Report WP 1:
Progress towards establishing a MLTVI and designing a ricebean marketing strategy

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FOSRIN > WP 1 > Overview

- Objective 1: Scrutinizing the ricebean supply-chain
- Objective 4: Development of a market-based legumes traits value index (MLTVI)
- Objective 5: Design of a marketing strategy for an improved ricebean
- Discussion in this sequence:
  - Objective 1 (RAEM)
  - Objective 5 (RAEM)
  - Objective 4 (DB)

FOSRIN > WP 1 > Objective1 > Analyzing the RB-SC

- General questions:
  - How to reduce loss of product value on the way from producers to consumers?
    - loss of quality
    - intermingling of qualities
    - loss of info about quality
    - etc
  - How to avoid unnecessary costs in the movement of a product from producers to consumer?
    - transport cost
    - storage costs
    - transaction costs
- Two perspectives:
  - Supply-chains are really networks
  - products = stuff + info about the stuff + other info
    ~ inspection attributes; experience attributes; metaphysical attributes

FOSRIN > WP 1 > Objective1 > Elements of Objective 1

- analyze the the ricebean supply-chain for stages and linkages where product value may be compromised or lost;
- base this analysis on a model of the legumes supply-chain in India and Nepal
- for this purpose, use a network model consisting of:
  - breeders who produce improved ricebean seed
  - small-scale ricebean growers
  - intermediaries at various market stages
  - women-consumers of ricebean

FOSRIN > WP 1 > Objective1 > Data collection

- review of the grey lierature on the legumes supply-chain in India and Nepal
- interviews with legumes market experts
- interviews with legumes market experts from all stages of the SC
- observation of transaction practices on organized legumes markets

FOSRIN > WP 1 > Objective1 > Data analysis

Based on the data collected:

- quantify approximately the volume and value of legumes moved through the SC-links and
- identify
  - classes of SC-agents and their key activities
  - product related info linkages between the agents
  - formal and informal transaction relationships
  - formal rules and regulations as well as
  - informal norms and practices that govern the conduct of SC-agents
- model the legumes SC and pinpoint linkages where
  - value is dissipated
  - info integrity is threatened

FOSRIN > WP 1 > Objective1 > Draw inferences for RB-SC

- What insights from the analysis of the legumes SC apply fo the RB-SC?
  - highly heterogenous product
  - seasonal market presence (~ no all year storage)
  - low volume
  - no grades
  - imprecise measures (e.g. sold by the cup!)
  - no price and volume reporting

FOSRIN > WP 1 > Objective1 > Potential of SNA for SC-Modeling

- Social Network Approach to SC-modeling

- Social Network Analysis
  - provides workable models of networks
  - relates network attributes to measures of network outcomes
  - provides a framework for collecting & organizing data
  - provides network researchers with essential tools
    - network diagrams
    - quantitative measures of network related attributes of network members
    - quantitative and qualitative measures of the whole network
- SNA benefits from spill-ins from graph theory

FOSRIN > WP 1 > Objective1 > Elements of Social Network Models

- Mathematical foundation: **Graph theory** (Frank Harary)
- A social network is defined by:

$$S = \{N, L, G_d, \mathbf{A}, \mathbf{C}\}$$

- N: nodes represent the actors in a social network
- L: links or ties represent the relationships among actors
- G_d: sociograph or drawing of the nodes & links
- **A**: quadratic ($n \times n$) adjacency matrix with elements a_{ij} representing the links between the nodes i and j
- **C:** a rectangular ($n \times l$) matrix with l characteristics for the *n* actors
- SNA is data intensive
  - number of data for a network with **n actors** and **l actor characteristics** :

$$(n \bullet l) + (n \bullet n) = n\ (l + n)$$

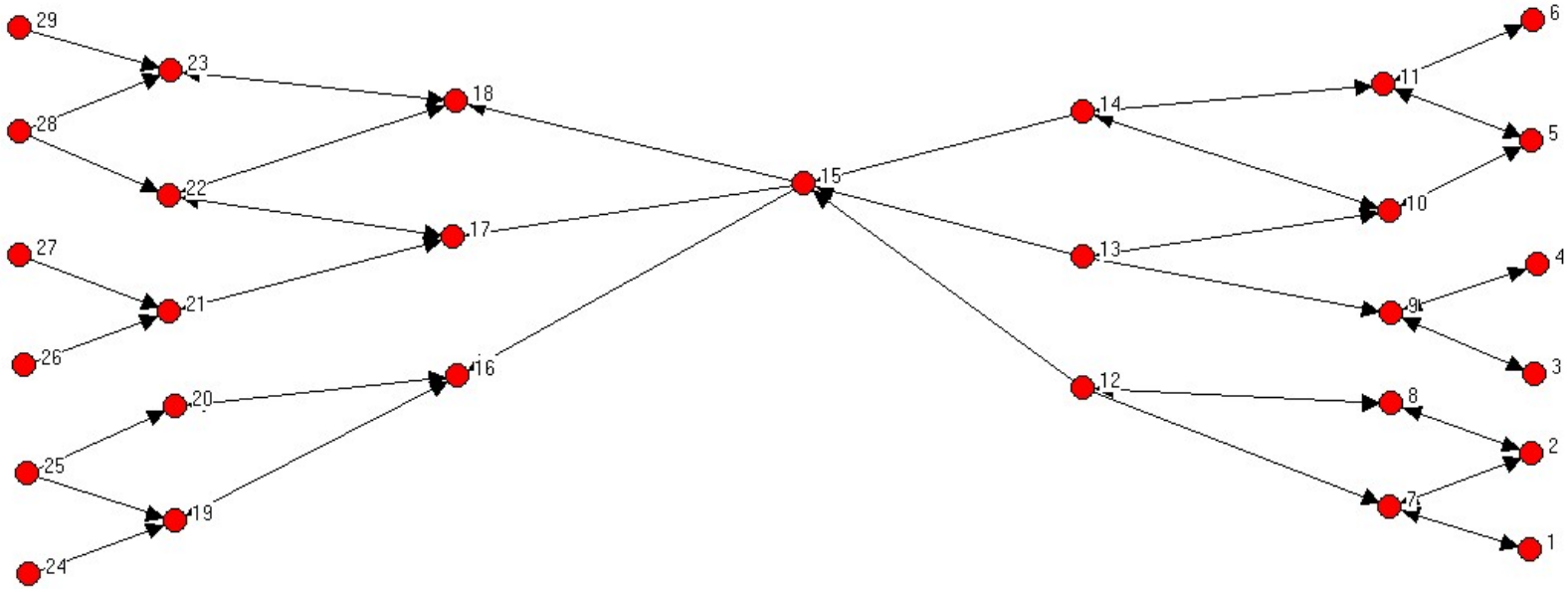
  - an adjacency matrix is required for each type of relation between actors; for a network with **r relations**:

