NUTRIENT CONSUMPTION OF SOME NON-TRADITIONAL ENERGY CROPS

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- The need of finding renewable energy sources arouse quest of low-input crops in order to achieve positive energy balance of the production chain.

- Beside other inputs, energy cost of fertilizers has to be taken into consideration.

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- The main object of the study is to compare the nutrient consumption of some non traditional and traditional crops for producing 100 kg seeds, 100 kg oil in the seeds and 100 kg flax in the plant residues.

Tested crops

Crambe

(Crambe abyssinica)

PTION OF SOME
ENERGY CROPS

Tested crops

Camelina

(Camelina sativa)

Tested crops

Lalemantia

(Lalemancia liberica)

Tested crops

Castor bean

(Ricinus communis),

SUMPTION OF SOME
AL ENERGY CROPS

Tested crops

Sylibum

(Silybum marianum),

SUMPTION OF SOME
NAL ENERGY CROPS

Tested crops

Safflower

(Carthamus tinctorius)

ON OF SOME
RGY CROPS

Tested crops

Pumpkin

(Cucurbite pepo)

TION OF SOME
NERGY CROPS

Tested crops

Traditional for the country oil crops

Sunflower

Oil seed rape

Experimental locations

- Vrajdebna – “V” (Chromic Luvisols, medium to high nutrient content in the soil; annual precipitations – 606 mm)

- Barzia - “B” (Eutric Planosols, low nutrient content in the soil; annual precipitations – 825 mm).

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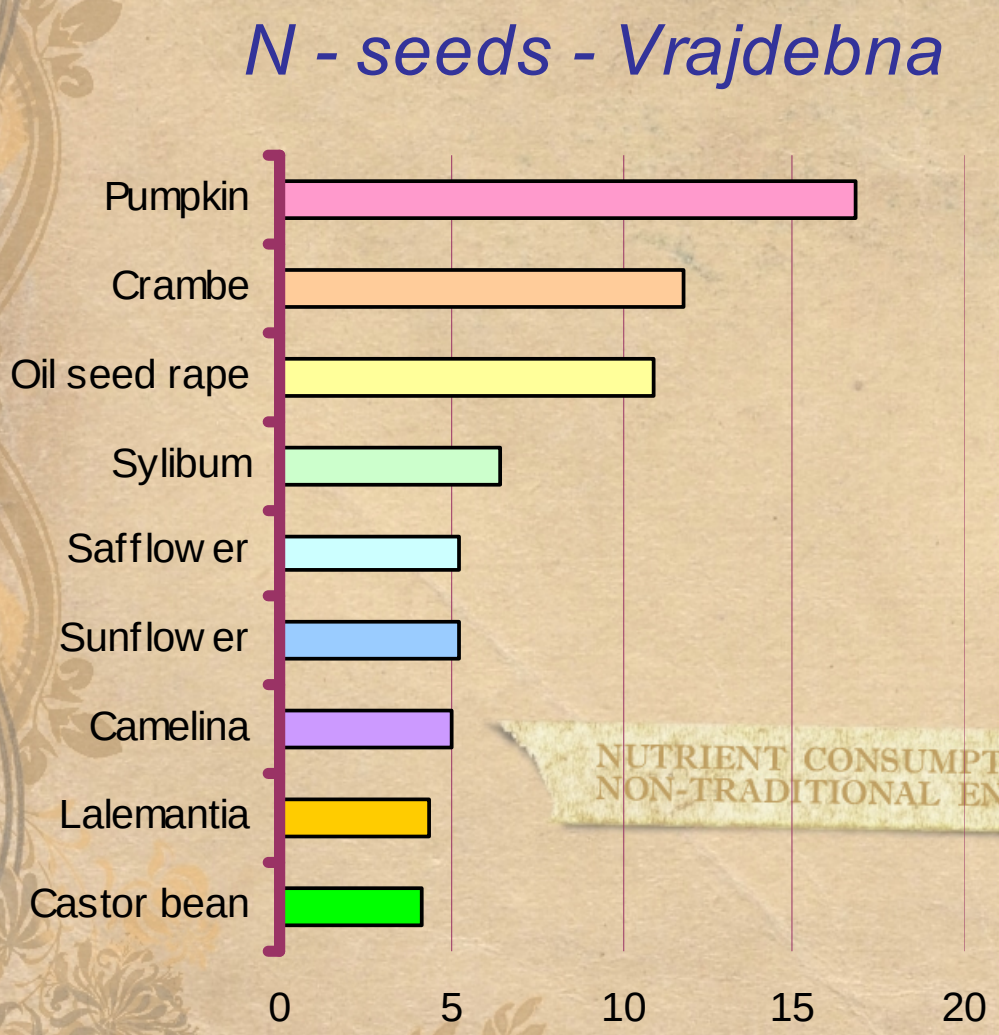
Nitrogen consumption



