Root Crops for People and Pigs:

Food Security and Income Generation to support Transition from Upland Rice Cropping in Northern Laos

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NAFRI

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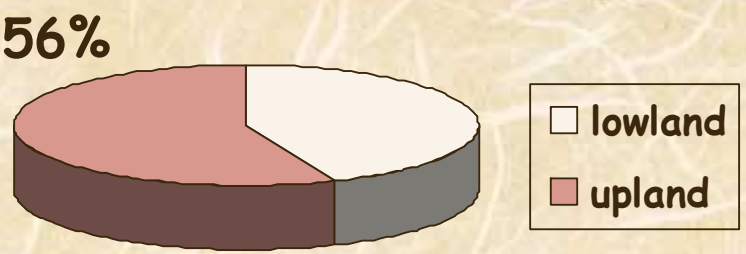
Rice Area (ha)

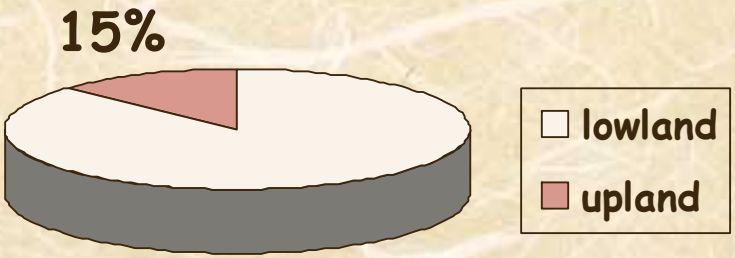
Lao PDR

Oudomxay Province



Production (tons)

Lao PDR



Oudomxay Province

source: DOA, MAF (2005)

Upland Rice – Systems in Decline

- Produced almost exclusively in fallow rotation ("shifting cultivation") systems
- Increasing population and land use restrictions cause decreasing fallow periods
- Decreasing yields (from weed pressure, declining soil fertility) result in decreasing returns to labor = poverty trap
- Lao government policy aims to eradicate shifting cultivation by 2010
  - Permanent cropping on fixed fields
  - Diversified production systems

Upland Rice – Food Security

- Rice is (and will likely remain) the staple crop of upland people in Laos.
- Rice insufficiency is a serious problem for many upland households in northern Laos.
- Difficult for HHs to consider new livelihoods when food is not secure (adding risk to instability)
- Incremental (transitional) changes more likely to succeed
- Currently, HHs cope with rice insufficiency by selling livestock ("piggy banks") to buy rice and by harvesting forest foods (especially roots and tubers for starch and calories).

Research Question:

Can traditional pig production systems be intensified *using locally grown feed resources* to provide a livelihood alternative to upland rice farming ?

- **Buy rice for food security**
- **Generate attractive levels of income**

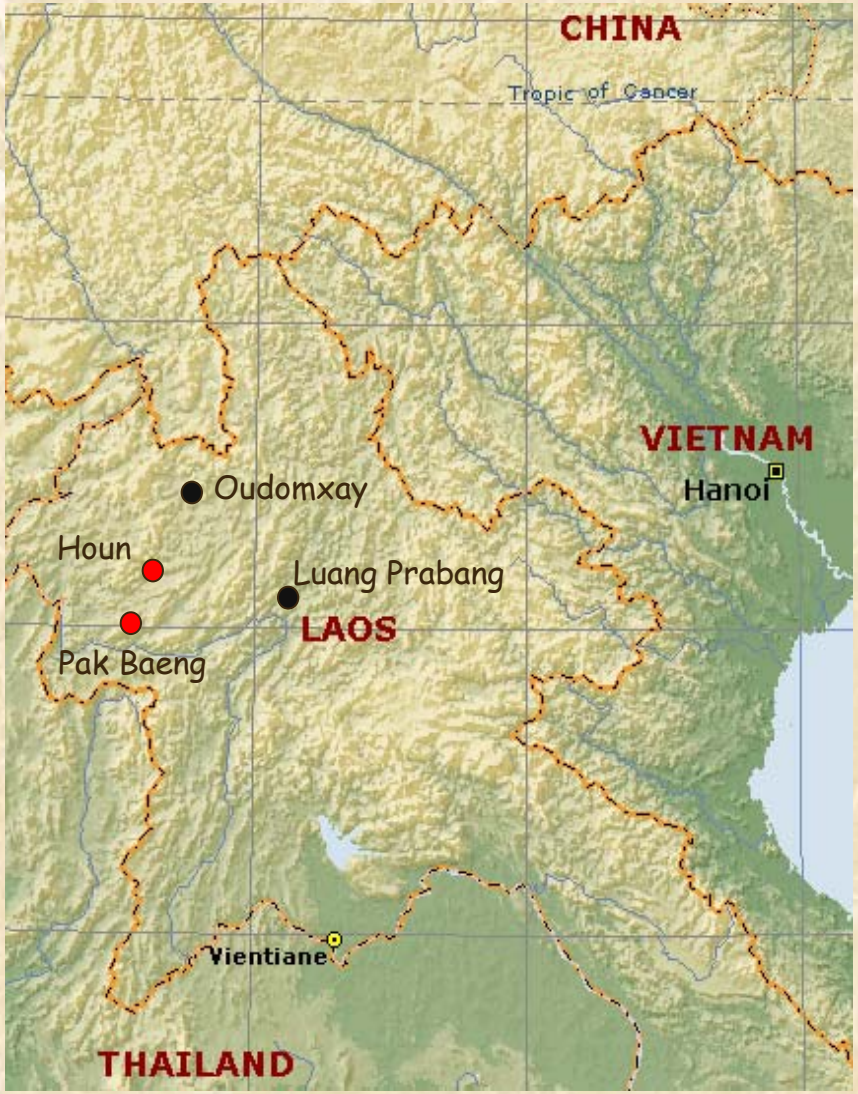
Oudomxay Community Initiatives Support Project (OCISP)