$$DV = (n \bullet l) + r\ \ (n \bullet n) = n\ \ (l + r \bullet n)$$

FOSRIN > WP 1 > Objective1 > Network Diagrams & Measures

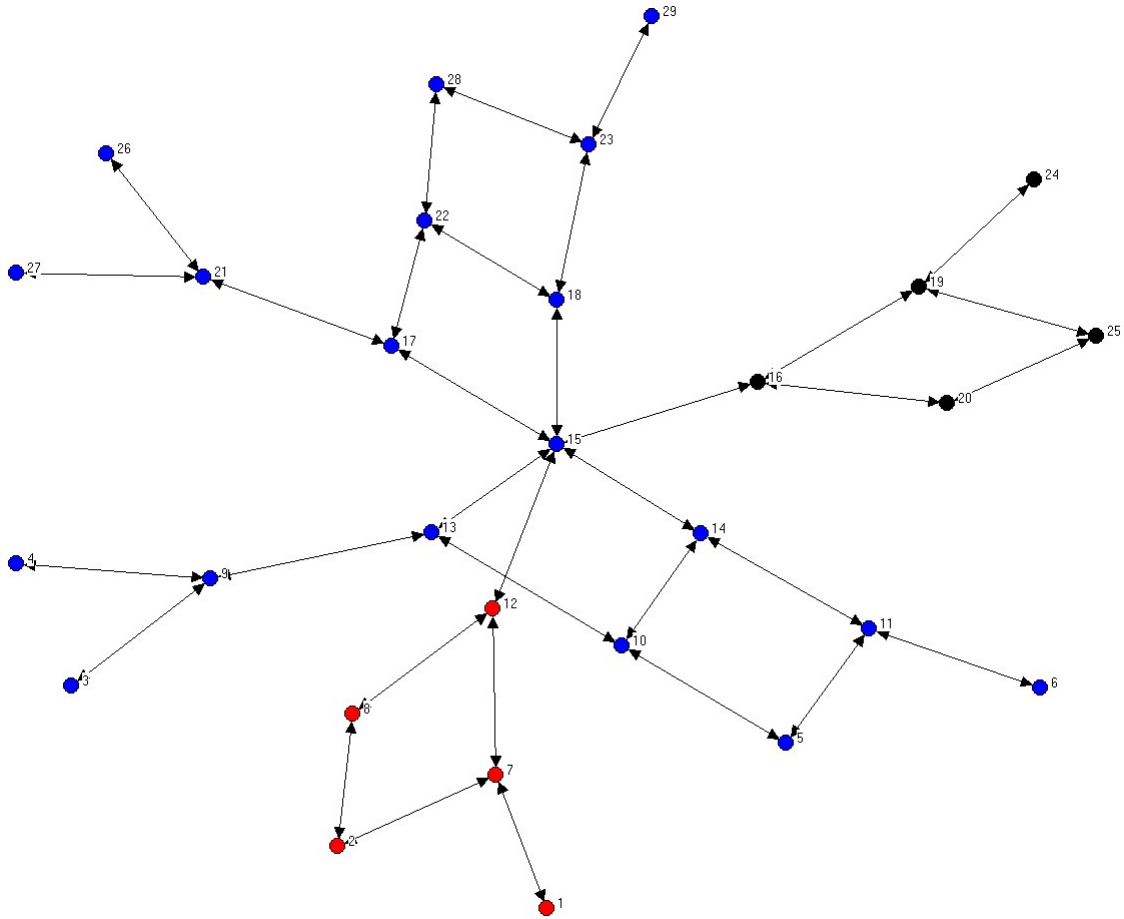
- Network diagrams
  - have no dimensions
  - obey several conventional norms & rules
- Measures of network attributes
  - (network) attributes of individual agents
    - degree - closeness - betweenness
  - attributes of the network
    - completeness - diameter - density
    - cut points - cut sets - k cores

FOSRIN > WP 1
> Which graph is best? This?



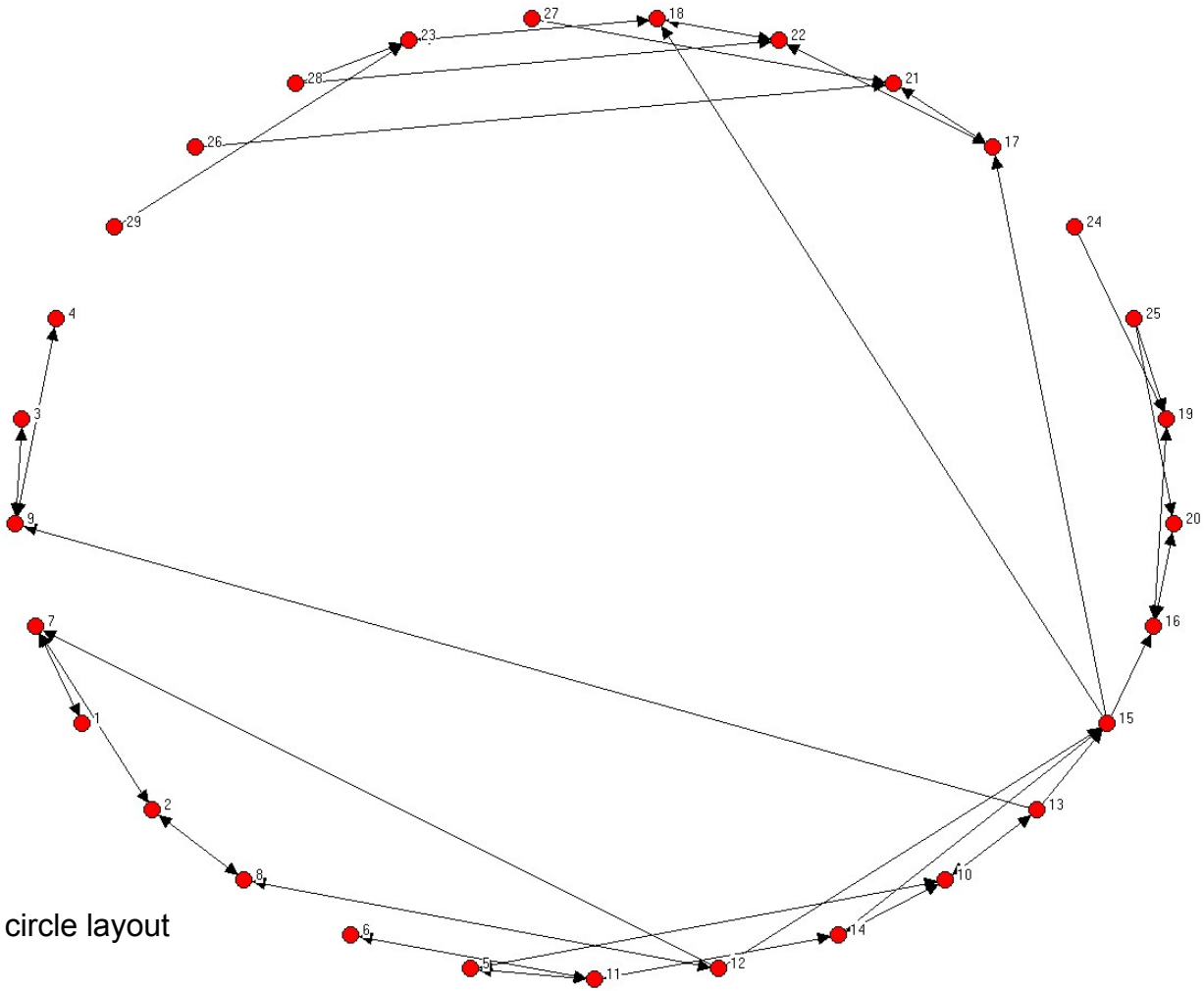
original layout

FOSRIN > WP 1
> Or this?