100 kg **seeds**

V - Vrajdebna

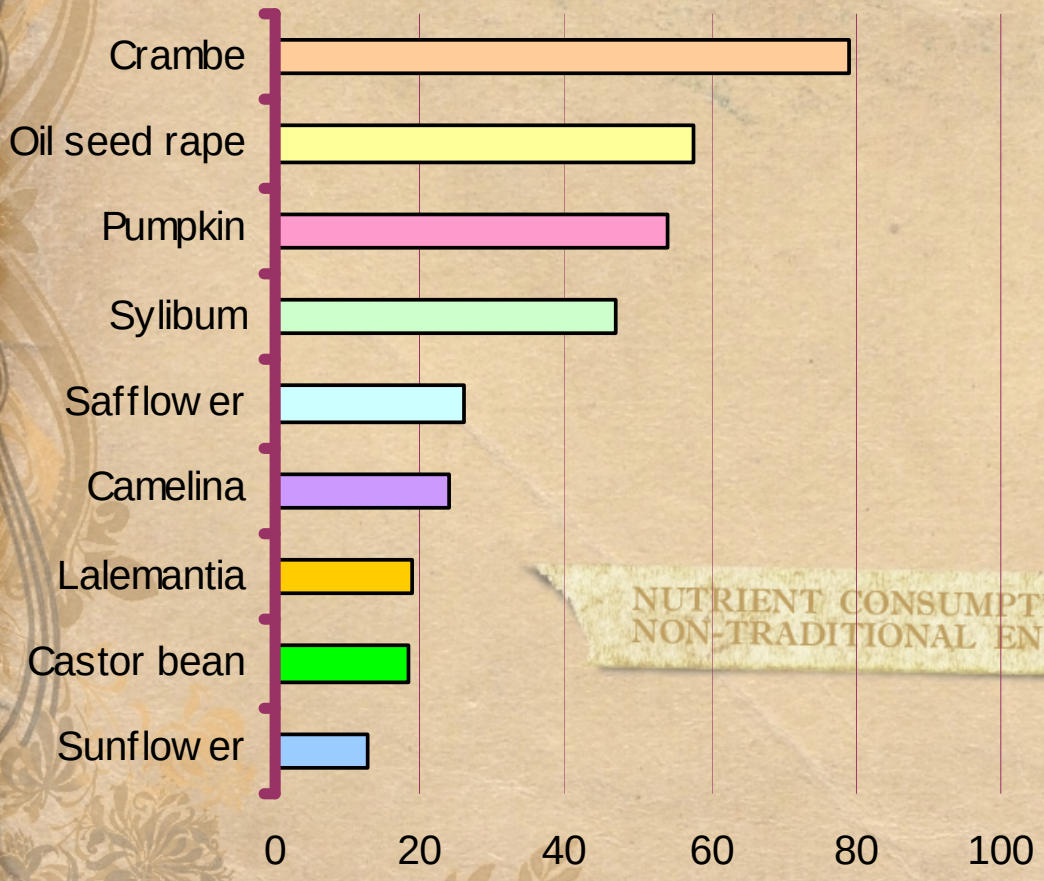
4.1-16.8 kg

Highest – crambe, oil seed rape (low yields)

Lowest – castor bean and lalemantia (14-22% less than the next crop and 27% than sunflower)

Nitrogen consumption

N - oil - Vrajdebna



100 kg **oil**

V - Vrajdebna
12.8-79.3 kg

Highest – crambe, oil seed rape

Lowest – sunflower

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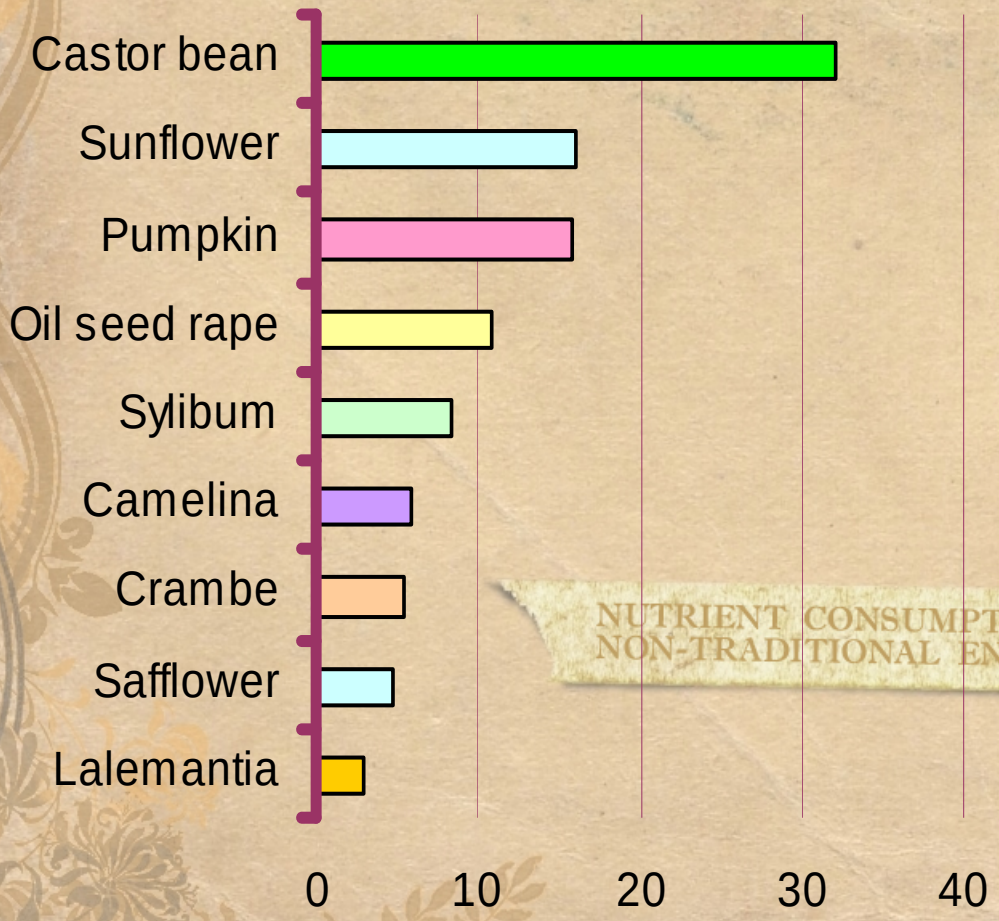
(9% more than castor bean because of high oil content)

