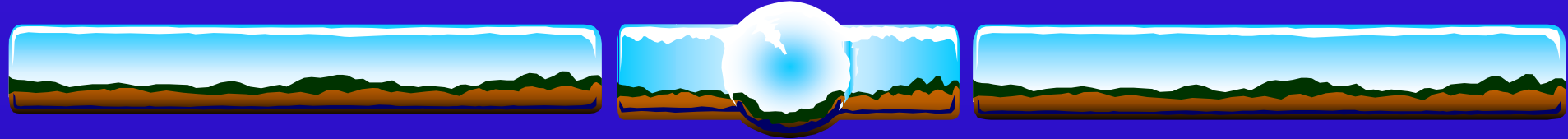




**FPR TRIALS ON CASSAVA
INTERCROPPING AND
WEED CONTROL
IN VIETNAM**



FARMER PARTICIPATING RESEARCH IN VIETNAM

FPR TRIALS:

- NEW VARIETIES
- FERTILIZERS
- SOIL EROSION
- **INTERCROPPING**
- **WEED CONTROL**



CASSAVA INTERCROPPING

INTRODUCTION

- **best use of land**
 - wide space
 - slow initial development
- **higher total income**
 - yield of interplanted crops
- **less erosion**
 - completely cover the soil
- **maintaining soil fertility**
 - N resource + residues

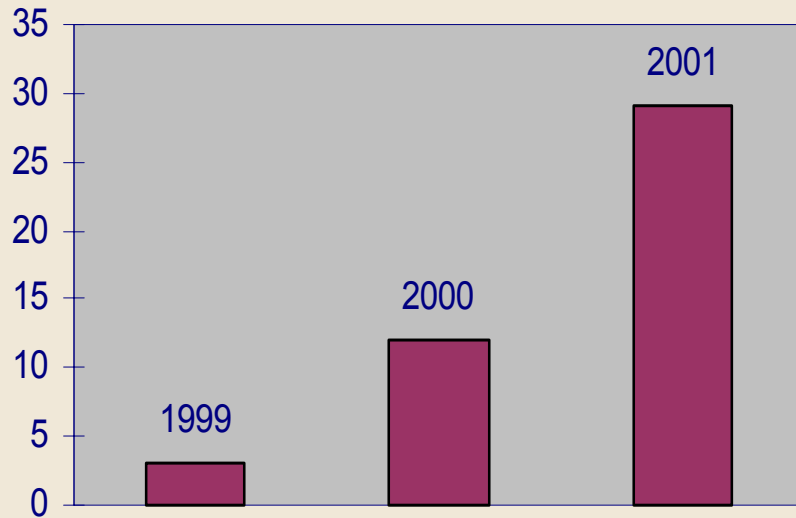
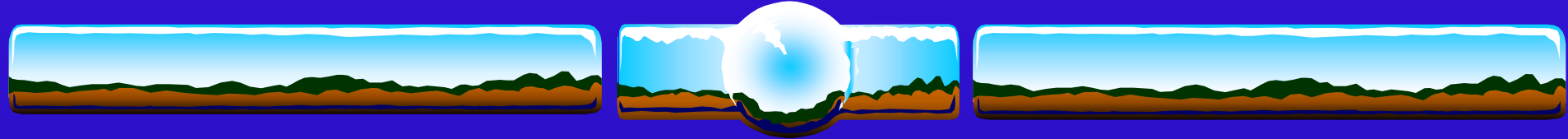


Chart 1: Number of FPR trials on cassava intercropping in Vietnam

EFFECTIVE FACTORS

- **kind of intercrop**
- **spacing**
- **growth duration**
- **time of planting**
- **fertility of the soil**
- **climatic conditions**

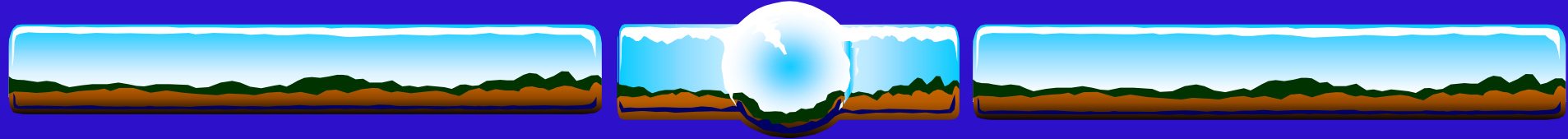


INTERCROPS

The most suitable crop combination depends on:

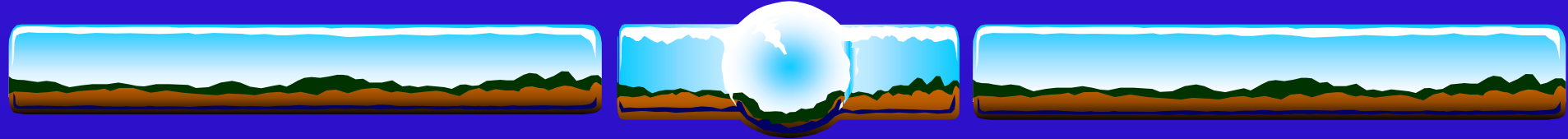
- soil
- varieties.
- climatic conditions
- availability of labor
- market conditions

Soils	Regions		
	North	Central	South
Clay	X	X	X
Clay loam	X	X	X
Sandy loam	X		X
Sandy clay loam	X	X	



