Physiological traits and cultivation technology of hybrid rice for high yield

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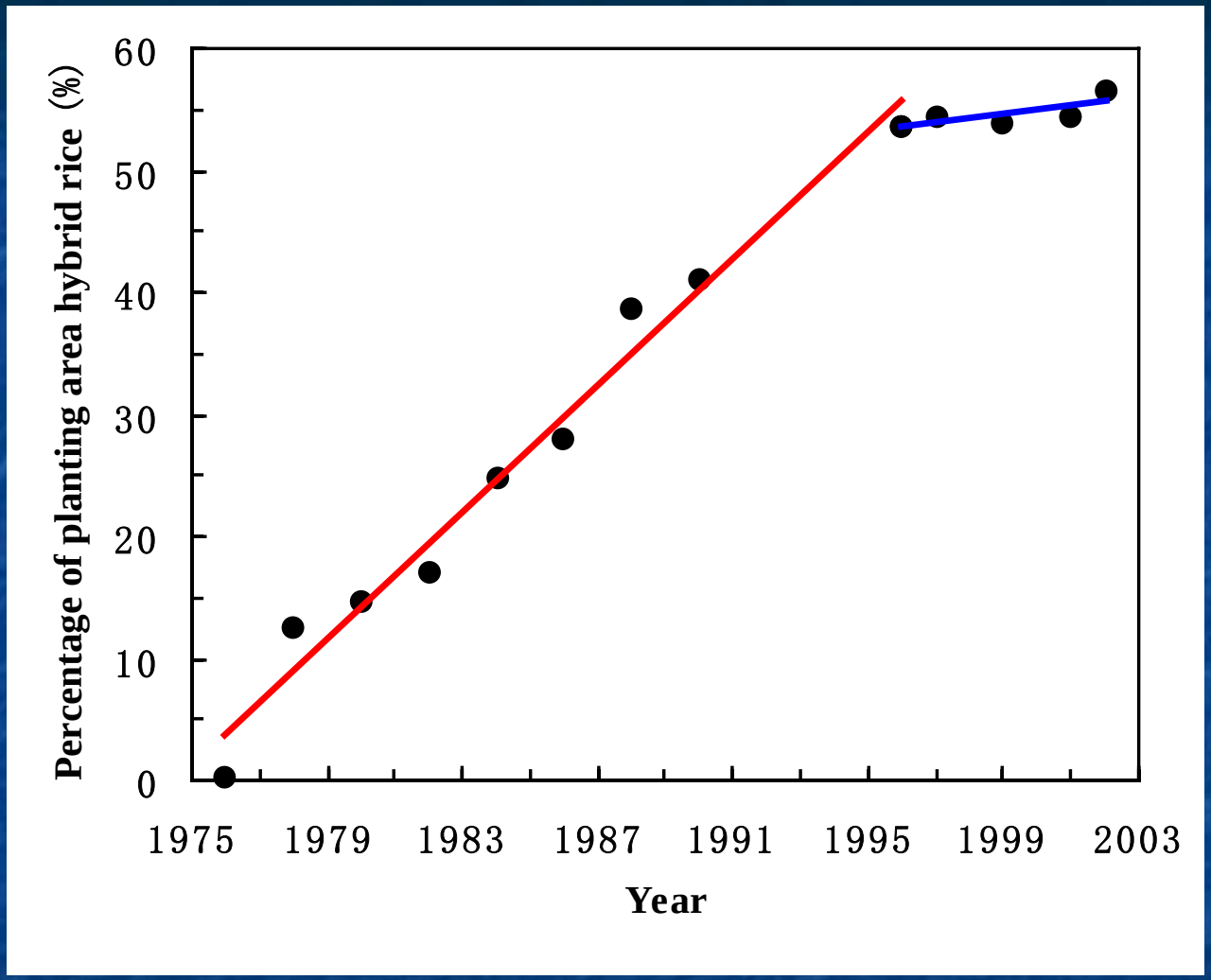
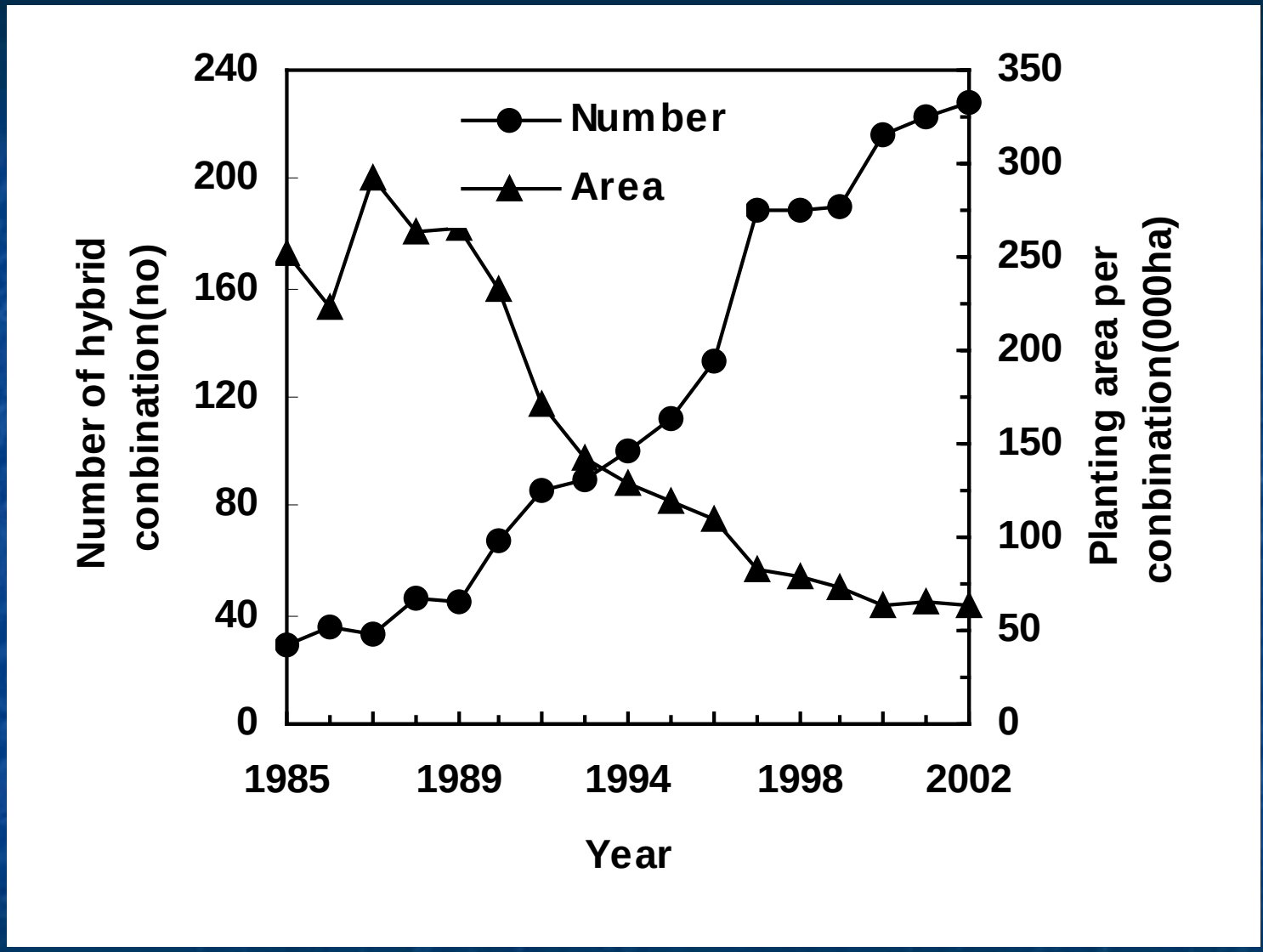
1. **Planting area of Hybrid rice**
2. **Physiological traits**
3. **Yield Advantage**
4. **Cultivation technology**

