Nutrient management in peri-urban horticulture in Nepal

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Urban agriculture in developing countries

INTRODUCTION

"200 million people worldwide are employed in urban farming and related enterprises … providing the food supply of 800 million urban dwellers." *(UNDP, 1996).*

11 % of the Nepalese HH are depending on UA *(Nigeria → 27%)*

57 % of the nepales urban population is engaged in UA *(Ø DC = 37 %)*

80 % of the poorest quantile is relying on UA *(Zezza, 2010)*

↳ **54 %** of the poorest quantile is uneducated *(Nepal Population Report, 2011)*

Education is very expansive and difficult to achieve, especially for women

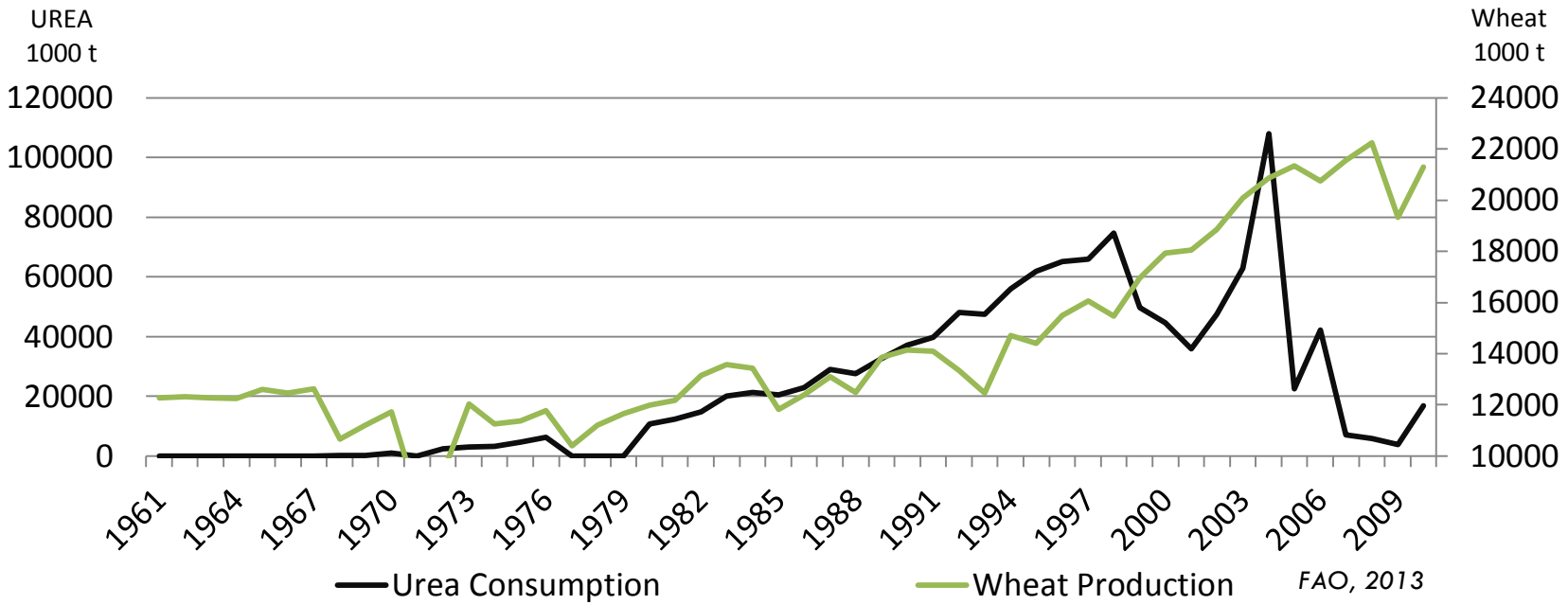
60 % of the work in UA is done by women *(Sapkota, 2004)*

→ Lack of agricultural education

→ Use and amounts of agrochemicals based on the advices of fertilizer sellers and an the experiences of the farmer