Characteristics

	Clay	Clay loam	Sandy loam	Sandy clay loam
Sand (%)	19.7 - 42.1	21.4 - 44.0	61.7 - 69.7	45.6 - 58.7
Silt (%)	6.7 - 32.9	19.1 - 47.7	19.0 - 20.2	18.9 - 25.0
Clay%)	47.6 - 74.0	27.8 - 39.3	18.7 - 19.0	22.4 - 29.4
pH	4.2 - 5.1	4.2 - 5.6	4.0 - 5.1	4.6 - 4.9
OM (%)	1.7 - 4.6	1.6 - 4.4	1.5 - 3.7	1.6 - 2.6
P (ppm)	1.4 - 56.9	0.8 - 17.4	3.7 - 12.0	1.0 - 98.8
Ca (meq/100g)	0.20 - 8.00	0.31 - 14.29	0.60 - 2.46	0.49 - 1.97
Mg (meq/100g)	0.58 - 5.49	0.17 - 3.84	0.09 - 0.30	0.13 - 1.91
K (meq/100g)	0.04 - 0.39	0.11 - 0.37	0.05 - 0.14	0.06 - 1.04



Intercrops	Regions		
	North	Central	South
Peanut	X	X	X
Mungbean	X	X	X
Maize	X		X
Black bean	X	X	
Red bean		X	
Cowpea			X
Soybean			X
Watermelon	X		



SPACING

**Intercrops: 1 row
2 rows**

**Cassava: 1 x 1 m
(10.000 plants/ha)**

GROWTH DURATION

Intercrops: 45 -90 days

CASSAVA VARIETY: KM 94

FERTILIZER: 80 - 40 -80

TIME OF PLANTING INTERCROPS

- **Before planting cassava 15 days**
- **At the same time as cassava**
- **After planting cassava 15 days**



RESULTS

IN THE NORTH

Ha Tay province

Table 1. Average results of three FPR intercropping trials conducted by farmers in Tran Phu commune, Chuong My district, Ha Tay, Vietnam in 2000/01.

Treatments	Cassava yield (t/ha)	Intercrop yield (t/ha)	Gross income ²⁾ ('000 dong/ha)	Product. costs ³⁾	Net income	Farmers' preference (%)
Cassava monoculture	29.03	-	8,709	3,900	4,809	-
C+peanut (1 row)	32.50	0.887	14,185	5,143	9,042	-
C+peanut (2 rows)	30.43	1.760	17,929	5,386	12,543	94.0
C+blackbean (1 row)	27.27	0 ¹⁾	8,181	5,020	3,161	-
C+blackbean (2 rows)	25.83	0 ¹⁾	7,749	5,140	2,609	-




Table 2. Average results of three FPR intercropping trials conducted by farmers in Tran Phu commune, Chuong My district of Ha Tay province in 2001.

Cropping system ¹⁾	Cassava root yield (t/ha)	Intercrop yield (t/ha)	Gross Production		Net income	Farmers' preference (%)
			income ²	costs		
			-----('000 dong/ha)-----			
1. Cassava monoculture	29.46	-	8,838		0	0
2. C+ 1 row of peanut	22.37	0.975	11,586		0	0
3. C+ 2 rows of peanut	31.96	2.125	20,213		100	100
4. C+ mungbean	33.45	0.133	11,099		12	12
5. C+ watermelon	32.09	0	9,627		0	0

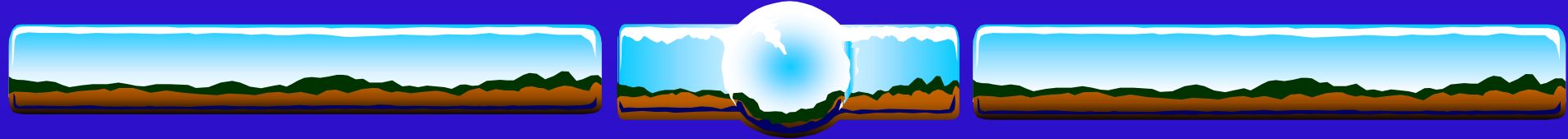


Table 3. Average results of four FPR intercropping trials conducted by farmers in Thach Hoa commune, Thach That district of Ha Tay province in 2001.

Cropping system ¹⁾	Cassava yield (t/ha)	Peanut yield (t/ha)	Gross income ² -----('000 dong/ha)-----	Production costs	Net income	Farmers' preference (%)
1. Cassava monoculture	24.9	-	7,470			0
2. C+1 row of peanut	23.1	1.293	13,395			0
3. C+2 rows of peanut	27.8	1.870	17,690			100
4. C+3 rows of peanut	29.9	2.220	20,070			0

(Source: Trinh phuong Loan et al., 2000-01)



Tuyen Quang province

Table 4. Results of an FPR intercropping trial conducted by a farmer in Hong Tien commune of Son Duong district in Tuyen Quang province in 2001.

Treatments 1)	Yield (t/ha)		Gross income	Production costs ²⁾ (‘000 dong//ha)		Net income	Farmers’ preference (%) ³⁾
1	23.60	-	11,800	4,330	7,470	11	
2	26.30	1.08	14,770	5,530	9,240	2	
3	33.30	-	16,650	5,580	11,070	5	
4	29.10	0.76	18,350	5,630	12,720	50	

1. Cassava monoculture

2. C +maize

3. C +mungbean

4. C +peanut

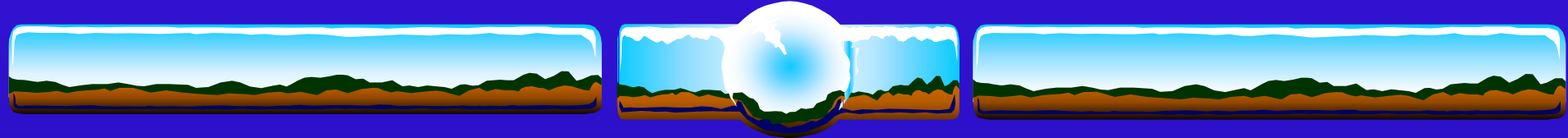


Table 5. Results of an FPR intercropping trial conducted by a farmer in Am Thang commune of Son Duong district in Tuyen Quang province in 2001.