1. Planting area of hybrid rice



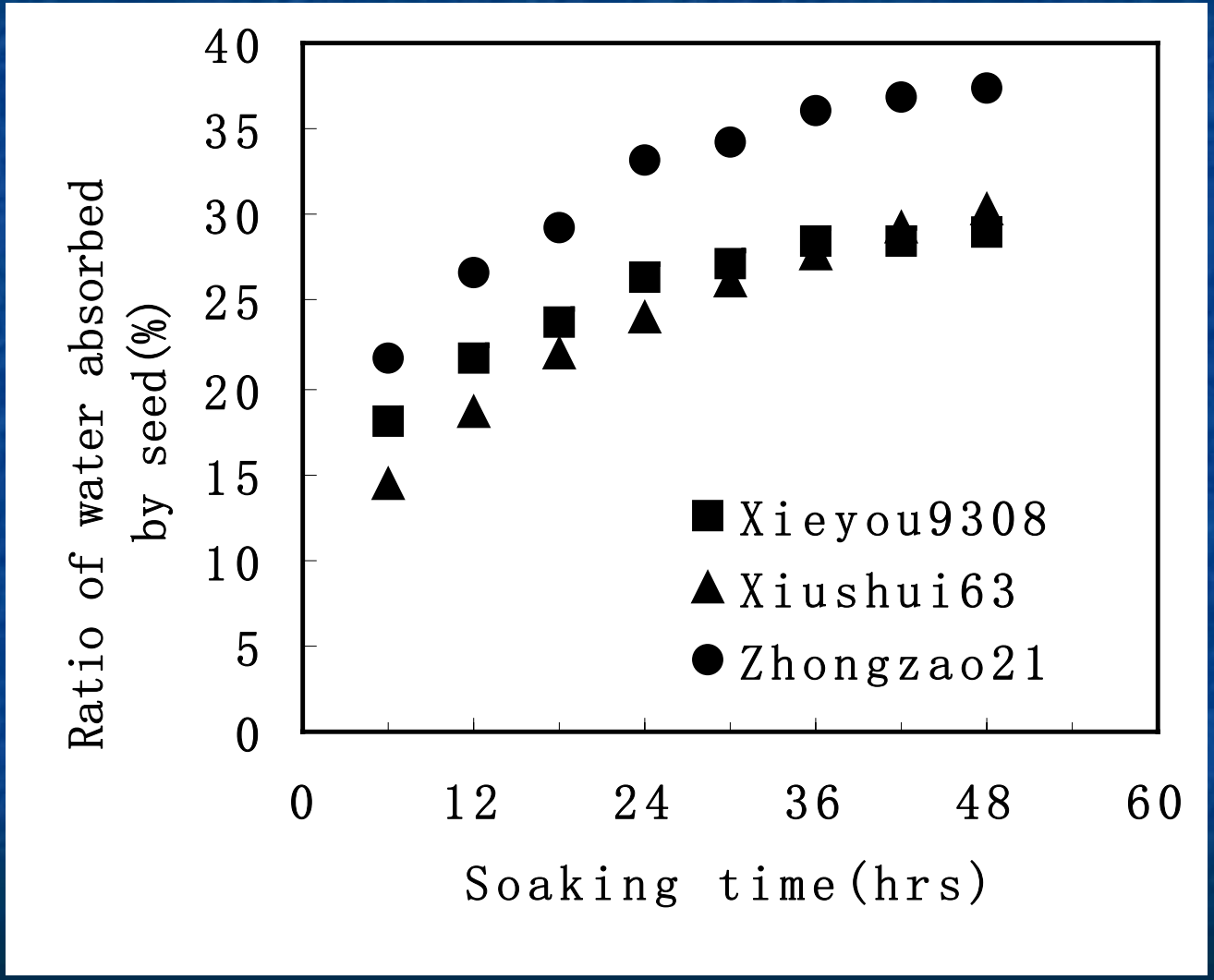
Planting area of hybrid rice in China

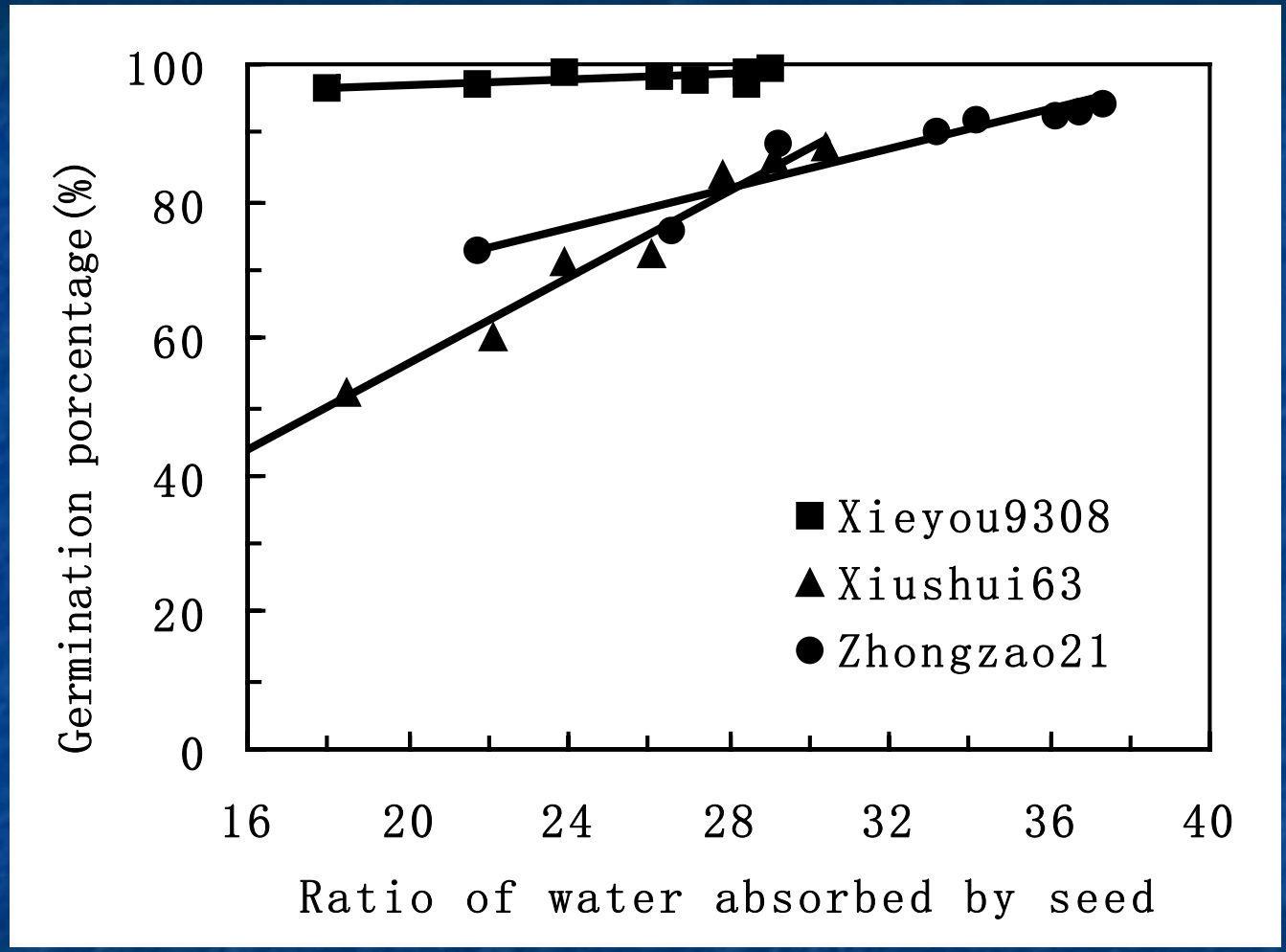


Number of hybrids and its planting area per each hybrid

