

# A prospection of the properties of Cup-plant (*Silphium perfoliatum*) as a fodder crop

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## 1. Samenvatting

Zonnekroon is een meerjarige plant die potentieel een interessant landbougewas kan zijn. Het is een overblijvend gewas dat 20 jaar productief kan blijven zonder de grond te hoeven bewerken. Bovendien is het een zeer hoge plant, die meer dan 3 m hoog kan worden en dus veel biomassa produceert. Zijn vermogen om droogte te weerstaan dankzij zijn wortels die meer dan 2 m diep gaan, in combinatie met zijn vermogen om overstromingen te weerstaan voor meerdere dagen in de winter, maken het een aantrekkelijk gewas in het licht van de huidige veranderende weerspartronen als gevolg van klimaatverandering. Daarnaast kunnen de diepe wortels voedingsstoffen recupereren die anders te diep in de grond zouden weggelekt zijn. Bovendien produceren de planten veel bloemen, die zeer aantrekkelijk zijn voor vele nuttige insecten zoals zweefvliegen (natuurlijke vijanden) en bijen (bestuivers). De planten bloeien vrij laat in de zomer, in een periode waarin er weinig andere planten nectar produceren. Het bloei-eigenschappen van de plant zijn dus extra interessant, evenals de directe gewasopbrengst. Aanvullende voordelen worden in het voorwoord van het verslag besproken.

De belangstelling voor het gewas richt zich momenteel vooral op het gebruik als energiegewas. De huidige studie onderzoekt echter het potentieel van het gewas om als veevoeder gebruikt te worden, nadat de plant tot bloei is kunnen komen.

De belangrijkste conclusie van deze studie is dat het gewas, wanneer het aan het eind van zijn bloeiperiode wordt geoogst, inderdaad veelbelovende voedereigenschappen vertoont, hoewel het aangevuld moet worden met andere producten die minder structuurrijk zijn. Het eiwitgehalte lijkt sterk te variëren, maar hangt waarschijnlijk samen met de vruchtbaarheid van de bodem en de mate van uitdroging van de planten. De planten bevatten veel suiker, dus het product zal waarschijnlijk smakelijk zijn, en het zal waarschijnlijk kunnen worden ingekuild.

Sommige sporelementen en mineralen zijn duidelijk verhoogd in zonnekroon: Calcium bijvoorbeeld is ongeveer in 10 keer hogere hoeveelheden aanwezig dan in maïs.

De resultaten van planten die al ongeveer 10 jaar oud zijn, doen niet onder voor de jongere planten.

De aantrekkelijkheid voor bestuivers werd onderzocht op 1 locatie, maar door onvoorzien omstandigheden slechts op een handvol planten.

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## 2. Summary

Cup-plant is a perennial plant which shows potential to be an interesting crop. It is a perennial crop that can stay productive for 20 years with no need to work the soil. Furthermore, it is a very tall plant, reaching over 3m tall, that produces a lot of biomass. Its capacity to withstand drought due to its roots that dig over 2m in to the ground in combination with its capacity to withstand flooding for multiple days in winter make it a very flexible crop under the currently changing weather conditions due to climate change. Moreover, the deep roots make it possible to recover nutrients that might otherwise have leaked away too deep into the soil. Additionally, the plants produce a lot of flowers, which are very attractive to many beneficial insects like hoverflies (natural enemies) and bees (pollinators). The flowers are being produced rather late in summer, during a period in which few other plants are producing nectar. The flowering profile of the plant thus is of much interest, as well as the direct yield of the plant as a crop. Additional benefits are discussed in the preface of the report.

The main interest in the crop currently is focussing on its usage as an energy-crop, for methanization.

The current study however explores the potential of the crop to be used as fodder, after allowing the plant to flower.

The main conclusion of this study is that the crop, when harvested at the end of its flowering period, indeed shows promising properties, although it should be supplemented with other products which are less structure rich. Protein levels seem to vary a lot, but probably correlate with soil fertility, and the level of desiccation of the plants. The plants had a lot of sugar, so the product will probably be palatable, and it will probably be possible to ensilage the product.

Some trace elements and minerals are clearly elevated in cup-plants. Calcium for instance is about 10 times more abundant than in corn, which is of much interest for dairy cattle. Results from plants that already are about 10 years old are not performing less than the younger plants.

Attractiveness for pollinators was investigated on 1 location, but only on a handful of plants due to unforeseen circumstances.

