Maize and cassava production , breeding and soil management situation in Lao PDR

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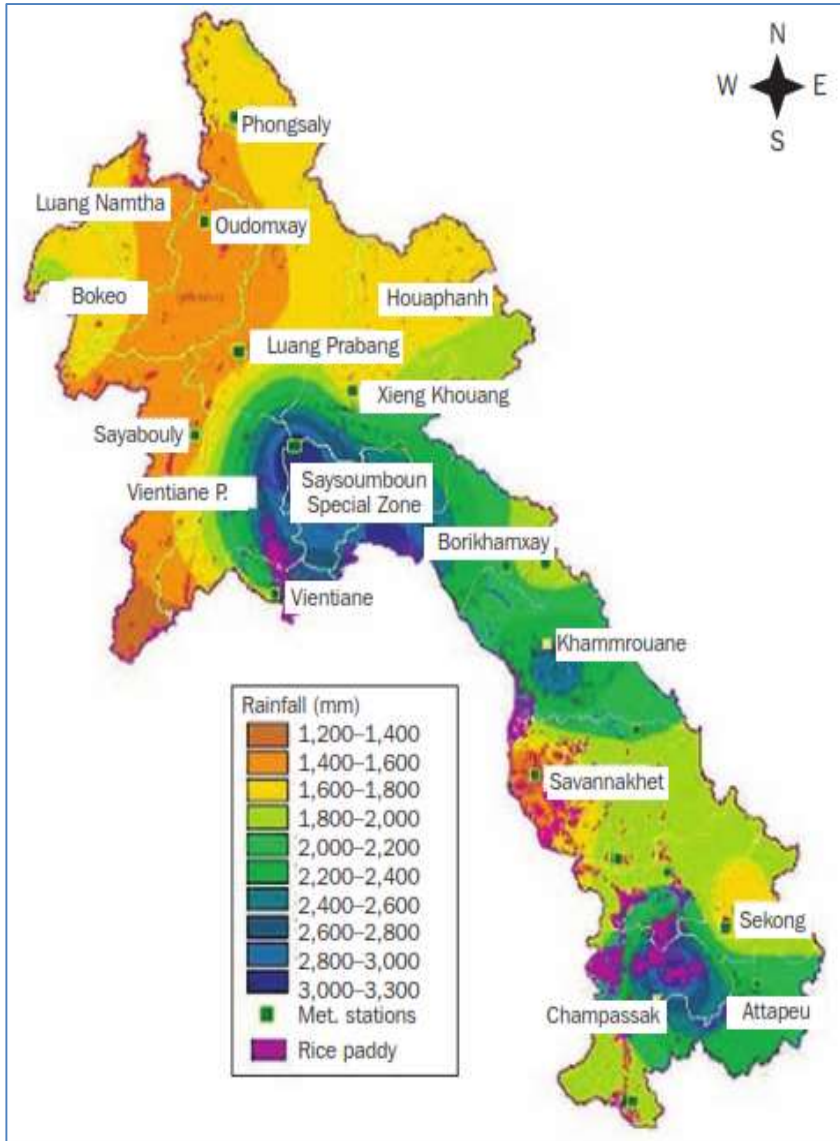
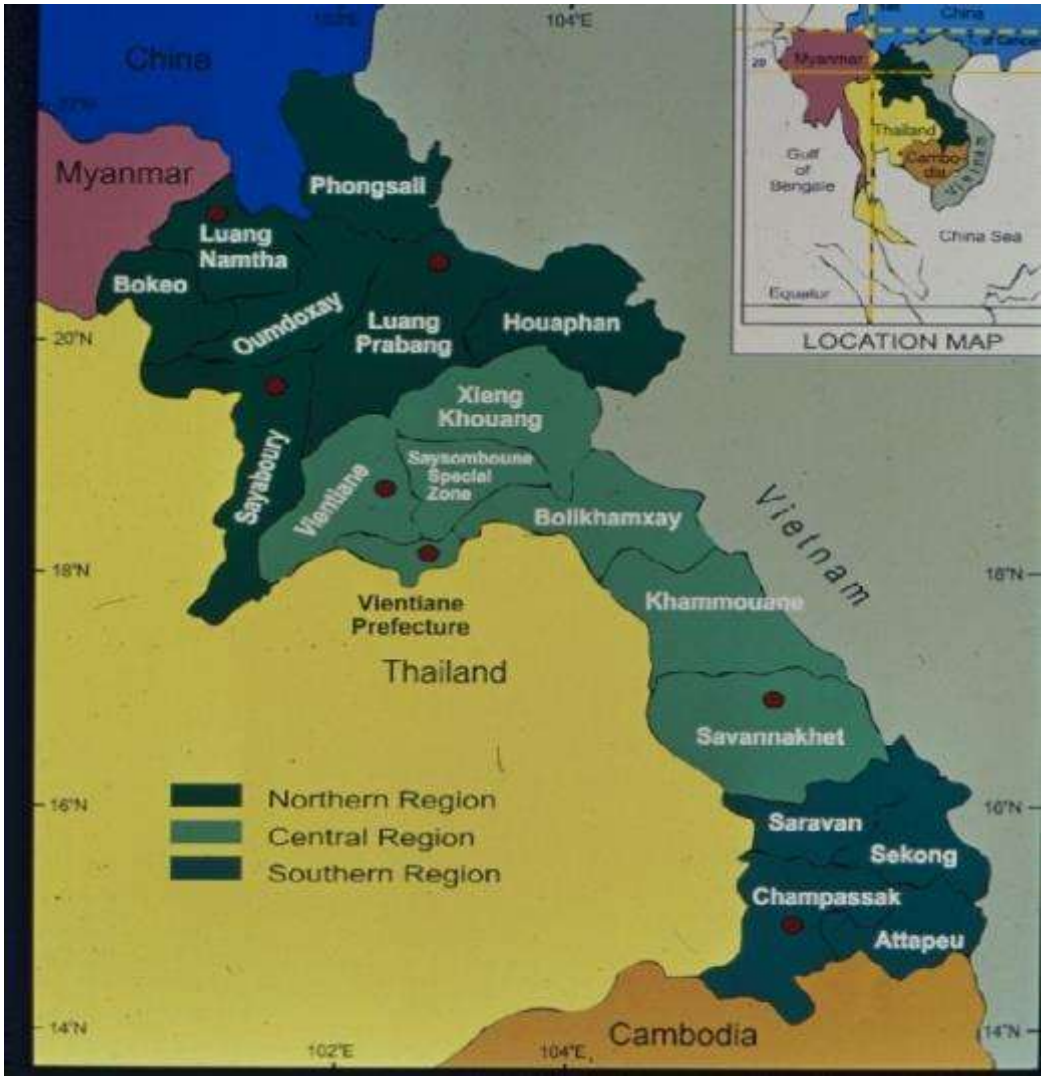
Location of

