“Catch crops. Efficiency?”, 2020-10-28,Latvia

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SOIL FERTILITY AND CAPACITY OF CATCH CROPS TO IMPROVE IT. NUTRIENT BALANCE, NITROGEN TRANSFORMATION IN SOIL

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Relevance of the study

- Seeking for reduction of environmental pollution, the incorporation of the catch crop plants into an intensive cropping areas is recommended (Souza et al., 2016).
- Catch crop plants are biologically accumulating the nitrogen in the growing biomass and consolidating the soil nutrients with roots in the soil organic-mineral complex preventing the nutrients from being leached (Talgre et al., 2011).

The objective of this study

- To establish the catch crop demonstration sites in two Lithuanian localities representing the Venta and Lielupe RBDs. Two years (2017-2018) implemented observations on both catch crop sites could help to evaluate the: (a) *changes in soil agrochemical properties*; (b) *nitrogen leached from soil properties*; (c) *aboveground biomass of catch crops*.

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Establishment of catch crop demonstration sites

In 2017 catch crop demonstration sites were established in two farms in the selected Lithuanian localities (1) in Mažeikiai district (Viekšniai municipality, Čekai village; farmer Saulius Šaulys) and (2) in Pasvalys district (Vaškai town; farmer Laura Masilionytė). It was aimed that the selected localities will represent the Venta and Lielupe RBDs, respectively.

Figure 1. Establishment of catch crop demonstration sites in 2017 in Lithuania.

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Establishment of catch crop demonstration sites

Winter wheat grown in 2017 (sown in September, 2016) was selected to be the preceding crop before the establishment of both catch crop demonstration sites. Straw yielded from preceding winter wheat was chopped and spread evenly over the experiment area before catch crop sowing. The preceding crops for the catch cropping were different in both experimental sites in 2018, - farmer in Viekšniai was growing field pea, while farmer in Vaškai had the possibility to cultivate the spring wheat.

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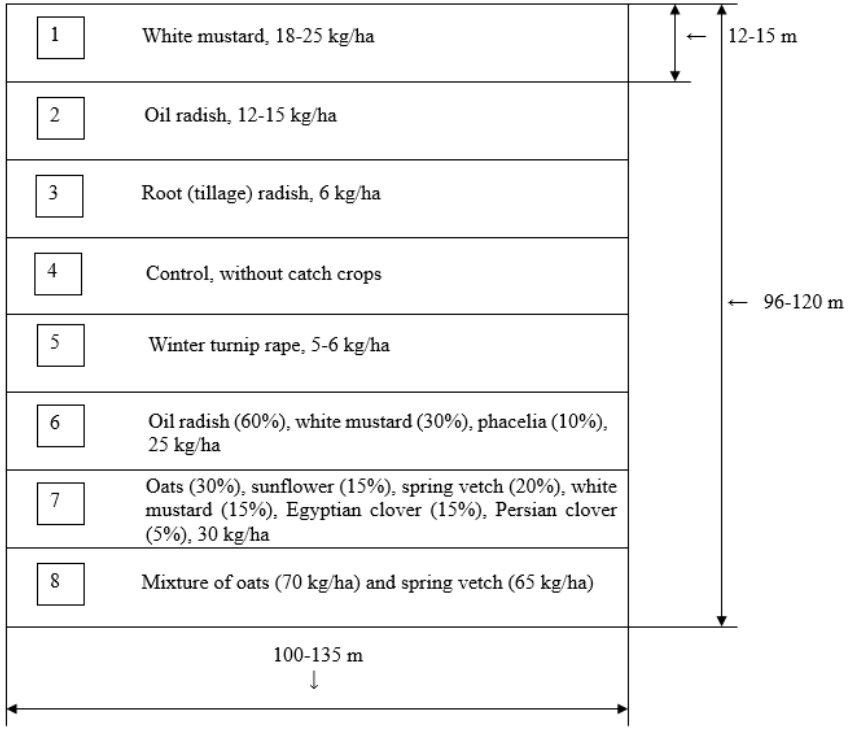
Establishment of catch crop demonstration sites