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### 3. Inhoudsopgave

1. SAMENVATTING	2
2. SUMMARY	3
3. INHOUDSOPGAVE	4
4. PREFACE	5
5. MATERIALS AND METHODS	6
5.1. Herent	6
5.2. Oud-Turnhout	7
5.3. Rumbeke (Inagro)	7
5.4. Sart-à-Rèves	8
5.5. Zwalm	8
6. RESULTS	9
6.1. Calculated parameters	9
6.2. Measured parameters	11
6.3. Minerals and trace elements	13
6.5. Nutritional value, minerals and trace elements, in different parts of the plant	16
6.6. Attractiveness to pollinators	18
7. DISCUSSION	19
7.1. Calculated parameters	19
7.2. Measured parameters	19
7.3. Minerals and trace elements	20
7.4. Different plant parts	20
7.5. Age of the plants	20
7.6. Attractiveness to pollinators	20
8. CONCLUSION	21
9. BIBLIOGRAPHY	22
10. ADDENDUM: RESULTS PER SAMPLING LOCATION	23

## 4. Preface

Diversification of agroecosystems is one of the methods that is being proposed to enhance the performance and robustness of ecosystem services. Cup-plant (*Silphium perfoliatum*) could be a valuable crop in the search for a such more sustainable agriculture.

Furthermore, it is a crop that produces flowers that attract many insects, and thus could support the ecosystem services such as pollination and pest control in the agricultural landscape.

Cup-plant is a perennial plant that can grow over 3m tall, with multiple stems originating from the same plant, and thus the plant can produce a lot of biomass. It has an extensive and deep rooting rootstock with roots reaching over 2m down into the soil (Schoo et al., 2017), resulting in a crop that is rather draught-tolerant during summer (Gansberger et al., 2015).

During winter, the stems die off and during that time, it is said that the plant is tolerant to being submerged by floods for multiple days: in its native distribution in northern part of North-America, the plant grows on floodplains (Stanford Geoffrey, 1990).

The leaves are opposite and fused together at the base, forming a cup, hence the name.

Compared to corn, cup plant is said to have numerous advantages, both ecologically and economically: No need for herbicides after the first growth-year (weeds can also be managed mechanically), reduced costs on tillage (no tillage needed after the installation), improved soil quality by accumulation of organic matter and increased presence of soil organisms, reduced compaction of the soil, the root system can capture nutrients from deep in the soil preventing those nutrients from ending up in ground water, the permanent character of the crop protects the soil from erosion, no need to buy seeds every year because the crop can be harvested up to 20 years, draught-tolerant, tolerates wet (or even sporadically submerged) soils during winter, resistant to disease and herbivory.

Furthermore, growing multiple crops spreads the risks from years with unfavorable growing conditions for corn (e.g. cold spring, dry summer) (*Silphium Perfoliatum Innovative Energy Crop from Donau-Silphie | Biogas-Consult, n.d.*).

In a study which currently is taking place in Belgium ("Klimaatrobuste ruwvoederproductie", funded by CCBT), the methane reducing capacity of cup-plant as a fodder crop is being assessed.

Because of the ecological properties of the plant, caution is being advised since many properties co-align with those from invasive alien plant species. Seeds of the cup-plant however have a poor germination success in our region, which most probably limits the invasive potential strongly.

A review article that investigated the use and yield of the crop from 121 scientific papers found an average dry matter yield of 13,3 tons/ha, with a range from 2 to 32 tons/ha (Peni et al., 2020). The study refers to another study where the yield was measured in 6 subsequent years, which found that the yield increased while the crop gets older.

Although the crop is being promoted as a fodder crop, not many studies are available that look into the actual properties of the crop for feed.

In this study, data has been collected on the nutritional value of cup-plant in Belgium.

## 5. Materials and methods

Samples have been collected from 5 fields in Belgium, on august 24<sup>th</sup> 2022, from fields that are only harvested once per year at the end of summer.

In each field 3 types of samples were collected, in 3 replicates: whole plants, flower- /seed heads, and stems.

Samples were shredded on site, and stored in a refrigerated box.

Below follows a list of the sampling locations, with some background information

Pollinators were sampled by observing flowering plants for 5 minutes per week. Only a couple of plants at the border of the strip reached the flowering stage (mismanagement because of a flow in communication). Thus, it was not possible to delineate a certain, fixed area in which to count bees. Observations come from about 5 plants that reached the flowering stage, but were situated some distance from one another.

### 5.1. HERENT

- Seed supplier
  - Vaste plantenkwekerij Guido Van de Steen
- Soil type
  - Loam
- Method of installation
  - Planted
- Year of installation
  - April/May 2017
- Dimensions of the field
  - Approximately 4m x 30m
- Fertiliser
  - None, only the nutrients from the clippings that are left after mowing
- Usage of the product
  - None

## 5.2. OUD-TURNHOUT

- Seed supplier
  - Puur Landelijk
- Soil type
  - Sandy, dry
- Method of installation
  - Sown, but installation failed
  - Planted
- Year of installation
  - 2021
- Dimensions of the field
  - 500m<sup>2</sup> (A strip of about 6m wide)
- Fertiliser
  - 35 tons of cattle slurry
  - Applied at the 1<sup>st</sup> of march
- Usage of the product
  - Fodder for cattle

## 5.3. RUMBEKE (INAGRO)

- Seed supplier
  - Donau Silphie
- Soil type
  - Disturbed sandy loam
- Method of installation
  - Sown, together with *Lolium perenne*
- Year of installation
  - 2020
- Dimensions of the field
  - 6m x 70m
- Fertiliser
  - None (Mown, with removal of the clippings)
- Usage of the product
  - None