Nitrogen consumption

N - seeds - Barzia



100 kg **seeds**

B – Barzia

2.9-32.0 kg

Highest – castor bean
(low seed yield)

High – sunflower, oil seed rape

Lowest – lalemantia (65% less tan safflower)

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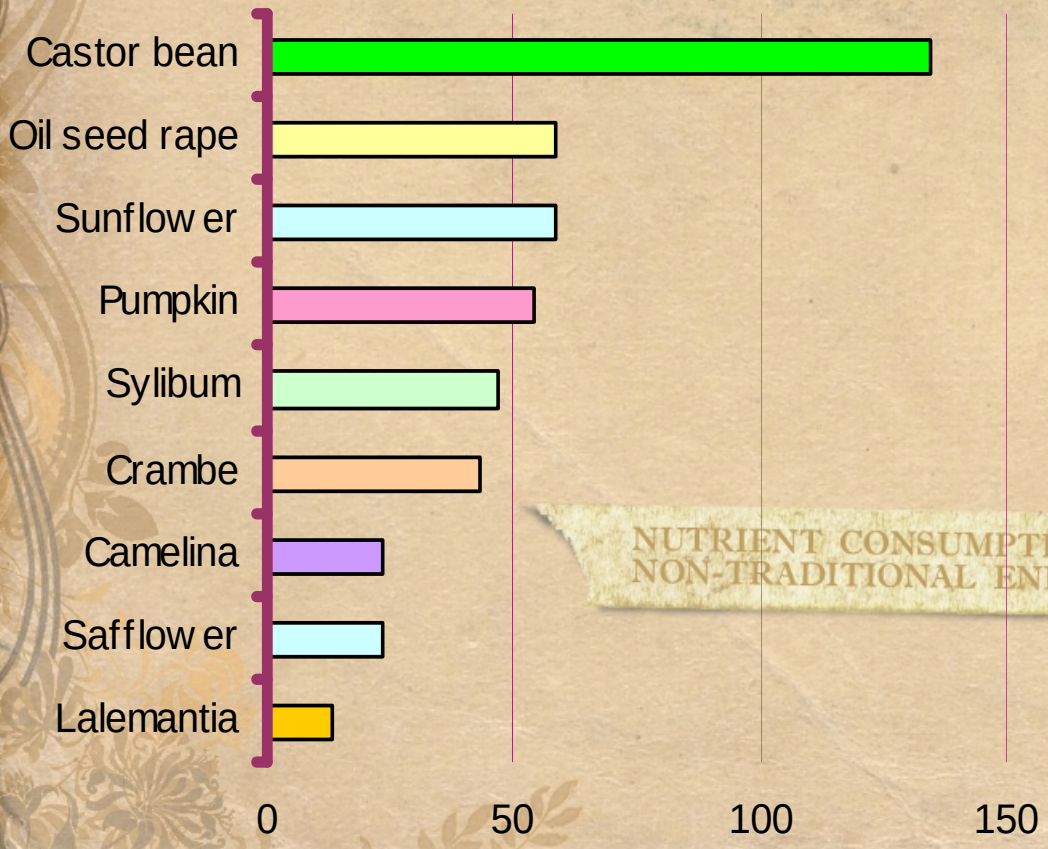
Nitrogen consumption

N - oil - Barzia



100 kg **oil**

B – Barzia

13.1- 134.7 kg

Highest – castor bean, sunflower, rape

Lowest – lalemantia (76% less than safflower)

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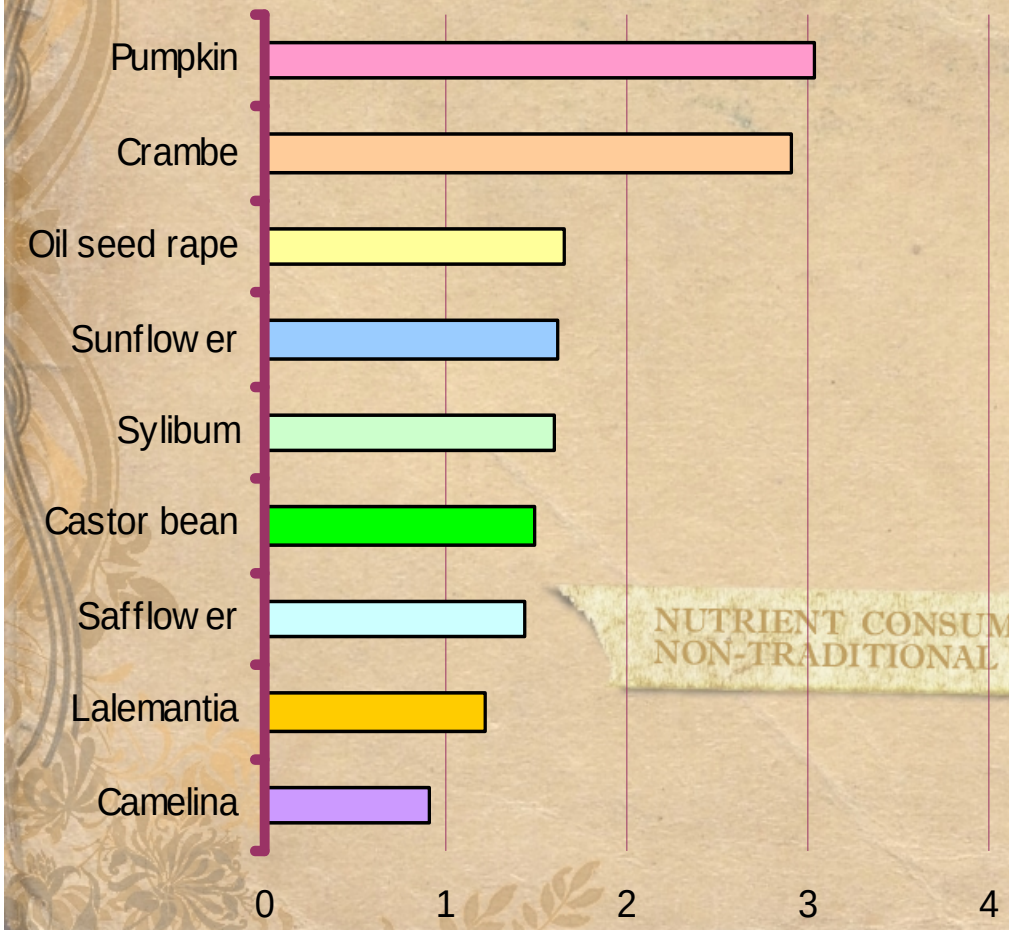
Nitrogen consumption