2. Physiological traits

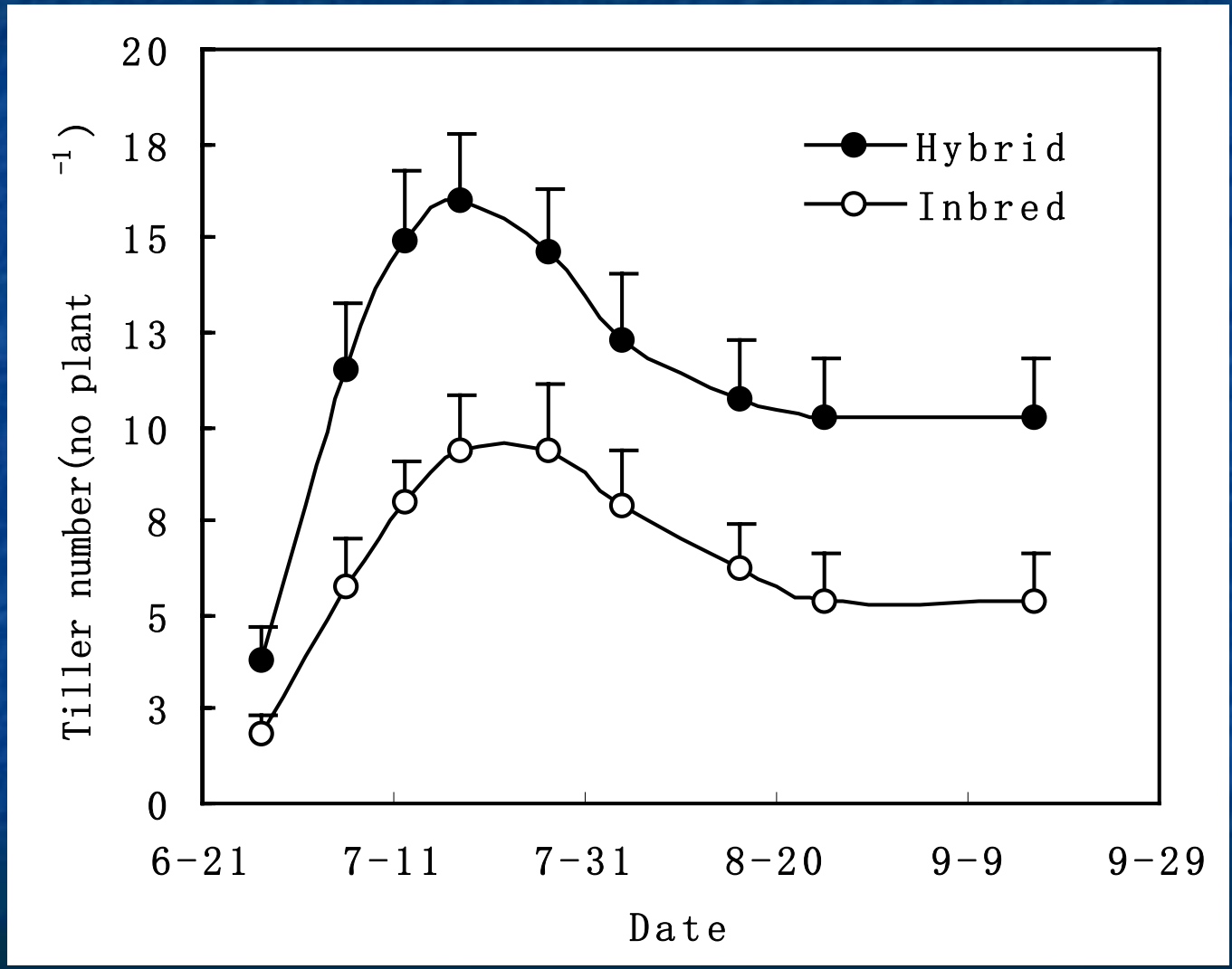
2.1 Germination





Relation of water absorbed and germination percentage

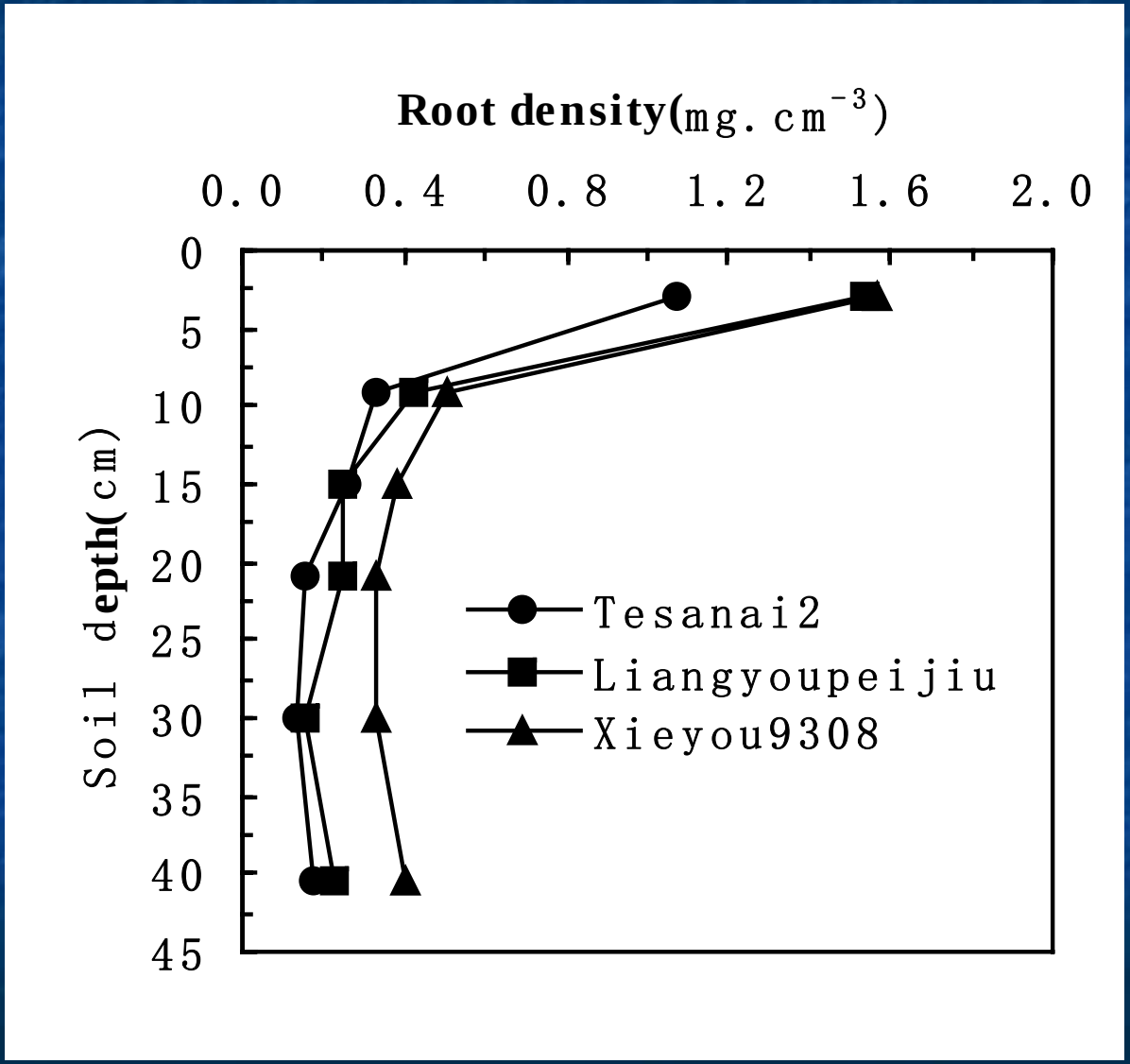