- Provincial Agriculture and Forestry Office (PAFO)
- District Agriculture and Forestry Extension Office (DAFEO)

Participatory Research for Development in the Uplands (PRDU)

Integrated Cassava-based Cropping and Livestock Systems Project

Focus Villages



- Houn district
  - Phoulat Village (132 HH)
  - Kone Thoey village (88 HH)
- Pak Baeng district
  - Kone Lang village (60 HH)
  - Mok Loi Village (25 HH)

- Remote locations
- Kh'mou ethnic minority
- Average HH size = 6.7
- 3.4 laborers/HH
- 63% of HHs experience rice deficiency for average of 4.5 months

Crops Planted in Focus Villages (2005)

village survey questionnaires (2005) n = 80 HH

Crops	% of HHs	Area Cropped / HH (m^2) (HHs growing these crops)		
		average	min	max
Upland Rice	89	9,700	1200	21,670
Wet Season Paddy	35	2,600	500	9,000
Dry Season Paddy	29	2,300	200	8,000
Maize	57	3,000	200	10,000
Job's Tears	29	1,100	100	10,000
Soybean	6	200	50	5000
Sesame	16	2,600	130	20,000
Cassava	33	700	50	3,000
Sweetpotatoes	30	200	50	1,000

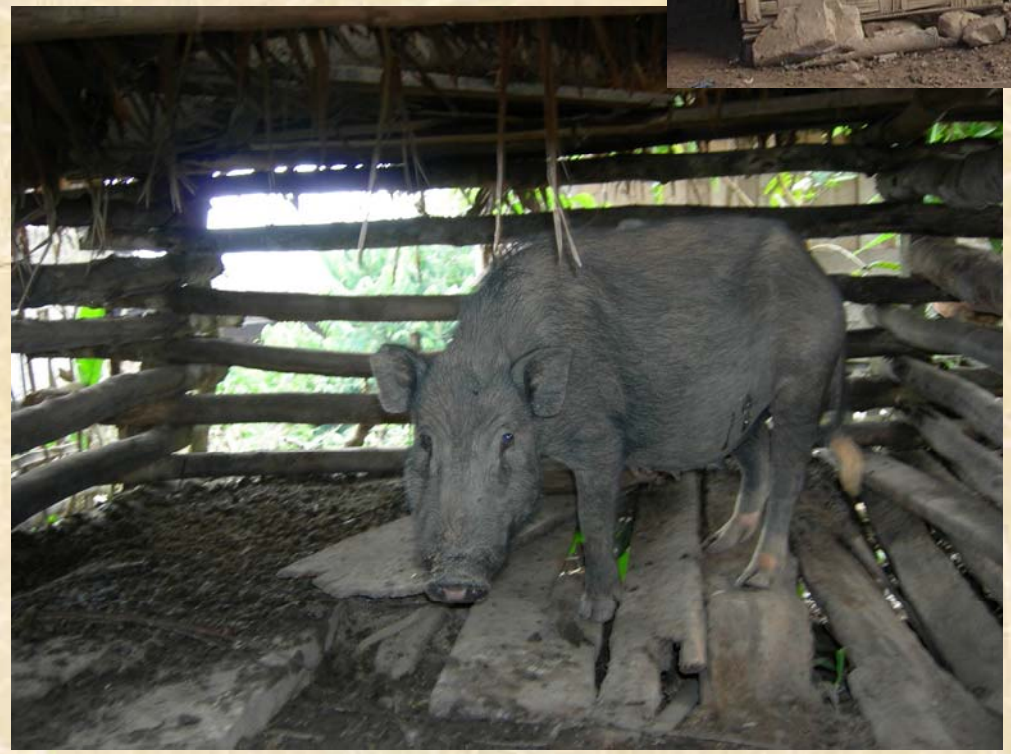
Livestock Holdings in Focus Villages (2005)