Urea Consumption Nepal

INTRODUCTION



FAO, 2013

1998: deregulation of the market and introduction of the ***APP:***

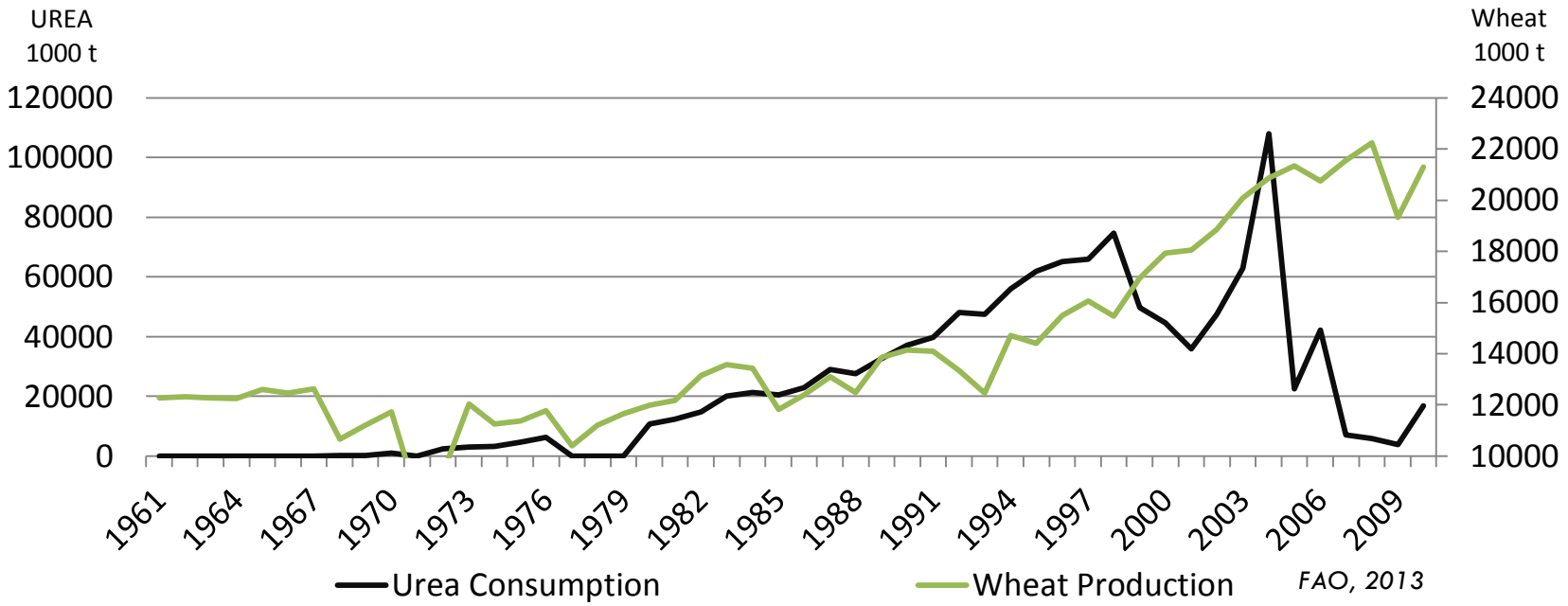
- Chemical fertilizers as the „*engine of agricultural development*“
- Production should increase about **64-75** % by the use of chemical fertilizers

1995: **31 kg/ha** ⟶ 2017: **131kg/ha**

(Shresta, 2010)