Catch crops:

1. White mustard, 18-25 kg/ha
2. Oil radish, 12-15 kg/ha
3. Root radish, 6 kg/ha
4. Control, without catch crop
5. Winter turnip rape, 5-6 kg/ha
6. Oil radish (60%)+white mustard (30%)+phacelias (10%) (25 kg/ha (TGS-3))
7. Oats (30%)+sunflower (15%)+spring vetch (20%) + white mustard (15%)+Egyptian clover (5%)+Persian clover (5%) (30 kg/ha (TGS-4))
8. Mixture of oats (70 kg/ha)+spring vetch (65 kg/ha)

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Catch cropping impact evaluation in Viekšniai (Mažeikiai district, Lithuania, Saulius Šaulys farm)

Catch crop demonstration site in Viekšniai (Mažeikiai distr.) was established in loamy sand texture soil. Sandy particles could indicate a low nutrient and water holding capacity of the soils,- leaching of nutrients from soils could be intensive.

Table 1. Content of nitrogen in lysimeters and in soil in catch crop demonstration site in Viekšniai, 2017

Catch cropping (CC) composition	Content of nitrogen in water in lysimeters, mg/L			Content of leached nitrogen, kg/ha			Microbial nitrogen, mg N /kg soil	
	$N\text{-}NH_4$	$N\text{-}NO_3$	N_{tot}	$N\text{-}NH_4$	$N\text{-}NO_3$	N_{tot}	$N\text{-}NH_4$	$N\text{-}NO_3$
Control (without CC)	**<0.03**	**12.1**	**15.3**	<0.003	**1.00**	1.26	**35.1**	122.1
White mustard	**<0.03**	2.7	4.9	<0.003	0.27	0.49	43.5	110.2
Oil radish	**<0.03**	2.1	4.3	<0.003	0.22	0.45	47.2	109.3
Root (tillage) radish	**<0.03**	4.4	6.8	<0.008	**1.10**	1.70	51.8	128.8
Winter turnip rape	**1.04**	1.5	5.1	0.14	0.69	0.21	**96.7**	114.2
Oil radish, white mustard and phacelia	0.06	0.7	2.7	0.006	0.07	0.26	50.1	**108.7**
Oats, sunflower, spring vetch, white mustard, Egyptian clover and Persian clover	0.05	**14.7**	**17.8**	0.008	**2.39**	**2.89**	53.8	**130.2**
Oats and spring vetch	0.04	3.8	5.5	0.003	0.27	0.39	49.8	112.4

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Catch cropping impact evaluation in Viekšniai (Mažeikiai district, Lithuania, Saulius Šaulys farm)