Lao People's Democratic Republic (Lao PDR)

Climate information

- **Laos has a tropical monsoon climate with the rainy and dry season**
- **average annual rainfall of between 1,800 – 2,000 mm**
- **average annual temperature of 26.7°c (maximum and minimum of 31.8°c and 21.7°c respectively)**





Area: 236,800 Km^2

- Northern
- Central
- Southern

There are 3 ecologicals:

- Rainfed lowland
- Rainfed upland
- Irrigated

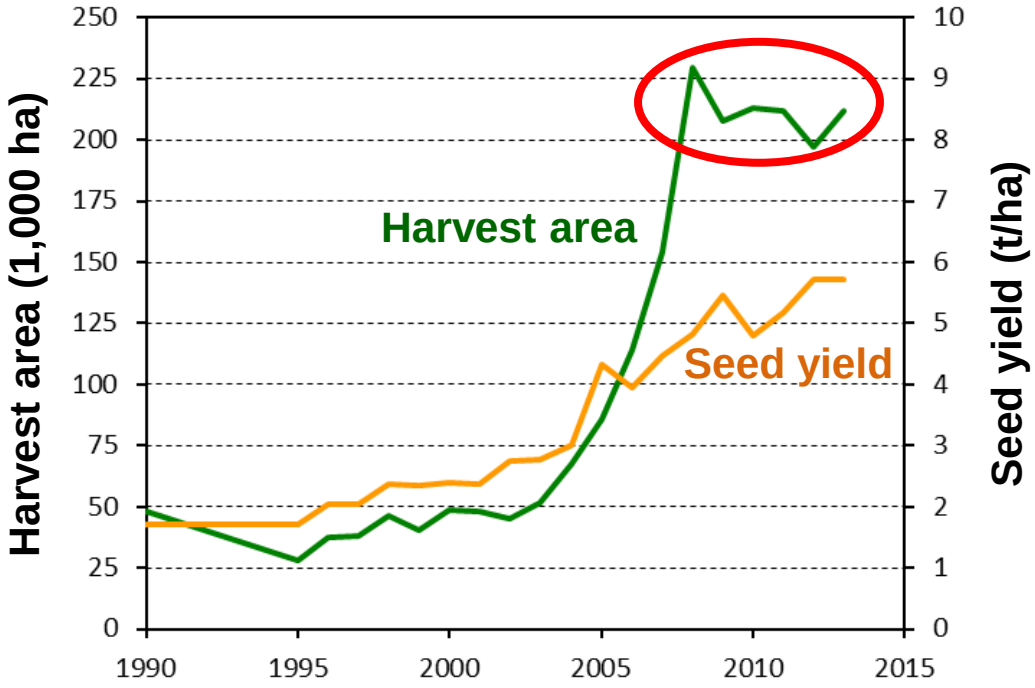
1. Overview on Agricultural Development in Laos