Urea Consumption Nepal

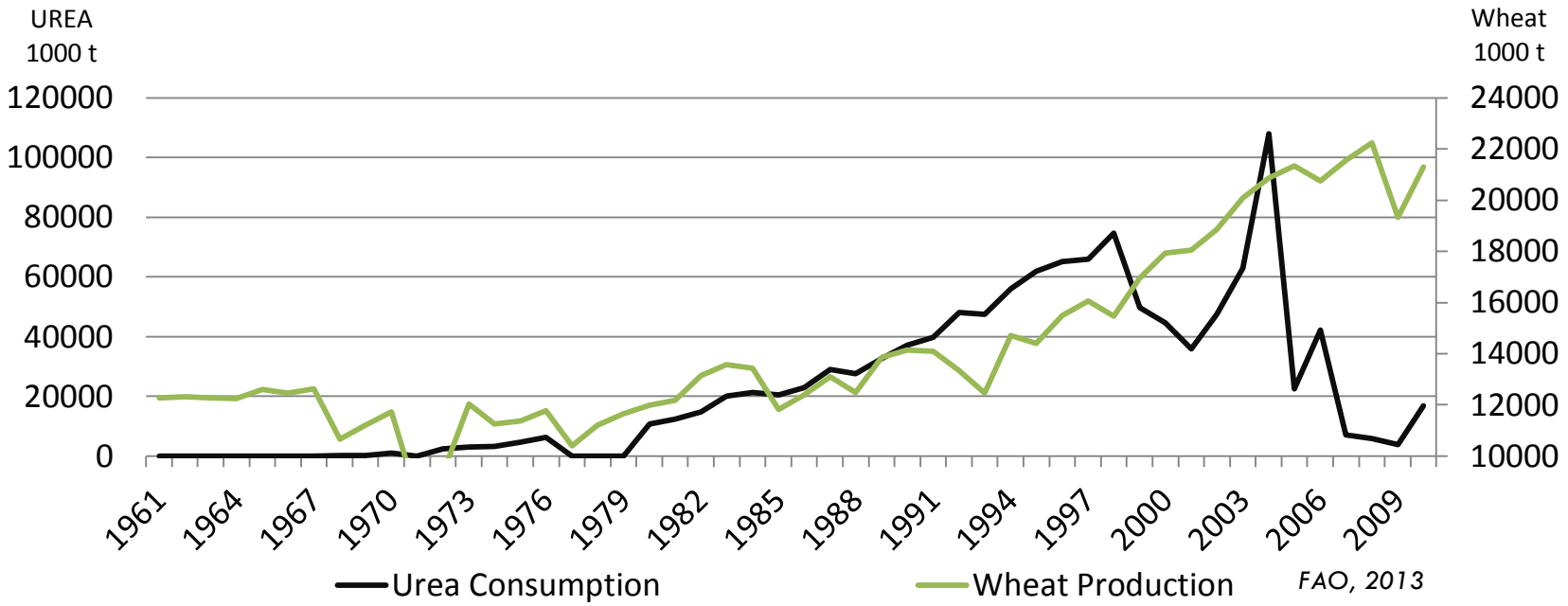
INTRODUCTION



→ Inofficial import between India and Nepal since deregulation
→ **2/3** of the used fertilizers is inofficial (280000 t)
→ Annual increase of fertilizer of **17 %** (Urea) and **20%** (DAP)
→ **10 %** annual decrease in official fertilizer sales
→ Inofficial fertilizers are cheaper, but with unsecure quality (Diwikar, 2008)

Urea Consumption Nepal

INTRODUCTION



(Diwikar, 2008)

- Regional difference of the fertilizers prices

  → **164 kg/HH** (Terrai) // **36 kg/ HH** (Hill Region)