village survey questionnaires (2005) n = 80 HH

Livestock	% of HHs	Herd Size (head) (HHs raising these animals)		
		average	min	max
Cattle	14	2.8	1	8
Buffalos	33	2.3	1	6
Total Pigs	86	4.4	1	21
sows	72	1.4	1	4
boars	19	1.4	1	3
Chickens	97	21.4	3	65
Ducks	38	3.2	1	8
Goats	34	4.7	1	25

Traditional Pig Production Systems in Focus Villages

- Raised for 2-3 years before selling (at 45-50 kg)
- Penned or free-ranging (scavenging)
- Feed amount and content depends on availability (rice bran, rice soak water, greens, HH food scraps)
- Collecting greens, firewood, cooking takes 1-2 hours/day; mostly by women
- Weight gain (in 4 months) of monitored pigs in traditional systems:
  - Penned and fed: 3.8-8.5 kg
  - Free-range scavenging: 2.5 kg

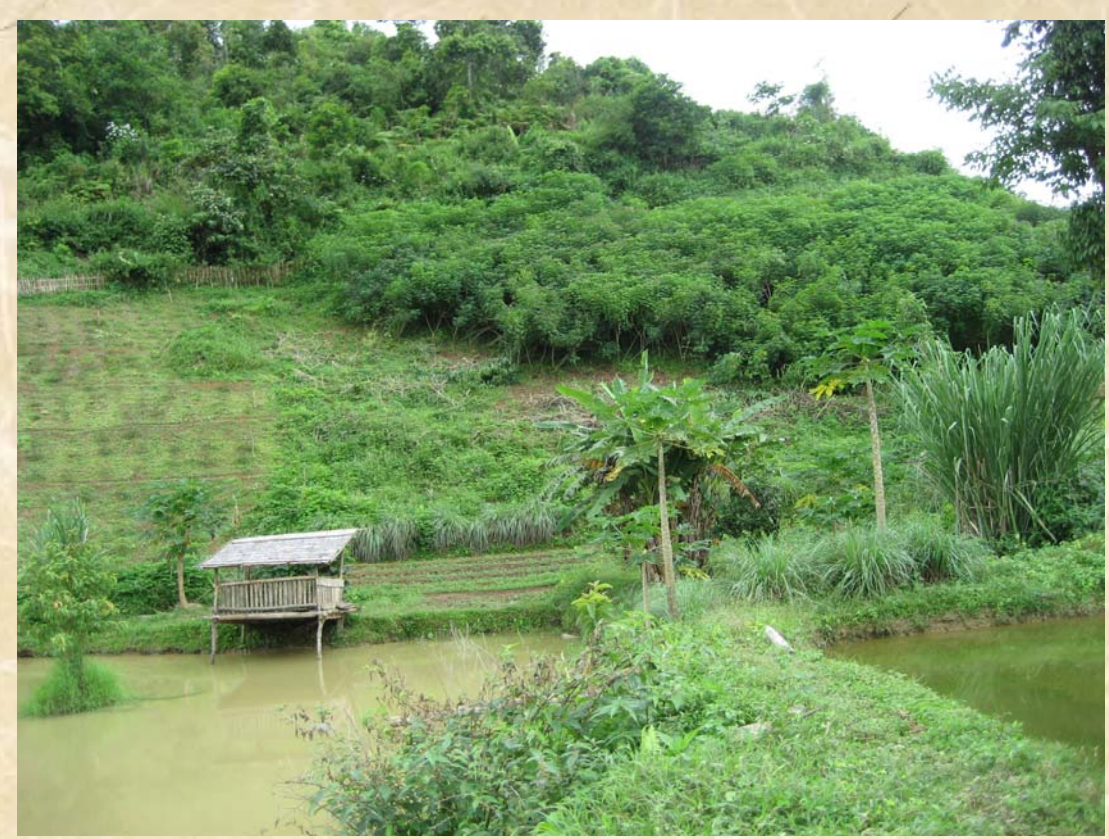


Project Activities (root crops) 2004

- Participatory problem diagnosis (Apr)
- Planting demonstration trials with farmer groups (Jun)
  - Cassava – 7 improved varieties from Thailand (high yield, high starch content)
  - Sweetpotatoes – 7 improved multi-purpose varieties from Viet Nam (high vine and root yields)
- Farmer field day at Sweetpotato harvest (Nov) – with farmer field school on production and multiplication: expert from VN Field Crops Research Institute)

Project Activities (root crops) 2005

- Training for provincial officers, district extensionists (NAFRI, LRC) on cassava production, processing and utilization of cassava and sweetpotato for livestock feed (Apr)
- Farmer field days at cassava harvest (May)
- Expanded plantings of cassava and sweetpotatoes with HHs in focus villages (May-Jun)
- Livelihoods Analysis focus group discussions, survey questionnaires (Sep & Dec) – for PM&E, planning



Sweetpotato Vine and Root Yield (t/ha)

means of 3 samples -- 2004 harvest

varieties	vines	roots
KL5	21	25
KB1	21	31
97-6	37	45
97-15	28	40
98-5-15	15	30
KB1/KL5	36	43
K51	7	40
Local	*4*	*2*
AVERAGE (introduced)	24	36

Cassava Root and Starch Yields

means of 7 samples – 2006 harvest

variety	average root yield (t/ha)	starch content [1] (%)	starch yield (t/ha)	eating quality
Rayong 2	18.4	17	3.1	+ + +
Rayong 5	17.5	24	4.2	+
Rayong 60	17.4	19	3.4	+
Rayong 72	23.4	23	5.5	+ +
Rayong 90	16.7	24	3.9	+
KU 50	20.4	25	5.0	+
Ha Natee	13.0	18	2.4	+ + +
Local (ODY red)	13.0	18	2.4	+ + +