- **Lao PDR covers area of 236,800 km2**
- **Population is about 6.7 million (2015)**
- **Mountainous areas account for 80% and about 20% is lowland area.**
- **Cultivated land covers about 1.2 million ha , rice is occupying 60-70% of the total crop area.**

- **Lao PDR is largely an agrarian society with 80% of people living in rural areas.**
- **The Government policy framework promotes seven agricultural products: rice, sugarcane, maize, coffee, rubber, cassava, and beef**
- **Rice is the main staple food of Lao people which is currently sufficient for domestic production**

Maize

Maize harvest area has increased since 2005.



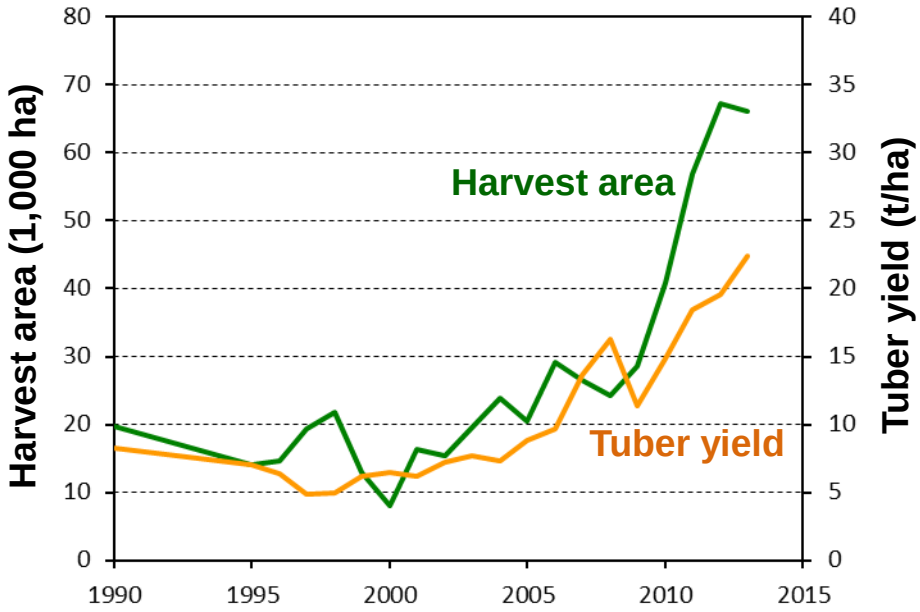
What constraints limit maize area expansion up to 200 thousand ha?

Market ? Cost ?
Labor shortage ? Variety?, Soil ?

Sources: NAFRI and JIRCAS

Cassava

Cassava area has increased since 2010.



Dry cassava chips market is developing in Laos.

Area planted to cassava is expected to increase further.

Sources: Phanthasinh and Saythong

Ministry of Agriculture and Forestry (MoAF)

National Agriculture and Forestry Research Institute (NAFRI)

Maize and Cash Crop Research Center (11 Research centers)

Responsibility

- **Major Crops**
  - Maize
  - Legume(soybean, mungbean, peanut etc)
  - Tuber Crop (Cassava and sweetpotato)
- **Research on**
  - Germplasm collection
  - Breeding program
  - Crop production and management
  - Seed production

Germplasm Collection in RRC and MCRC

Rice: 14,238 samples

Maize: 234 samples

Cassava: 48 samples

Grain legume: 88 samples

Wide sugarcane: 108 samples

Sorghum: 264 samples

Sweet potato, taro etc: 20 samples

Maize and Cassava breeding

1. Maize for Consumption:

- Germplasm Collection (185 Samples) almost of them are waxy corn , some for feed and pop corn
- Characteristic and Develop OPV for **high yielding**
- Sweet corn started 2014 by introduce varieties from Thailand, Vietnam and ICF (Korea)

Maize breeding:

- Germplasm Collection almost introduced from Thailand, Vietnam and China and CIMMYT (will get soon)
- Develop OPV (Waxy corn)
- Develop Recombination Inbred Line (around 400 lines) and doing diallel cross for developing Hybrid (High yielding and drought tolerance)
- ***Mutation breeding : radiated in Vienna (TC) but selection failed.***

VTE 450

Maturity: 95–115 days

Yield: 6–7 t/ha

Promising Crosse VT155 x VT094

VT114 x VT132

Seed production in MCRC

Cassava: (48 Samples)

- Evaluation and utilization used: Vars. From Thailand and Vietnam


Maturity: 8 months -1 year
Yield: 35 t/ha
R 72


Maturity : 8 months-1 year
Yield: 35-40 t/ha
KU 50


Maturity : 8 months -1 year
Yield: 19 t/ha
NEP


Maturity : 8 months -1 year
Yield: 20 t/ha
NARC 61


NARC195
C
1

Breeding for Cassava

Recently, we don’t have any breeding programme

Traits: High yielding, high starch content and drought tolerance

Maize

Maize is cultivated in fields with good soil.