- Kathmandu Valley: Cheap prices and good provision of fertilizers

Concept of investigation

INVESTIGATION CONCEPT

Field Work

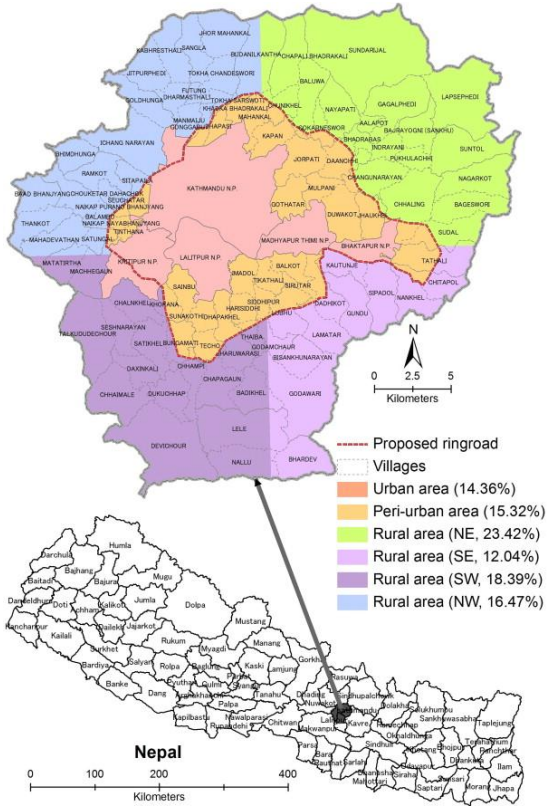
Interviews

Soil Sampling

Soil Analyses

Data Analyses

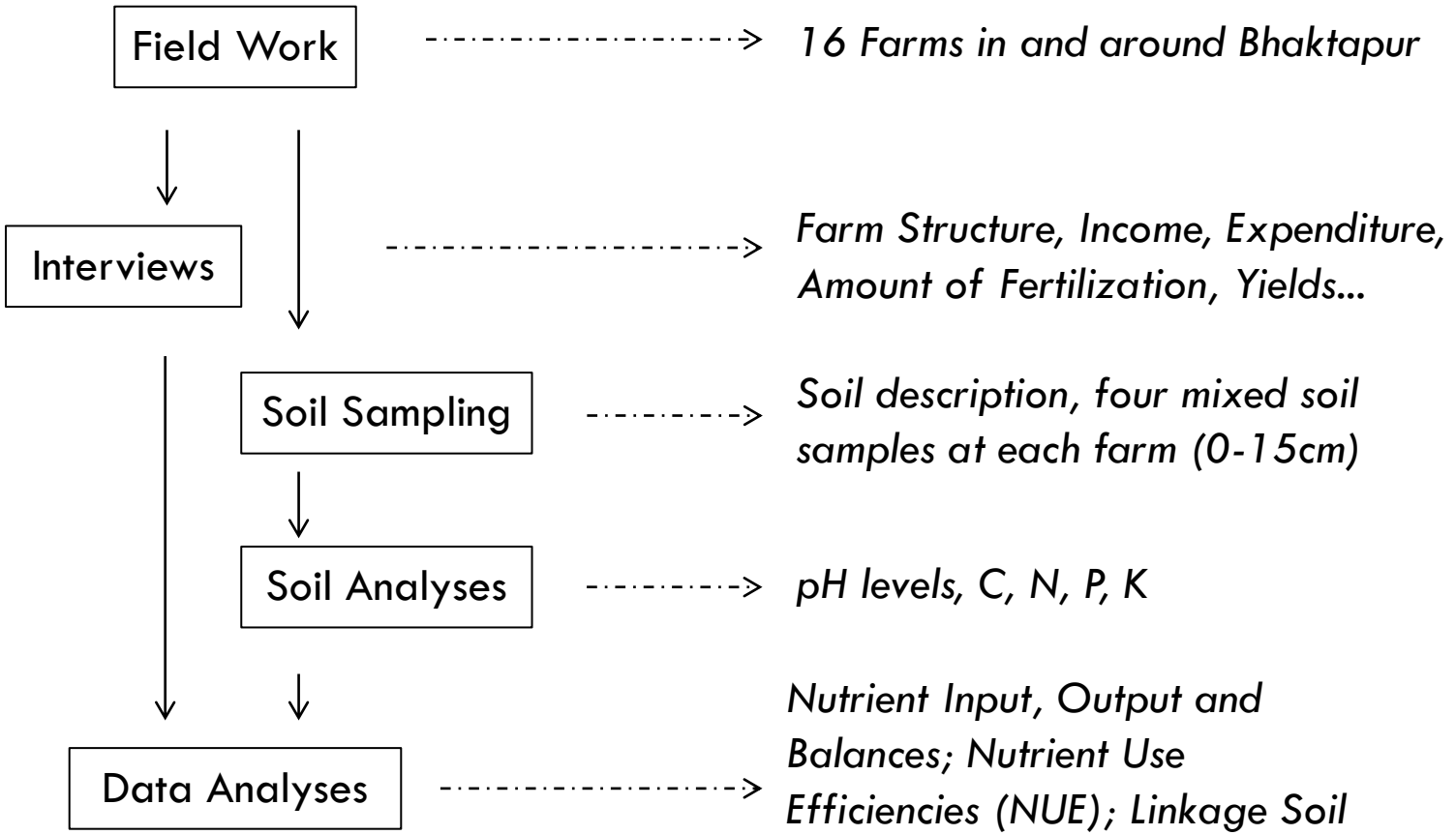
16 Farms in and around Bhaktapur



(Thapa, 2012)

Concept of investigation

INVESTIGATION CONCEPT



Soils

→ **70%** of the land in Kathmandu Valley is classified as fertile „*khet*“ land

→ Inceptisol → Aquept

→ Topsoils: loam, clay or silty clay