Cropping system ¹⁾	Yield (t/ha)		Gross income ²⁾	Production costs ²⁾		Net income	Farmers' preference (%) ³⁾
				('000 dong//ha)			
1	15.00	-	7,500	4,330	3,170	11	
2	32.50	1.030	17,795	5,530	12,265	2	
3	31.20	0.400	18,000	5,580	12,420	5	
4	23.70	0.500	14,350	5,630	8,720	50	

1. Cassava monoculture

2. C +maize

3. C +mungbean

4. C +peanut

(Source: Nguyen the Dang et al., 2000-01)



Phu Tho province

Table 6. Results of two FPR intercropping trials conducted by farmers in Thong Nhat commune, Phu Ninh district, Phu Tho, in 2001/02.

Treatments¹⁾	Cassava yield (t/ha)	Intercrop yield (t/ha)	Gross income²⁾	Product costs²⁾	Net income
C monoculture	15.8	-	6,320	4,539	1,781
C+peanut	15.0	0.90	11,400	6,374	5,026
C+black bean	15.2	0.37	7,375	6,374	1,001

(Source: Thai Phien et al., 2000-01)

(Mil. Dong/ha)



Yen bai province

Table 7. Results of FPR intercropping trial conducted by farmer in Hung Yen commune, Van Yen district, Yen Bai, in 2001

Treatments	Cassava Intercrop		Gross	Product	Net	Farmers'
	yield (t/ha)	yield (t/ha)	income	costs	income	preference
			('000 dong/ha)			(%)
1. Cassava monoculture	41.5	-	12,4	4,2	8,2	0
2. C+ peanut (1 row)	39.2	0.970	16,6	6,6	10,0	
3. C+ peanut (2 rows) (before planting cassava 15 days)	38.5	1.660	19,8	7,6	12,2	30
4. C+ peanut (1 row)	39.6	0.890	16,3	6,6	9,7	
5. C+ peanut (2 rows) (at the same time as cassava)	39.0	1.530	19,3		11,7	70
6. C+ peanut (1 row)	40.8	0.69	15,7	6,6	9,1	0
7. C+ peanut (2 row) (after planting cassava 15 days)	40.0	0.960	16,8	7,6	9,2	

(Source: Vu thi Luu et al., 2001)