## 5.4. SART-À-RÈVES

- Seed supplier
  - Silphie Belgique, "variety" = Abica perfo
- Soil type
  - Silt
- Method of installation
  - Sown
- Year of installation
  - 2021
- Dimensions of the field
  - 0,5 ha
- Fertiliser
  - Mineral fertiliser, 70 units of N in April
- Usage of the product
  - Biogas

## 5.5. ZWALM

- Seed supplier
- Soil type
  - Loam / Sandy loam
- Method of installation
- Year of installation
  - Around 2012
- Dimensions of the field
  - 6m x 25m
- Fertiliser
  - None, only the nutrients from the clippings that are left after mowing (mown after the plants have fallen over)
- Usage of the product
  - None

## 6. Results

Figure 1 and figure 2 show the results from the analysis on the value of the crop as fodder for cattle. Each parameter that is shown in these figures is the result from a calculation which is based on measured variables. These calculated parameters are typically used in Flanders and the Netherlands, and represent different important feed-characteristics of crops. Results from each sampling location are shown, as well as the average value of -well fertilised- corn (for silage) in 2022, from analysis in Belgium and the Netherlands (Source: Eurofins Agro).

The other figures show the results from more universally used parameters concerning feed, and the content of minerals and trace elements.

### 6.1. CALCULATED PARAMETERS

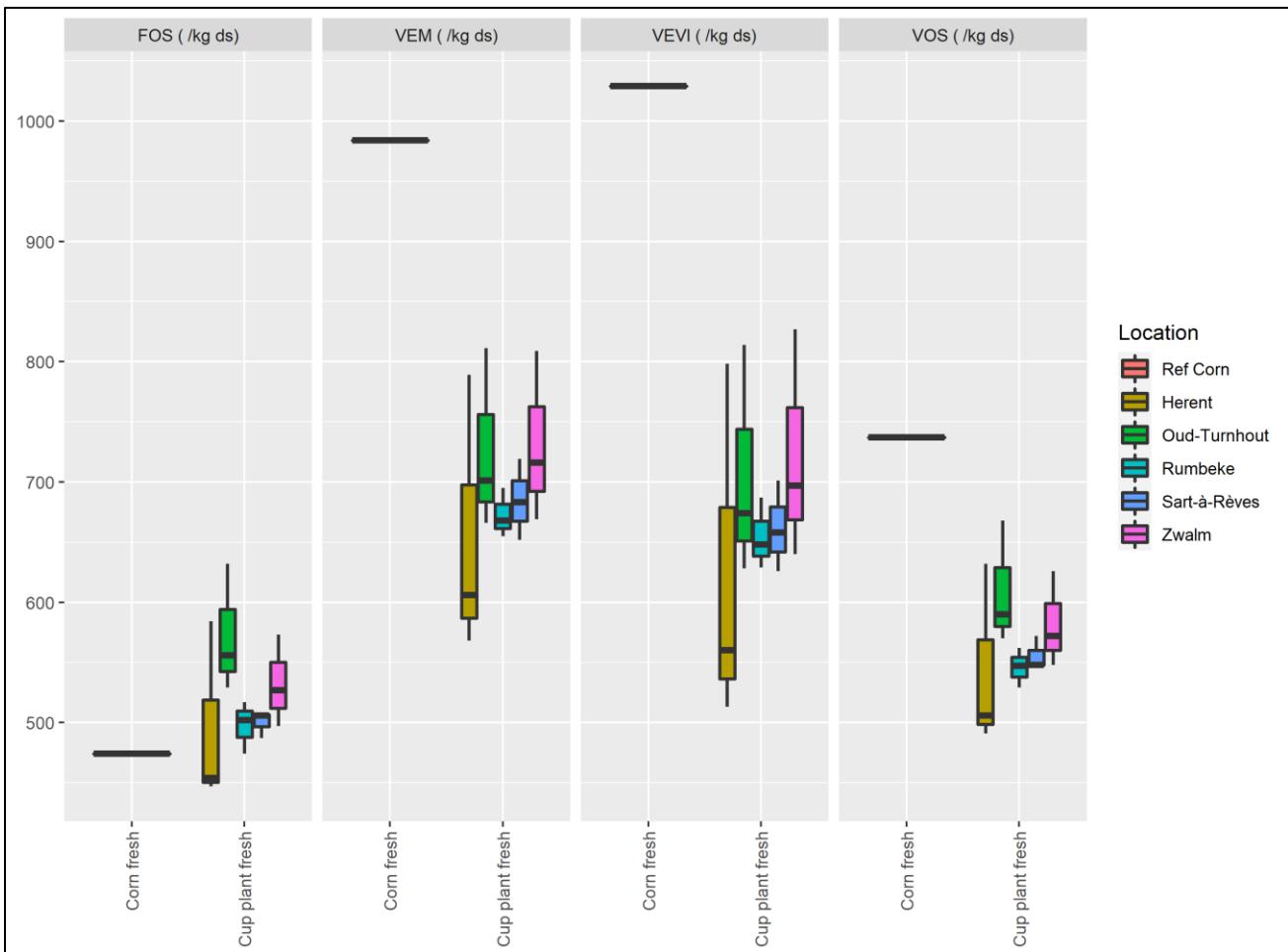


Figure 1: Calculated feed-parameters of whole cup-plants (part 1/2).