2.2 Tillering



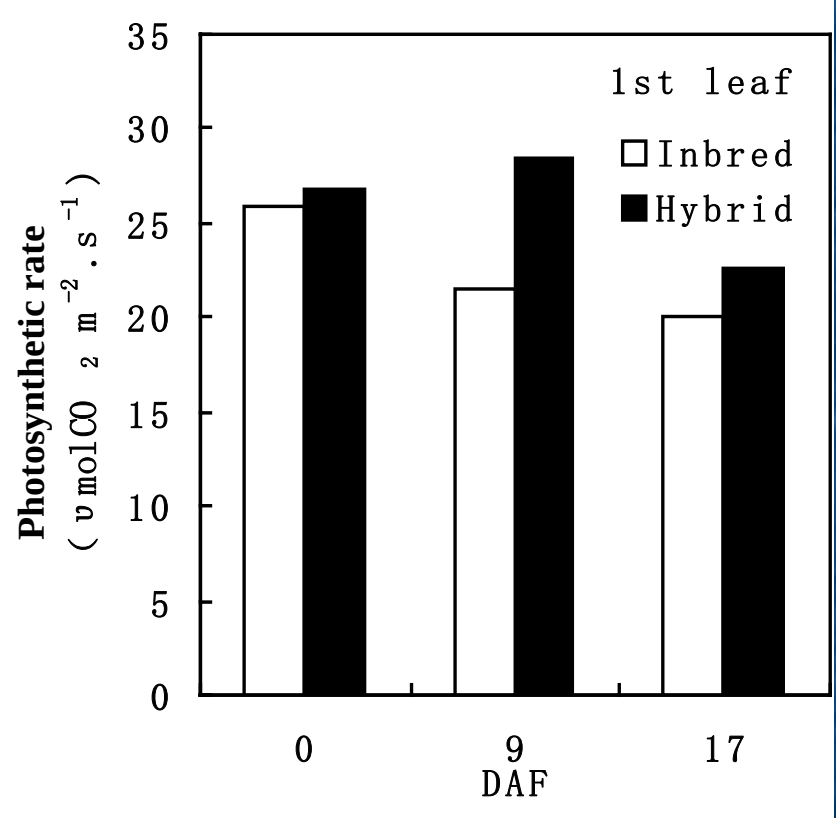
Comparison of tillering capacity between hybrids and inbred after 25 days after sowing

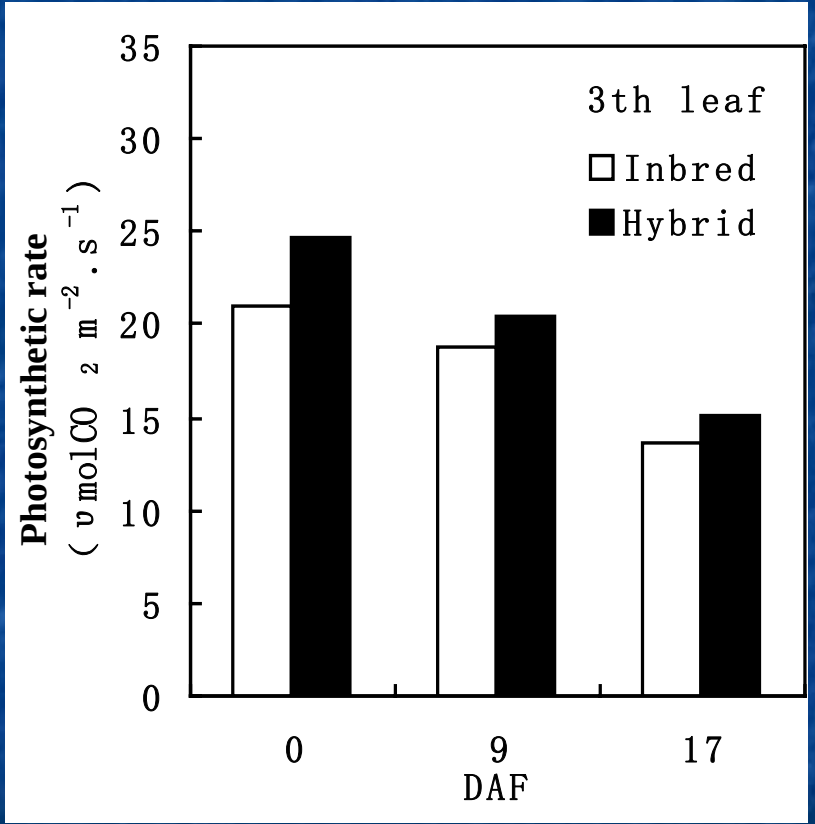
Type	Variety	Tiller (no seedling^{-1})	Relative percentage(%)
Hybrid	Liangyoupeijiu	1.42 a	187
	Teyouming86	1.36 ab	180
	Shanyou63	1.24 b	163
	Xieyou9308	0.83 c	110
Inbred	Zhe156	0.76 c	100

