Case study on cup-plant (*Silphium perfoliatum*) *as an ecofriendly perennial fodder crop*

Results of the second full growing season (2025):

Yield, value as fodder

Thomas Van Loo
Cluster Agro-environment

ondernemen in west-vlaanderen

inagro
ONDERZOEK & ADVIES IN LAND- & TUINBOUW

1. Index

2. Background of this case-study

A changing climate with more extreme events, the call for a more sustainable agriculture, the decline in available pesticides, the decline in pollinator numbers, the search to diversify crops both in terms of profit as well as in terms of increasing the robustness of the ecosystem services that are being provided, eutrophication of water due to the loss of fertilisers in the soil, …
The properties of cup-plant could provide an answer -or at least partially- to all of the abovementioned stresses in the agricultural landscape, making it a potentially valuable crop for the future.

Furthermore, the crop shows interesting properties towards reducing the amount of CO_2 in the atmosphere: the extensive root system builds up carbon level in the soil, whilst the perennial lifespan of the plant results in a lowered need for fossil fuels to annually prepare new seedbeds. Additionally, the addition of cup-plant in the diet of cattle might lower their production of methane (after CO_2 the 2nd most important greenhouse gas that is link to climate change).

A call for caution: there is still no sound consensus on the potential invasive behaviour of this plant in our region. Currently, the risk is perceived as low because the crop has been grown for multiple years already in our neighbouring countries without news of invasive behaviour, and it is said that the seeds have a low germination rate in our region if not pre-treated. Nevertheless, caution still is relevant.
Therefore, and because of the habitat (moist soils) in its original growing range (North-America) we advise **not to sow or plant the crop close to waterways or in whet soils**.

Despite that, cup-plant has many properties that might be interesting for the farmers as well as the environment, and previous research indicated that including the crop in the diet of cows could reduce methane production (Biomora-project). Furthermore, the crop already is commercially being used as a source of fibres to produce paper or packaging (see e.g. www.out-nature.de).

Because cup-plant shows so many promising properties, and because a previous pilot study pointed out the potential of the crop for animal feed, Inagro installed a -small- research field in 2023 to further look into this potential perennial crop.

2 Management strategies are implemented on the field:

1. 1 cut per year.
   The plants are harvested once per year at the end of august/beginning of September. This is about at the end of the flowering stage of the plants.
2. 2 cuts per year.
   The plants are harvested around June and Oktober.

After the first full growing season, a first report has been published detailing the preparation and installation of the crop, and reporting on yield and fodder value as well as biodiversity.
A summary of this report can be read (in Dutch) on this page at the website of Inagro.
The web-page includes a link to the more detailed report (in English).

The document that you are reading now reports on findings from that same field, but from 2025.

3. The field in 2025

3.1. WEED PRESSURE DEPENDS ON MOWING REGIME AND INTERROW DISTANCE

Looking at the field in winter, it becomes clear that both mowing regimes have a different impact on weed suppression. The part that is only mown once every year (in August/September, on the left side in the image below) has remained mostly bare after the cut at the end of August 2024, leaving more room for weeds to develop. The period after this cut usually still is ideal for mechanical weed control, but this has not been executed.

The difference in weed pressure between rows with different inter-row spacing is also remarkable: with a spacing of 70 cm the weed pressure is clearly much lower than with a spacing of 90 cm. Due to practical constraints, the distance between successive passes of the machinery when sowing was usually 90 cm instead of 70 cm.

Figure 1: difference in weed pressure (January 2025) between the 2 management strategies. 1 cut per year on the left hand side, and 2 cuts per year on the right hand side.

Similarly to 2024, the first new shoots from the perennial plants appeared from very early in the season already in February 2025, and by March new shoots are visible on all plant-clusters.

Figure 2: new shoots appear already in February, and by March all plant clusters are showing new shoots. (Picture above: 4/3/2025)

3.2. SEEDLINGS: THE POTENTIAL OF SPONTANEOUS GROWTH.

At the end of 2024, quite some new seedlings of cup-plant had been noticed in the part of the field that is only being mown once per year. As 2024 was the first flowering season of the crop, these seedlings must have emerged from seeds that had been produced earlier in 2024. Since in this management regime the crop only is harvested at the end of the flowering season, and wilting flowers are already producing mature seeds before the end of the flowering season, it is inevitable that quite some mature seeds fall down to the ground when harvesting when most flowers have wilted and produced ripened seeds (fig. 8).

Note that the crop is being harvested manually, which probably results in a larger portion of mature seeds that end up at the ground surface compared to harvesting with a normal harvesting machine such as those that are used to harvest maize.
In the early spring of 2025, these seedlings were no longer present, which suggests that the seedlings are not tolerant to the combination of cold and moist conditions or that they are not frost tolerant (repeated periods with light to medium frost over the course of winter 2024-2025: minimum registered temperature at 1,5m above the soil level = -3,5°C.).

By mid-April 2025, new cup-plant seedlings were noticed, but these had disappeared again by the time the crop was harvested. Most probably the seedlings lose the competition for light from the older plants. No seedlings were found in the 3m grass strip surrounding the crop.

Especially in situations where the vegetation is cut only once per year, the plants are able to set seed successfully. As a consequence, vigilance is required, particularly in the vicinity of watercourses and on moist soils.
A German study reported a high potential for seed-based spread of the species, although dispersal distances were still limited. Moreover, spontaneous establishment of the crop was documented in nearly all German federal states.

These observations indicate that the potential invasive character of the species deserves continued attention and should be taken into account when considering large-scale cultivation. **As a precautionary principle, it currently seems advisable to proceed cautiously when introducing the crop.**

3.3. FERTILISER

In contrast to 2024, fertiliser was applied in both management blocks on March 27th 2025:
150 kg nitrogen/hectare + 290 kg potassium/hectare, from a combination of "OPF" (10–0–5 NPK) + "Patentkali" (0–0–30 NPK + 15(S) – 10(Mg)).

However, the crop most probably has not been able to benefit from the fertiliser much, since the weather turned bone dry after the application (see graph on precipitation in annex). This resulted in the fertiliser grains not being diluted, and soil conditions that were not favouring the activity of soil life that is needed to turn the applied fertiliser from OPF into a form that can be used by the plants. After the first cut, the fertiliser pellets could still be found intact at the soil surface (see fig. 5).

So, the application of the fertiliser was unsuccessful in such a way that we doubt whether it would have had an effect on plant development.

3.4. SOIL ORGANIC CARBON

The engine of a healthy soil is soil organic carbon.
Any increase in carbon percentage leads to greater water holding capacity, which is important with respect to increasing drought problems, and promotes infiltration and drainage, which is important with respect to increasing flooding risks.

To invest in soil organic carbon is to improve the resilience and fertility of soils.

The cup-plant (Silphium perfoliatum) is studied with respect to it's potential to be used as a crop for livestock feed. But does it have a positive effect on soil organic carbon too?

3.4.1. Natural decomposition rate

The table below shows the modelled natural decomposition rate of soil organic carbon on the trial plot, based on the data from soil sampling in 2023.