→ **8 to 30%** clay

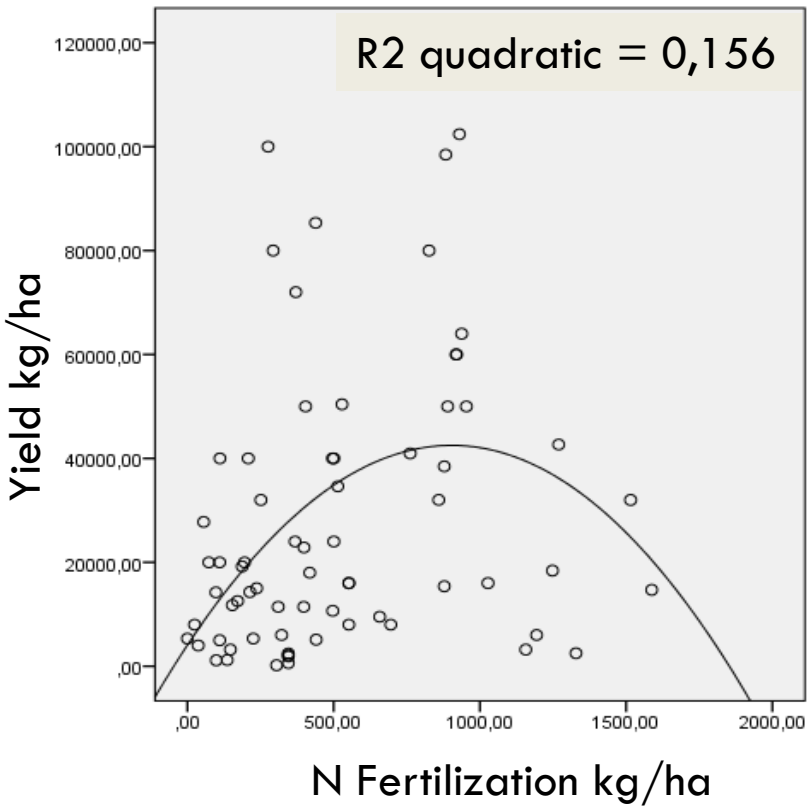
→ Subsoils: loamy sand/ coarse sand

→ Oxidation and reduction in the 2. Horizon due to flood irrigation

→ Anthropogenic elements like charcoal, bricks or plastic in the subsoils

Vegetable Yields

RESULTS INTERVIEWS



→ Weak correlation between yield and nitrogen fertilization

	Yield (dt/ha/a)	Literature
Cabbage	12 – 2000 (700)	400 - 700
Cauliflower	95 – 581 (535)	350 - 400
Coriander	11 – 2564 (437)	110 - 220
garlic	2 – 1587 (386)	60 - 140