FOS: "Fermenteerbare Organische Stof" (fermentable organic matter in the rumen of dairy cattle)

VEM: "Voeder Eenheid Melk" (net energy content for dairy cattle)

VEVI: "Voeder Eenheid Vleesvee Intensief" (net energy content for beef cattle)

VOS: "Verterbare Organische Stof" (digestible organic matter)

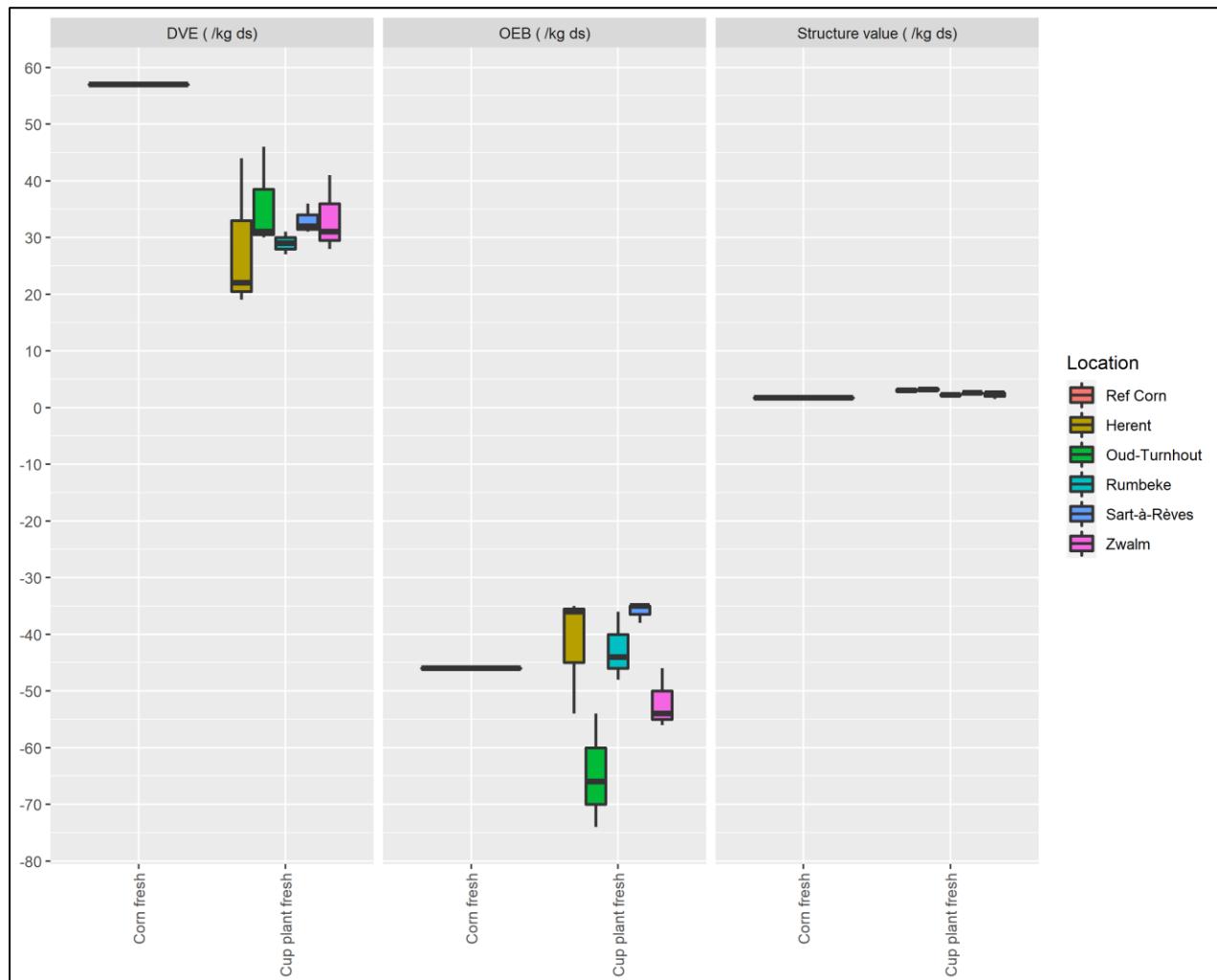


Figure 2: Calculated feed-parameters of whole cup-plants (part 2/2).

DVE: "Darm Verteerbaar Eiwit" (Digestable protein in the small intestine)

OEB: "Onbestendige Eiwit Balans" (Scale which represents the available amount of protein of the feed against the amount of protein which is needed by the microbes in the intestines. If this balance is in equilibrium, then OEB = 0. In that case, all of the ingested protein is being transferred into milk production.)

Structure value (SW): "Structuurwaarde" (Gives an indication on the contribution of the product to the stability in the rumen).