Tabel 1: Natural decomposition rate of soil carbon on the experimental plot.
Values in the 0-30 layer are model-based and based on soil type, whereas values in the lower layers are estimated based on those models (the models themselves are developed for the 0-30 layer, and the decomposition rate in the lower layers probably is slower).

Soil profile (cm)	Mowed once (ton C/ha/year)	Mowed twice (ton C/ha/year)
0-30	1,49	1,49
30-60	0,66	0,66
60-90	0,20	0,20

3.4.2. Effect over the years

No animal manure was used in 2023 nor in 2024, and consequently there was no supply of carbon from this source. The plot was not treated with chemical fertilizer either. So, the field didn't receive carbon from an external source.
But as the crop is not harvested in the first year, all biomass (mainly leafy material) that was produced in 2023 fell to the ground after a frost spell in January 2024.

From the samples in February 2024 we see a stable to slightly increasing effect on soil organic carbon, compared to the situation in May 2023.
In May 2025 OPF was applied as a fertiliser at 1500 kg/ha. This is a fertilizer that is based on organic matter and thus contains carbon. The estimated amount that was applied with the opf-fertiliser in March 2025 is 625 kg C/ha, which is substantial but still much lower than the estimated natural decomposition of 1,5 ton of C /ha/year in the topsoil of the field.

Looking at the past three years, there has been no significant change in soil carbon: the differences in reported values remain within each other's error margins.
Further monitoring is needed to see whether this trend continues.

Tabel 2: Evolution of soil organic carbon (%C on dry soil) over multiple years, on the plot where the plants were mowed only once (values that are underlined are below the detection limit).

1 cut / year				
Soil layer (cm)	Soil sample May 2023 (%C)	Soil sample Febr 2024 (%C)	Soil sample Febr 2025 (%C)	Soil sample Febr 2026 (%C)
0-30	1,53	1,54	1,36	1,46
30-60	0,68	0,83	0,75	
60-90	<u>0,26</u>	<u>0,33</u>	<u>0,30</u>	

Tabel 3: Evolution of soil organic carbon (%C on dry soil) over multiple years, on the plot where the plants were mowed twice (values that are underlined are below the detection limit).

2 cuts / year				
Soil profile (cm)	Soil sample May 2023 (%C)	Soil sample Febr 2024 (%C)	Soil sample Febr 2025 (%C)	Soil sample Febr 2026 (%C)
0-30	1,53	1,54	1,35	1,43
30-60	0,68	0,65	1,02	
60-90	<u>0,26</u>	<u>0,31</u>	0,57	

3.5. WEATHER

The precipitation-cumulation curves of both 2024 and 2025 are presented in the graph in annex. The data on which that graph is based comes from a KMI-weather station that is very close by, at only 830m away from the field.

Starting in October and November 2023 with an extravagant amount of continuous rain, the growing season of 2024 was one with significantly more rain than in an average year. 2025 on the other hand was completely the opposite, accentuated by a very dry and hot spring, but followed by several other dry spells over a soil that had already been dried out completely in spring.

Even for a crop with roots going as deep as the roots of cup-plant, these dry conditions in combination with low nutrient availability in 2025 will most probably have had an impact on the plants growing behaviour: the plants grew well up to the first cut in june, but after that, many plants didn’t form new stems and only produced ground-leaves (see fig. 11 and 12 for the average number of stems per meter, and the average stem height at each cut).

3.6. DISEASE

From summer onwards, several stems across both parts of the field showed signs of dieback at the top of the stems. This was noticed in 2024 too. In an effort to find out what was causing this, plant tissue was investigated on pathogens at the lab of Inagro.

Several pathogens were isolated: mainly Phoma and Alternaria, as well as some Botritis and Fusarium, and secondarily Penicilium, Chladobotryum and Mucor.

The isolates of Phoma and Alternaria are being preserved in cryo-conservation at the lab of Inagro for future reference, if necessary.

Figure 3: Dieback of several stems in summer 2025

4. Yield, feed value and mineral composition

To assess fresh matter yield, 6 single rows of about 14m long are being harvested, shredded and weighed in each management block (the inner 2 rows of the 4 rows from the sowing machine).

A subsample from 3 of those samples then is collected and brought to the lab for further analysis. on feed value and mineral composition (analytical chemistry (not using the NIR-technique).
So, the lab-analysis is on fresh material, not on conserved biomass.
The results are shown in the tables in annex (annex 6.2 (fodder value) and 6.3 (mineral composition)).

A first observation is that the total dry matter yield is very similar between 2024 and 2025 despite the very different growing conditions in both years (2024 was very wet and 2025 was exceptionally dry from very early in the season), and despite the application of fertiliser in spring 2025 (the impact from the fertiliser should be nuanced as it has been unsuccessful, as described above):
Under a mowing scheme of 1 cut per year, total dry matter yield was 14.73 T/ha in 2024, compared to 13.13 T/ha in 2025. Total dry matter yield of the field with 2 cuts per year was 16.8 T/ha in 2024, compared to 16.21 T/ha in 2025.
So, the dry matter yield of 2 cuts is clearly higher in both years.

An extra added benefit of harvesting multiple times per year concerns the hypothesized potential invasive behaviour of the plant:
harvesting only once per year results in many seeds that mature on the plant and thus can fall to the ground. Whereas when the crop is harvested 2x per year, no seeds mature at the 1st harvest, and not as many seeds mature by the time 2nd harvest is at hand.
Furthermore, overall weed pressure is lower when cutting 2 times per years since the soil is covered until harvest in October, whereas it is left bare in case of 1 cut/year after the harvest in August/September.

Considering the reported VEM-values which are often used as a value that summarises fodder value: "Crude ash" has a negative impact on the calculated "VEM" value, which might give misleading results for cup-plant since mineral loads are included in "crude ash", and some elements are present in rather high amounts in cup-plant (e.g. Potassium and Calcium).
So, the VEM-value that is being presented in the tables will most probably be a bit higher in reality.

Furthermore, we have been harvesting the crop manually, which results in the plants falling to the ground after being cut and then being gathered and shredded. We expect that more soil particles are collected this way compared to a mechanical harvest where the plants are cut, gathered and shredded in one pass without the plants touching the ground. This impact will be more pronounced under humid harvesting conditions such as the cut on 11/6/2024.
Additionally, since for some reason many plants produced mainly ground leaves after the first cut in 2025, the mowed material consisted of many loose leaves which had to be harrowed manually to be able to collect the harvest. This harrowing will most certainly have introduced more soil particles in the samples. Additionally, leaves that are close to the soil will catch more splattering soil-particles under heavy rain events. This can clearly be seen from the tables in annex: "crude ash" per kg DM is about 100 units higher from the harvest in October 2025 compared to all other crude ash values, and some mineral components exceed levels that can be expected (e.g. Cobalt and Iron).