- **Lalemantia** is the non traditional crop with lowest nitrogen consumption for 100 kg seeds and oil on both locations.
- From the traditional oil crops better results show sunflower in Vrajdebna but not on the other location. Oil seed rape gave in to sunflower on both locations because of non sustainable yields.

Phosphorus consumption

P - seeds - Vrajdebna



100 kg seeds

V – Vrajdebna

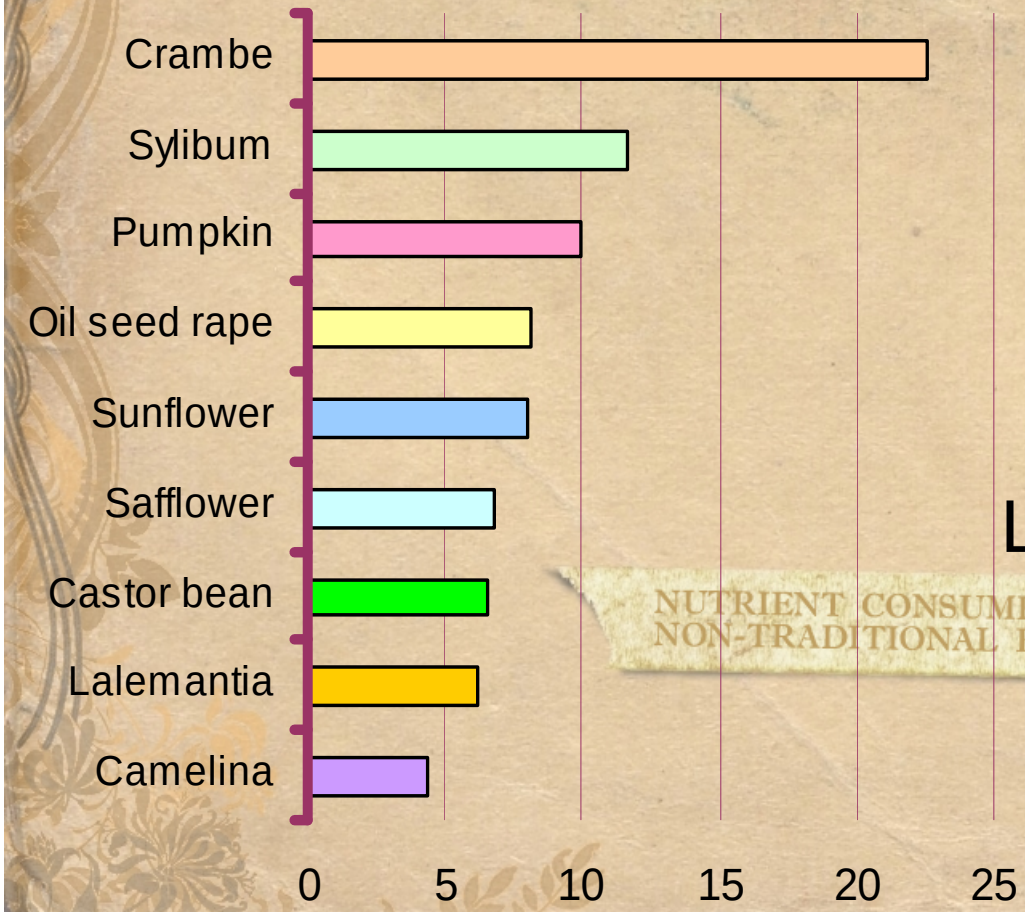
0.9-3.4 kg

Highest – pumpkin, crambe

Lowest – camelina - 33 % less than the next crop (lalemantia)