2.3 Roots

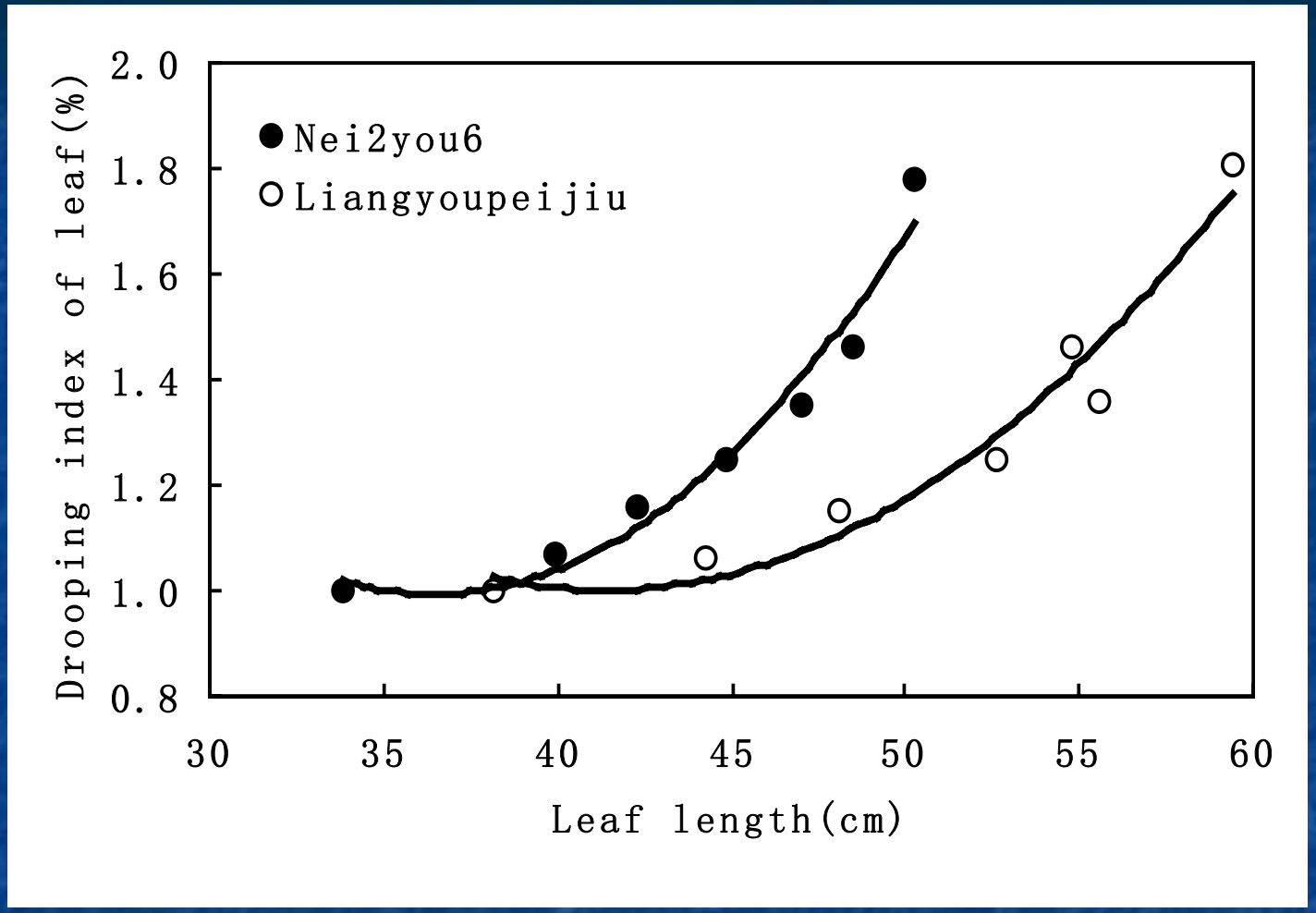

Root density(mg. cm^{-3})
0.0
0.4
0.8
1.2
1.6
2.0
Soil depth(cm)
0
5
10
15
20
25
30
35
40
45
Tesanai2
Liangyoupeijiu
Xieyou9308