Overall, the potential of the crop as fodder for cattle is low when it is cut only once per year. When the crop is harvested 2x each year, the potential is higher, mainly because the quality from the first cut is higher.
The field will be fertilized using cattle slurry in 2026, which most probably will have a positive impact.

The high levels of Calcium and Potassium indicate that the fodder shouldn't be included in large quantities in the rations of non-lactating cows. 10% Should probably be fine. It's also suitable to include in the ration of young animals.
The overall mineral profile is suitable for dairy cows (but take the above into account). But the value of the feed is not optimal. Energy comes mainly from the high sugar content and NDF (the crop is high in fiber, but a lot of it is digestible fiber NDF and ADL).

Another point of attention is the low %DM at harvest considering the preservation of the harvest (silage). Ideally this should be around or above 30%.
Furthermore, the high sugar content might result in a higher potential for aerobic spoilage ('broei') when the silage is opened again after the fermentation phase is completed.

Figure 4: View on the field at the first cut in june 2025 (part of the field with 2 cuts/year). The plants look vital.

Figure 5: granules of the fertiliser that was applied in March 2025 were still visible on the soil in the beginning of July 2025.

Figure 6: mid-July a shallow pass with a cultivator (spring-tooth) effectively killed the weeds that were present and opened up the topsoil.

Figure 7: View on the field at harvest in September 2025 (part of the field with 1 cut/year).

Figure 8: Seeds that fall down and remain at the field after the harvest at the part of the field with only 1 cut/year.

Figure 9: View on the field at the second cut in October 2025 (part of the field with 2 cuts per year). Note that stems remained rather short and many plants didn't produce stems at all (only ground leaves).

Figure 10: Shredded stems, from the harvest in June 2025.

Figures 11 and 12 show some properties of the growing behaviour of the plants in 2024 and 2025.

Figure 11 shows the average number of stems in a row, per meter.
On the one hand, the figure learns that we have about 25 stems per meter in both management blocks, with slightly more stems per meter in the part with 1 cut/year although this has not been assessed using further statistical analysis. On the other hand, it is clear that there is a drastic drop in the number of stems per meter at the second cut of the part of the field with 2 cuts/year. Many plants only produced new leaves at ground level and no flowering stems. Sadly we lack the count-data, but this is not something that was observed in 2024.

Figure 12 shows that the stems that were harvested at the second cut in 2025 were much shorter as well compared to normal stem lengths: only 85cm against about 2m in 2024.
In general, stem length was lower in 2025 than 2024.

Despite these pronounced morphological differences between different cuts, the overall dry biomass yearly yield between both years is quite similar (even more so for the part of the field with 2 cuts/year).

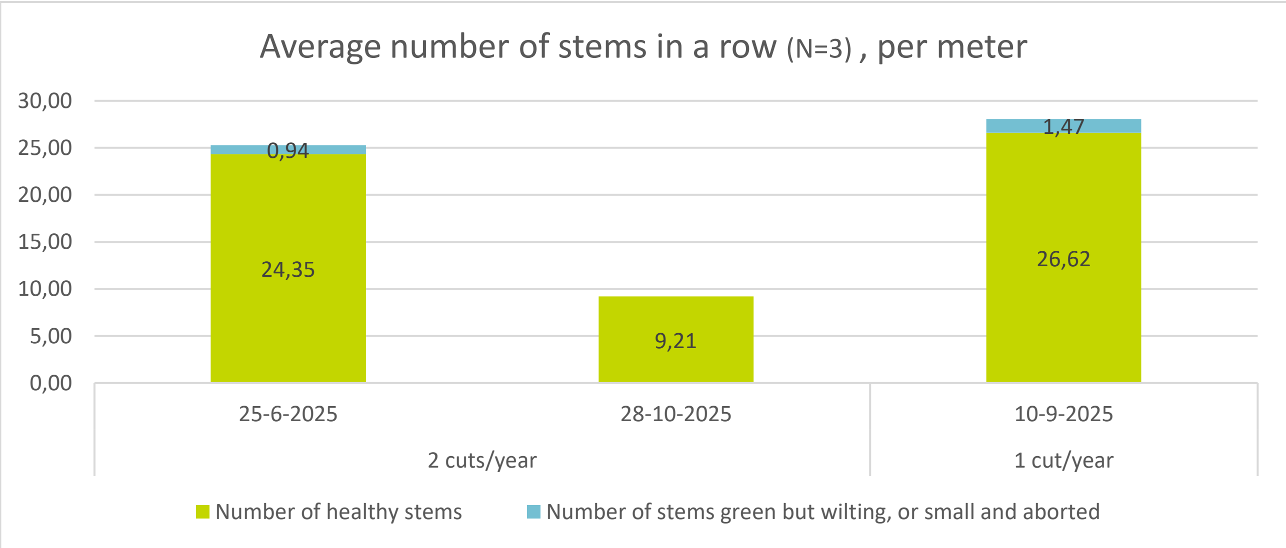


Figure 11: Number of stems per meter at each harvest. Data from 2024 are lacking. "Stems" = the stem that grows upwards and ultimately bears the flowers and the seeds.

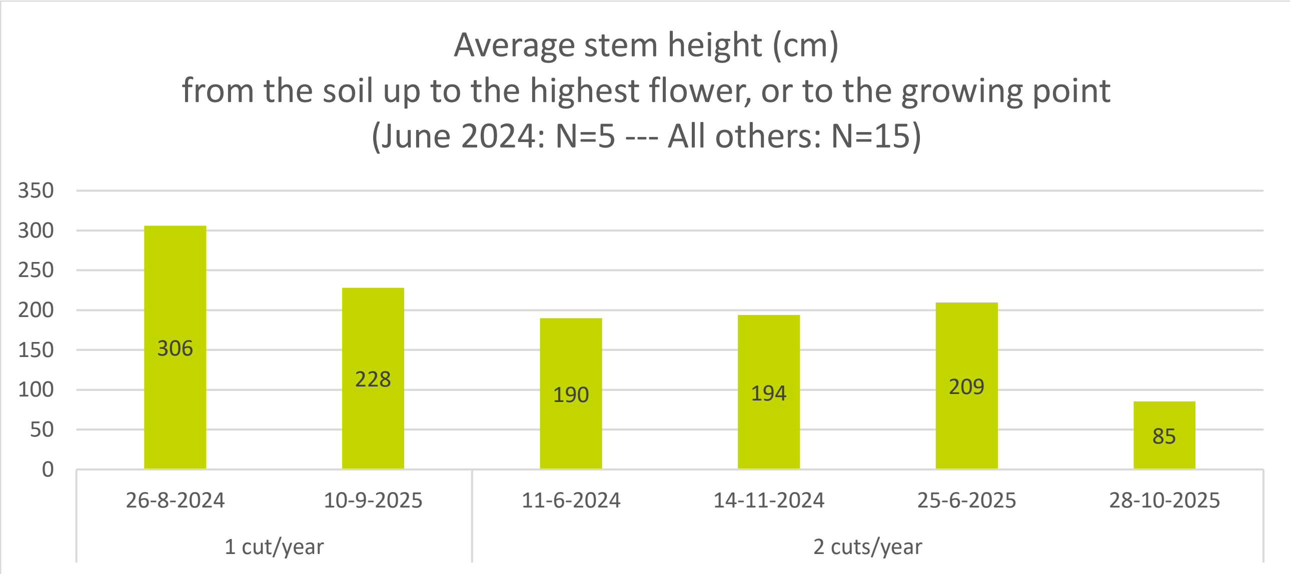


Figure 12: Average stem length of cup plant stems, at harvested.