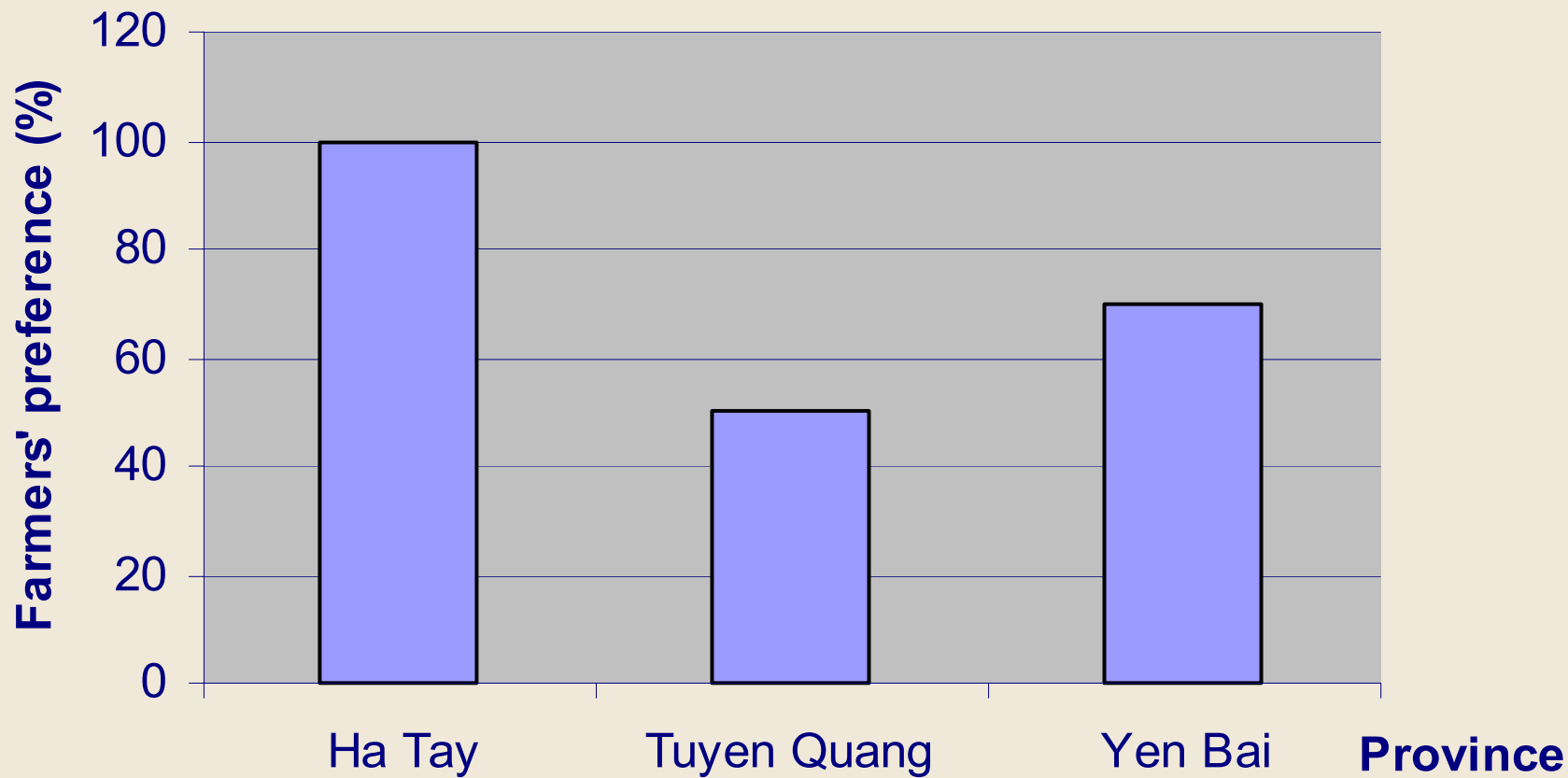


Chart 2: Farmers' preference for "cassava + peanut" in the North Viet Nam



IN THE CENTRAL

Table 7. Average results of two FPR intercropping trials conducted by farmers in Thuong Long village, Hong Ha commune, A Luoi district, Thua Thien-Hue, Vietnam in 2000.

Treatments	Cassava yield (t/ha)	Starch content (%)	Intercrop yield (t/ha)	Gross	Product	Net	Farmers' preference (%)
				income ¹⁾	costs ²⁾	income	
				('000 dong/ha)			
1.Cassava monoculture	7.14	27.0	-	3,570	1,800	1,770	0
2.C+red bean	8.80	27.3	0.600	6,500	2,940	3,560	100
3.C+peanut	8.77	27.7	0.400	5,985	4,060	1,925	0
4.C+black bean	8.84	27.8	0.600	6,520	2,940	3,580	100
5.C+mungbean	8.73	27.6	0.300	6,165	3,180	2,985	54

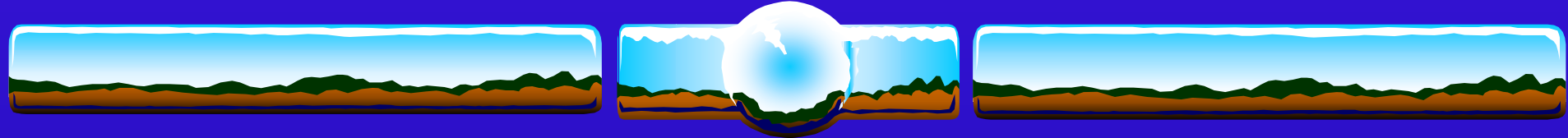
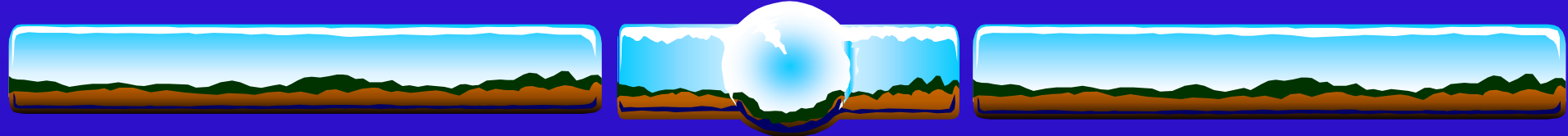


Table 8. Results of an FPR intercropping and fertilizer application trial conducted by farmers in Thuong Long commune, Nam Dong district of Thua Thien Hue province in 2001/02.

Cropping system	Cassava yield (t/ha)		Starch content (%)		Intercrop yield (t/ha)	
	no fert	with fert	no fert	with fert	no fert.	with fert
1. Cassava monoculture	9.9	26.0	26.7	27.8	-	-
2. C + red bean	9.7	25.7	26.4	28.1	0.500	0.750
3. C + peanut	9.6	25.1	26.8	27.9	0.430	0.600
4. C + black bean	9.7	24.9	26.7	27.7	0.500	0.750
5. C+ mungbean	9.6	25.0	26.5	28.0	0.300	0.450



Cropping system	Gross income ²⁾		Product. costs ²⁾		Net income		Farmers' preference	
	('000 dong/ha)		('000 dong/ha)		('000 dong/ha)		(%)	
	no fert	with fert.	no fert	with fert.	no fert	with fert.	no fert	with fert.
1. Cassava monoculture	4,950	13,000	1,800	3,700	3,150	9,300	0	0
2. C + red bean	6,600	15,475	2,940	4,840	3,660	10,630	0	100
3. C + peanut	6,950	15,550	4,028	5,928	2,922	9,622	0	100
4. C + black bean	6,350	14,700	2,940	4,840	3,410	9,860	0	10
5. C+ mung bean	6,600	15,200	3,180	5,080	3,420	10,120	0	74

(Source: Nguyen thi Cach et al., 2000-01)