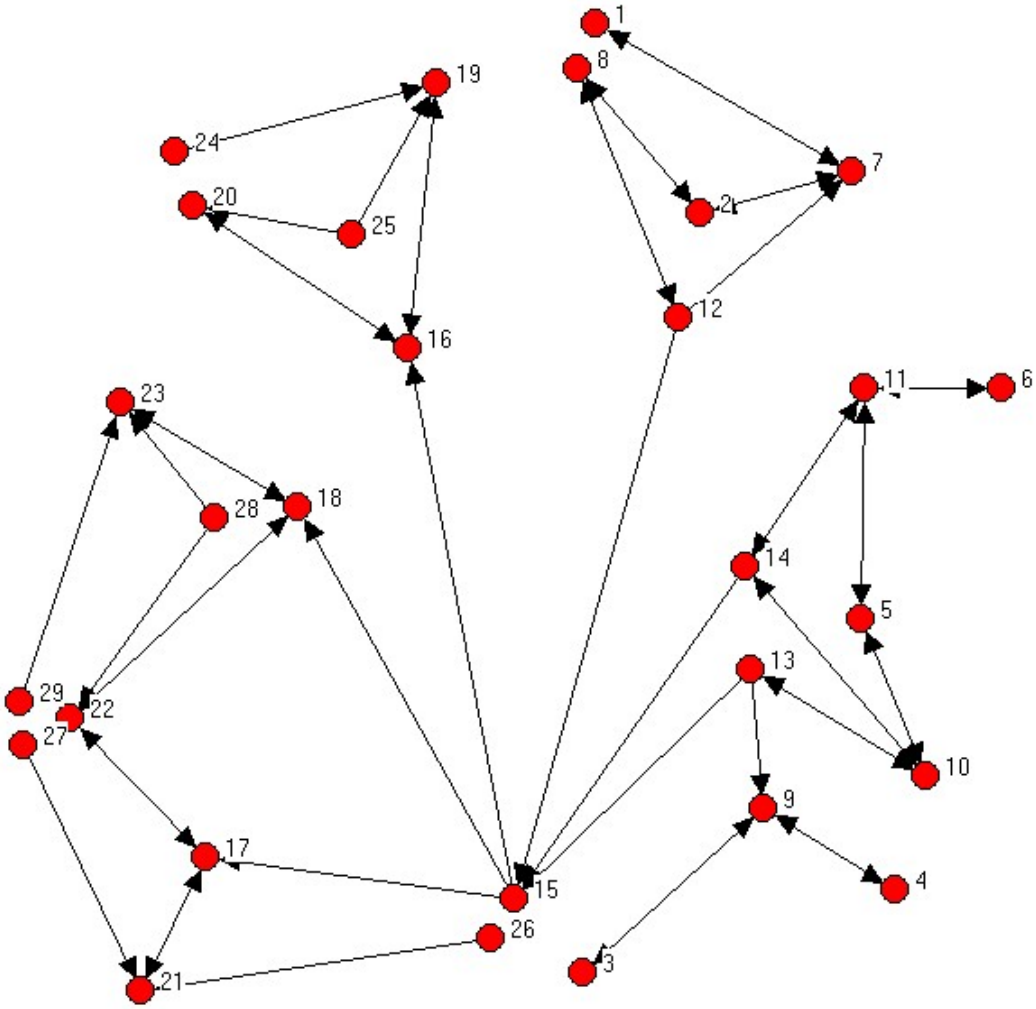
cluster

FOSRIN > WP 1
> Or this?

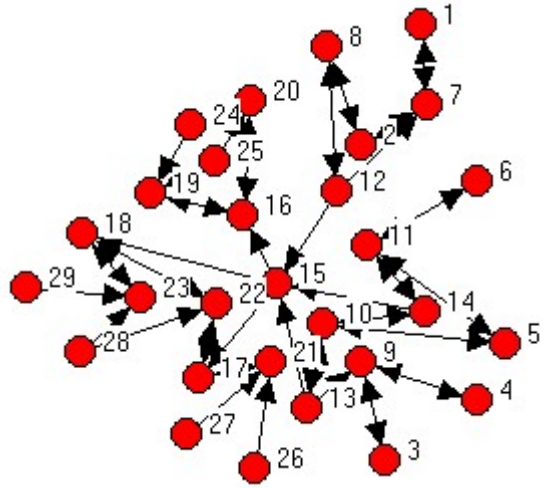


circle layout

FOSRIN > WP 1
> Or one of these?



at random



at random

FOSRIN > WP 1 > Objective 5 > Marketing strategy

- Where and how can farmers sell ricebean?
  - Collection centers — but: low quantity
  - grading schemes — but: heterogenous product & some important quality characteristics are not observable
  - providing market intelligence to producers and traders
    but: widely dispersed growers, most with only small marketable surplus
    mobile phone info center?
  - info & training for traders?
  - are there export opportunities
    - ethnic Indians abroad?
    - speciality products?

WP 1

2nd annual meeting FOSRIN

University of Kiel

Rolf A.E. Müller

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WP 1 - Content

- used chemical analyses
- results:
  - important differences between analysed pulses
  - compare ricebean to chickpea
  - present results of the regression

Physical Parameters

- Shape (elongated, kidney, round, angular, lentil-like)
- Color
- Foreign matter (dirt, other pulses…) in %
- 100 Seed Weight, g
- 100 Seed Volume, ml
- Water Absorption, %
- Volume Extension, %

Nutritional parameters

- Moisture
- Protein, % (Kjeldahl)
- Fat, % Soxhlet
- Total Minerals, Ash %,
- Carbohydrates, % (as difference)

for all these analyses: grind beans to 1mm

Nutritional compounds > Moisture

- weight sample and dish
- dry over night, 95-100°C
- re-weight
- weight lost = water content

Nutritional compounds > Protein

- Protein: Kjeldahl
  - quantitative determination of nitrogen N
  - solubilize sample by cooking with sulfuric acid, H_2SO_4 (K_2SO_4)
  - ► ammonium sulfate $(NH4)_2SO_4$)
  - distillation with water steam
  - neutralisation $(NH4)_2SO_4$) with NaOH ► NH_3
  - $B(OH)^-_4 + NH_3$ ►NH_4
  - titration with H_2SO_4 (0,1 mol) and indicator
  - used H_2SO_4 depicts N content (1 ml H_2SO_4 0,1 N = 1,4 mg N)
  - N * 6.25 = % protein