## 6.2. MEASURED PARAMETERS

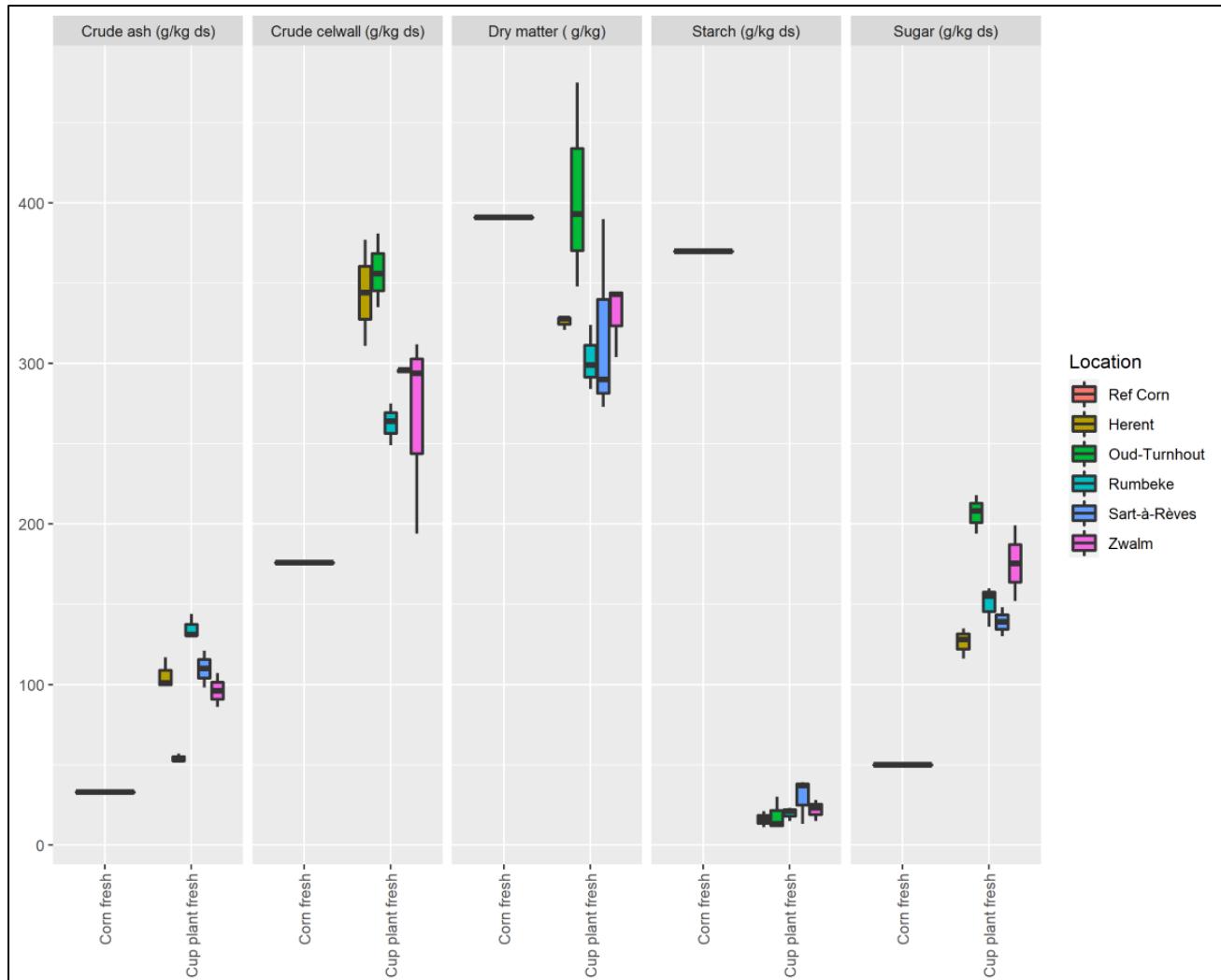


Figure 3: Measured parameters regarding the nutritional value of whole cup-plants (part 1/2).