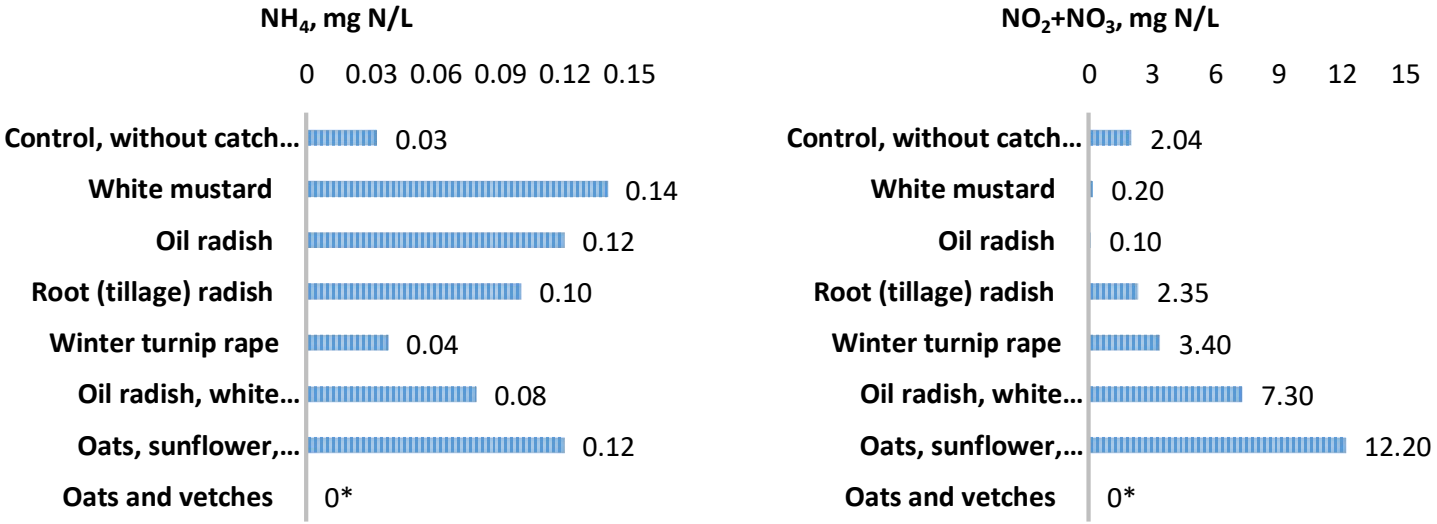

Figure 2. Content of ammonium (N – NH_4^+) and nitrate (N – NO_2^-+NO_3^-) nitrogen in soil water in spring (in April 2018) following the first year catch cropping (in 2017) in Viekšniai

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Catch cropping impact evaluation in Viekšniai (Mažeikiai district, Lithuania, Saulius Šaulys farm)

Table 2. Above-ground biomass fresh and dry weight in catch crop demonstration site in Viekšniai

Catch cropping (CC) composition	Above-ground fresh biomass weight, t/ha		Above-ground biomass dry weight, t/ha	
	2017	2018	2017	2018
Control (without CC) with only chopped straw of preceding winter wheat	**0.47**	13.7	**0.06**	**1.24**
White mustard	**2.03**	**17.5**	0.29	1.61
Oil radish	**2.64**	**29.0**	**0.39**	**4.20**
Root (tillage) radish	1.59	14.6	0.19	1.50
Winter turnip rape	1.17	**9.7**	**0.05**	**1.15**
Oil radish, white mustard and phacelia	1.66	**11.5**	0.26	1.62
Oats, sunflower, spring vetch, white mustard, Egyptian clover and Persian clover	1.30	15.6	0.18	2.71
Oats and spring vetch	**0.67**	**11.5**	**0.07**	1.41

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Catch croping impact evaluation in Vaškai (Pasvalys district, Lithuania, Laura Masilionytė farm)

Catch crop demonstration site in Vaškai (Pasvalys distr.) was established in sandy loam texture soil. Prevalence of silt particles could indicate about the increase in soil cation exchange capacity and the relevance in increased accumulation of nutrients, thus, the reducing of nutrient leaching.

Table 3. Content of nitrogen in lysimeters and in soil in catch crop demonstration site in Vaškai, 2017

Catch cropping (CC) composition	Content of nitrogen in water in lysimeters, mg/L			Content of leached nitrogen, kg/ha			Microbial nitrogen, mg N /kg soil	
	$N\text{-}NH_4$	$N\text{-}NO_3$	N_{tot}	$N\text{-}NH_4$	$N\text{-}NO_3$	N_{tot}	$N\text{-}NH_4$	$N\text{-}NO_3$
Control (without CC)	-	-	-	-	-	-	**62.5**	**127.3**
White mustard	**<0.033**	**<0.02**	**0.86**	<0.002	**<0.001**	0.05	110.3	128.4
Oil radish	**<0.033**	0.13	1.01	<0.001	0.003	**0.03**	103.6	130.2
Root (tillage) radish	**0.04**	0.96	2.06	**0.008**	**0.18**	**0.39**	**121.6**	132.0
Winter turnip rape	**<0.033**	1.78	2.90	<0.001	0.06	0.10	101.0	131.0
Oil radish, white mustard and phacelia	-	-	-	-	-	-	67.4	128.2
Oats, sunflower, spring vetch, white mustard, Egyptian clover and Persian clover	**<0.033**	**42.0**	**47.0**	**<0.0001**	0.08	0.09	99.3	**160.7**
Oats and spring vetch	**<0.033**	0.63	2.60	<0.005	0.10	**0.41**	107.2	131.6