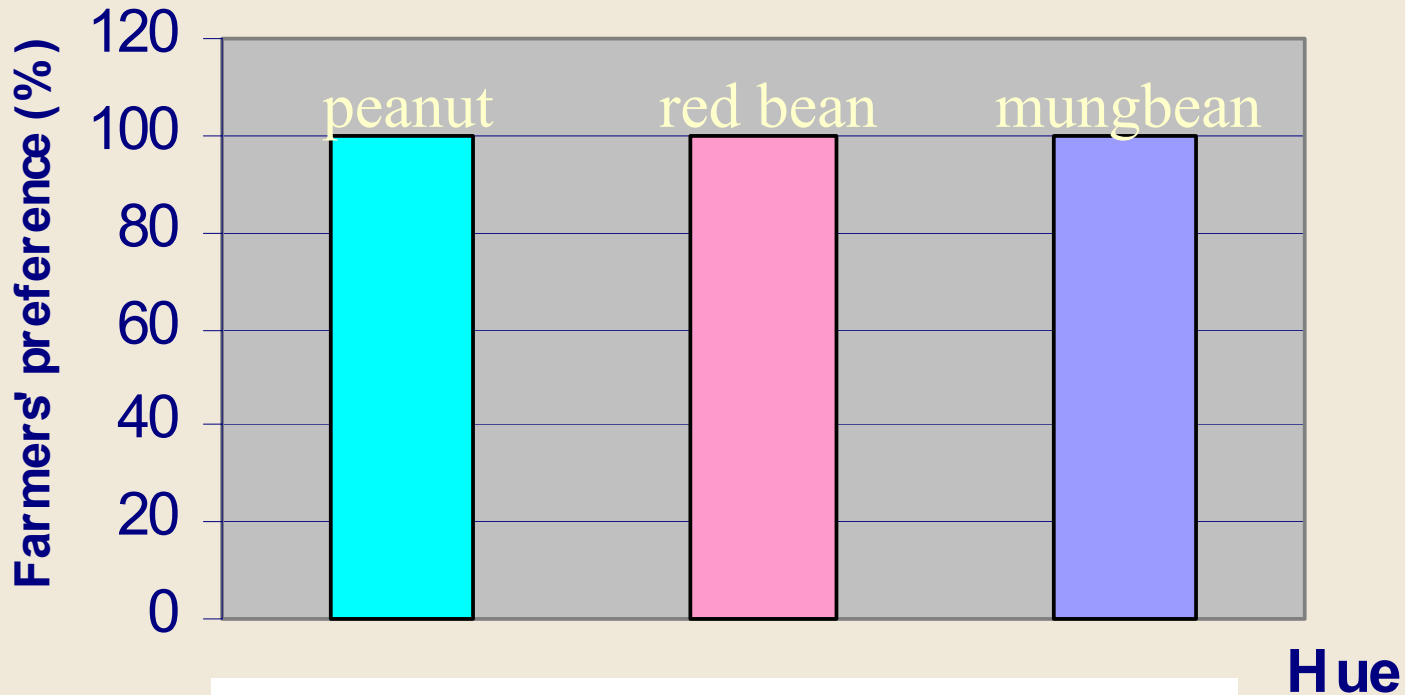


Chart 3: Farmers' preference of cassava intercropping in the central



IN THE SOUTH

Table 9. Average results of three FPR intercropping trials conducted by farmers in An Vien village, Thong Nhat district, Dong Nai, Vietnam in 2000/01.

Treatments	Cassava yield (t/ha)	Intercrop yield (t/ha)	Gross	Product	Net	Farmers' preference (%)
			income ¹⁾	costs ²⁾	income	
			('000 dong/ha)			
C.monoculture	30.60	-	8,874	4,298	4,576	50
C+peanut	30.28	0.20	9,781	5,248	4,533	50
C+cowpea	23.89	0	6,928	4,798	2,130	0
C+mungbean	29.74	0	8,625	4,698	3,927	0

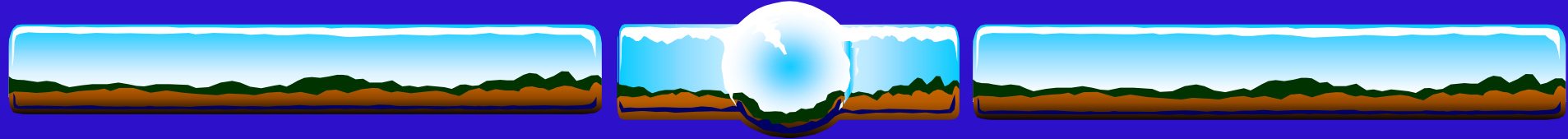


Table 10. Average results of three FPR intercropping trials conducted by farmers in An Vien village, Thong Nhat district of Dongnai, Vietnam in 2001/02.

Treatments	Yield (t/ha)		Gross income ¹⁾ -----('000 dong/ha)-----	Product. costs	Net income	Farmers' preference (%)
	cassava	peanut				
1. Cassava monoculture	29.15	-	12,243	4,651	7,592	30
2. C+ peanut (1 row)	33.32	-	13,994	5,051	8,943	50
3. C+ peanut (2 rows)	30.73	-	12,907	5,451	7,456	20

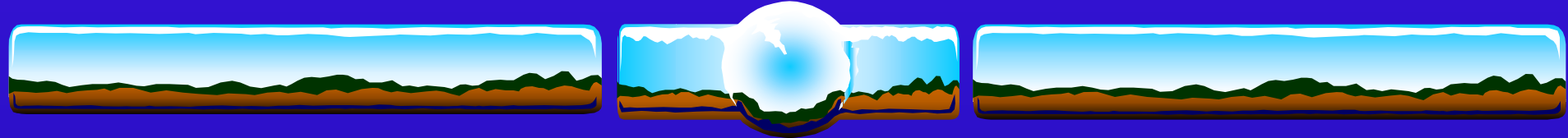


Table 11. Average results of two FPR intercropping trials conducted by farmers in Dong Tam village, Dong Xoai district, Binh Phuoc, Vietnam in 2000/01.