Nutritional compounds > Fat

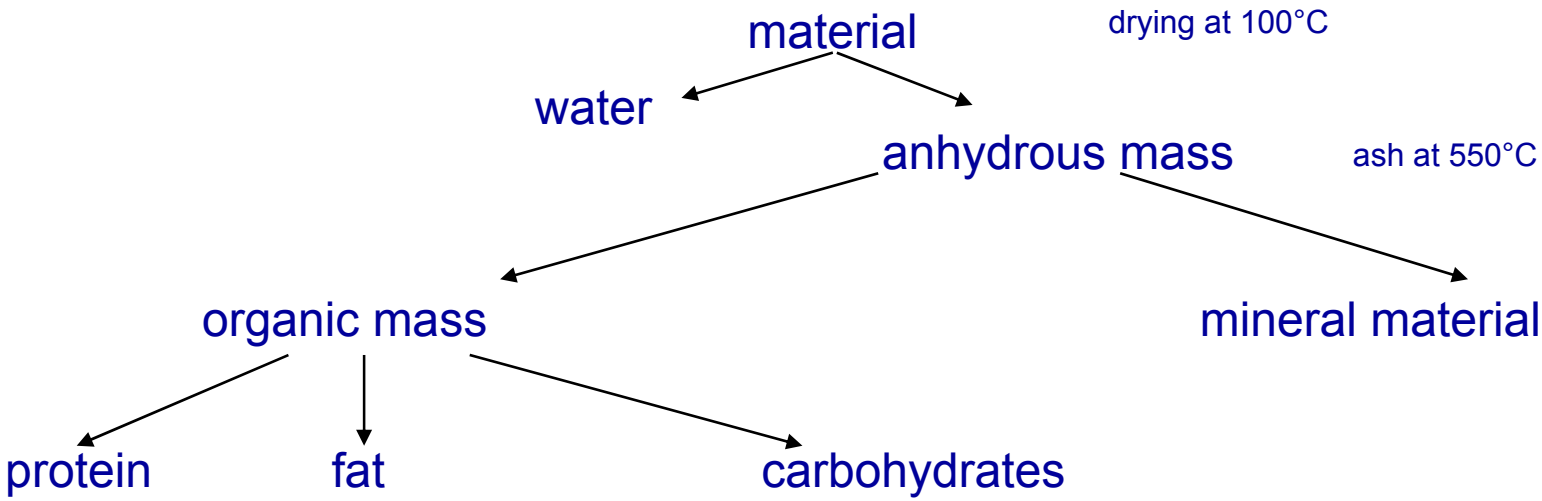
- dry flask over night at 100°C
- weight sample 5 g and flask
- wash sample for 4 hours with ether
- dry flask with collected fat to remove water
- reweigh flask, additional weight is fat