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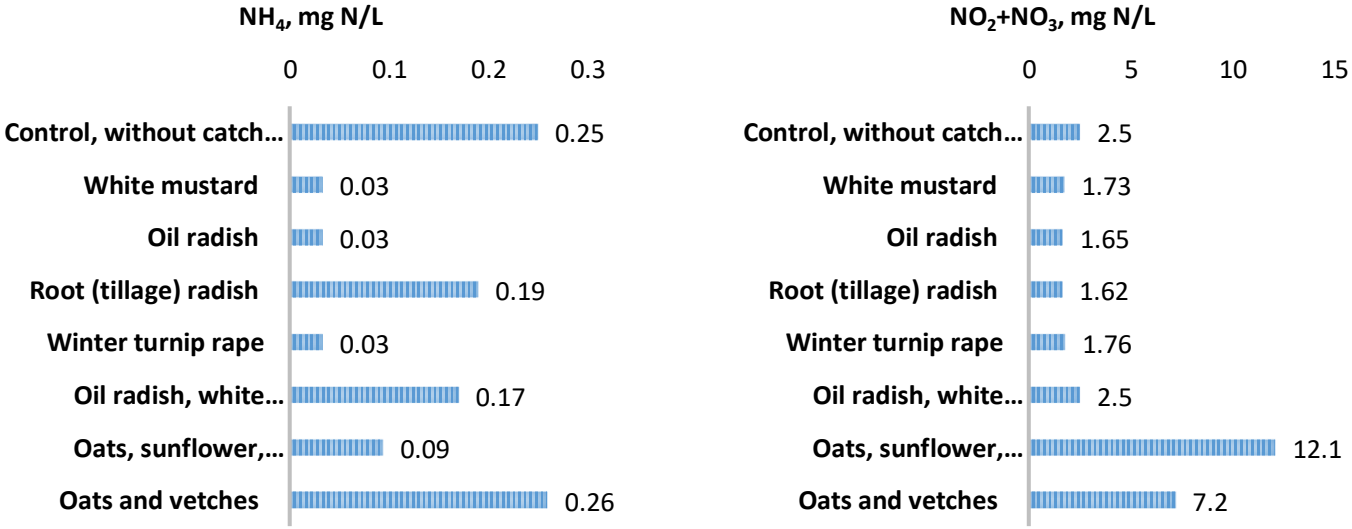
Catch croping impact evaluation in Vaškai (Pasvalys district, Lithuania, Laura Masilionytė farm)