(our survey)

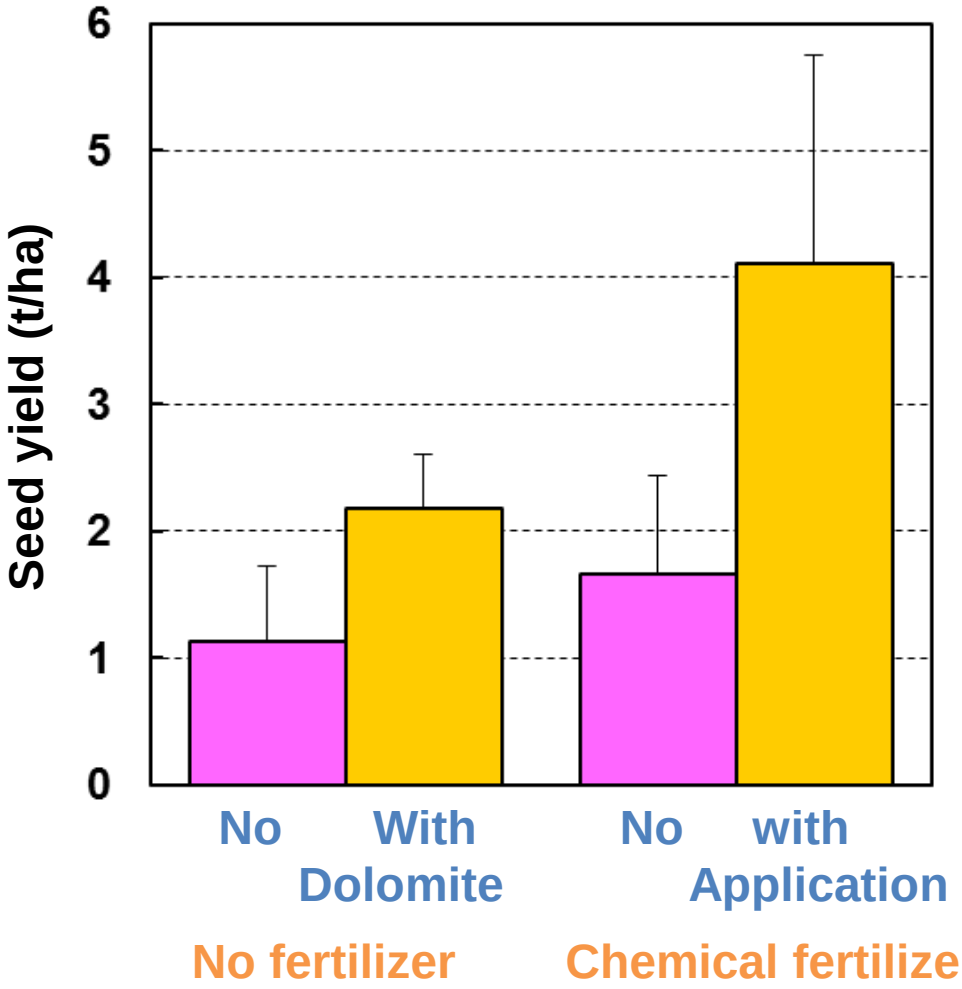
Ratio of fields with suitable soil for maize cultivation to the number of farm fields in Laos

	pH	T-C	T-N	ava-P	ex-K	ex-Mg	ex-Ca
Adequate level	<6.0	<10 g/kg	<1.0 g/kg	<5 mg/kg	<0.3 cmolc/kg	<1.0 cmolc/kg	<8 cmolc/kg
Maize field	68%	95%	88%	46%	61%	97%	73%
All fields	32%	81%	79%	50%	32%	52%	31%

Large areas have soil deficient in P, Mg and Ca for maize growth.

Sources: NAFRI and JIRCAS

Maize



Dolomite supplies Mg and Ca to soil.