[1] average of 7 measurements at several locations in Laos

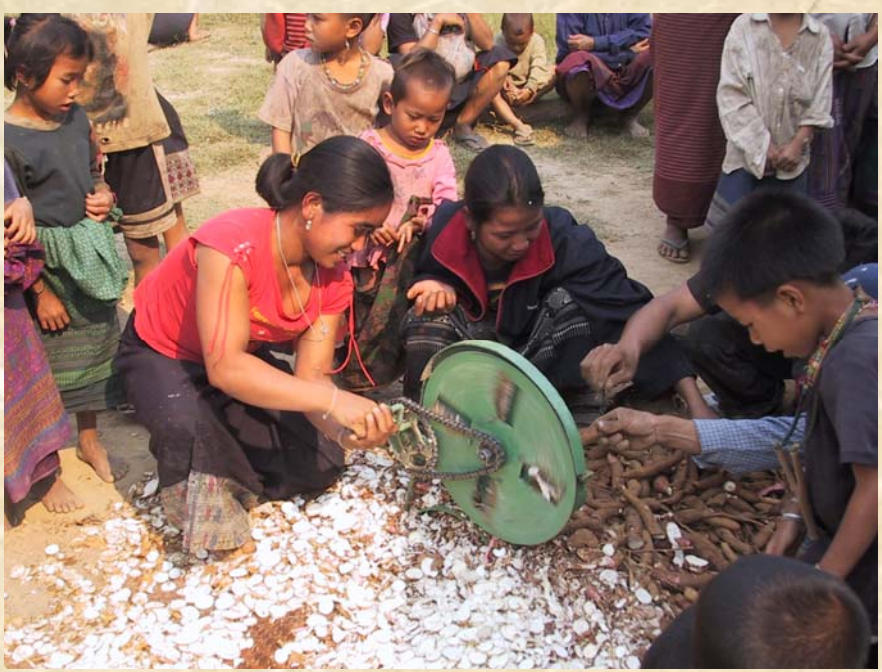
Project Activities (root crops) 2006

- Farmer field day at sweetpotato harvest (Mar)
  - farmer field school on multiplication strategies, preservation of varieties over dry season & integrated pest management
- Farmer field days at cassava harvest (Mar)
  - with villagers and extensionists from other districts
- Farmer training (by extensionists) on root crop processing, silage making (Mar)
- Researcher meeting to plan rations for pig feeding trials (Mar) – NAFRI, NIAH, CIAT, CIP)
- Training for students (LP Ag College) on silage production and monitoring pig feeding trials (Apr)
- Root crop harvest and processing by farmers and students to prepare for pig feeding trials (May)

Post-Harvest Processing of Feed Crops

(to facilitate storage, preserve nutrients, avoid cooking, destroy anti-nutrients)

- Slicing – cassava, sweetpotato roots
- Grating – cassava, sweetpotato roots
- **Drying, Wilting** – cassava roots, cassava and SP leaves
- Crushing – dried cassava, stylo leaves
- Pounding – dried roots, maize, soybean
- **Ensilage – (anaerobic fermentation)**