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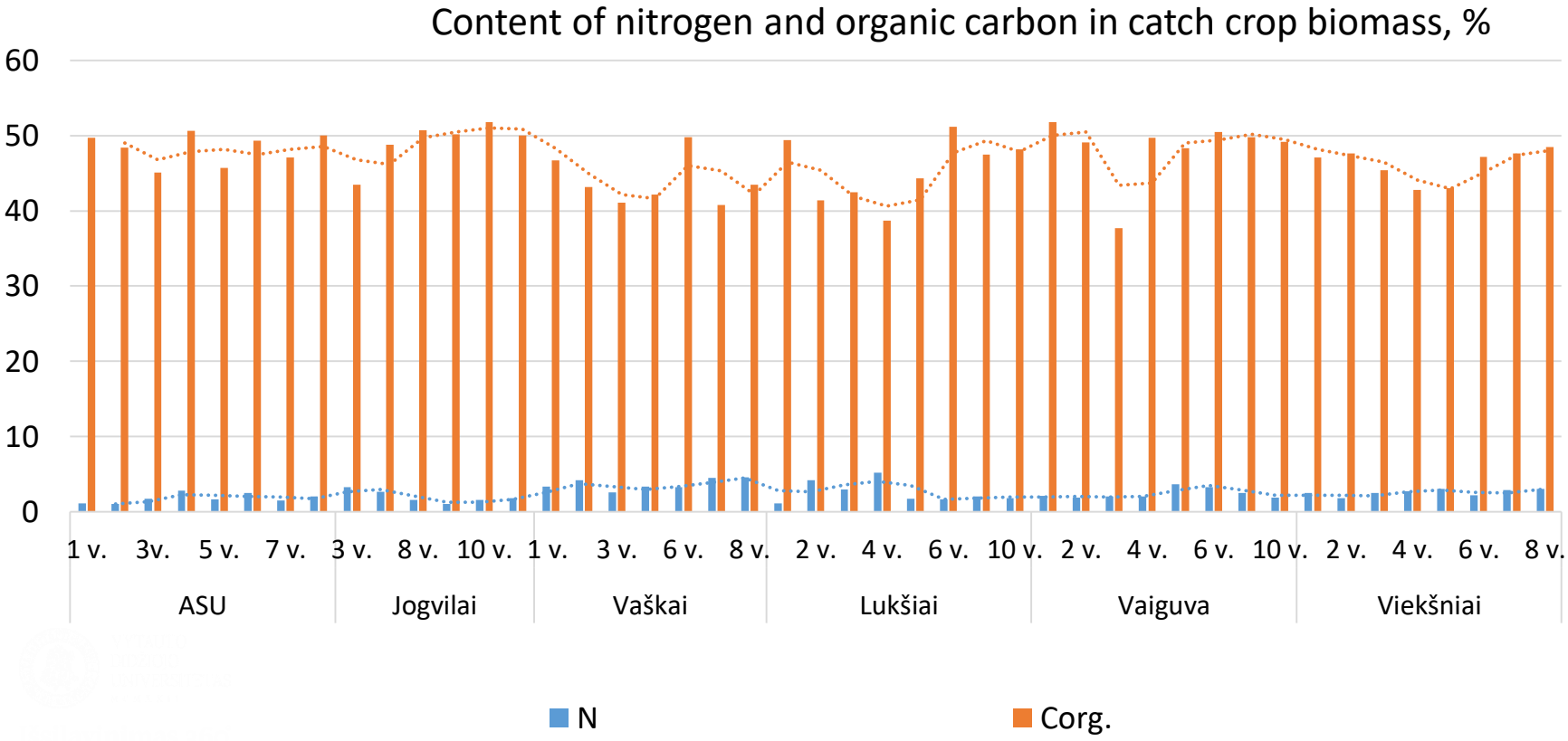
Catch croping impact evaluation in Vaškai (Pasvalys district, Lithuania, Laura Masilionytė farm)

Table 4. Above-ground biomass fresh and dry weight in catch crop demonstration site in Vaškai

Catch cropping (CC) composition	Above-ground fresh biomass weight, t/ha		Above-ground biomass dry weight, t/ha	
	2017	2018	2017	2018
Control (without CC) with only chopped straw of preceding winter wheat	**0.54**	**2.20**	**0.08**	0.32
White mustard	1.76	11.05	0.23	**1.56**
Oil radish	0.99	7.52	0.12	0.94
Root (tillage) radish	0.82	1.52	0.11	**0.19**
Winter turnip rape	**0.57**	7.10	**0.09**	1.05
Oil radish, white mustard and phacelia	**2.17**	**13.20**	**0.31**	1.49
Oats, sunflower, spring vetch, white mustard, Egyptian clover and Persian clover	0.87	8.50	0.11	0.98
Oats and spring vetch	1.04	**2.50**	0.15	0.45