Dolomite application	ex-Mg (cmolc/kg)	ex-Ca (cmolc/kg)
Without	0.17-0.22	0.4-0.5
With	0.52-0.69	1.7-2.0

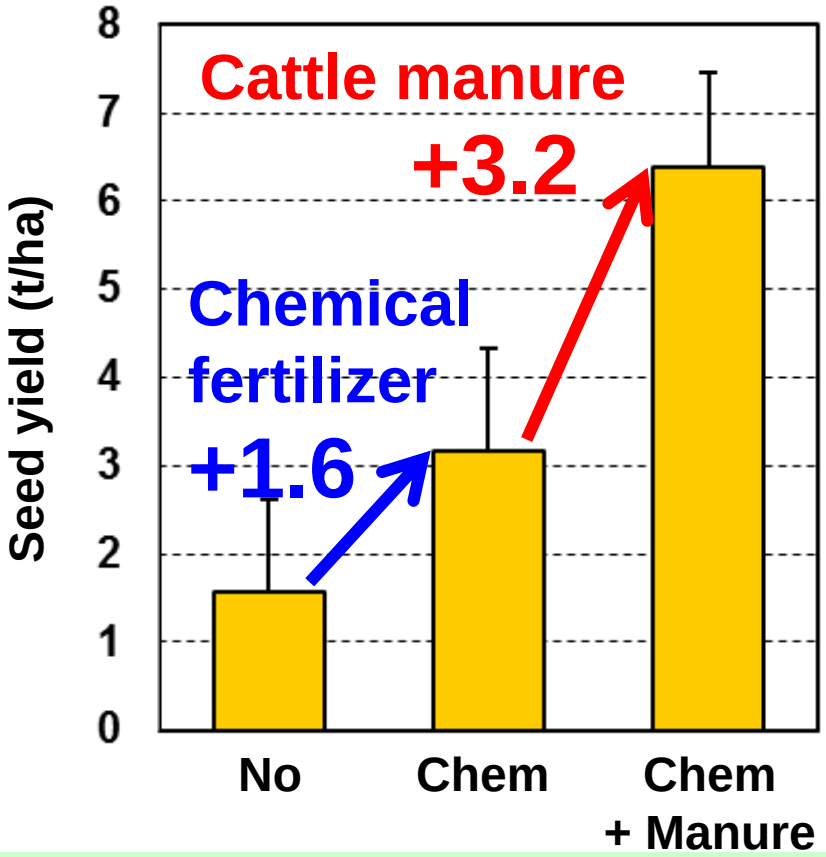
Deficiency of Mg and Ca remedied.

The effect of chemical fertilizer after amendment of soil with dolomite.

Sources: NAFRI and JIRCAS

Maize

Chemical fertilizer and cattle manure increase seed yield and farmers income.



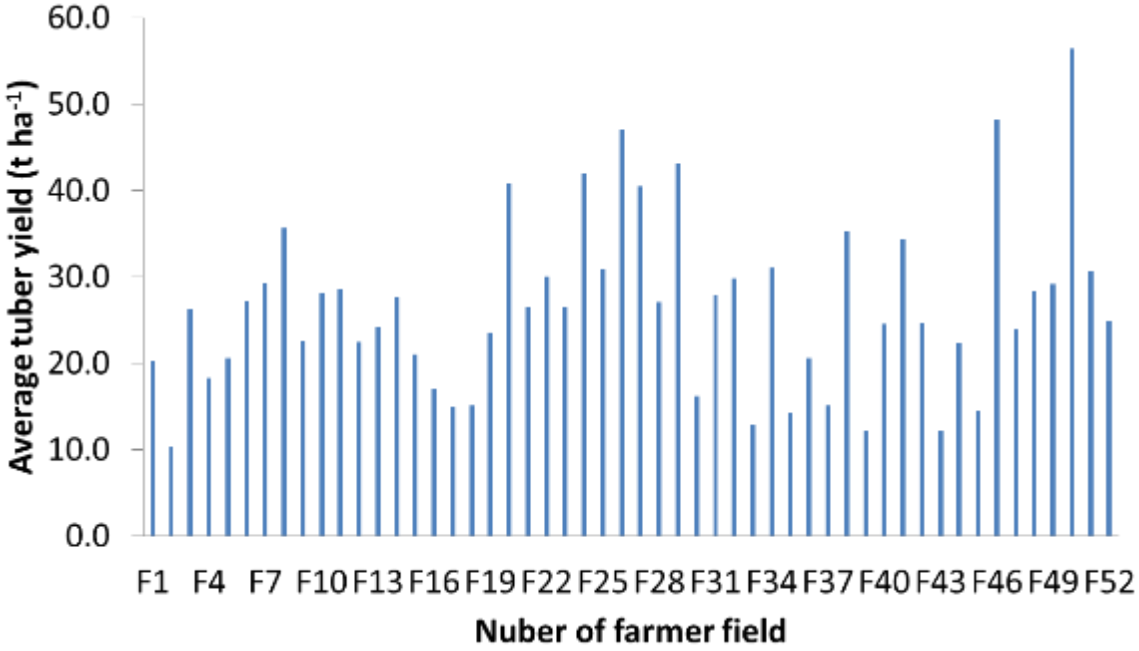
Cost of dolomite is 0.4 million LAK/ha

Cost-benefit (million LAK/ha)

	Income	Cost	Benefit
Chemical fertilizer	3.2	2.0	+1.2
Cattle manure	6.4	3.3	+3.1

Sources: NAFRI and JIRCAS

Yield of cassava in farmer fields (Xayaburi, Vientiane, Bolikhamxay and Champasak provinces)



Tuber yield in farmer fields varied 10-56 t ha^{1}
(survey, NAFRI-JIRCAS, 2013-15).