Treatments	Cassava yield (t/ha)	Intercrop yield (t/ha)	Gross	Product	Net	Farmers' preference (%)
			income ¹⁾	costs ²⁾	income	
			('000 dong/ha)			
Cassava monoculture	30.23	-	8,767	3,879	4,888	60
C+cowpea	29.33	-	8,506	4,359	4,147	0
C+peanut	30.22	0.225	9,889	5,139	4,750	40
C+mungbean	29.70	-	8,613	4,299	4,314	0

(Source: Nguyen huu Hy et al., 2000-01)

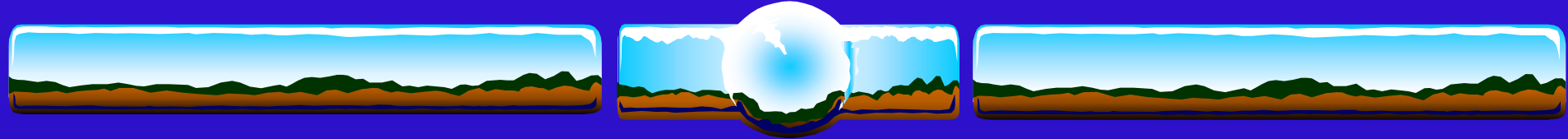


Table 12. Average results of two FPR intercropping trials conducted by farmers in Suoi Rao village, Chau Duc district, Baria-Vungtau, Vietnam in 2000/01.

treatments	Cassava	Starch	Intercrop	Gross	Product	Net	Farmers'
	yield (t/ha)	content (%)	yield (t/ha)	income ¹⁾	costs ²⁾	income	preference (%)
				('000 dong/ha)			
1.C.monoculture	36.13	30.4	-	10,839	6,843	3,996	0
2.C+peanut	40.20	29.6	0.524	14,890	8,360	6,530	17
3.C+mungbean	42.24	30.0	0.287	14,394	7,600	6,794	100
4.C+maize	29.07	27.7	4.653	13,467	8,200	5,267	38



Table 13. Average results of three FPR intercropping trials conducted by farmers in Suoi Rao and Son Binh villages of Chau Duc district, Baria-Vungtau, Vietnam in 2001/02.

Treatments	Yield (t/ha)		Starch content (%)	Gross income ¹ -----('000 dong/ha)-----	Product. costs	Net income	Farmers' preference (%)
	cassava	intercrop					
1.Cassava monoculture	31.88a	-	27.9	17,534	7,116	10,418	29.0
2.C+peanut	30.74a	1.483	27.7	25,805	10,071	15,134	48.3
3.C+mungbean	29.81a	0.570	26.7	20,386	8,640	11,743	41.9
4.C+soybean	34.54a	0	27.5	18,997	8,620	10,377	6.4
5.C+maize	21.00b	3.643	24.3	14,829	8,588	6,969	35.0
C.V. (%)	12.16	LSD (0.05)	6.872				

(Source: Tran thi Dung et al., 2000-01)