5. Biodiversity

5.1. FLOWERING SEASON

The flowering phenology of the crop followed the same pattern in 2025 as in 2024, but flowering started about 2 weeks earlier in 2025.

Both management regimes combined on the same field result in about 3 to even 4 months of continuous flower availability, spanning the summer months (see fig 13).
But even on their own, both management regimes provide flower resources over an extended period of time: if the crop is cut only once per year, then it provides flowers from the end of june/beginning of July op until the beginning of September (or until the crop is cut). If the crop is cut twice per year, then the start of the flowering season is postponed until the end of August and lasts until mid-October (or until the crop is cut).

This period is a crucial period for many pollinator species, as it generally is a period with a strongly reduced flower availability in the landscape.

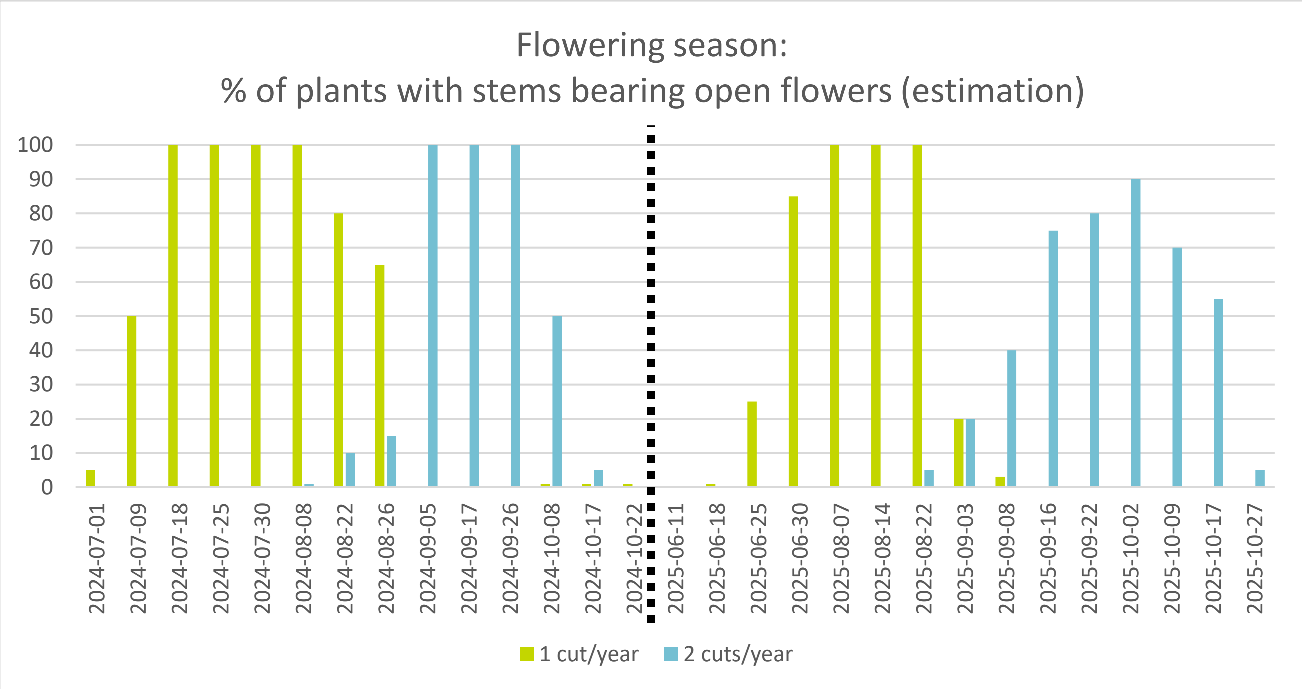


Figure 13: Flowering phenology of the crop.

5.2. POLINATORS

During the 2024 monitoring campaign, pollinators were monitored either by counting the maximum number of pollinators per species that were present in a quadrant during 15 minutes (1 count per observation round), or by counting the maximum number of pollinators per species in a quadrant during 1 minute, but replicated 10 times per observation round.
In 2025, all observations have been made using the "10 x 1 minute" approach.

The results from these 2 methods of observations have been converted into "maximum number of individuals per species per m², per minute", which are the numbers that have been used for the graph.

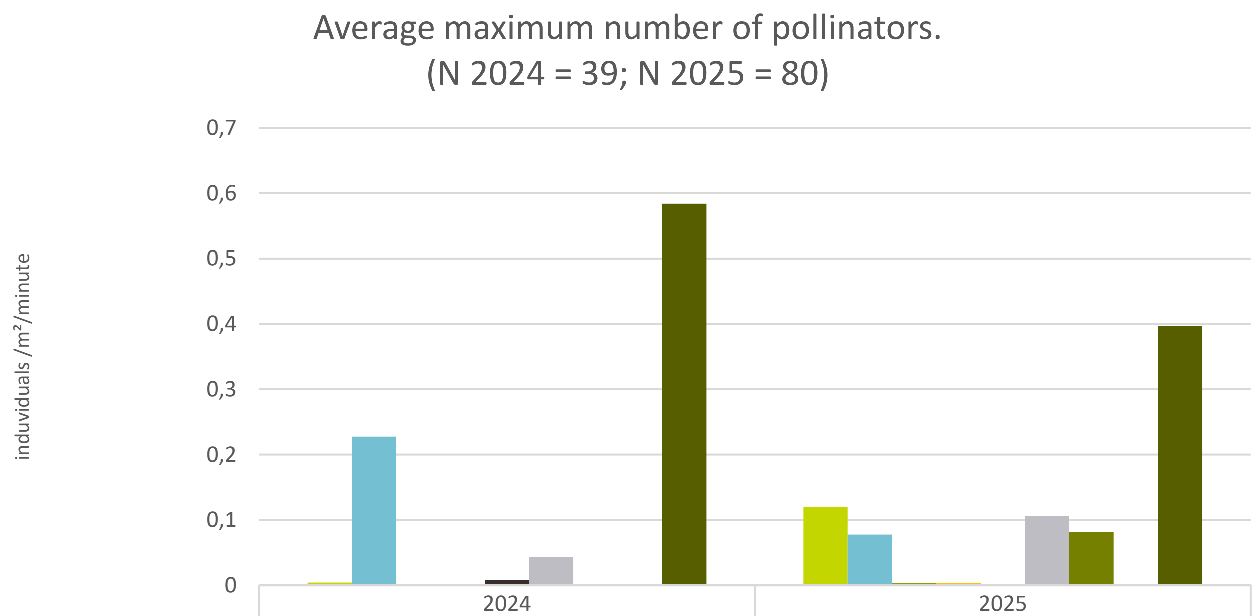
As in 2024, hoverflies are the most observed group of flower visitors in 2025.
Hoverflies were counted as a group, and were not identified to species during the observations. At the end of each round of observations, an extra transect was done to identify what species of hoverflies were present. In 2025, nearly all observed hoverflies in both years were *Eristalis tenax* specimen, supplemented with some *Episyrphus balteatus*. A couple of other species have been observed in very low numbers, but since it was not possible to capture them, it was not possible to identify these specimen.
In 2024 some other species were identified as well (see the report of cropyear 2024).