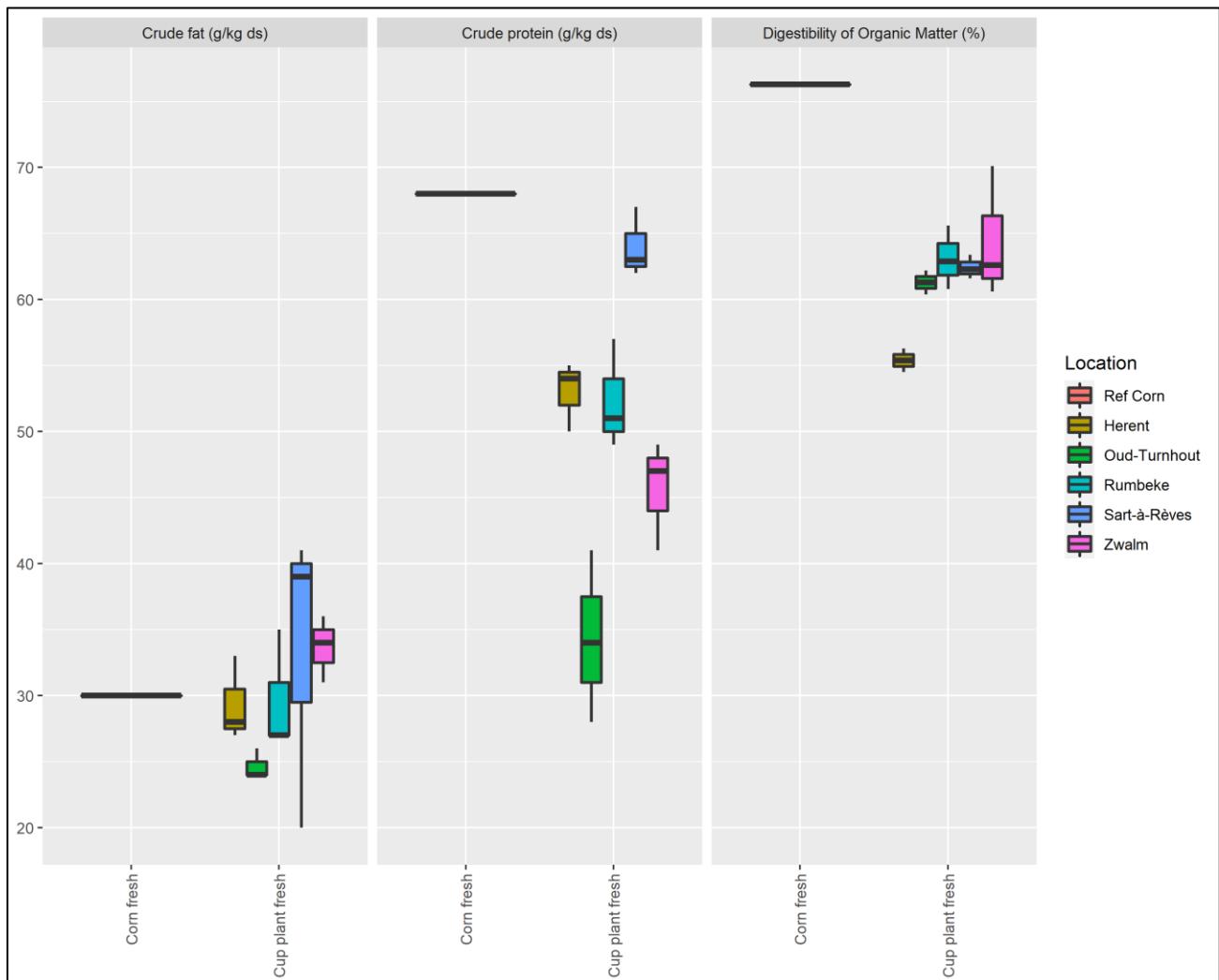


Figure 4: Measured parameters regarding the nutritional value of whole cup-plants (part 2/2).