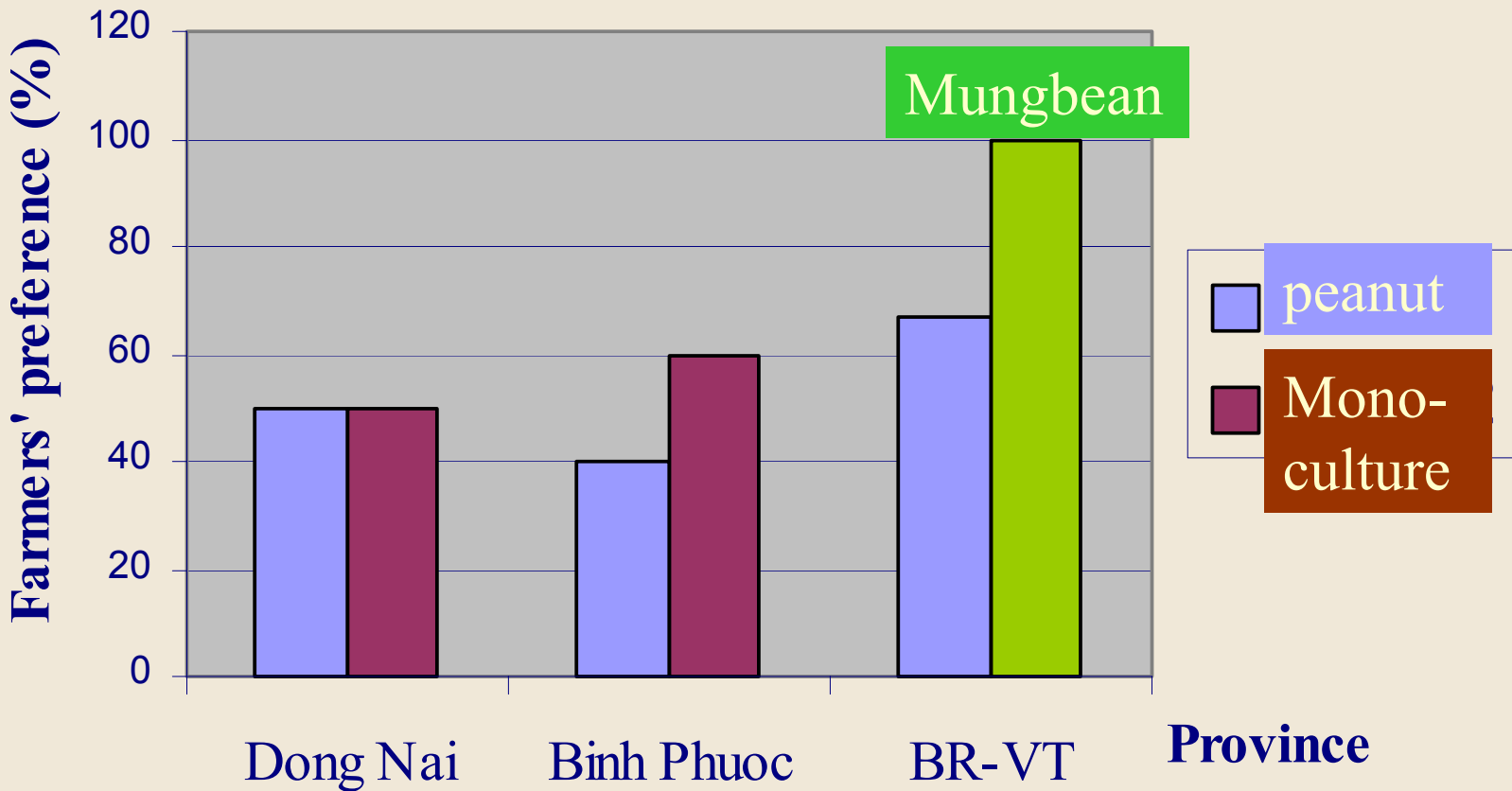
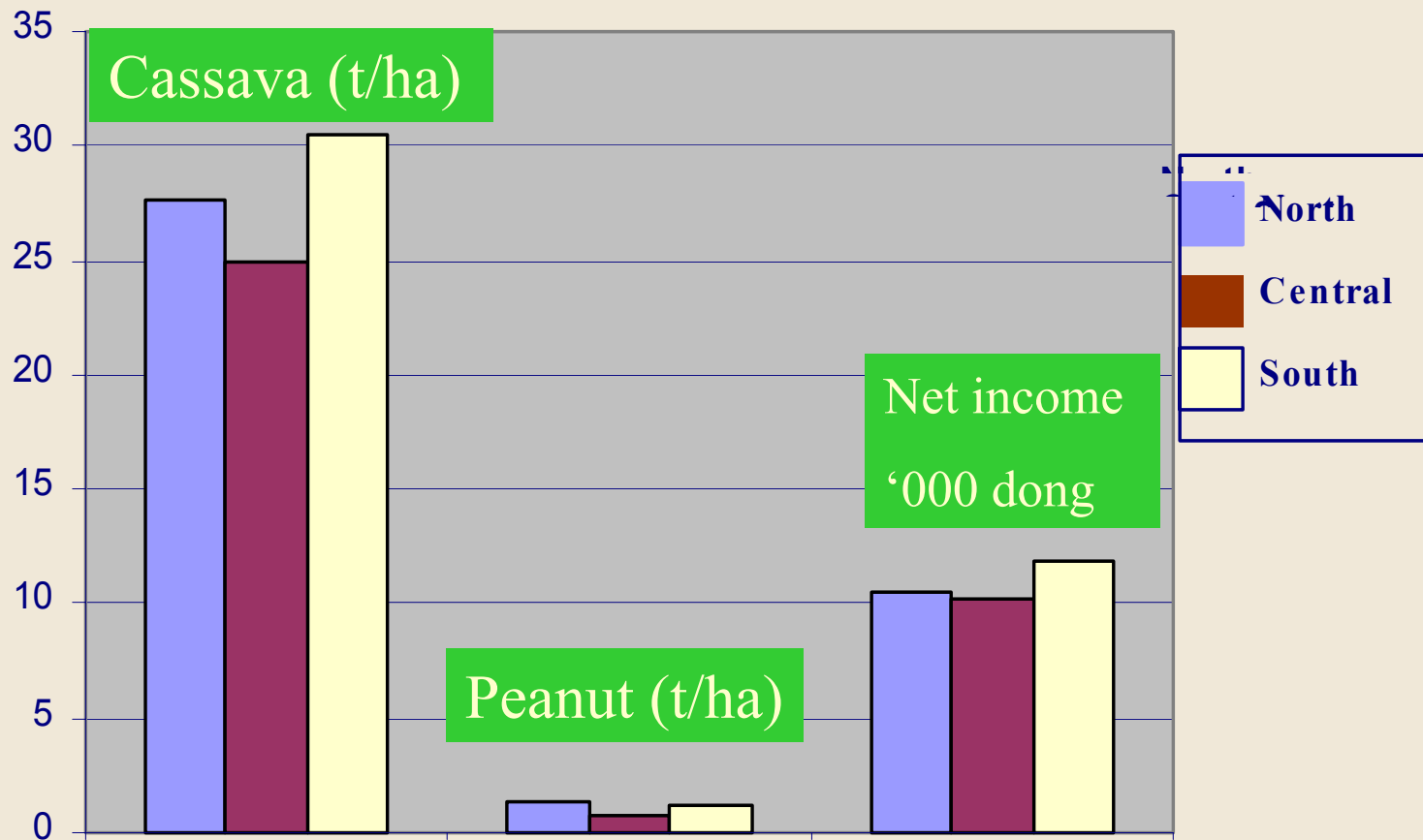
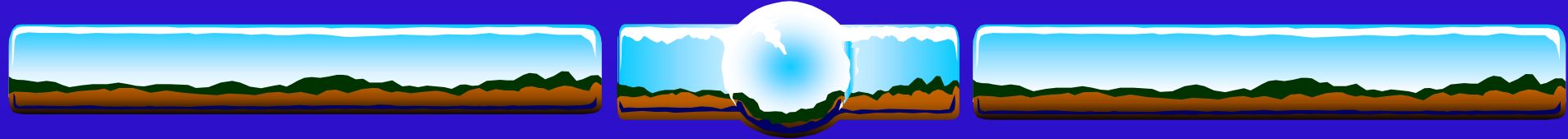
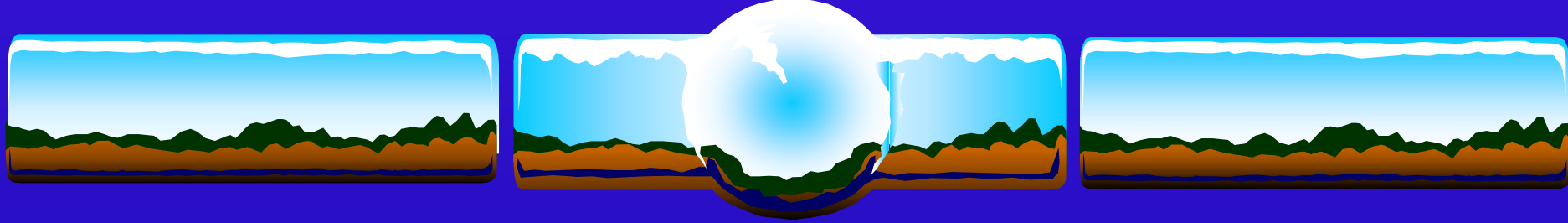