As mentioned in the report on the situation in 2024, pollinator numbers were generally low in 2024, and this was observed across multiple countries in the area. The decline was very pronounced for the generalist species *B. lapidarius*.
In 2025, a gentle recovery of *B. lapidarius* was reported, and this can be seen from the observations in cup-plant as well.
The *B. terrestris* complex too was observed in higher numbers in 2025 compared to 2024.
In contrast, only about half of the number of *B. pascuorum* individuals were observed in 2025 compared to 2024 whilst this species too was reported to have had a bad year in 2024.

An anecdotical observation worth mentioning: during the summer of 2025, *Vespa velutina* was seen hunting insects in the crop, and whenever individuals of these species were present, pollinator activity was very low. It looked as if the pollinators recognised this species and stayed away from the flowers in the crop when *V. velutina* was seen patrolling in the crop.

Next to bees and hoverflies, butterflies were often present on the flowers of cup plant: mainly *Aglais io*, *Pieris sp.*, and *Vanessa Atalanta*.

All of the observed species of pollinators are common species that act as pollinators of many crops as well as wild plants in the agricultural landscape. The absence of more "special" pollinator species might rather be because these species are not abundantly present in the landscape, instead of the crop being "useless" for these species.



	2024	2025
B. terrestris-complex	0,004355164	0,120311394
B. pascuorum	0,227436321	0,077848549
Megachilidae sp.	0	0,00353857
B. hypnorum	0	0,00353857
Bombus sp.	0,007258606	0
Apis melifera	0,043551636	0,106157113
B. lapidarius	0,001451721	0,08138712
B. pratorum	0,000967814	0
Syrphidae sp.	0,584075828	0,396319887

Figure 14: Average maximum number of pollinators (bees and hoverflies) observed per m² and per minute, visiting the flowers of cup-plant (averaged over multiple weeks of observations across the flowering season of both management regimes, generally with multiple observations per week following the "10 x 1 minute" approach (more so in 2025 than 2024).)

5.3. EARTHWORMS

The number of earthworms that was counted in November 2025 was in line with what we found in 2023 and 2024 at the field. Looking at the averages there seems to be a tendency towards an increase in numbers in 2025, but statistical analysis (Anova + Tukey) shows no significant differences between any of the groups at $p<0,05$ nor at $p<0,01$.

Soil temperature at 22-11-2024 was 3,8°C and at 18/11/2025 it was 7°C.
The soil moisture content in 2025 was 17.09% in the part of the field that is only cut 1x per year, and 17.55% in the part of the field that is harvested 2x per year.

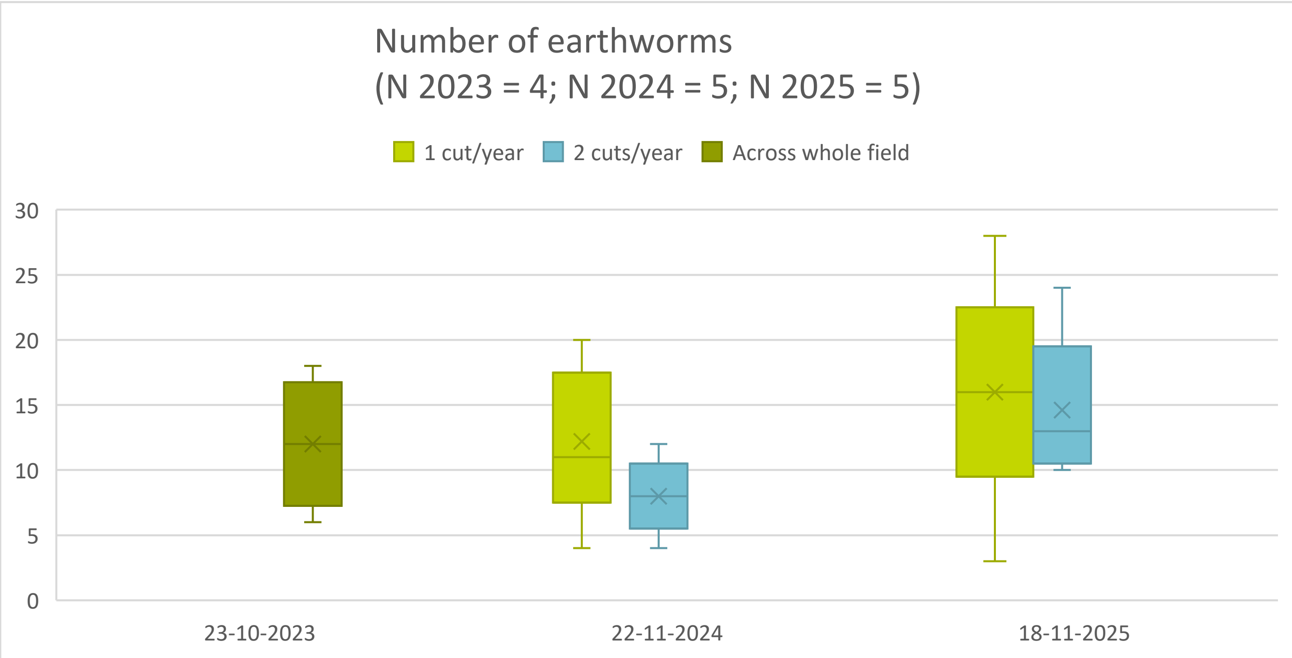


Figure 15: Number of earthworms extracted from a 20x20x20cm block of soil, in both parts of the field.

5.4. MOTHS (LED-BUCKETS)

In 2025 the presence of moths was monitored using LED-buckets. This was done on the field with *Silphium perfoliatum* as well as on several other locations close by (see annex 6.4 for an aerial view over the sampling locations). Traps were installed about 2 times each month for 1 night, from mid-April up to the end of September. Trapped species were identified using "ObsIdentify".

The graphs below show the results.
Generally speaking, the biodiversity at the field with *S. perfoliatum* ("FiZkr") outperforms other cropped fields with non-flowering crops ("FiNBA", "Fi9Tr10,5", and "FiRef"), but remains lower than the sampling location in the perennial flowers strip – mixed hedge combination ("Fs-HeW" (even whilst 'Fs' was bare ground across 2025), which is expected.