	Catch crops:
1 v.	White mustard
2 v.	Oil radish
3 v.	Root (tillage) radish
4 v.	Control (without CC) with only chopped straw of preceding winter wheat
5 v.	Winter turnip rape
6 v.	Oats and spring vetch
7 v.	Lupin 55%, oil radish25%, phacelias10%, white mustard10%
8 v.	Pea45%, lupin25%, oil radish20%, phacelias10%
9 v.	Oil radish60%, white mustard 30%, phacelia10%
10 v.	Oats30%, sunflower15%, spring vetch20%, white mustard15%, Egyptian clover15%, Persian clover5%
11 v.	German mix


Content of nitrogen and organic carbon in catch crop biomass, %
60
50
40
30
20
10
0
1 v.
3v.
5 v.
7 v.
3 v.
8 v.
10 v.
1 v.
3 v.
6 v.
8 v.
2 v.
4 v.
6 v.
10 v.
2 v.
4 v.
6 v.
10 v.
2 v.
4 v.
6 v.
8 v.
ASU
Jogvilai
Vaškai
Lukšiai
Vaiguva
Viekšniai
N
Corg.

Soil fertility and capacity of catch crops to improve it. Nutrient balance, nitrogen transformation in soil, J.Aleinikovienė, V.Bogužas ir kt.

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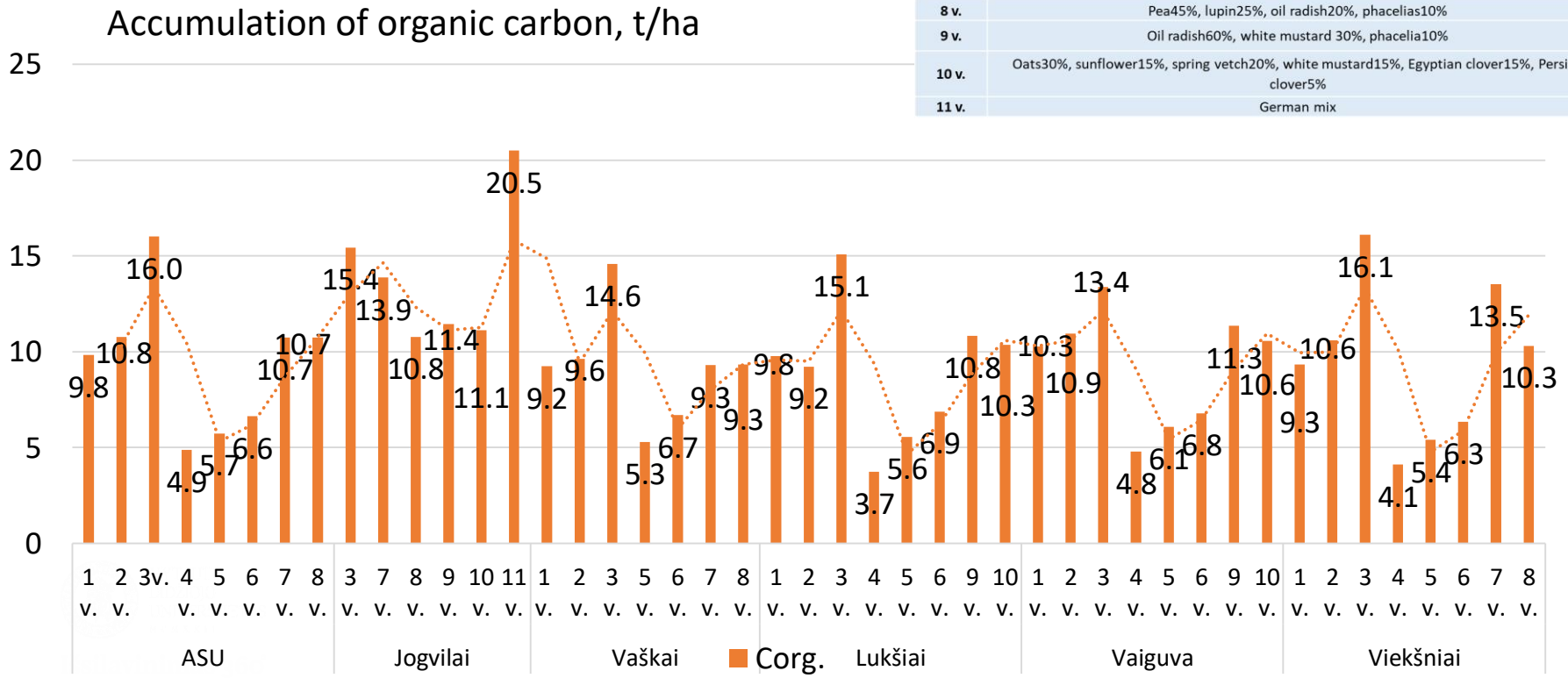