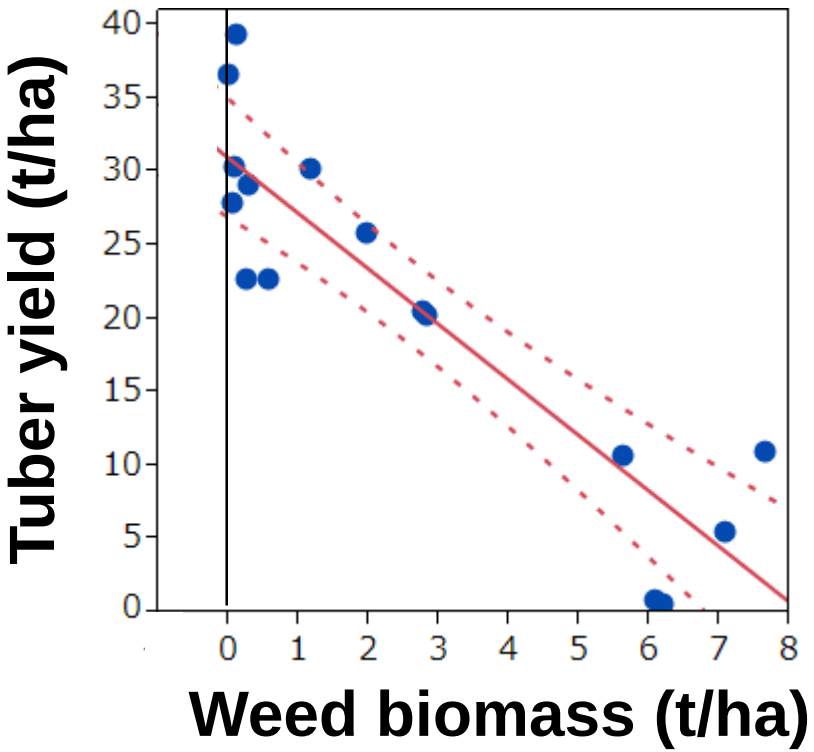
The varied yield might cause by low soil fertility, weed, variety, pests and diseases.

Sources: NAFRI and JIRCAS

Cassava

Most farmers do weeding only once a year.

(our survey)



Weeding frequency	Weed biomass (t/ha)
No	6.1 - 7.7
1 time	2.0 - 5.6
2 times	0.1 - 1.2
3 times	0.0 - 0.2

Tuber yield declined with increase in weed biomass. (Exp in ARC)

It is difficult to reduce weed biomass with just one weeding. (Exp in ARC)

Sources: NAFRI and JIRCAS

Cassava

K, Mg, Ca contents in soil in some cassava fields in Bolikhamxay Province were very low. (our survey)

	Bolikhamxay	Nameuang	
pH	4.3-5.8	4.1-5.1	
T-C	6-32	11-22	g/kg
T-N	0.5-3.4	1.1-1.9	g/kg
avail-P	2-78	19-39	mg/kg
ex-K	0.03-0.46	0.08-0.39	cmolc/kg
ex-Mg	0.03-0.85	0.07-0.71	cmolc/kg
ex-Ca	0.1-5.9	0.2-1.3	cmolc/kg

In Nameuang Village, cassava can grow without any fertilizer application.