2.4 Biomass production





Photosynthetic rate



Drooping index of leaf and its length

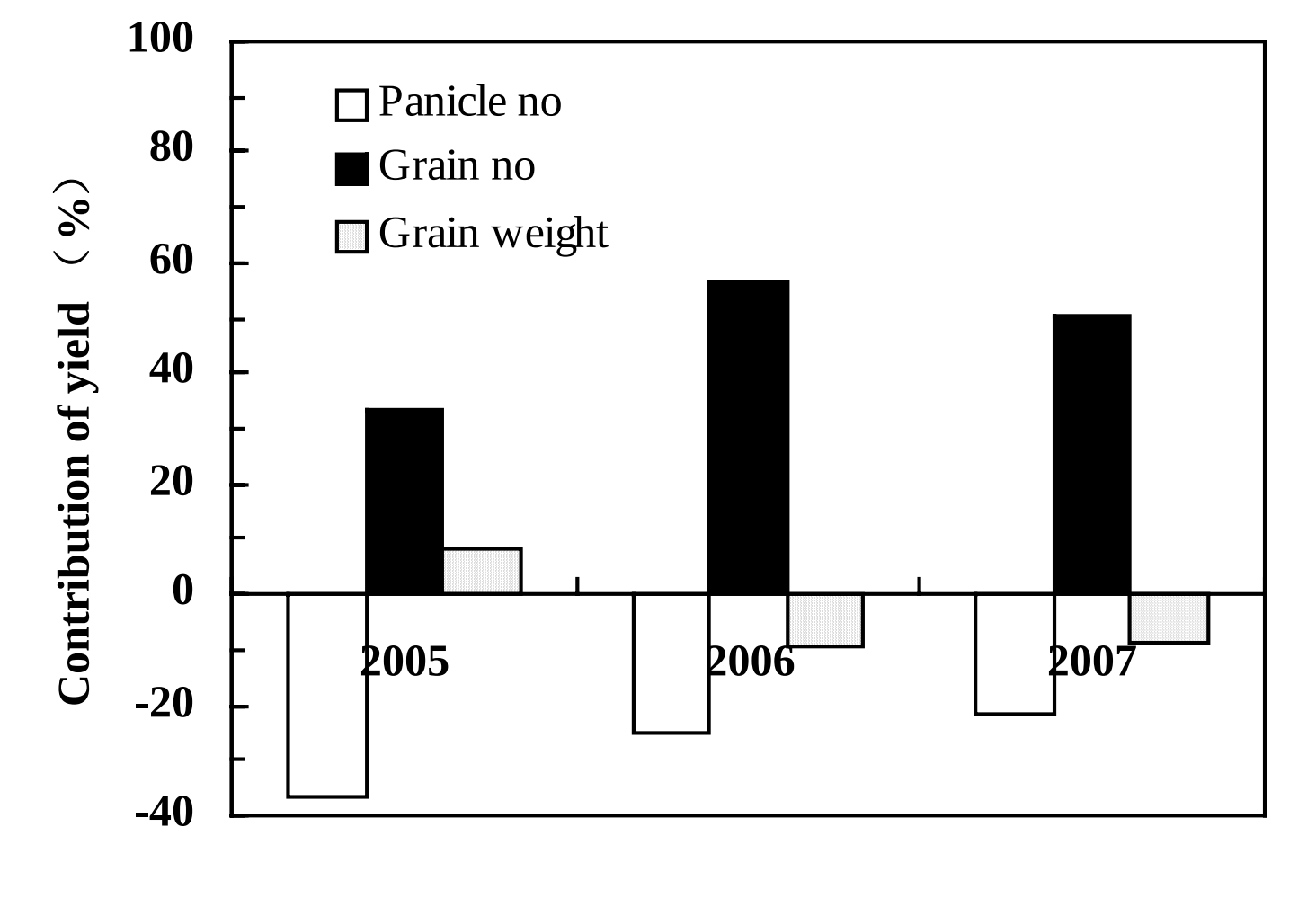
3. Yield Advantage

Contribution of biomass and harvest index to yield increase in the evolution of rice variety from 1940s to 1990s in China

Period	Variety type	Biomass (t ha^{-1})	Harvest index	Yield (t ha^{-1})
1940s-60s	Tall variety	11.04	0.385	4.25
1960s-80s	Semidawf	11.82	0.545	6.44
1970s-90s	Hybrid	15.03	0.545	8.19

Comparison of yield between hybrid and inbred (2004)

Type	Yield(t/ha)	Relative yield(%)
Hybrid	6.57	124
Inbred	5.31	100



Contribution of yield components to yield increase of Japonica hybrid rice compared with Japonica inbred rice

4. Cultivation technology

4.1 Raising strong seedling

Delay irrigation

Early fertilization

Fertilization before seedling pulling

Seedling raising in upland seedbed

Effect of seed quality on germination and seedling establishment

Hybrid	Item	Floated seeds	Sinking seeds	Total
Liangyoupeijiu	Grain(%)	8.7	91.4	100
	Germination rate(%)	34.6	97.5	92.1
	Seedling establishment rate(%)	30.7	74.6	70.8
Xieyou7954	Grain(%)	9.8	90.1	100
	Germination rate(%)	66.3	96.6	93.5
	Seedling establishment rate(%)	42.1	77.4	73.9

Effect of seed rate of hybrids and chemical regulator (paclobutrazol) in seedbed on tiller emergence at 7 leaf age.

Variety	Treatment	Seed rate(kg 667m^{-2})				
		5	10	15	25	40
IIyou7954	MET	5.4	5.4	3.8	3.9	3.4
	Check	4.7	3.7	2.8	3.3	1.8
Nei2you6	MET	5.0	3.3	2.9	2.8	1.5
	Check	3.7	2.9	2.5	1.9	1.0

Effects of water management on seedling growth in seedbed

Water depth	Tiller (no seedling^{-1})	Plant height (cm)	Root weight (g 10seedlings^{-1})	Ratio of root to above-ground part
Wet	5.6 a	28.4 c	1.89 a	0.34 a
2cm	4.9 b	28.0 c	1.72 ab	0.32 a
4cm	4.0 b	32.4 b	0.90 c	0.17 b