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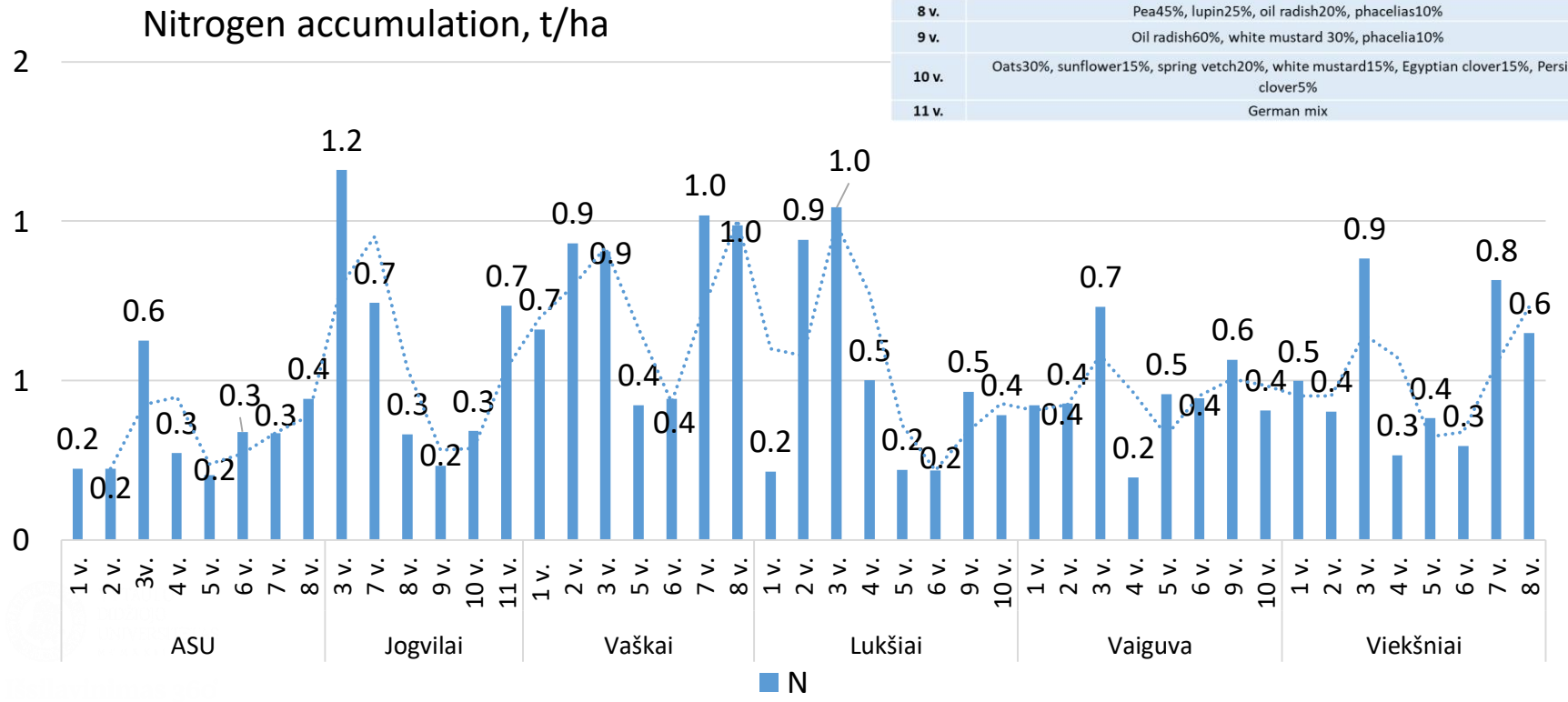