Phosphorus consumption

P - oil - Vrajdebna



100 kg oil

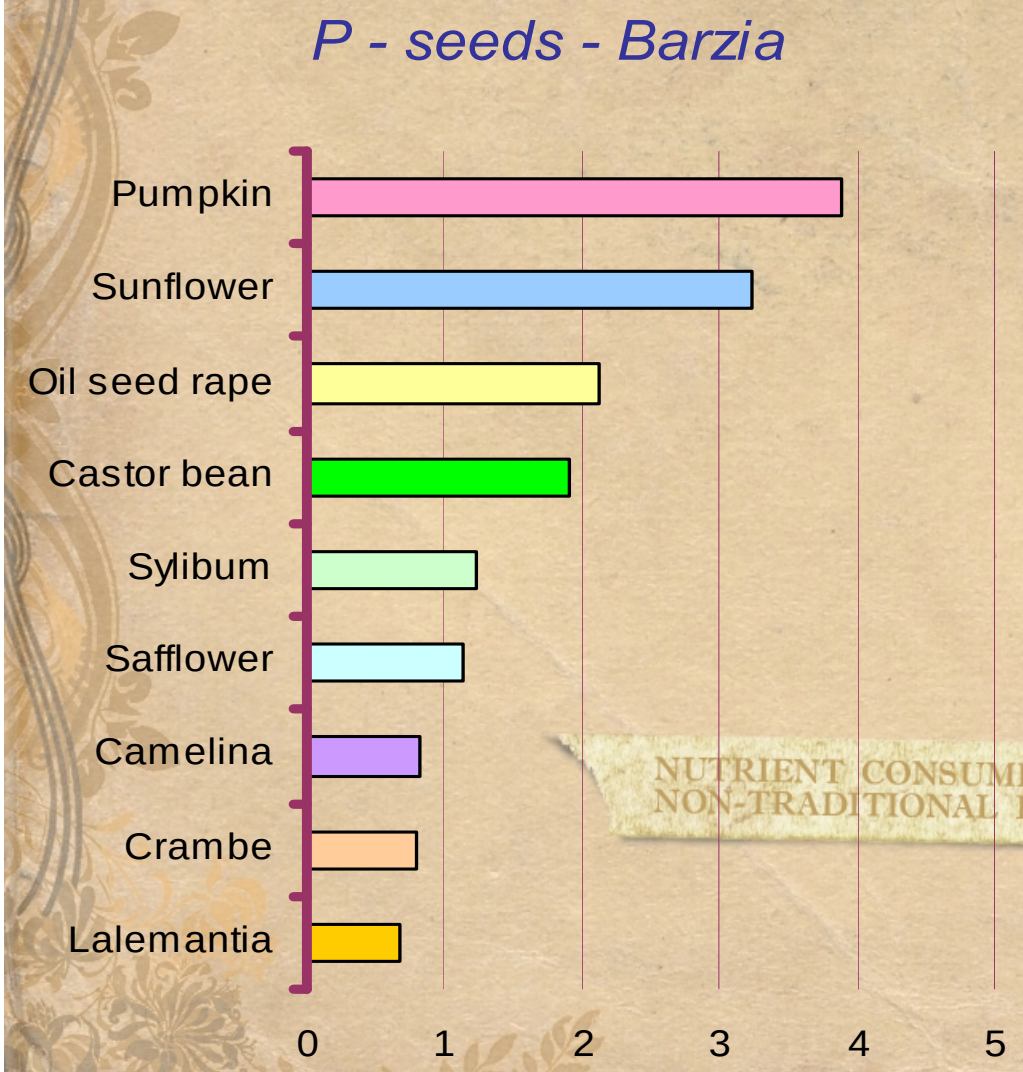
V – Vrajdebna

4 - 22.6 kg

Highest – crambe, sylibum

Lowest – camelina- 40% less than the next crop (lalemantia)

Phosphorus consumption



100 kg seeds

B – Barzia

0.7-3.9 kg

Highest - pumpkin, sunflower

Lowest – lalemantia –

4.8 x less than sunflower

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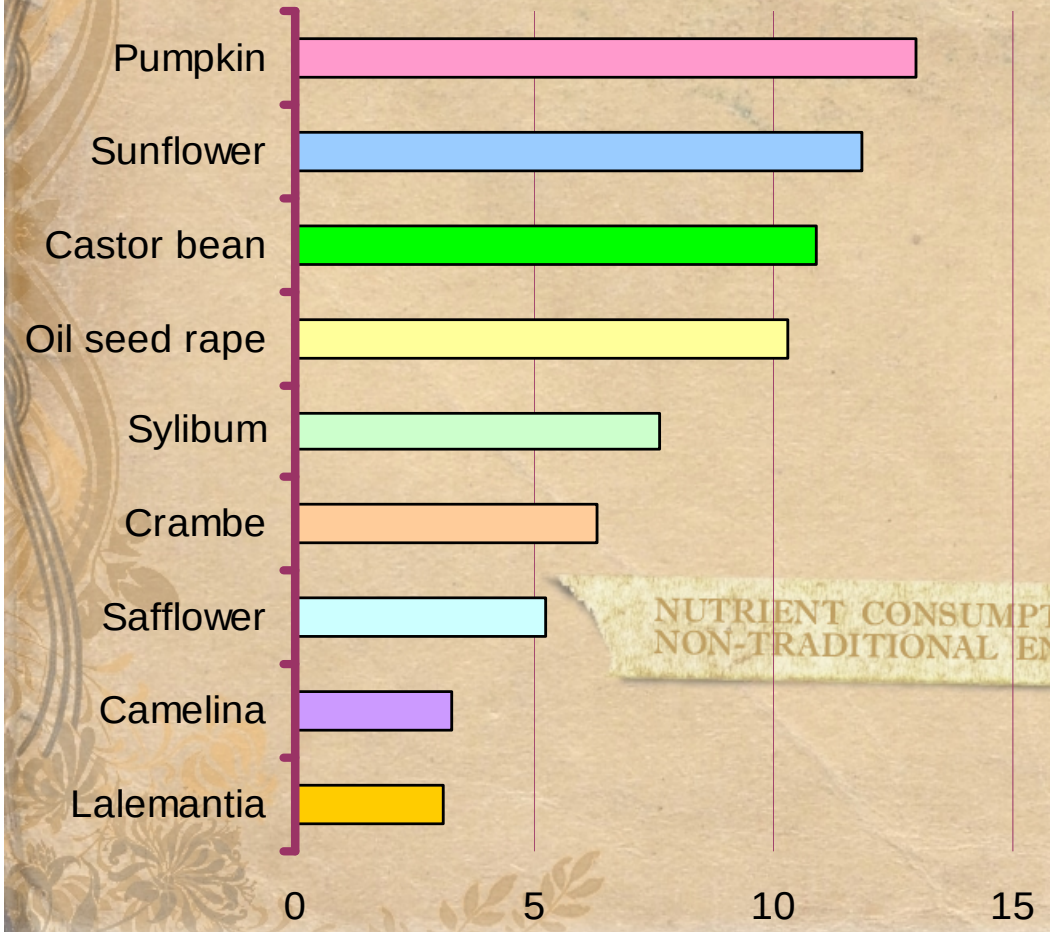
Phosphorus consumption