Nutritional compounds > Ash

- dried samples, weighted
- over night at 550°C in a furnace
- remnant = % ash

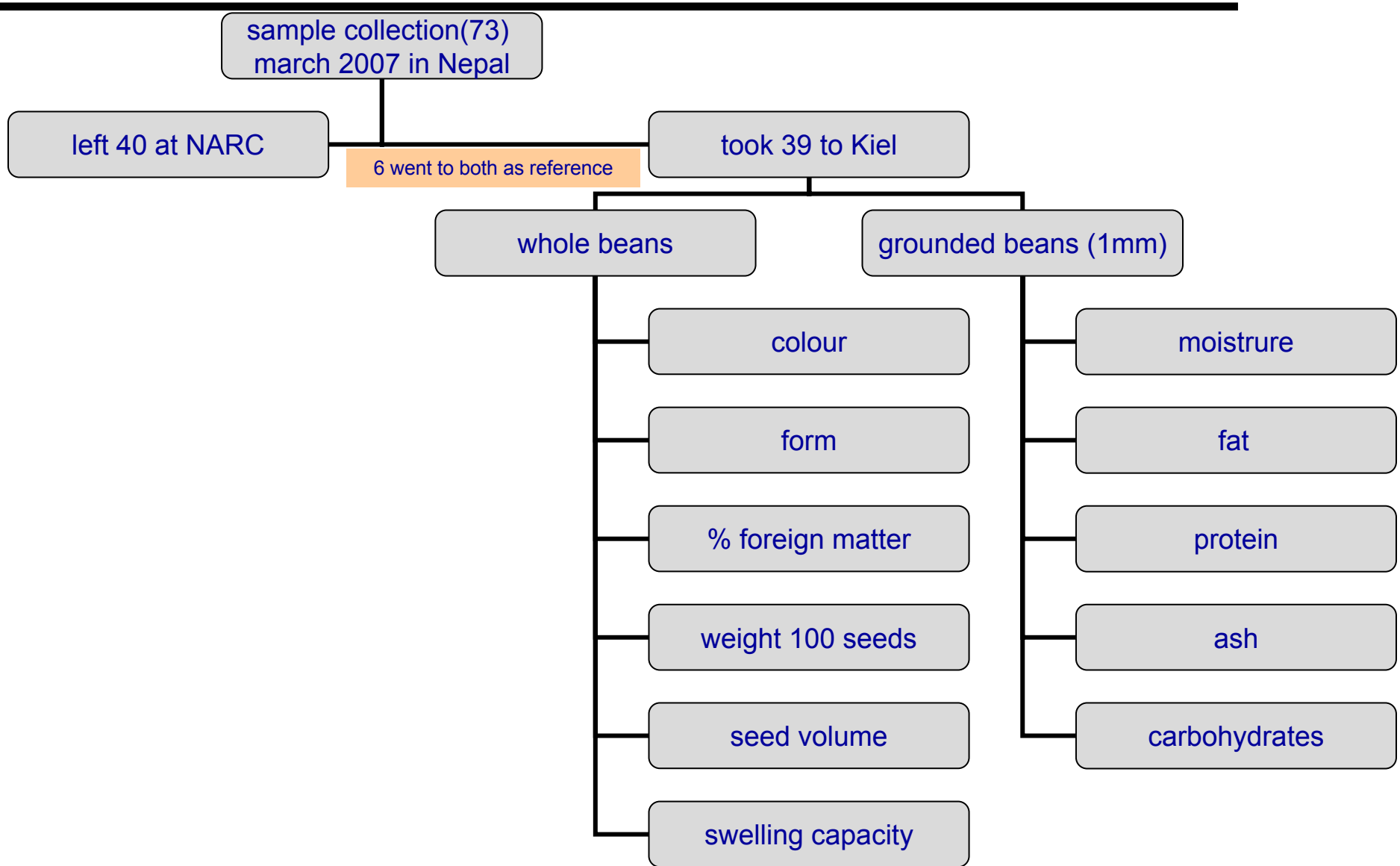
Nutritional compounds > Carbohydrates

Weender Analysis

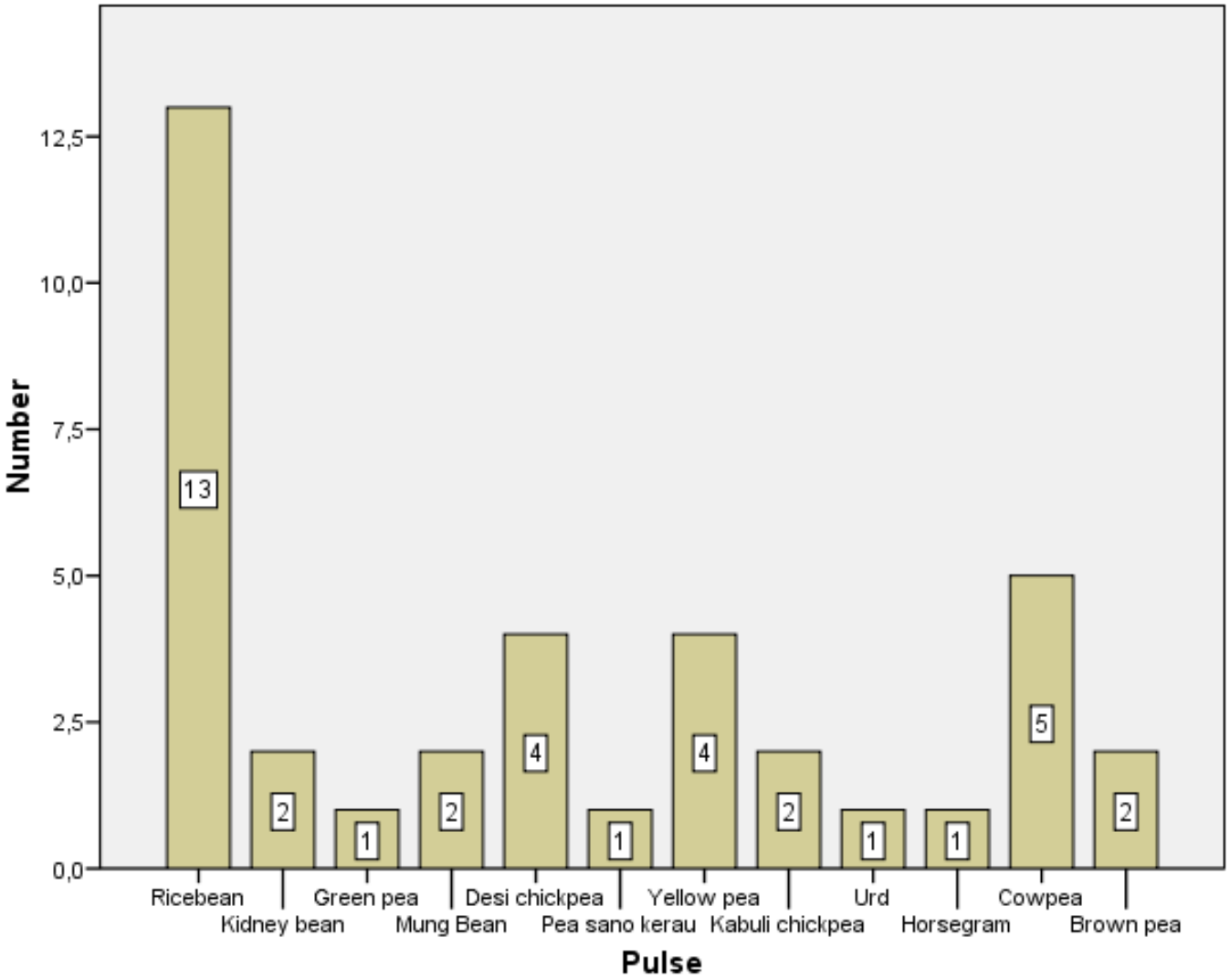


carbohydrates = sample (100%) – moisture % - ash % - protein % - fat %

flow diagramm laboratory analysis



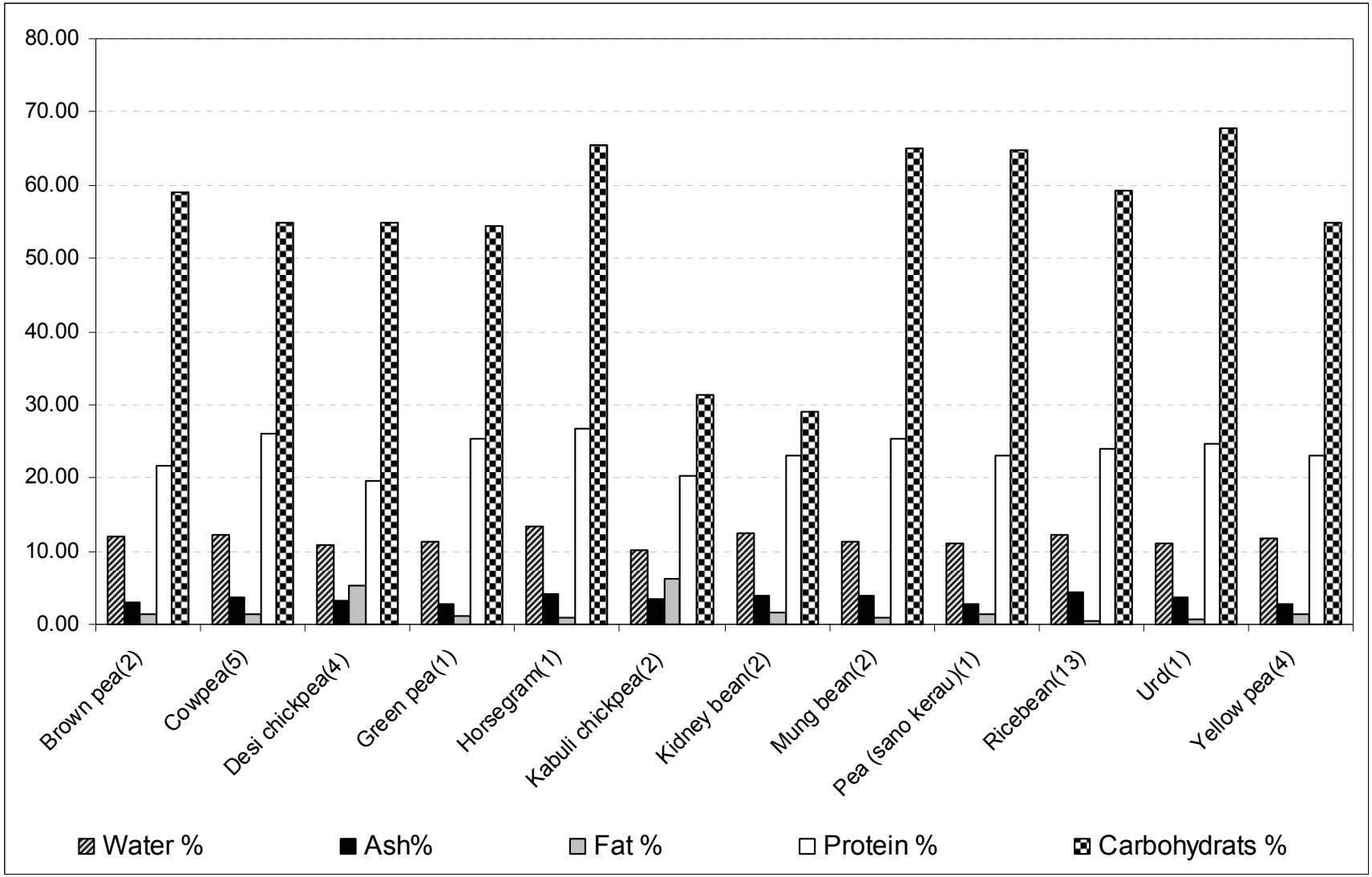
pulse varieties



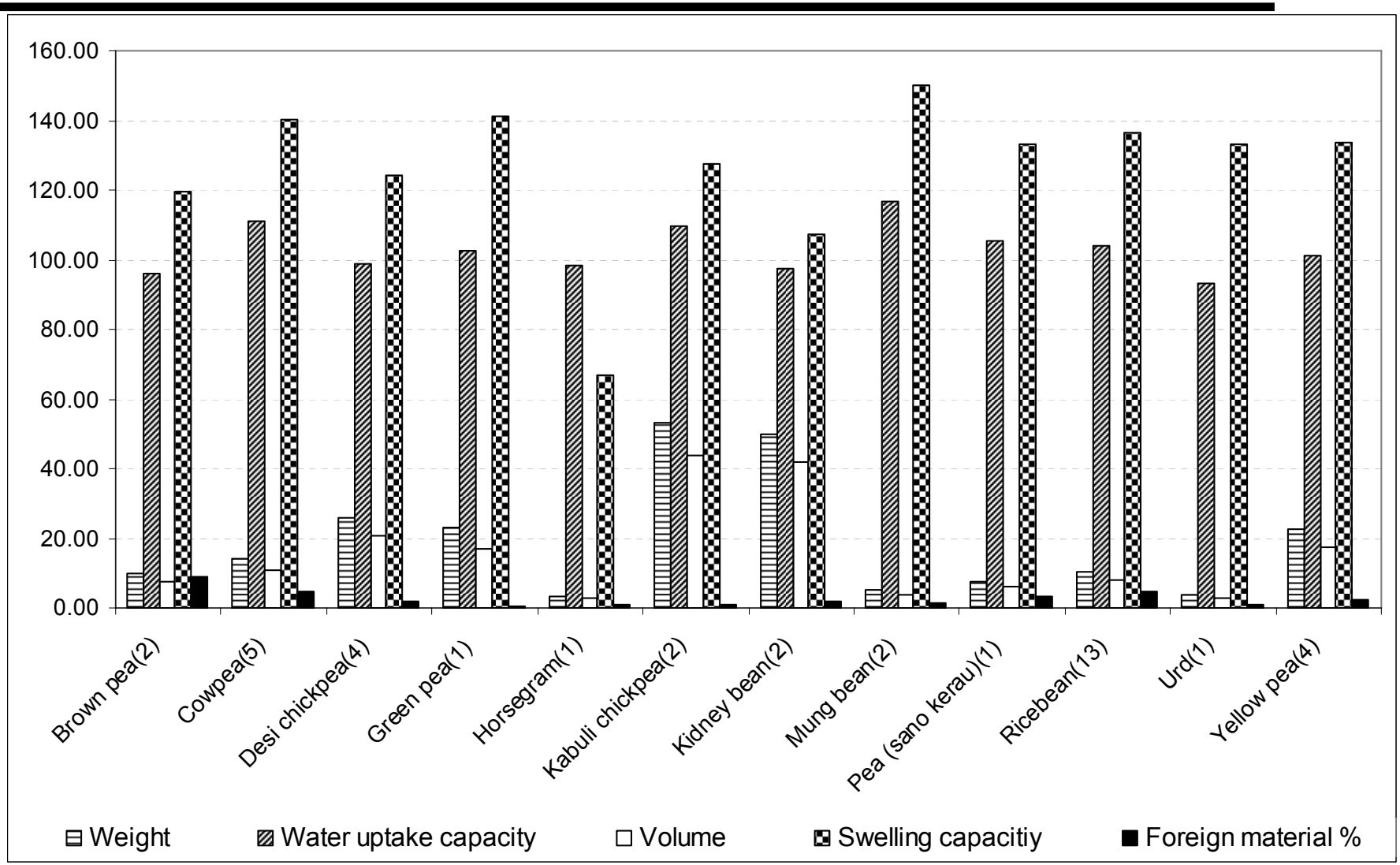
Lab results at a glance

Characteristic	Unit	Minimum	Maximum	Mean
Price	in NRP/ kg	**32.0**	**90.0**	**58.0**
		Yellow pea	Mung bean/ Kabuli chickpea	
Weight	g/100 seeds	**3.1**	**54.5**	**17.7**
		Horsegram	Kidney bean	
Water uptake capacity	in %	**84.6**	**129.9**	**103.8**
		Ricebean	Mung bean	
Seed Volume	ml/100 seeds	**3.0**	**46.0**	**14.0**
		Urd	Kabuli chickpea	
Swelling capacity	in %	**66.7**	**175.0**	**131.3**
		Horsegram	Mung bean	
Foreign material	in %	**0.2**	**8.9**	**3.4**
		Desi chickpea	Brow n pea	
Water	in %	**9.7**	**16.7**	**11.8**
		Kabuli chickpea	Ricebean	
Ash	in %	**2.5**	**5.2**	**3.7**
		Brow n pea	Ricebean	
Fat	in %	**0.4**	**6.2**	**1.7**
		Ricebean	Kabuli chickpea	
Protein	in %	**15.0**	**26.9**	**23.5**
		Desi chickpea	Ricebean	
Carbohydrates	in %	**24.7**	**67.8**	**55.4**
		Kidney bean	Urd	

