip irrigation under film mulch in Xinjiang

5 Ecological function of paddy field

Ecological function of paddy field

- Water storage for flood prevention
- Temperature reduction
- Purification of underground water
- Other function as wetland

Percentage of paddy field over land and arable land and its water storage

Region	Province	Percent of paddy field to land(%)	Percent of paddy field to arable land(%)	Water storage amount in paddy field(Mm^2)
Yangtze river	Shanghai	12.9	43.5	0.21
Yangtze river	Zhejiang	7.4	40.8	1.57
Yangtze river	Hubei	9.1	36.2	3.38
Yangtze river	Anhui	14.1	34.5	3.95
Yangtze river	Jiangsu	21.1	47.2	4.50
Yangtze river	Jiangxi	11.6	68.4	3.87
Yangtze river	Hunan	12.6	70.5	5.34
South China	Hainan	5.0	24.5	0.36
South China	Fujian	5.3	49.4	1.31
South China	Guangdong	5.6	35.8	2.03
South China	Guangxi	4.8	27.0	2.27
Southwest	Guizhou	3.9	15.2	1.36
Southwest	Chongqing	8.3	30.7	1.37
Southwest	Yunan	2.7	17.2	2.08
Southwest	Sichuan	4.1	33.8	4.01
Northeast	Liaoning	4.5	16.1	1.32
Northeast	Jilin	3.6	12.5	1.38
Northeast	Heilongjiang	6.5	24.9	5.89

Comparison of temperature over paddy field and upland

Land type	Temperature(^{0}C)
Paddy field	X
upland	X+1.5

Note: temperature on 20cm over land

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