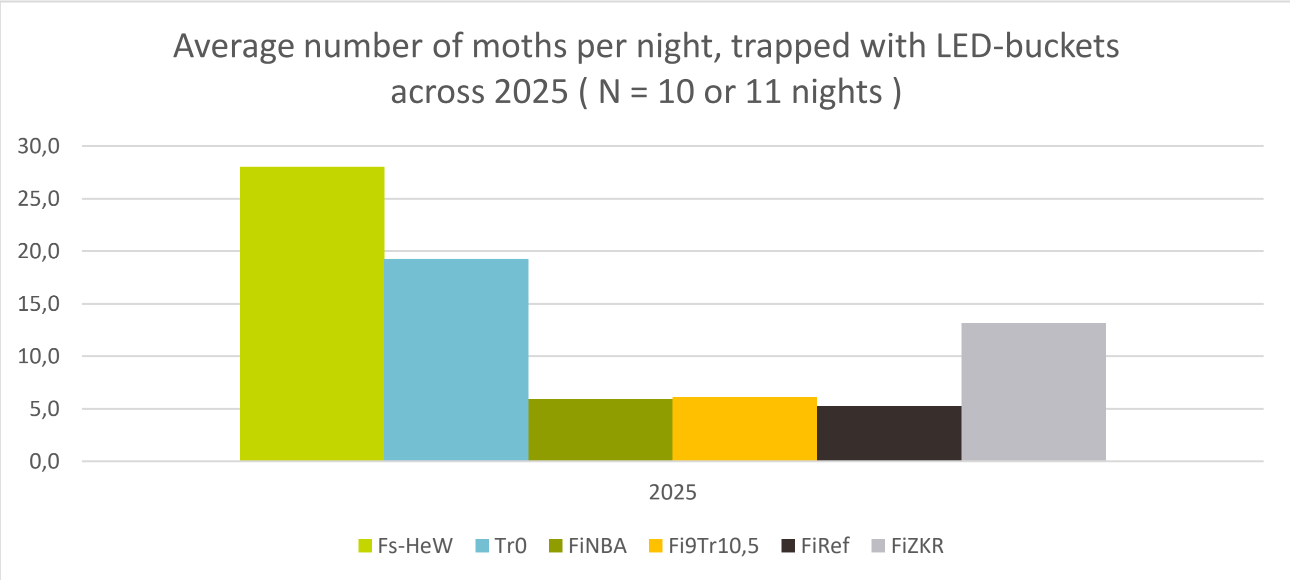


Figure 16: Average number of moths per night.
(Fs-HeW = Perenial flowerstrip (bare in 2025) along a mixed hedge; Tr0 = the grassy treestrip at the agroforestry field, FiNBA = the cropfield (celeriac in 2025) at the field "Nature Inclusive Farming"; Fi9Tr10,5 = the middle of the cropstrip (temporary rye-grass) at the agroforestry field; FiRef = the reference cropfield (wheat followed by stubble after the harvest in July); FiZkr = the cropfield with cup-plant).

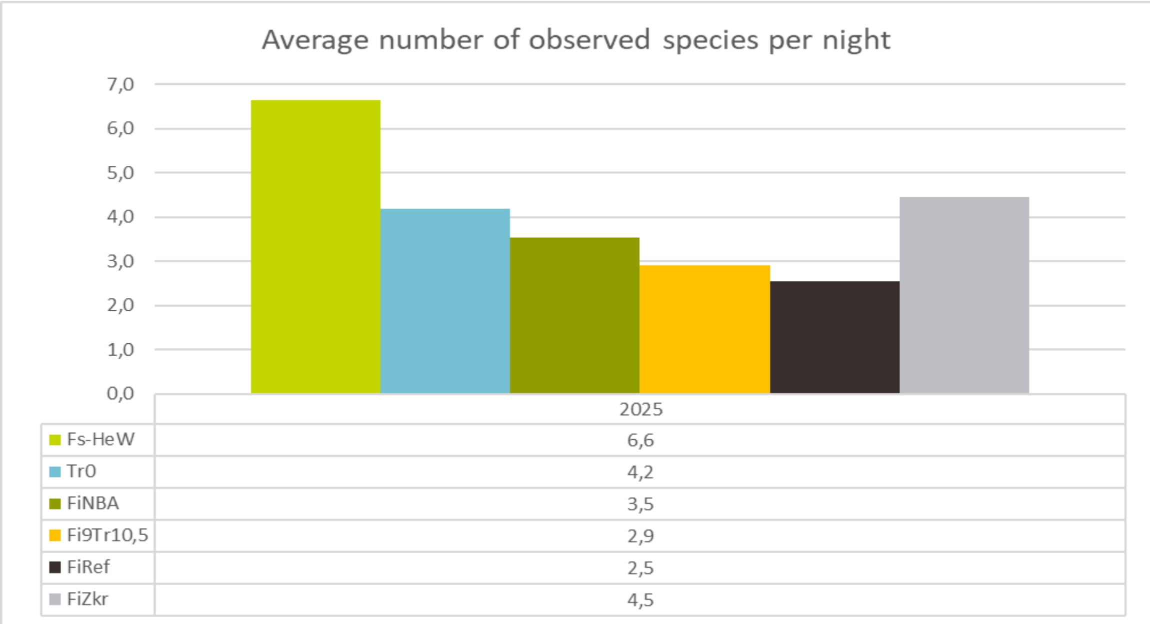


Figure 17: Average number of observed species per night in 2025 (total number of species / number of sampled nights).
(Fs-HeW = Perenial flowerstrip (bare in 2025) along a mixed hedge; Tr0 = the grassy treestrip at the agroforestry field, FiNBA = the cropfield (celeriac in 2025) at the field "Nature Inclusive Farming"; Fi9Tr10,5 = the middle of the cropstrip (temporary rye-grass) at the agroforestry field; FiRef = the reference cropfield (wheat followed by stubble after the harvest in July); FiZkr = the cropfield with cup-plant).