Chart 4: Farmers' preference of cassava intercropping in the South Viet Nam



Yiel and net income of "cassava+peanut in Vietnam



CONCLUSION

- **Cassava intercropping: feasible and adoptable system
for poor farmers (limited land and capital)**

in small farms, on slope areas, with labor available

-**The best practice:**

***Intercrops: Cassava + peanut or Cassava + mungbean**

***Population: 10.000 cassava plants/ha – 2 rows of intercroops**

***Variety: non or late branching, high starch content**

***Planting time: before or at the same time**

***Fertilizers: 80-40-80 or 60-60-80**



Cassava + mungbean



WEED CONTROL

INTRODUCTION

Weed control: - reduce competition of light, water, nutrient
- increase root yields

Methods: - Hand weeding

- Herbicide

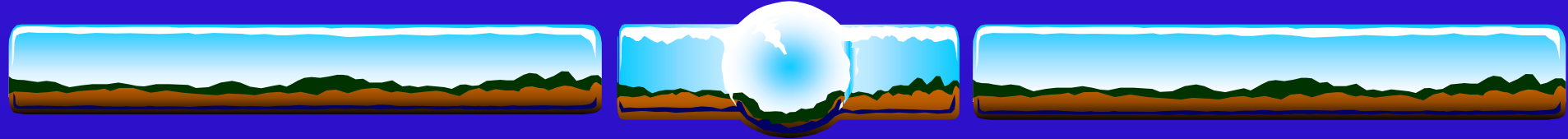
lack of labor

produce on a large scale

reduce cost of production

environmental pollution

- Plastic covering



Weed control period: **2 or 3 month after planting**
2 or 3 times for hand weeding

CHEMICAL WEED CONTROL

Dual : pre- emergency herbicide

Round up, Gramoxon: post- emergency herbicide

2 l /ha

From planting to 3 months after



RESULTS

Table 14. Average results of three FPR weed control trials conducted by farmers in An Vien village, Thong Nhat district, Dong Nai, Vietnam in 2000/01.

Weed control treatments	Cassava root yield (t/ha)	Gross income¹⁾ ('000 dong/ha)	Product. costs¹⁾	Net income	Farmers' preference (%)
Weed control by hand	26.66	7,731	4,298	3,433	30
Weed control by 2.0 l Dual/ha+1HW	29.40	8,526	3,878	4,648	70




Table 15. Average results of three FPR weed control trials conducted by farmers in An Vien village, Thong Nhat district of Dongnai, Vietnam in 2001/02.

Weed control treatments	Cassava yield	Gross income²⁾	Weed control costs	Production costs	Net income	Farmers' preference
	(t/ha)	-----('000 dong/ha)-----				(%)
Weeding by hand (3x)	33.02	13,868	1,600	4,651	9,217	40
Application of Dual (2 l/ha)	31.35	13,167	520	3,571	9,596	40
Soil covered with plastic	38.28	16,078	5,000	8,051	8,027	20

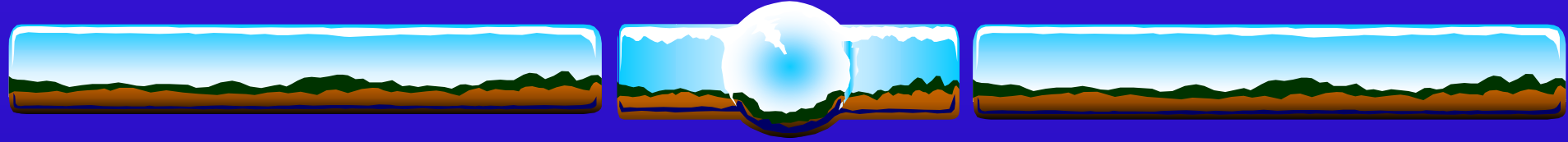
(Source: Nguyen huu Hy et al., 2000-01)



CONCLUSION

Weed control: reduce the cost of cassava production
better yield and net income

- * Weeding time: 2 or 3 months after planting**
- * Hand weeding: 2 or 3 times (weed population, soil fertility, rainfall, cropping system)**
- * Herbicide: pre-emergence herbicide Dual (2l/ha)**
(predominant weed species)
- * Plastic covering: high cost**



THANK YOU