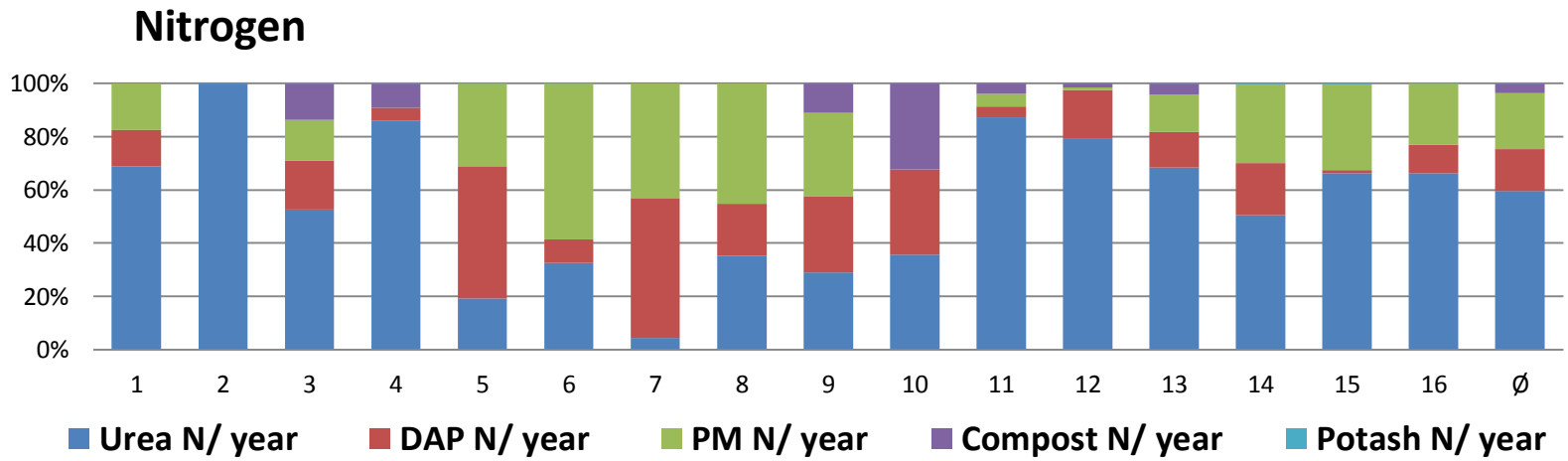
→ Many yields above average yields of literature