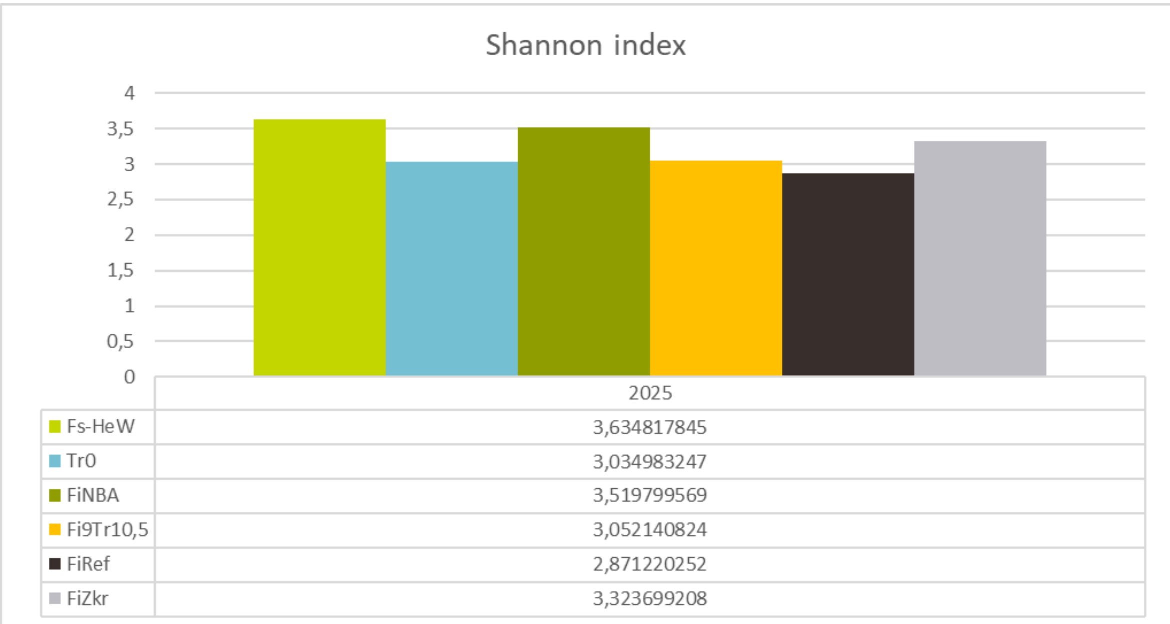


Figure 18: Shannon index from the different sampling locations.
(Fs-HeW = Perenial flowerstrip (bare in 2025) along a mixed hedge; Tr0 = the grassy treestrip at the agroforestry field, FiNBA = the cropfield (celeriac in 2025) at the field "Nature Inclusive Farming"; Fi9Tr10,5 = the middle of the cropstrip (temporary rye-grass) at the agroforestry field; FiRef = the reference cropfield (wheat followed by stubble after the harvest in July); FiZkr = the cropfield with cup-plant).

6. Conclusions

- Weed pressure in the part of the field that is being cut only once each year seems to be higher (no soil coverage after the cut in August/September).
  Furthermore many seedlings of the crop emerge between the rows, but they don’t survive the winter. Seedlings that emerge in spring most probably are overgrown and lose the competition for light from the older plants.

- Soil organic carbon seems to remain stable even without an external carbon source.
  This should however be investigated on the longer term, and using a statistically robust design (with replicated samples) to cope with variability. Yet, this goes beyond the scope of this pilot.

- Despite the sharp contrast in growing conditions between 2024 and 2025, the dry matter yield was rather stable between both years, with a yield between 16 and 17 T DM / ha / year when the crop is being cut 2x per year.
  (Note that in 2023 and 2024 the crop didn’t receive any fertiliser, and that the fertiliser application in 2025 most probably wasn’t effective since the OPF granules were still present on the soil surface at harvest.)

- The management regime with only 1 cut per year results in fodder of low quality for dairy cows.
  The fodder that is produced under a regime with 2 cuts per year results in a better quality, especially the first cut, but still on the lower side of the spectrum, with energy mainly coming from the high sugar content together with NDF and ADF.
  The mineral profile is suitable for dairy cows, although it signals caution for non-lactating cows because of the high levels of K and Ca. Inclusion of about 10% in the ration still should be fine. For young cows this is not an issue. It also is suitable as fodder for beef cattle when they are in between the nursing of calves, but the energy content is too low to be used as fodder when fattening before being slaughtered.
  The true VEM-value will most probably be higher than those that are reported, since the ash content in our samples is high, which has a negative impact on the VEM-value. The ash content most probably is higher than it should be because the crop is being harvested manually with the stems falling to the ground. The high levels of some minerals too will contribute to the high ash content.

- Preservation of the harvest might prove to be a challenge since it is very whet at harvest. And although sugar is needed to be able to ensilage harvested biomass, the sugar content might be so high that it could still be present in large quantities when opening silage after the fermentation process, resulting in a higher risk of aerobic spoilage upon opening.

- Both management regimes combined on the same field result in about 3 to even 4 months of continuous flower availability, spanning the summer months.
  Even on their own both management regimes provide flower resources over an extended period of time in a period where flower availability generally is lowered in the landscape: if the crop is cut only once per year, then it provides flowers from the end of june/beginning of July op until the beginning of September (or until the crop is cut). If the crop is cut twice per year, then the start of the flowering season is postponed until the end of August and lasts until mid-October (or until the crop is cut).
  This flowering phenology makes the crop very interesting for flower-visiting insects.

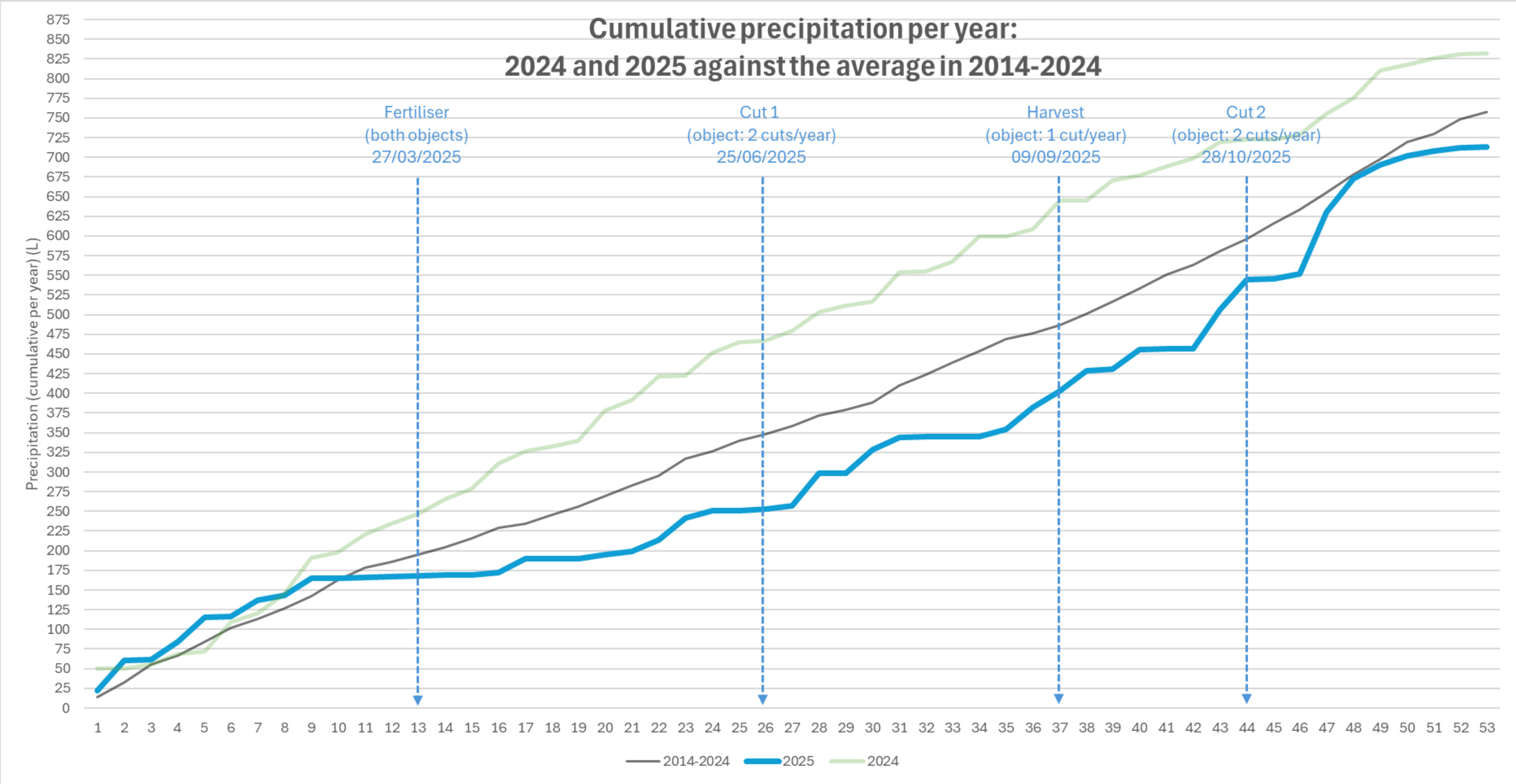
- In 2024 hoverflies were more abundant than bees (2024 was a bad year for bees), but in 2025 both groups were seen in about equal numbers. Observed bees belong to the common generalist species of bumblebees as well as honeybee. It is not known whether this is because more rare species and solitary bee species are not attracted to the flowers, or this is because those species are not (or only scarcely) present in the surrounding landscape.
  A couple of common species of butterflies were observed too.