  - Root-based: cassava roots
  - Leaf-based: paper mulberry, sweetpotato

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Pig Feeding Demonstration Trials

to demonstrate "best practices" / assess pig response to improved feeding over 4 months (Jun-Oct 2006)

Farmers and Livestock

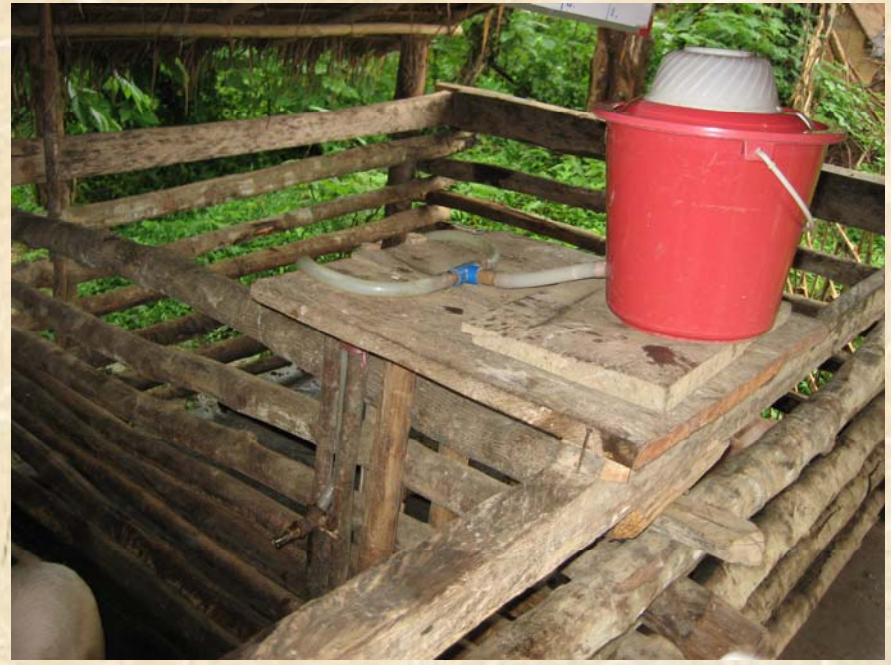
- 4 farmers (2 in 2 villages), 1 student monitoring trials with each household
- 4 cross-bred pigs (Landrace x Large White) / farmer

Management

- Disease control (quarantine, vaccination, de-worming)
- Improved housing, feed troughs, water access

Feed

- all pigs fed 50% silage / 50% dry feed (as-fed weight basis), mixed with water at feeding time. No cooking of any feed.
- 2 feed formulations (higher nutrition & lower nutrition dry feeds)

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Ration: Silage Formulas (fed to all pigs) -- seasonal availability of raw materials

Silage Formulas (%) 50% energy, 50% protein	early season		late season	
	energy (roots)	protein (leaves)	energy (roots)	protein (leaves)
cassava roots (slices)	70	--	70	--
paper mulberry leaf	30	90	--	--
cassava root meal	--	10	--	10
sweetpotato vines	--	--	30	90
salt	0.5	0.5	0.5	0.5