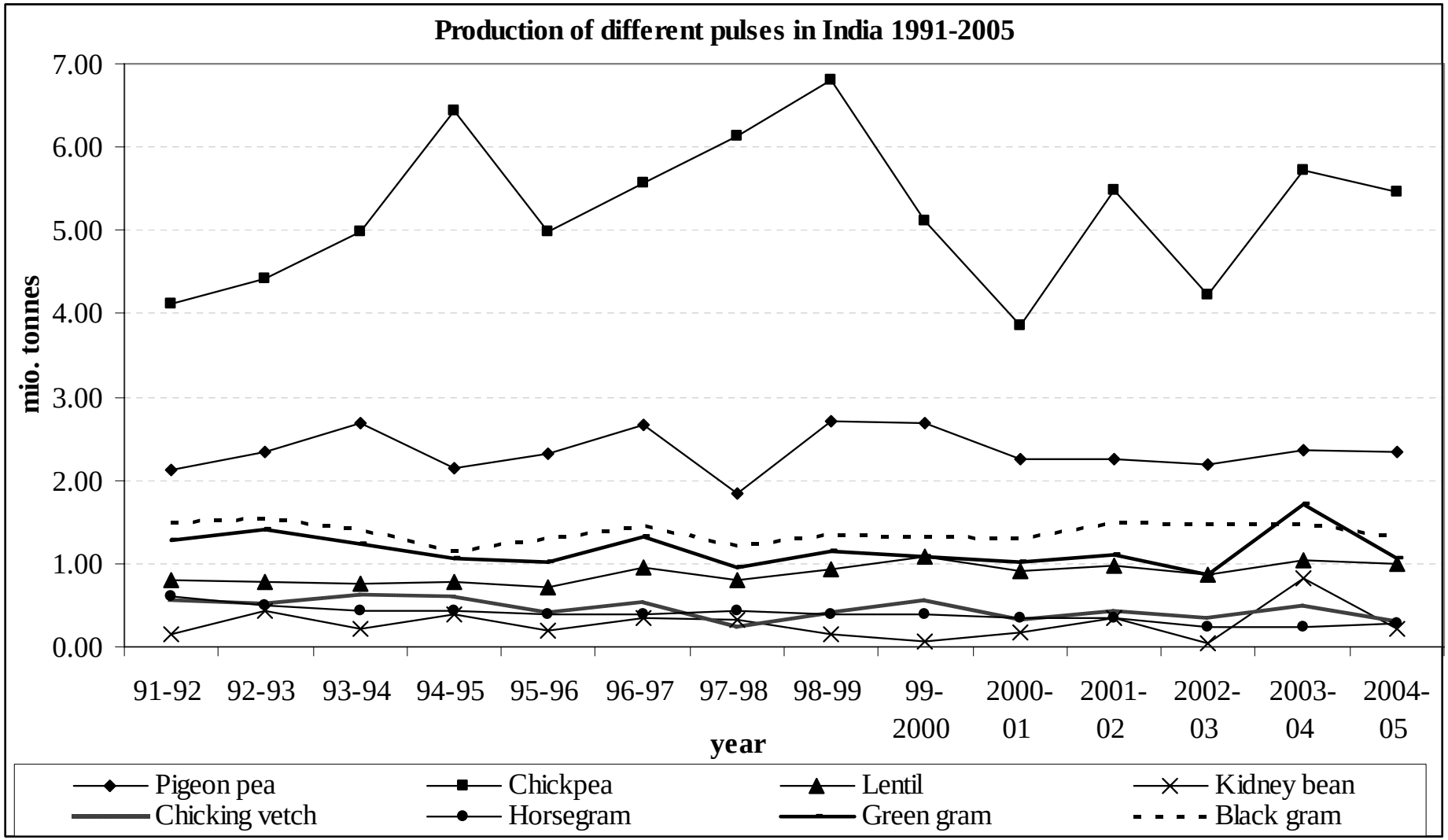
Nutritional parameter



Physical parameter

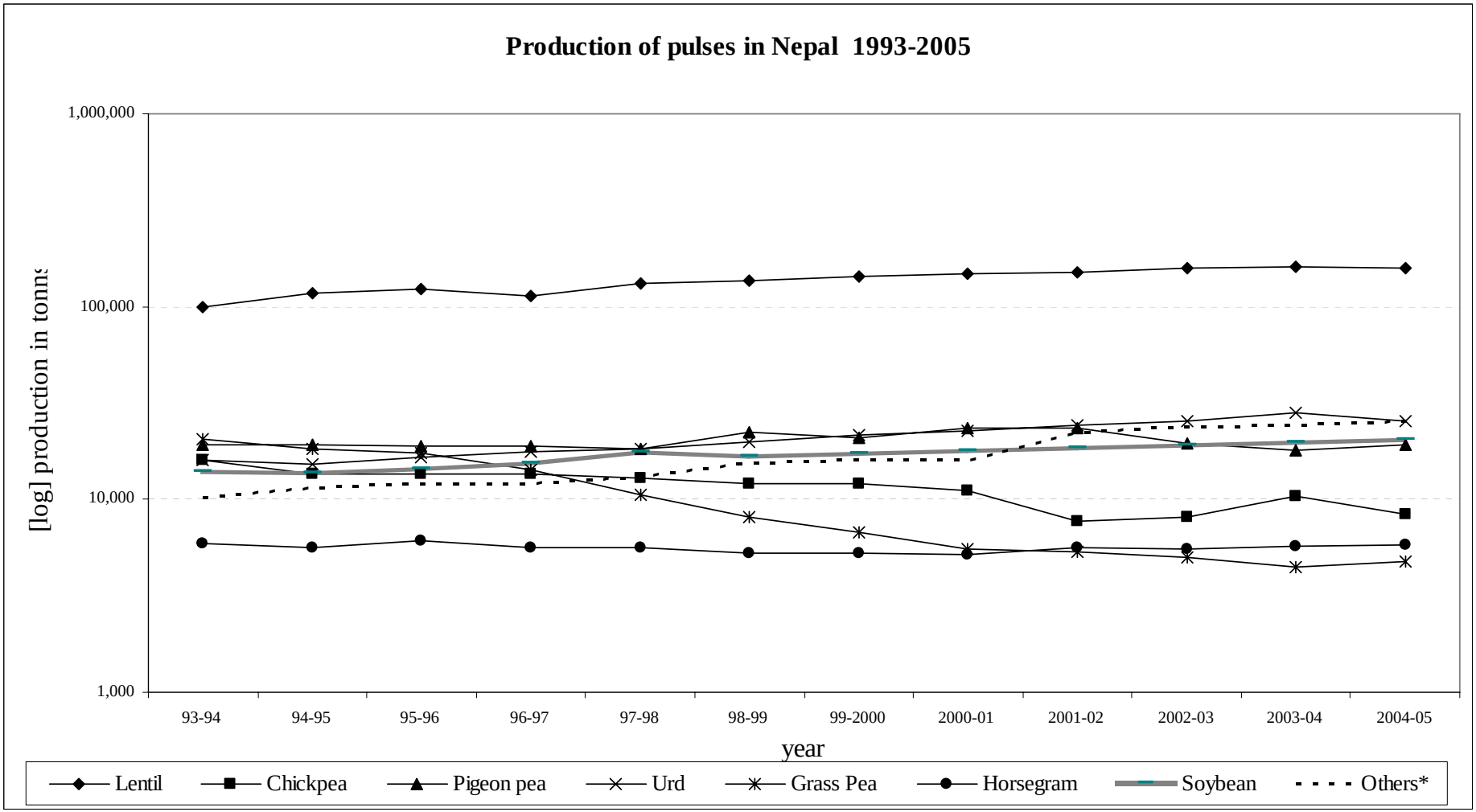


Important pulses in India



source: Ministry of Agriculture, India

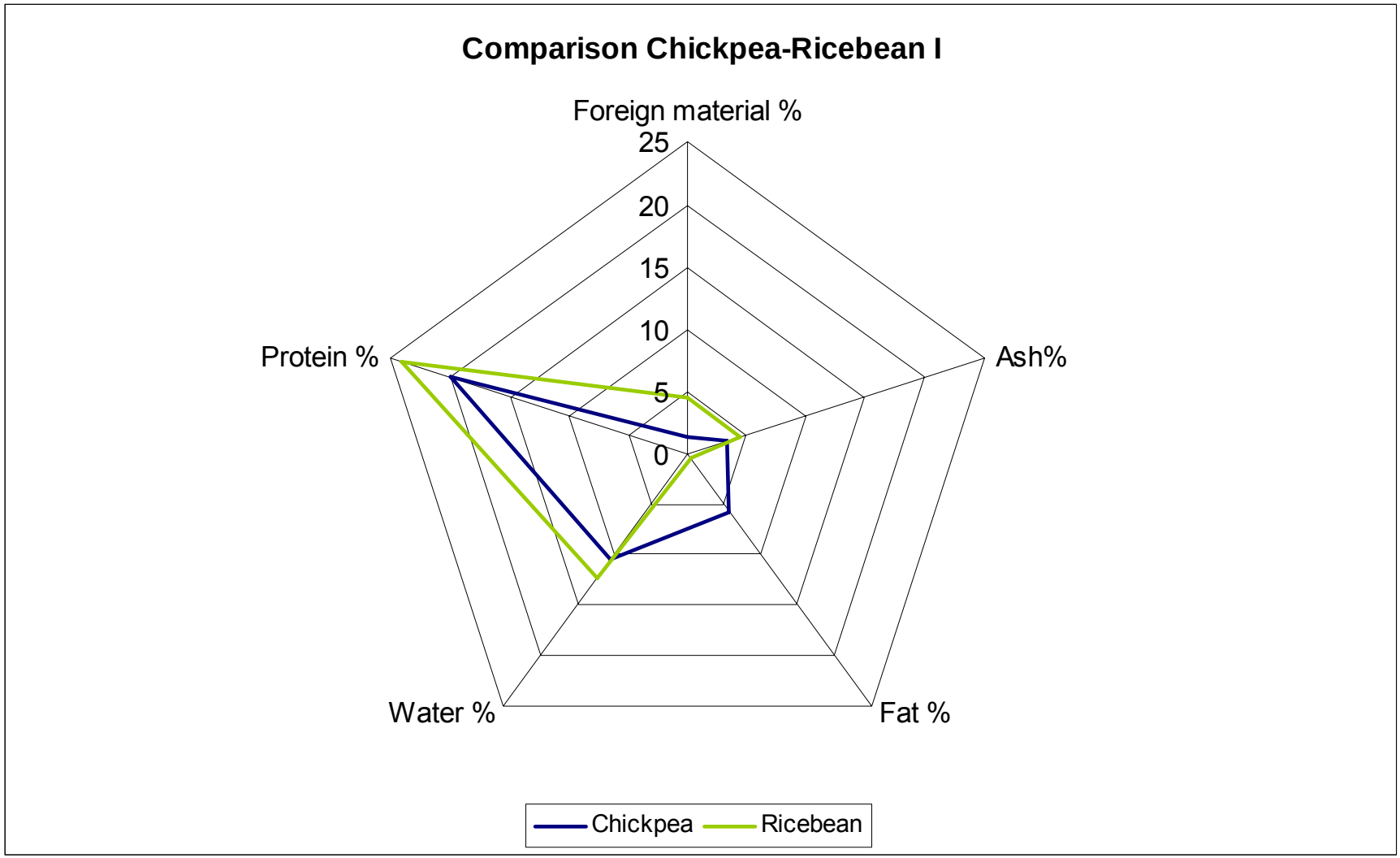
Important pulses in Nepal



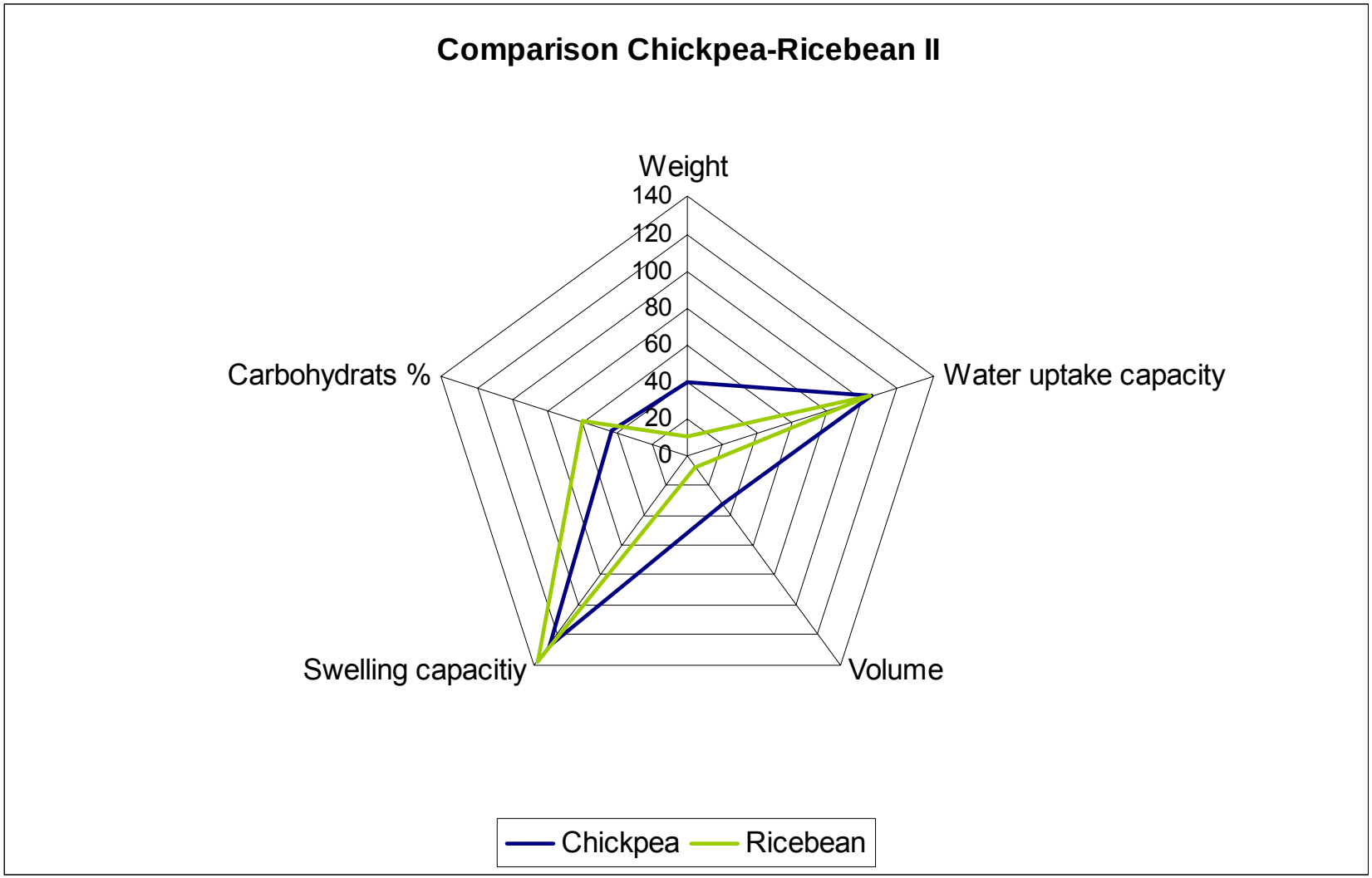
* Field pea, Cowpea, Broad bean, Phaseolus, Masyng, Mungi etc.

source: Ministry of Agriculture, Nepal

Chickpea-Ricebean I



Chickpea-Ricebean II



regression I

	B	standard error	stand. B	T	signifacance
(Konstante)	4.272	0.664		6.435	0.000
Dummy_mung bean	0.341	0.049	0.631	6.907	0.000
Dummy desi chickpea	0.083	0.054	0.211	1.528	0.146
Dummy yellow pea	-0.210	0.051	-0.534	-4.149	0.001
Dummy kabuli chickpea	0.281	0.055	0.519	5.094	0.000
Dummy Cowpea	0.136	0.032	0.381	4.291	0.001
Dummy Lalitpur 3	0.152	0.024	0.457	6.410	0.000
Dummy Patan 1	0.088	0.029	0.245	3.010	0.008
Dummy Patan 2	0.053	0.026	0.150	2.067	0.055
Dummy Patan 3	0.155	0.025	0.395	6.241	0.000
Dummy Kalimati 1	0.101	0.029	0.284	3.503	0.003
Dummy Kalimati 2	0.028	0.027	0.072	1.050	0.309
Dummy Malekhu	0.140	0.030	0.421	4.618	0.000
kidney	0.218	0.039	0.487	5.637	0.000
yellow	-0.038	0.022	-0.141	-1.678	0.113