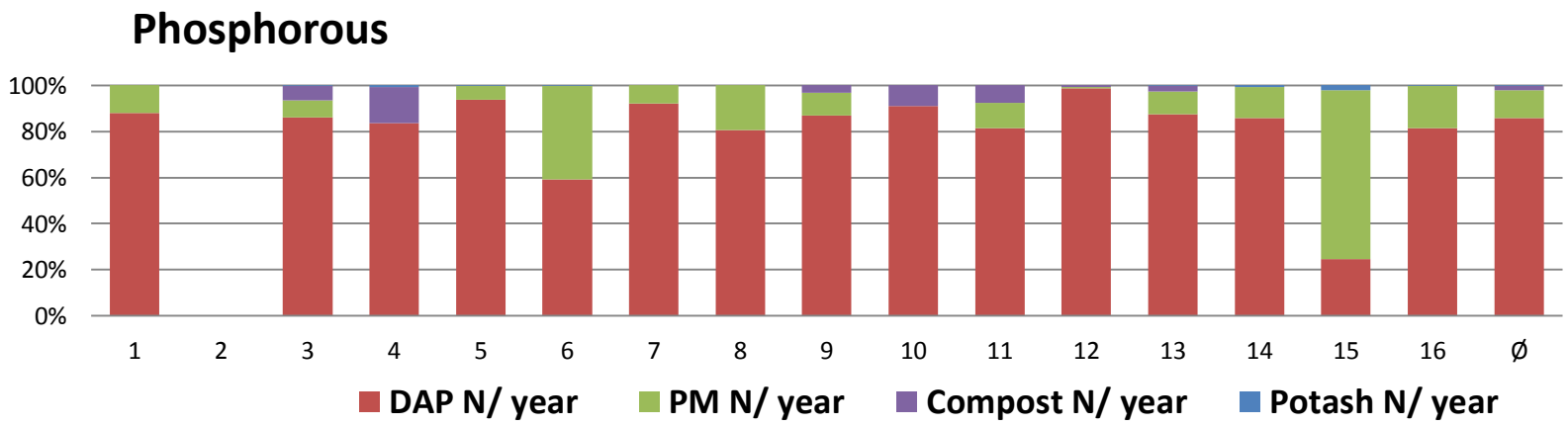
Fertilizer application

RESULTS INTERVIEWS

Fertilization Input Ratio

RESULTS INTERVIEWS





→ High ratio of chemical fertilizers

N: 41% - 100% (73%) **P:** 0% - 99% (76%)

Nutrient Balances

RESULTS INTERVIEWS

	N	P	K	Literature
Input (kg ha^{-1} year^{-1})	190 – 1208 (522)	0 – 1767 (338)	0 – 208 (65)	N: 361 – 1640 P: 197 – 260 K: 325 – 900
Output (kg ha^{-1} year^{-1})	50 – 257 (137)	7 – 49 (23)	41 - 366 (147)	N: 276 – 644 P: 37 – 65 K: 305 – 597
Balance (kg ha^{-1} year^{-1})	58 – 951 (385)	-8 – +1727 (295)	-328 – -6 (-85)	N: 85 – 882 P: 109 – 196 K: 20 – 306
NUE (%)	10 – 80 (30)	0 – 53 (15)	0 – 1992 (356)	N: 35 – 170 P: 7 – 82 K: 216 – 708

(Khai, 2007 in Vietnam)
(Safi, 2011 in Afghanistan)

Soil Analyses

VDLUFA Category C

P (g/kg)	0,11 – 0,79 (0,31)	0,1 – 0,2

Nutrition Category P	A	B	C	D	E
	0	0	1	4	11

The soils are oversupplied by Phosphorous

K (g/kg)	0,04 – 0,38 (0,13)	0,08 – 0,17

Nutrition Category K	A	B	C	D	E
	3	6	4	1	2

9/16 soils have a Potassium deficit

Soil acidification

ACIDIFICATION

→ Input of H+ due to chemical fertilizers

→ Release of Protons due to nitrification (~2 H+/ NH4+) and volitalization (Urea 36 H+/kg; DAP 72H+/kg)

pH ($CaCl_2$)	3,9 – 6,2 (5,0)
H+ Input via Fertilizer (kmol ha^{-1} $year^{-1}$)	3,8 – 43,2 (17,55)
Loss of CaO (kg ha^{-1} $year^{-1}$)	104 - 1191 (484)
Lime Demand (pH 7) (kg ha^{-1})	2150 – 14333 (5325)

Literature

→ 1,4 – 11,5 (kmol ha^{-1} $year^{-1}$) in Thailand *(Fujiij, 2009)*

→ 20 – 33 (kmol ha^{-1} $year^{-1}$) in China *(Guo, 2010)*

→ pH decrease 1980 - 2000 of 0,3

→ *doublication of Protons in the soil!!!*

Summary

SUMMARY

→ The Yields are not increased by the Nitrogen application and can be limited by the Potassium deficit.

→ The Nitrogen surplusses can get leached out and affect the environment.

→ A higher ratio of organic Fertilizers might decrease the N-surplusses and increase the K input.

further on:

→ Farmers complained about the decreasing soil fertility over the last years.

→ Most of the grown vegetables require a neutral soil reaction for best yields.

→ There could be an increasing risk of plant deseases (e.g. Clubroot).

essentially:

→ An independent agricultural guidance for the farmers is needed urgently.

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Thank you for your attention!

Annex

Increase of the leave – flower ratio by the excess supply of nitrogen at the beginning of cultivation?