Ration: Dry Feed Formulas
-- based on age of pigs, nutrition regime

Dry Feed Formulas (%)	young pigs		older pigs	
	higher nutrition	lower nutrition	higher nutrition	lower nutrition
rice bran	25	30	25	25
cassava root meal	20	30	20	45
cassava leaf meal	25	40	25	30
maize flour	20	--	20	--
soybean flour	10	--	--	--
stylo leaf meal	--	--	10	--

Indicators of Pig Growth

Results (means of 4 pigs/trial)	lower nutrition		higher nutrition	
	Pak Baeng	Houn	Pak Baeng	Houn
average initial weight (kg)	37	31	39	36
average final weight (kg)	67	66	81	60
average feed intake (kg/head/day)	2.7	2.4	3.8	2.3
average daily gain (g/day)	250	240	350	250
survival rate (%)	100	100	100	100

Cash Requirements (Rice) vs. Cash Income (Pigs)

- **Rice Requirements**

  (Percapita consumption = 180 kg/yr, milling efficiency = 60%, 20% losses)

  - Percapita = 360 kg/yr (paddy)
  - Per HH (6.7 people) = 2.4 t/yr (= 1.5-2.0 ha)
  - Purchased rice: 6.7 * 4,000 kip/kg * 180 kg
    = 4.82 million kip/yr (~ USD $503/yr)

- **Pig Sales**
  - 9,500 kip/kg * 80 kg = 760,000 kip/pig
    (~ USD $80/pig)

Sell 6.4 pigs/yr to meet rice requirements

Estimated Land Requirements (per HH) for Production of Feed Crops
(based on formulation in demo/trials)

Crop / Ingredient	avg yield (t/ha)	required for 8 pigs	
		(kg)	area (m^2)
cassava roots	18	4300	2400
cassava leaves	20	3200	*(1600)*
PM (posa) leaves	--	800	--
SP vines	24	1700	720
maize	4	510	1300
soybean	1	120	1200
stylo	--	136	small plot

Purchased feed inputs: rice bran (570 kg) = $45 ; salt (13 kg) = $2.75

Conclusions (1)

Opportunities/Advantages

- It is possible for farmers to get reasonably good growth of pigs using only locally grown feeds and improved management practices
- Provide steady and consistent supply of feed to pigs through processing and storage
- Labor savings (especially to women) for collection and preparation of pig feed
- Not recommending a sudden and complete shift from upland rice cropping to root crops/pig production (perhaps some transition)

Conclusions (2)

Limitations / Challenges

- Land availability / Land quality
  - Sweetpotato on moister lands, foots of slopes
  - Cassava should not be grown on steep slopes
- Disease management, vet. services
- Labor
  - Lots of work for preparation, then very easy
- Credit
  - For piglets (pig banks), housing, veterinary supplies and services
- Market Linkages

Cassava Erosion Control Treatments (Tuyen Quang, VN)

Erosion Control Treatments	Root Yield (t/ha)	Soil Loss (t/ha)
Cassava Monocrop No Hedgerows	32	18.0
Cassava Intercrop with Peanut (2 rows) No Hedgerows	31	8.6
Cassava Intercrop with Peanut (2 rows) Tephrosia Hedgerows	34	3.6
Cassava Intercrop with Peanut (2 rows) Stylo Hedgerows	32	6.8
Cassava Intercrop with Peanut (2 rows) Paspalum Hedgerows	36	3.2

Cassava Intercropping with Legumes (Tuyen Quang, VN)

Intercropping Treatments	Cassava Root Yield (t/ha)	Legume Yield (t/ha)	Economic Yield compared to Monocrop (%)
Cassava Monocrop (farmer practice)	39	--	--
Cassava w/ 2 rows Peanut	41	1.4	+ 73 %
Cassava w/ 2 rows Soybean	35	0.8	- 5 %
Cassava with 2 rows Black Bean (cowpea)	42	0.6	+ 66 %

Conclusions (2)

Limitations / Challenges

- Land availability / Land quality
  - Sweetpotato to moister lands, foots of slopes
  - Cassava should not be grown on steep slopes
- Disease management
- Labor
  - Lots of work for preparation, then very easy
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- Market Linkages

Acknowledgments

- Farmers:

  Ta On, Ta Nang, Ta Soun, Ta Seu

- LP Ag College Faculty & Students:

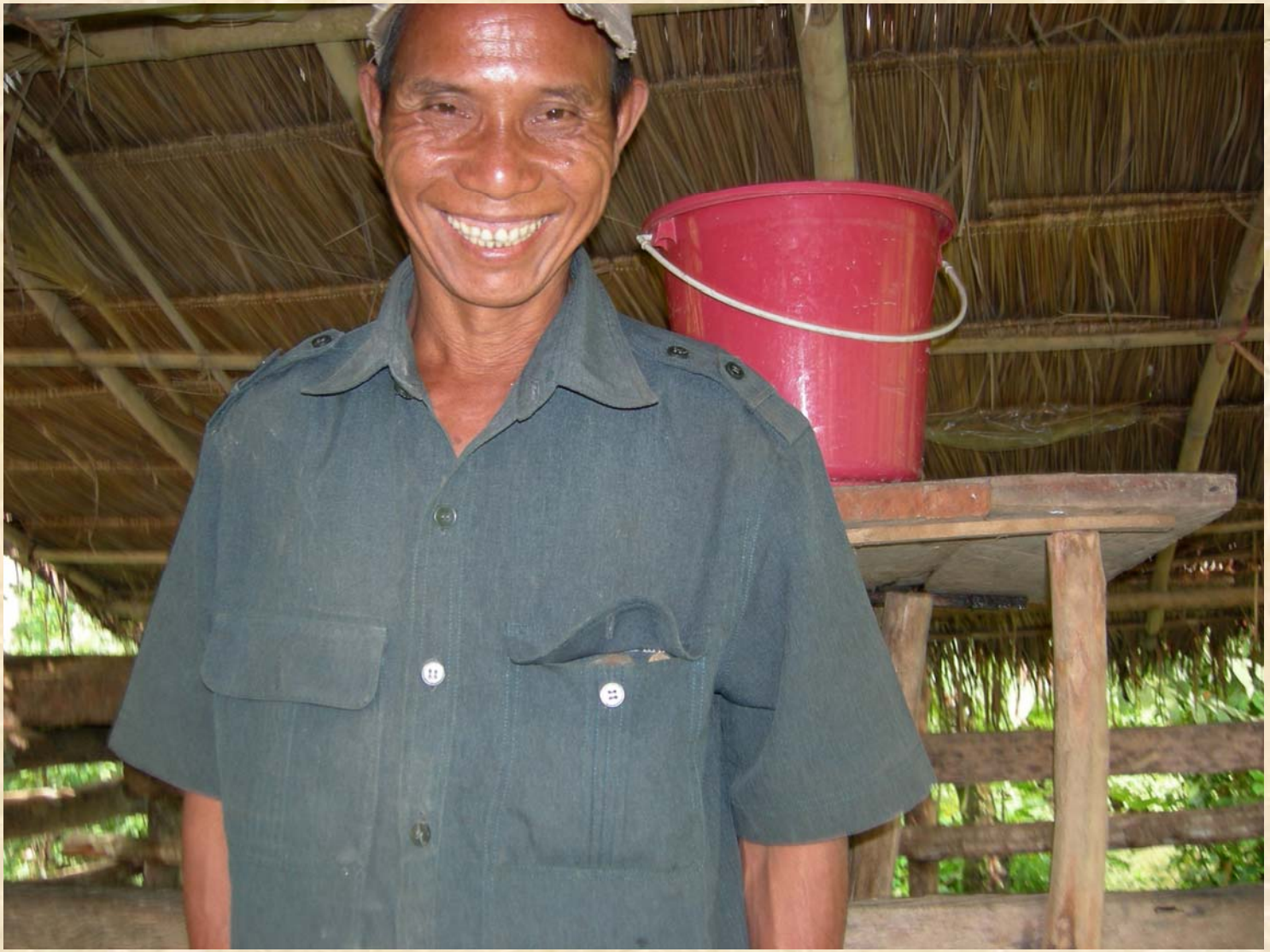
  Ms. Moukdala, Ms. Somxanh,

  Mr. Somvang, Mr. Cheu

- DAFEO Staff:

  Mr. Somsak, Mr. Chanhsamone

Thank You !



Feeding Target (recommended):

- for ADG = 500g/day
- feeding rate (dry weight) = 5% of body weight

Feeding Practice:

- according to pigs' appetite (farmers' and students' judgement)
- fed 2x/day (07:00 and 16:00)

Management:

- wooden pens (~2m^2/head)
- good hygiene
- water freely provided
- health: swine fever vaccination and de-worming