- Earth worm densities are stable across years, although the image is not clear since there is quite a lot of variability among samples (no statistically significant differences).

- Monitoring with LED-buckets in 2025 shows that the crop has value to support moth diversity when compared: the results from monitoring the crop nest themselves in between those found at the positive reference (a mixed hedge) and the other cropped fields (non-flowering crops).

Interreg
Cofinancé par l'Union Européenne
Medegefinancierd door de Europese Unie
France - Wallonie - Vlaanderen
AgriClimate

6.1. ANNEX 1: PRECIPITATION



6.2. ANNEX 2: FODDER VALUE (G/KG DM)

analytical chemistry (not using the NIR-technique).

2024: no fertiliser; 2025 ineffective fertiliser (granules still visible at harvest).

N=3	2024				2025			
	1 cut/year	2 cuts/year			1 cut/year	2 cuts/year		
	28-8-2024	11-6-2024	14-11-2024	sum 2 cuts/year	9-9-2025	25-6-2025	28-10-2025	sum 2 cuts/year
Fresh weight (T/ha)	64,81	94,06	28,63	122,69	46,87	70,31	14,33	84,64
Dry matter (T/ha)	14,73	10,81	6,00	16,80	13,13	12,94	3,27	16,21
%DM	22,73	11,57	21,00	/	28,03	18,37	23,03	/
VEM g/kg DM	582,67	808,00	535,67	/	647,33	757,33	690,33	/
DVE g/kg DM	18,00	54,00	13,67	/	28,00	49,67	33,00	/
OEB g/kg DM	-38,33	-38,67	-26,33	/	-33,67	-35,33	-30,33	/
VEVI g/kg DM	537,33	832,33	482,33	/	621,00	763,67	709,00	/
VOS g/kg DM	489,67	646,67	452,00	/	527,67	619,33	540,00	/
FOS g/kg DM	443,67	594,67	402,33	/	476,67	575,67	493,33	/
SW g/kg DM	3,00	2,50	3,20	/	2,47	2,50	1,53	/
Crude protein g/kg DM	46,00	83,00	55,67	/	62,00	83,33	71,67	/
Crude cellwall g/kg DM	342,33	274,67	360,67	/	287,00	288,33	194,00	/
Crude ash g/kg DM	129,33	152,67	154,33	/	139,67	141,33	268,67	/
VCOS T&T g/kg DM	56,23	76,30	53,43	/	61,33	72,13	73,83	/
Sugar g/kg DM	98,67	115,67	23,67	/	86,00	97,00	75,00	/
Starch g/kg DM		39,67	-	/	10,33	10,33	10,00	/
Crude fat g/kg DM		18,33	-	/	29,33	15,00	21,67	/
NDF g/kg DM		-	-	/	466,67	432,67	266,33	/
ADF g/kg DM		-	-	/	400,00	364,33	246,67	/
ADL g/kg DM		-	-	/	46,33	29,00	25,33	/

6.3. ANNEX 3: MINERAL COMPOSITION

analytical chemistry (not using the NIR-technique).

2024: no fertiliser; 2025 ineffective fertiliser (granules still visible at harvest).

N=3	2024				2025			
	1 cut/year	2 cuts/year			1 cut/year	2 cuts/year		
	28-8-2024	11-6-2024	14-11-2024	sum 2 cuts/year	9-9-2025	25-6-2025	28-10-2025	sum 2 cuts/year
Fresh weight (T/ha)	64,81	94,06	28,63	122,69	46,87	70,31	14,33	84,64
Dry matter (T/ha)	14,73	10,81	6,00	16,80	13,13	12,94	3,27	16,21
%DM	22,73	11,57	21,00	/	28,03	18,37	23,03	/
Natrium (g/kg)		<	<	/	<	<	0,23	/
Potassium (g/kg)		46,47	-	/	27,20	38,07	16,03	/
Magnesium (g/kg)		2,40	-	/	4,03	3,47	6,30	/
Calcium (g/kg)		16,93	-	/	28,10	19,90	36,73	/
Phosphorus (g/kg)		3,43	-	/	2,53	2,87	3,87	/
Manganese (mg/kg)		21,00	-	/	38,33	35,67	90,33	/
Zinc (mg/kg)		24,67	-	/	24,33	29,00	34,67	/
Iron (mg/kg)		380,67	-	/	249,00	193,33	1995,33	/
Copper (mg/kg)		6,33	-	/	8,43	8,83	15,60	/
Cobalt (µg/kg)		126,00	-	/	490,33	217,33	1183,33	/
Selenium (µg/kg)		39,67	-	/	57,67	59,33	169,33	/
Sulphur (g/kg)		0,97	-	/	0,97	1,27	1,33	/
Molybdenum (mg/kg)		0,60	-	/	0,40	0,40	0,37	/
Borium (mg/kg)		28,23	-	/	31,40	34,33	60,60	/

6.4. ANNEX 4: OVERVIEW OVER THE MOTH-SAMPLING LOCATIONS

- Fs-HeW = Perenial flowerstrip (bare in 2025) along a mixed hedge at the field "nature inclusive farming";
- Tr0 = the grassy treestrip at the agroforestry field,
- FiNBA = the cropfield (celeriac in 2025) at the field "nature inclusive farming";
- Fi9Tr10,5 = the middle of the cropstrip (temporary rye-grass) at the agroforestry field;
- FiRef = the reference cropfield (wheat followed by stubble after the harvest in July);
- FiZkr = the cropfield with cup-plant).