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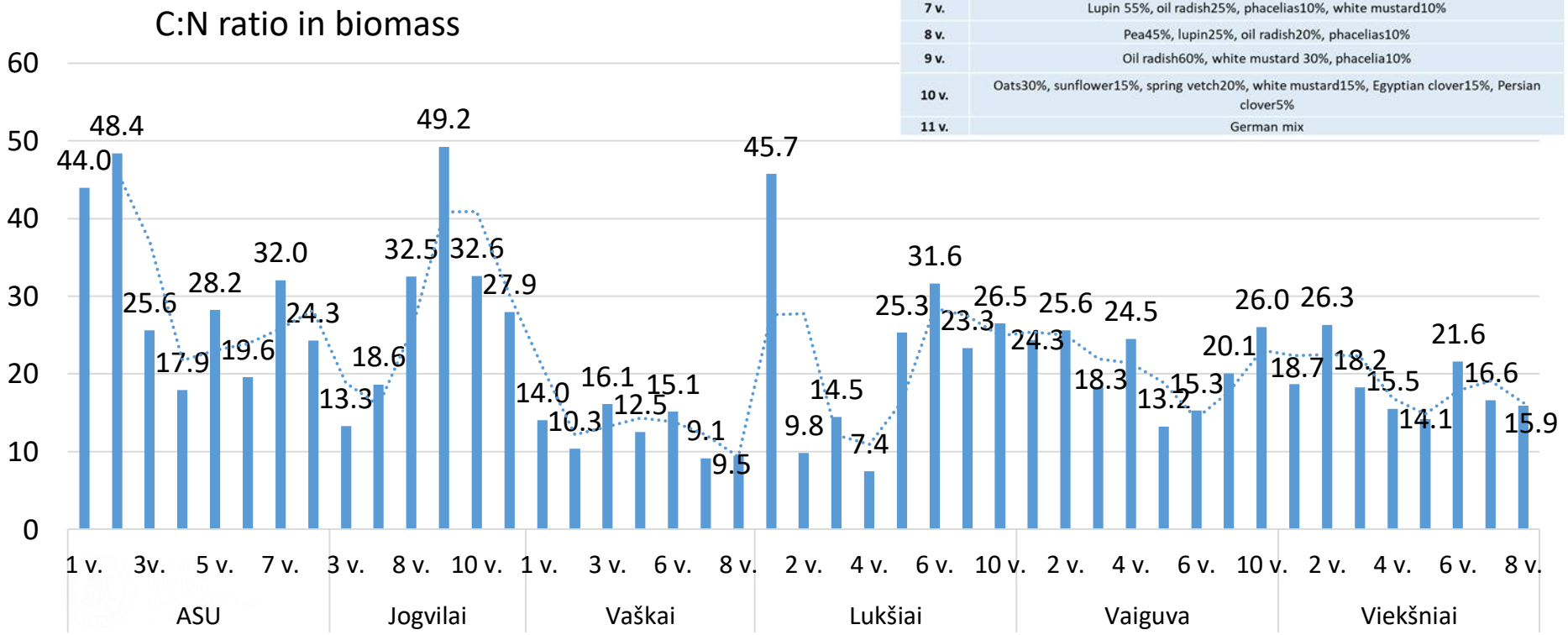

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Thank You for Your Attention

Paldies