4.2 Sparse planting with wide row

density: 15-25 hills/m2 with 1 or 2 seedling

geometry: wide row and narrow hill distance

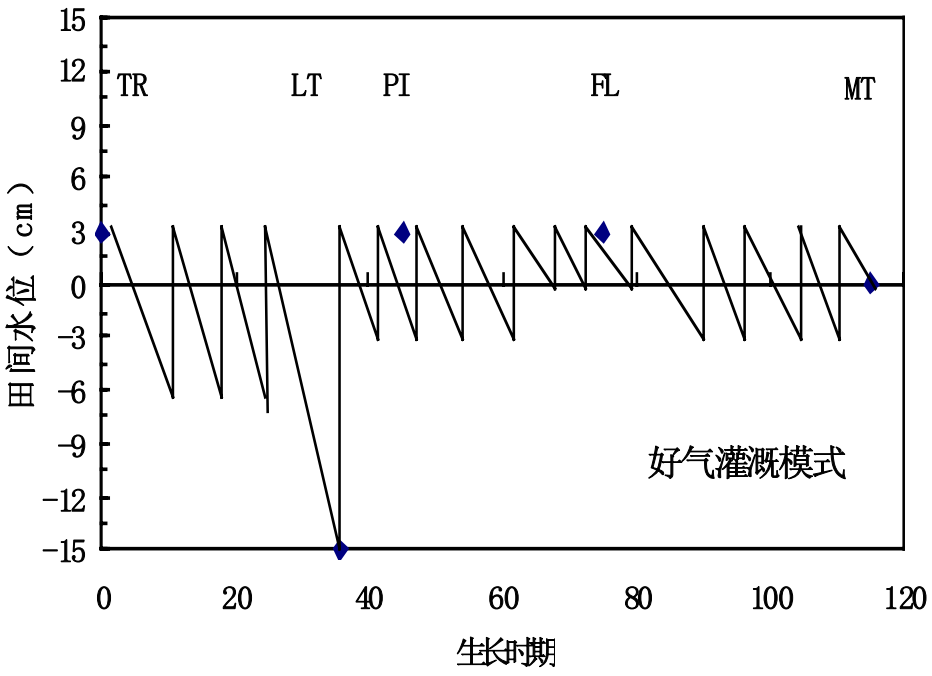
Comparison of yield(t ha^{-1}) of hybrid combinations in different plant densities

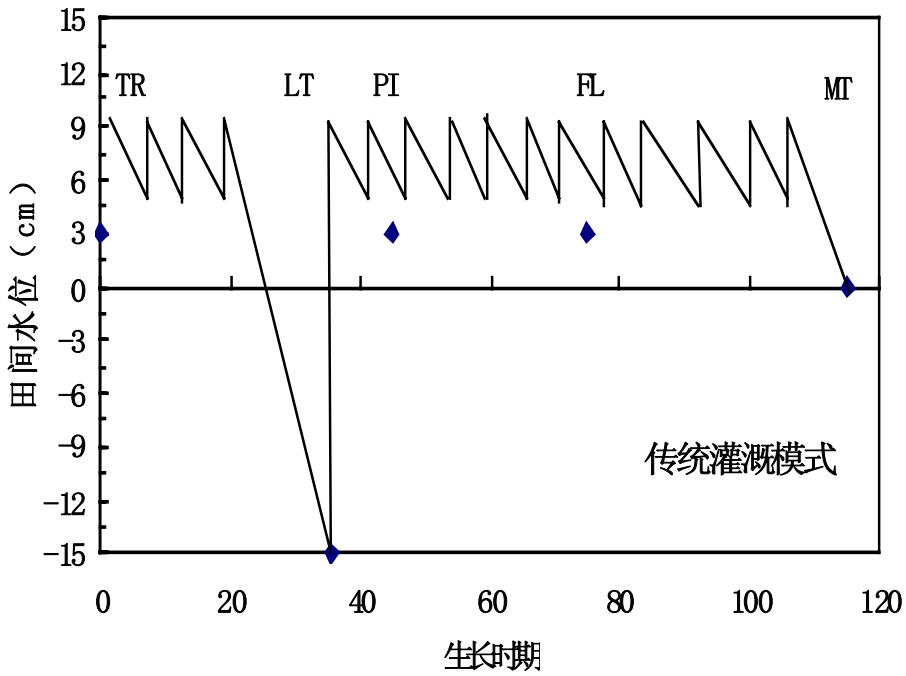
Density ($hill/m^2$)	2002		2003	
	Zhongyou 6	Liangyoupeijiu	IIyou 7954	Liangyoupei jiu
19.5	6.37 b	7.36 b	10.66 b	8.18 b
16.5	6.69 a	7.81 a	11.30 a	8.81 a
13.5	6.16 b	7.32 b	9.82 c	8.05 b
10.5	5.11 c	6.33 c	8.11 d	7.77 c
7.5	4.86 d	6.43 c	7.20 e	7.68 c

4.3 Control of plant number

- To determine basic plant number based on yield
- To control tiller number by combination of fertilizer application and irrigation
- To drain water promptly

4.4 Aerobic irrigation





Rice irrigation model

Comparison of root growth at panicle initiation stage between deep flood water(6cm) and intermittent irrigation methods

Hybrid	Irrigation	Root number (no hill^{-1})	Root weight (g /hill^{-1})
Liangyoupeijiu	Intermittent irrigation	780.0	2.3
	Deep flood water	719.0	2.0
IIyou7954	Intermittent irrigation	671.0	2.3
	Deep flood water	597.0	2.1

Transplanting in shallow water

Tillering in wet and shallow water

Drainage at enough plant number

Intermittent Irrigation

- Control unproductive tillers
- Make leaves erect
- Improve roots
- Aerobic soil

Recover irrigation

at 3-5 days before PI

4.5 Precision fertilization

- To determine fertilizer amount based on yield and soil fertility
- To increase K and control N fertilizer
- To increase ratio of fertilizer in late stage
- To combine fertilization and irrigation

4.6 Integrated Pest management

To reduce the occurrence of sheathblight, and control weeds through proper crop management.

To use pesticides based on local prediction of insects and diseases.


THANKS