P - oil - Barzia



100 kg oil

B - Barzia

3.1- 12.3 kg

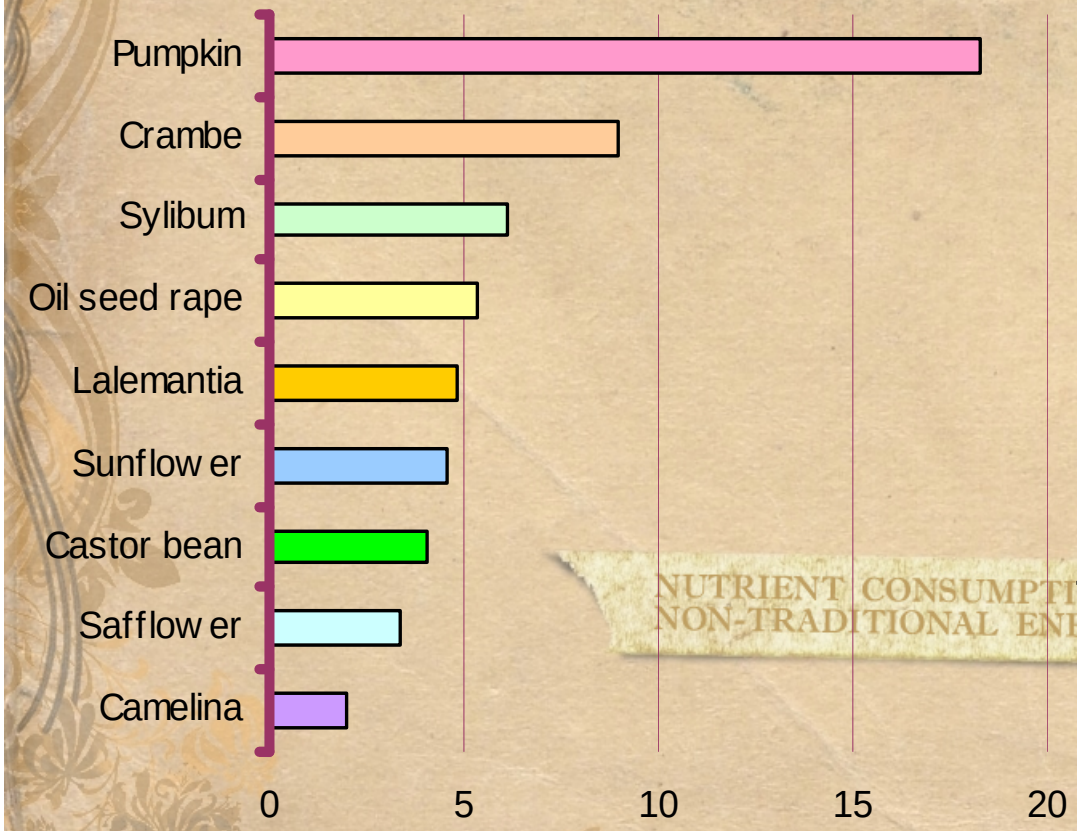
Highest - pumpkin, sunflower

Lowest – lalemantia and camelina (2-3 x less than sunflower)

Phosphorus consumption

Camelina and **lalemantia** are the crops with lowest phosphorus consumption for 100 kg seeds and oil on both locations