## 6.3. MINERALS AND TRACE ELEMENTS

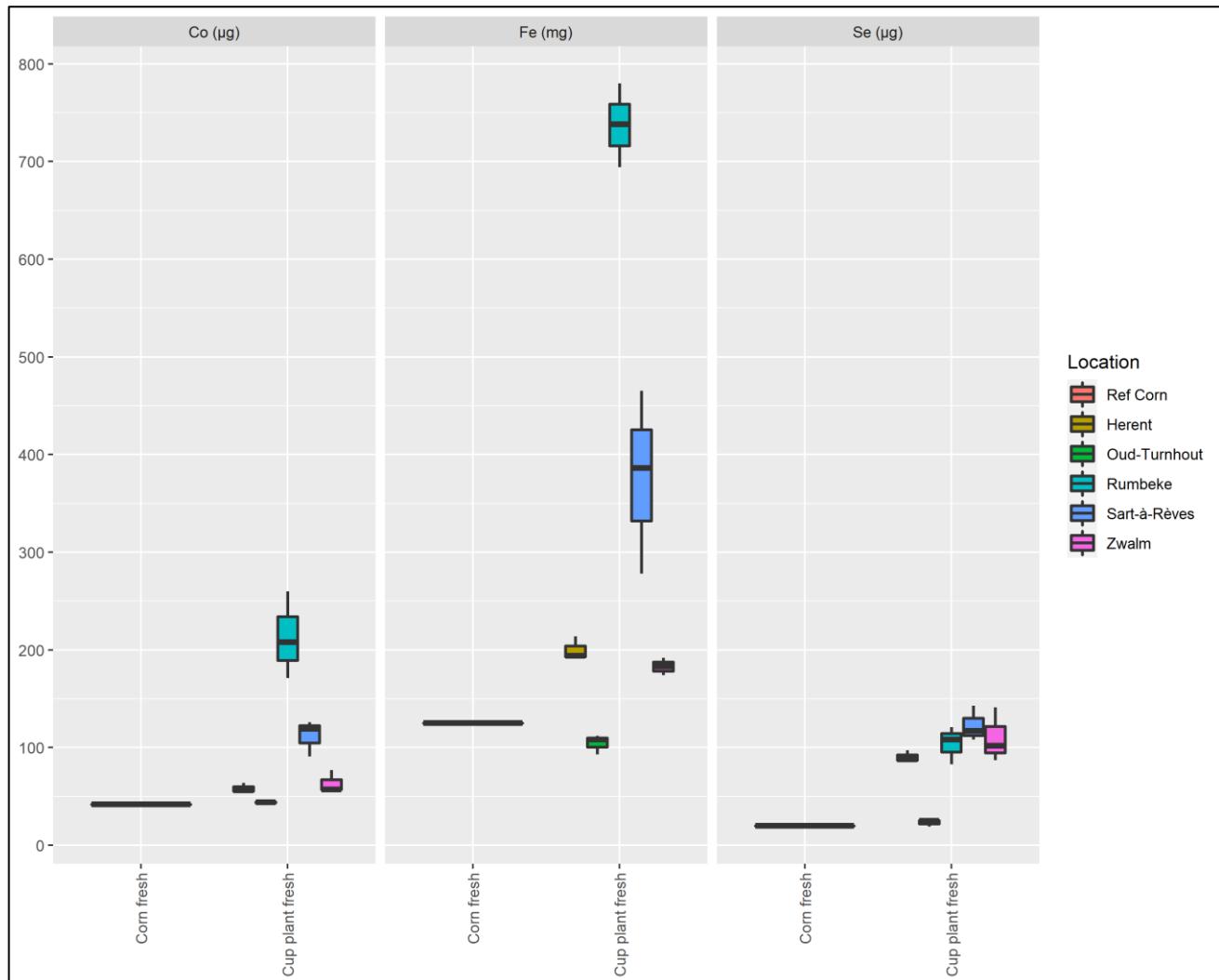


Figure 5: The composition of whole cup-plants regarding minerals and trace-elements (part 1/3).