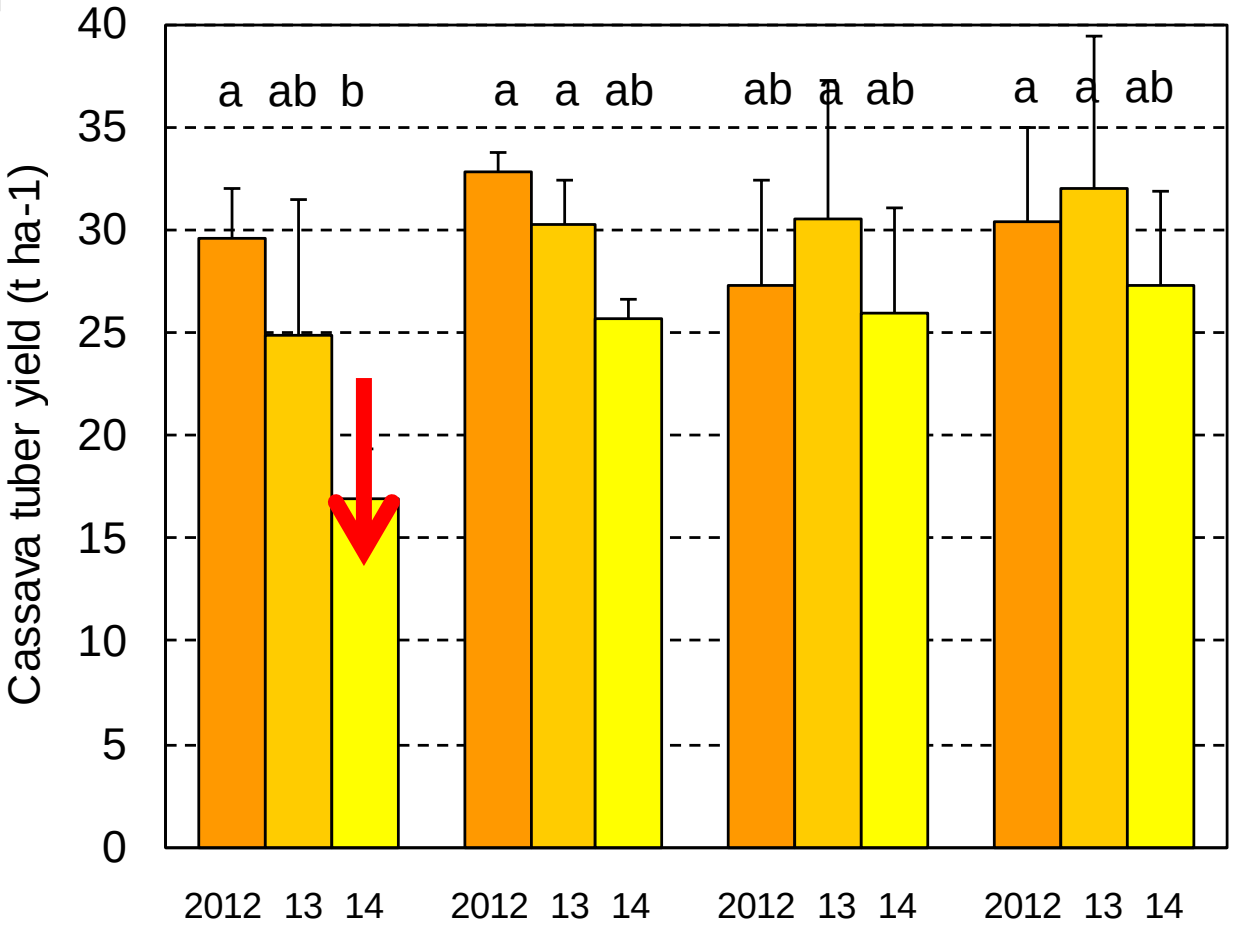
Farmers cultivate cassava without any fertilizer application and soil amendment. (our survey)

The problem of soil fertility decline might occur.

Sources: NAFRI and JIRCAS

Cassava

Tuber yield decreased at the 3rd cultivation in the ‘no application’ treatment due to small-sized tubers.