green	-0.182	0.040	-0.551	-4.604	0.000
log weight	1.297	0.680	3.232	1.907	0.075
log water uptake	-0.844	0.294	-0.248	-2.872	0.011
log volume	-1.593	0.747	-4.018	-2.132	0.049
log swelling	0.245	0.192	0.142	1.279	0.219
log ash	-0.778	0.188	-0.499	-4.129	0.001
log carbo	-0.493	0.301	-0.397	-1.637	0.121

regression II

	B	stand. B	T	signifacance
kidney	0.218	0.487	5.637	0.000
yellow	-0.038	-0.141	-1.678	0.113
green	-0.182	-0.551	-4.604	0.000
log weight	1.297	3.232	1.907	0.075
log water uptake	-0.844	-0.248	-2.872	0.011
log volume	-1.593	-4.018	-2.132	0.049
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log ash	-0.778	-0.499	-4.129	0.001
log carbo	-0.493	-0.397	-1.637	0.121

R	R^2	adjusted R^2
0.988	0.975	0.935

	B	stand. B	T	signifacance
kidney	0.190	0.459	3.675	0.002
angular	0.137	0.447	3.320	0.004
round	-0.313	-1.142	-8.892	0.000
brown	-0.166	-0.578	-5.305	0.000
yellow	-0.179	-0.727	-7.466	0.000
red	-0.133	-0.266	-2.280	0.036
log_weight	1.534	3.793	2.925	0.009
log_water_uptake	-0.471	-0.135	-1.870	0.079
log volume	-1.815	-4.555	-2.923	0.009
log % ash	-0.554	-0.324	-2.215	0.041
log % carbo	-0.578	-0.454	-2.013	0.060

R	R^2	adjusted R^2
0.984	0.969	0.932