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Guided tour: multi-year compost trial and silage trial at PSKW

On Thursday, 25 September 2025, during the guided visit on alternative lettuce at PSKW, the results of this year's long-term compost trial were presented. In addition, the design of the most recent silage trial was introduced (Figure 1).

Figure 1: Atmospheric photo during the guided tour.

Multi-annual compost trial

This long-term trial on organic fertilization began in 2006 at the PSKW research station (Figure 2). From the start, four types of organic fertilizers were included: mushroom manure, organic waste compost (GFT), green compost, and farmyard manure. These treatments are compared with a reference plot receiving no organic fertilizer, resulting in five treatments in total. Farmyard manure was not applied this year due to lack of material.

Figure 2: Overview of the compost trial and silage trial shown during the guided tour. After the lettuce harvest, grass was sown on this plot.

Since 2019, fertilization takes place every two-three years. To allow a fair comparison between the different fertilizers, each product is always applied at a rate supplying 10 tons of organic matter per hectare, even when this exceeds what is legally permitted in practice. This makes it possible to study the long-term effects of organic matter inputs under controlled conditions.

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This year, the organic fertilizers were distributed on 16 April, one week before planting red oak leaf lettuce on 25 April. Before application, the composts were analyzed to determine their chemical composition and to calculate the required dosage so that each plot received 10 tons of organic matter per hectare. The composition of the materials is shown in Table 1, while Table 2 summarizes the applied doses and the corresponding nutrient inputs.

Table 1: Composition organic fertilisers in kg/ton.

	Organic matter	Total nitrogen	Phosphate (P_2O_5)	Potassium (K_2O)	Magnesium (MgO)	Calcium (CaO)	Sodium (Na)
Mushroom manure	164	7,1	3,8	6,0	2,2	23	0,6
Organic waste compost	191	10,3	5,4	9,3	3,8	17,6	1,8
Green compost	174	8,7	3,3	7,1	2,9	13,2	0,5

Analysed op 27/03/2025 by BDB.

Table 2. Applied dosages on 16/04/2025.

	Dose	Nitrogen (Total N)	Nitrogen (Available N)	Phosphate (P_2O_5)	Potassium (K_2O)	Magnesium (MgO)	Calcium (CaO)	Sodium (Na)
	ton/ha	kg /ha	kg/ha(*)	kg /ha	kg /ha	kg /ha	kg/ha	kg/ha
Mushroom manure	51,2	433	130	232	366	133	1402	37
Organic waste compost	51,4	539	81	71(**)	487	199	921	96
Green compost	51,5	500	75	47(**)	408	167	759	26

(*) In Flanders: Coefficient of effectiveness for mushroom compost 30%, composts 15%
(**) In Flanders: Half of the phosphate applied is taken into account.

The organic matter contents of the three compost types were comparable, which is why similar tonnages were applied. Nitrogen and phosphate concentrations were in line with average reference values. Organic waste compost contained higher total nitrogen and phosphate levels than green compost, consistent with expected ranges for these materials.

In Flanders, specific regulations govern the application of nitrogen and phosphorus. These should be reviewed in this context. In total, each treatment received roughly 500 kg N/ha in organic form. In practical farming conditions, however, nitrogen and phosphorus norms in Flanders would limit these application rates. For compost, only the *effective* nitrogen fraction counts (around 15%), meaning that the applied dose corresponds to approximately 80 kg N/ha, which is allowed across all regions and crop classes. Mushroom manure, however, falls under animal manure legislation, and the 433 kg N/ha applied in the trial would exceed legal limits in practice.

To evaluate mineralization and nitrogen availability, soil samples were taken on 17 April (one week before planting) and on 26 June (two weeks after harvest). Nmin, the sum of nitrate (NO_3^-) and ammonium (NH_4^+), was low in mid-April (Table 3), as expected after winter. Already at this stage, plots receiving organic fertilizers tended to show slightly higher Nmin values. By late June (Table 4), mineralization had progressed substantially. The compost-amended plots showed clearly higher Nmin values than the unfertilized reference.

Another positive trend was seen in soil moisture. Plots with organic fertilization retained more moisture than those without, even during a period of limited rainfall. Repeated compost application significantly increased mineralization, which in turn built up organic matter. This structural increase improves both soil structure and water-holding capacity. Water infiltrates the soil more efficiently, making it more accessible to the plant. This beneficial effect is especially important in dry periods, when the little water that is available must be retained in the soil and accessible to the crop, rather than lost through surface runoff.

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Table 3: Nitrogen in different soil layers on April 17, 1 week before plant date.