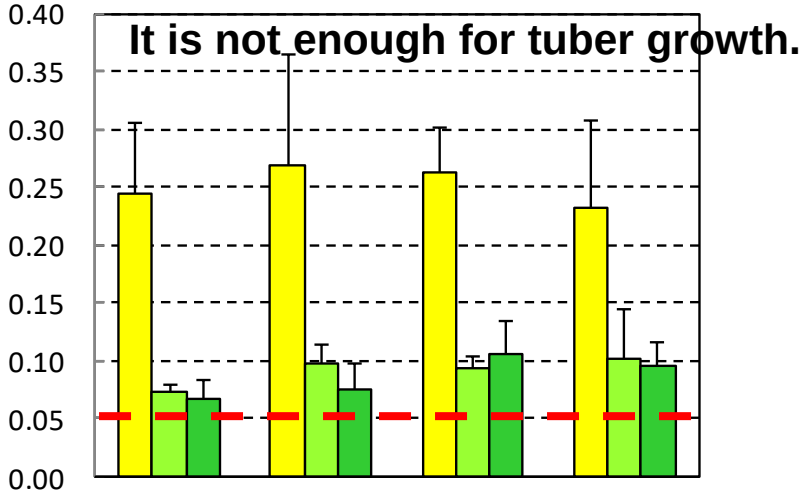


Field experiment in ARC

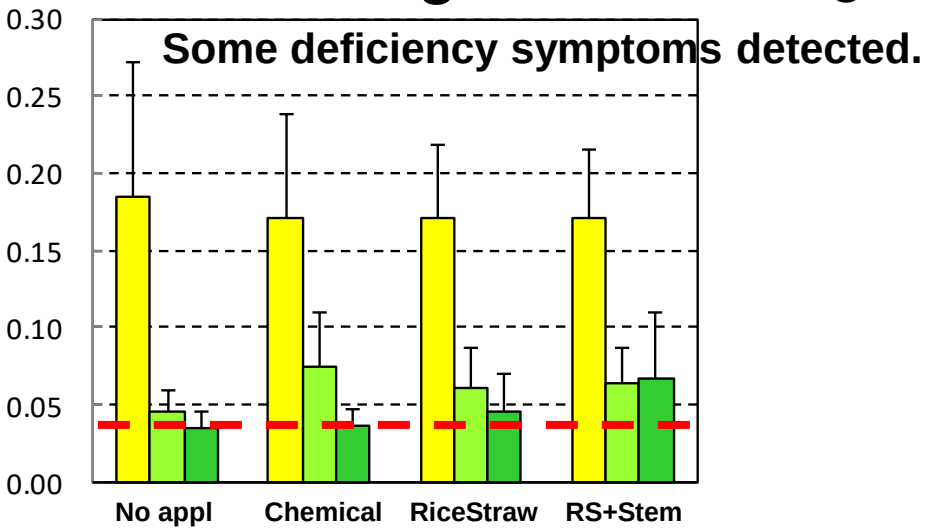
Sources: NAFRI and JIRCAS

Cassava

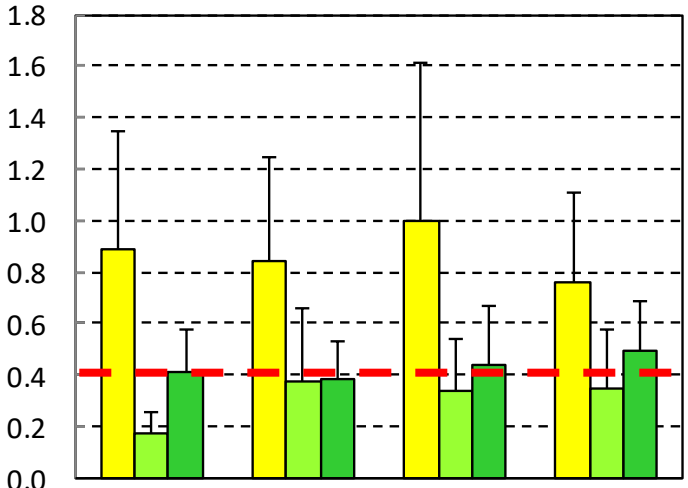
ex-K (cmolc kg-1) **ex-K 0.05 cmolc/kg**

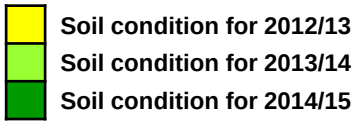


ex-Mg (cmolc kg-1) **ex-Mg 0.04 cmolc/kg**



ex-Ca (cmolc kg-1) **ex-Ca 0.4 cmolc/kg**





Enhancement of K, Mg, and Ca is recommended.

Other properties are not at limiting levels;
pH (4.8-4.9), T-C (8.5-9.4 g/kg),
T-N (0.88-0.92 g/kg), ava-P (18-22 mg/kg)

Sources: NAFRI and JIRCAS

Future plan

- Transfer technology: Training and demonstration (on-farm trails: the best management practice on maize and cassava production)

Treatments for On-farm trails 2018 (Maize)

Treatment	Treatment details
T1	control (1st check) meaning no NPK
T2	Area farmers' current practice (2nd check)
T3	Chemical fertilizer of N:P:K: 120 kg of N,26 kg of P, and 50 kg of K for a yield level of 7-8 MT ha^{-1}
T4	3 tonnes per hectare of animal manure + 120 kg of N,26 kg of P, and 50 kg of K for a yield level of 7-8 MT ha^{-1}
T5	Chemical fertilizer of N:P:K: 150 kg of N,26 kg of P, and 50 kg of K for a yield level of 9-10 MT ha^{-1}

Treatments for On-farm trails 2018 (Cassava)

Treatment	Treatment details
T1	control (1st check) meaning no NPK
T2	Area farmers' current practice (2nd check)
T3	Chemical fertilizer of N:P:K: 80 kg of N, 26 kg of P, and 160 kg of K for a yield level of 40 MT ha^{-1}
T4	3 tonnes per hectare of animal manure + 70 kg of N, 23 kg of P, and 140 kg of K for a yield level of 40 MT ha^{-1}
T5	Chemical fertilizer of N:P:K: 90 kg of N, 30 kg of P, and 180 kg of K for a yield level of 45 MT ha^{-1}

Thank you

crop in Laos

- Maize
- Cassava
- Sugarcane
- Sorghum