Potassium consumption



100 kg seeds

V – Vrajdebna

1.9 -18.3 kg

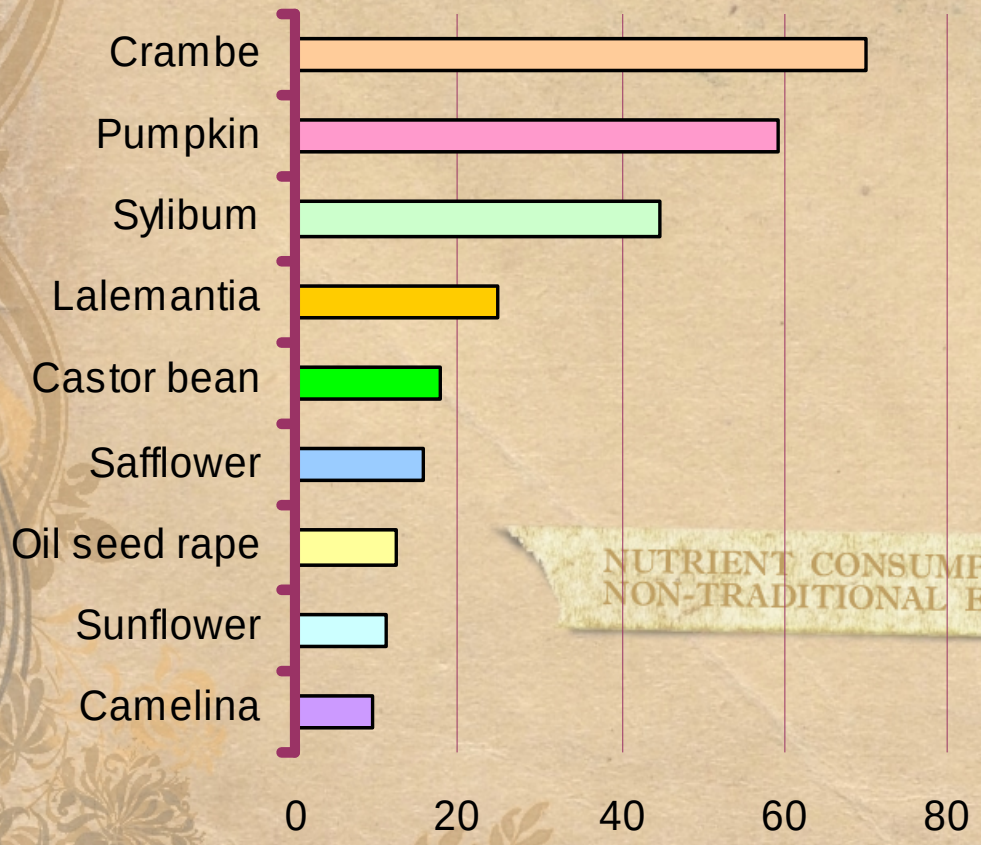
Highest – pumpkin, crambe

Lowest – camelina –

73.7 % less than the next crop safflower

Potassium consumption

K - oil - Vrajdebna



100 kg oil

V – Vrajdebna

9.6-59.2 kg

Highest – crambe, pumpkin

Lowest – camelina – 18 % less than the next crop safflower

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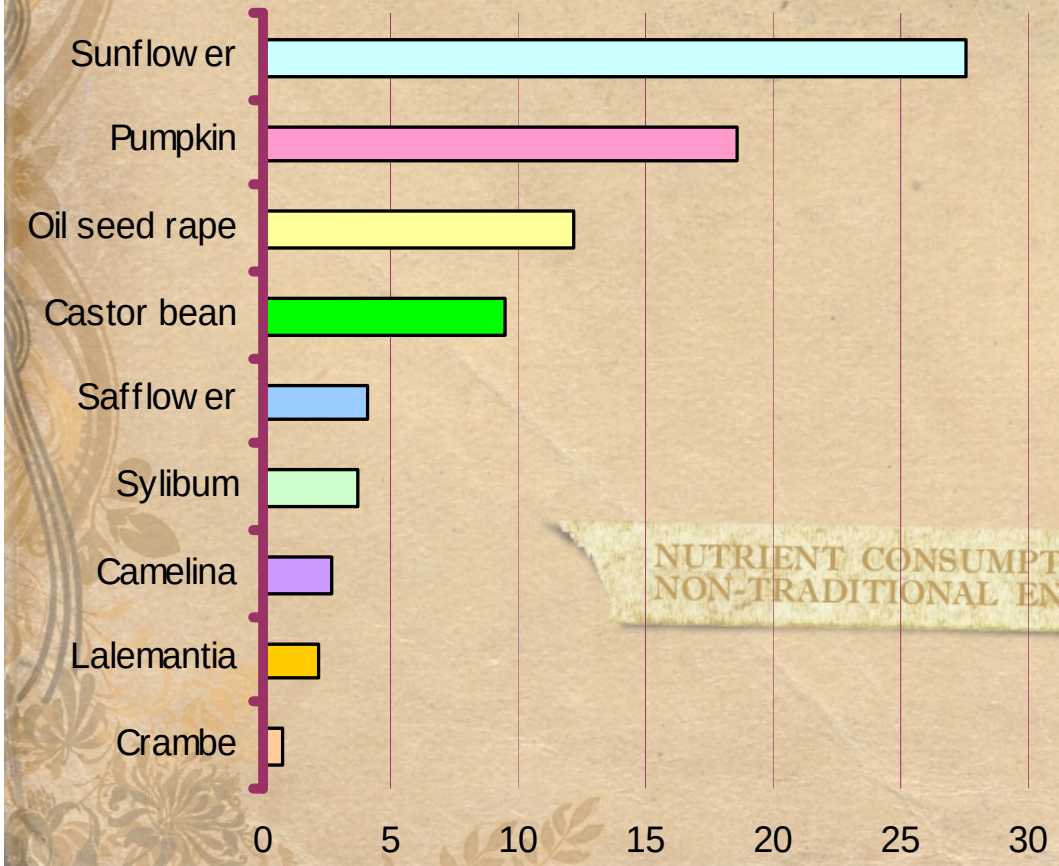
Potassium consumption