Object	kg Nmin/ha 0-30 cm	30-60 cm	60-90 cm	kg NO_3-N/ha 0-90 cm	Moisture content (%) 0-30 cm
No organic fertilisation	23 a	10 a	10 a	36 a	15,3 b
Mushroom manure	38 a	11 a	9 a	52 a	16,4 ab
Organic waste compost	45 a	20 a	10 a	69 a	17,9 a
Green compost	42 a	16 a	10 a	60 a	18,1 a
Farm manure	39 a	13 a	8 a	54 a	17,5 a

Averages followed by the same letter are not statistically different (Duncan, p= 0.05).

Table 4: Nitrogen in different soil layers on June 26, 2 weeks after harvest.

Object	kg Nmin/ha 0-30 cm	30-60 cm	60-90 cm	kg NO_3-N/ha 0-90 cm	Moisture content (%) 0-30 cm
No organic fertilisation	27 a	11 a	9 a	36 a	10,7 b
Mushroom manure	50 a	11 a	8 a	53 a	13,3 ab
Organic waste compost	69 a	18 a	12 a	82 a	14,3 a
Green compost	62 a	24 a	14 a	82 a	14,7 a
Farm manure	58 a	14 a	9 a	63 a	13,7 ab

Nitrate residue (0–90 cm) was also monitored to assess potential nitrate leaching. At the end of the crop cycle, all treatments remained at or below the Flemish target threshold, even for a nitrogen-demanding crop like lettuce. This indicates that the gradual release of nitrogen from compost can be compatible with low residual nitrate levels when fertilization is properly managed.

The long-term application of compost also translates into significantly higher yields compared to the plots without compost (Table 5). With a yield increase of more than 30%, red oak leaf lettuce responded spectacularly to these long-term organic matter applications. Previous trials have also shown that lettuce crops generally respond even more positively to organic fertilization than most other vegetables.

Table 5: Yield and quality sorting

Object	Production Gram/piece		Relative (%)	Quality sorting 27,5/100 kg (%)		30/100 kg (%)		35/100 kg (%)		45/100 kg (%)	
No organic fertilisation	326,7	b	100	16,7	a	50,0	a	33,3	a	0,0	a
Mushroom manure	460,9	a	141	0,0	a	0,0	a	16,7	a	83,3	a
Organic waste compost	476,0	a	146	0,0	a	0,0	a	33,3	a	70,0	a
Green compost	435,2	a	133	0,0	a	0,0	a	66,7	a	33,3	a
Farm manure	441,1	a	135	0,0	a	0,0	a	72,2	a	27,8	a

Averages followed by the same letter are not statistically different (Duncan, p= 0.05)

Conclusion

The results clearly demonstrate the cumulative effect of nutrient release from organic matter applied over multiple years. Treatments without organic fertilisation showed insufficient mineralization to support optimal production, while higher moisture levels and sustained nutrient availability in organically fertilised treatments contributed to increased yields. Previous studies confirm that leafy crops tend to respond even more strongly to organic fertilization than other vegetable crops. Moreover, the mineralization of organic matter allows substantial reductions in mineral

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fertilizer use. Accurately accounting for this nutrient release in fertilization planning is essential to achieve both optimal yields and acceptable nitrate residue levels.

Silage experiment

Beyond the compost trials, the CLOSECYCLE project also explores how residual streams from fruit vegetables such as tomatoes, peppers, and cucumbers can be sustainably transformed into compost. This compost can then be applied in horticulture to improve soil structure. Working with harvest residues from fruiting vegetables, however, poses a challenge: these materials are typically only available once or twice a year. Since composting all residues immediately is impractical and may cause logistical challenges, several exploratory trials have been initiated. These trials aim to identify effective methods for preserving and storing foliage over extended periods to ensure a consistent supply beyond the harvest season.

To preserve greenhouse foliage, we carried out a series of tests using shredded cucumber plants collected at the end of the cultivation cycle. After conducting several silage trials in June, July, and August, we explored an alternative preservation method: pressing the residues into bales, similar to hay bales (Figure 2). For this, we collaborated with three partners: De Ceuster, RKW Hyplast, and local contractor. De Ceuster, among other activities, provides contract work for greenhouse growers, while RKW Hyplast supplies silage materials and introduced several of their products for us to test. They also provided stretch film, which we used to tightly wrap the cucumber residues in bales. The main challenge in preserving greenhouse residues, particularly cucumber foliage, lies in their high moisture content, which makes compact bale pressing difficult. On the 12th of September, the cucumbers were harvested, but the plants remained in the greenhouse until the 17th of September to allow the growing mats to dry before disposal or reuse. This drying period also affected the moisture content of the cucumber foliage: at harvest it was still around 90%, but after five days it had dropped to 80%. Allowing the foliage to dry even longer could potentially improve conservation quality. These insights will guide our upcoming experiment in November, when larger amounts of pepper foliage will become available. The aim is to conserve this material more efficiently so it can later be used in composting in successive phases.

Figure 3: Wrapping the cumumber foliage in bales

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