K - seeds - Barzia



100 kg seeds

B - Barzia

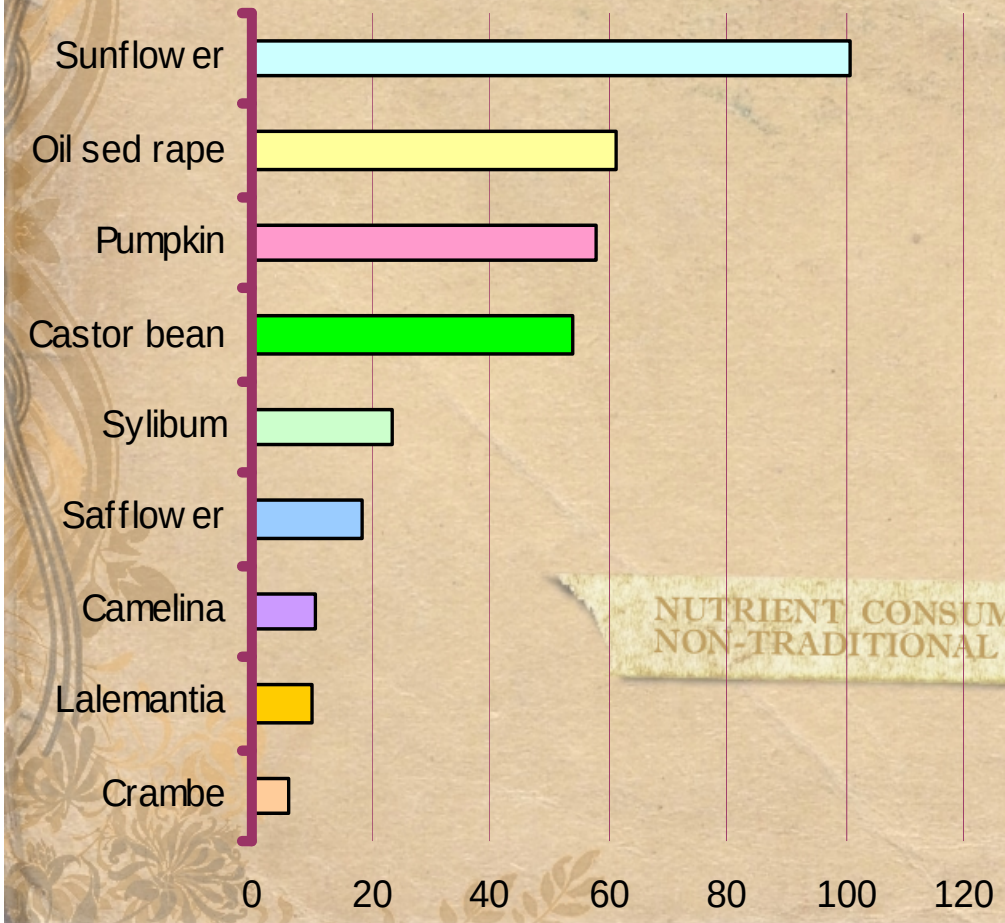
0.8-18.6 kg

Highest – sunflower, pumpkin

Lowest – crambe, lalemantia and camelina (5,5 x less than rape)

Potassium consumption

K - oil - Barzia



100 kg oil

B – Barzia

6.1- 61.2 kg

Highest – sunflower, oil seed rape

Lowest – crambe, lalemantia and camelina (70-75% less than the next crop)

Potassium consumption

Camelina and **lalemantia** are the crops with lowest potassium consumption for 100 kg seeds and oil on both locations.

Magnesium consumption
100 kg seeds

100 kg seeds

- V – 0.5-2.6 kg

Lowest – camelina and lalemantia – 24 % less than the next crop

- B – 0.3-6.4 kg

Lowest – crambe, lalemantia and camelina – 3 -10 times less than the next crop

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Magnesium consumption
100 kg oil

- High Mg demand for 100 kg oil is observed for sylibum on location V and castor bean and sunflower for location B.
- Relatively low is the Mg consumption for **camelina and lalemantia** for both locations.

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Calcium consumption
100 kg oil

- High Ca demand for 100 kg oil is observed for sylibum on location V and castor bean on location B.
- Relatively low is the Ca consumption for **sunflower** and **camelina** for location V and **camelina** and **lalemantia** for location B.

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Nutrient consumption
100 kg fiber

- In order the whole energy yield to be estimated, the plant residues were analyzed for fiber content
- High nutrient removal for fiber production has sunflower, mainly because of high nutrient content, while the other traditional oil crop – **oil seed rape has lowest removal**. From the non traditional crops low nutrient removals have **lalemantia, camelina** and partly crambe and castor bean.

Nutrient energy equivalents
100 kg oil

In order to compare the energy costs for fertilizers, N, P and K removals were expressed in energy equivalents

(*Pimental D.* N-77.5, P2O5-14.0, K2O-9.7 mJ)

- **V - 1160 – 8375 mJ.**

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- **B - 1157 – 5690 mJ.**

Crops ranking according to nutrient energy equivalents

100 kg oil

Vrajdebna	Barzia
Camelina	**Lalemantia**
Sunflower	Camelina
Castor bean	Safflower
Lalemantia	Crambe
Safflower	Sylibum
Sylibum	Pumpkin
Oil seed rape	Oil seed rape
Pumpkin	Sunflower
Crambe	Castor bean

Nutrient energy equivalents

- V - lowest energy cost for **camelina** – 26% less than the second crop (sunflower)

- B - lowest energy cost for **lalemantia** – 65 % less than the second crop (camelina)

Nutrient energy equivalents

Having in mind that nitrogen has the biggest share of the nutrient energy costs (70-85 %), the interest could be focused on N needs of the oil crops. In the study the lowest N consumption for unit oil production have lalemantia on both locations and sunflower in Vrajdebna.

Conclusion:

- There are big differences between studied crops concerning the nutrient demands per unit seeds or oil. Pumpkin spends high quantity of nutrients because of great amount secondary biomass. Lalemantia and camelina are the crops with lower nutrient demand for producing 100 kg seeds or oil because of sustainable yields during the two years and relatively high oil content in the seeds.

Conclusion:

- The traditional for the country oil crops – sunflower and oil seed rape show variable results depending on the site and the year. Generally for the traditional crops, the tendency is in favor with sunflower; oil seed rape gave way to sunflower in many respects.

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Conclusion:

- The nutrient energy costs for producing unit oil also show big differences between the studied crops. The ranking outlined camelina in Vrajdebna and lalemantia in Barzia as crops with lowest nutrient energy demands.

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Conclusion:

- The results show that taking into account the nutrient energy costs for producing unit oil for every one oil crop is important for improving the energy balance of the biodisel production chain.

Thank you for the attention!

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