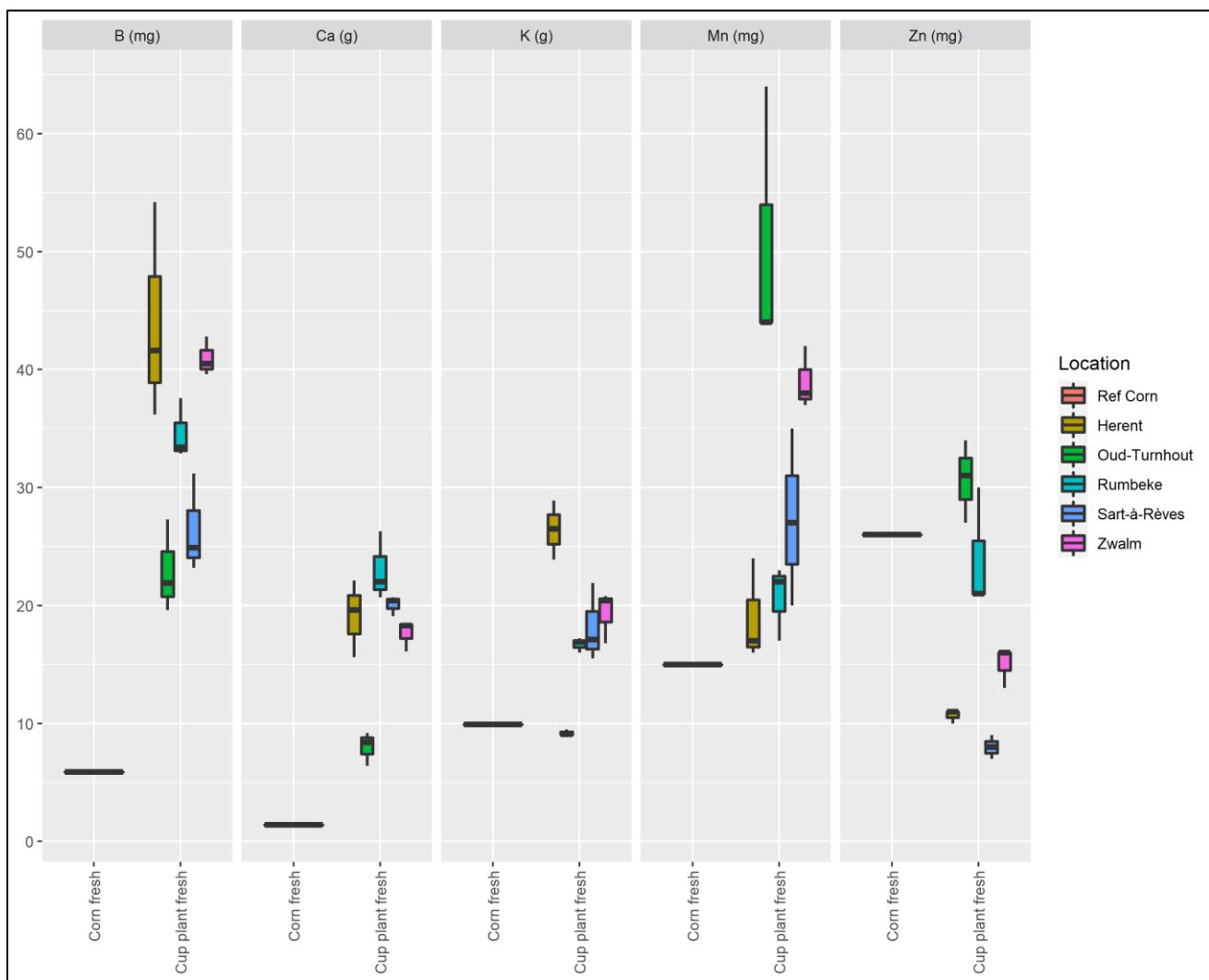


Figure 6: The composition of whole cup-plants regarding minerals and trace-elements (part 2/3).

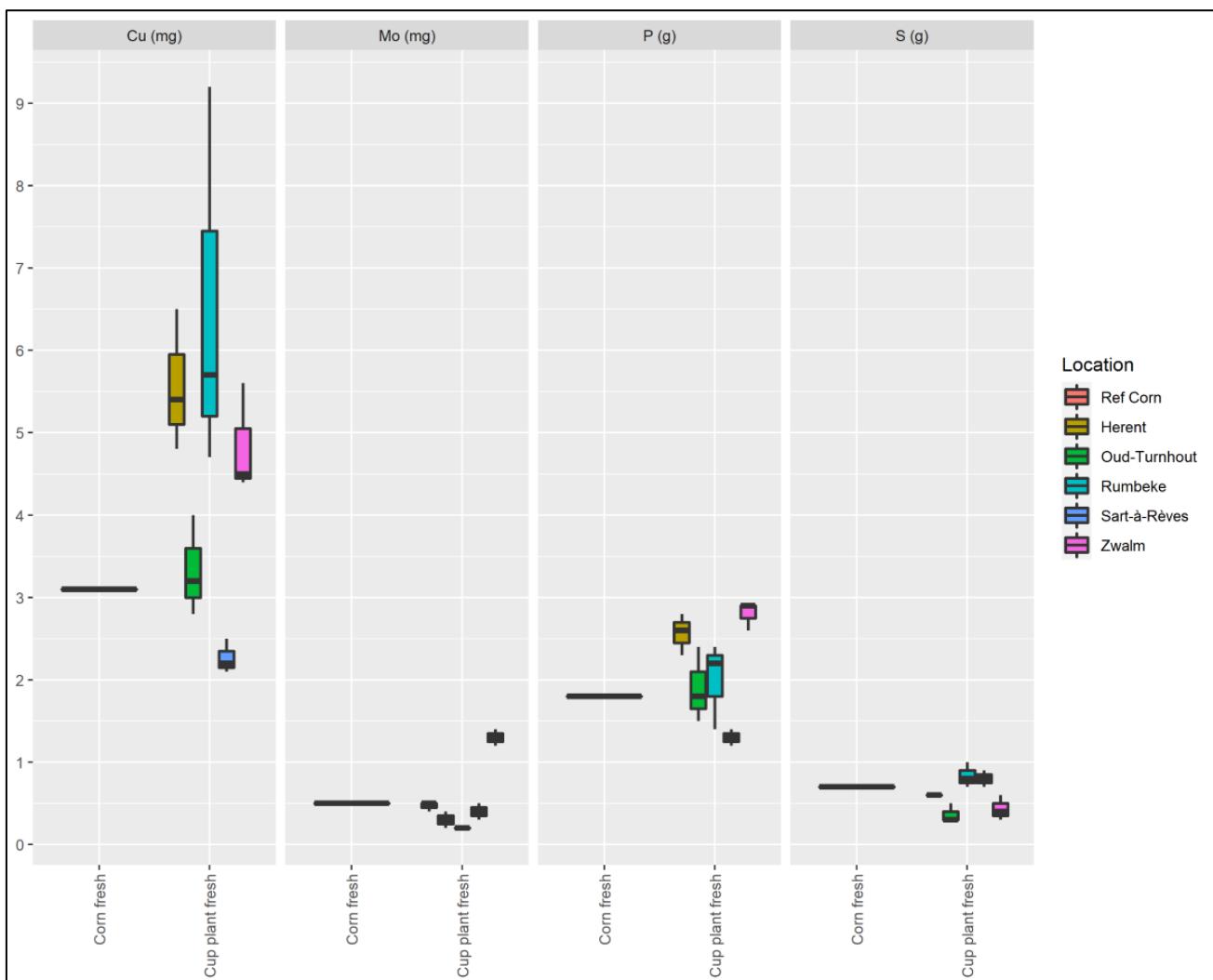


Figure 7: The composition of whole cup-plants regarding minerals and trace-elements (part 3/3).

## 6.5. NUTRITIONAL VALUE, MINERALS AND TRACE ELEMENTS, IN DIFFERENT PARTS OF THE PLANT

Table 1: nutritional value; minerals and trace elements in different plants of cup-plants

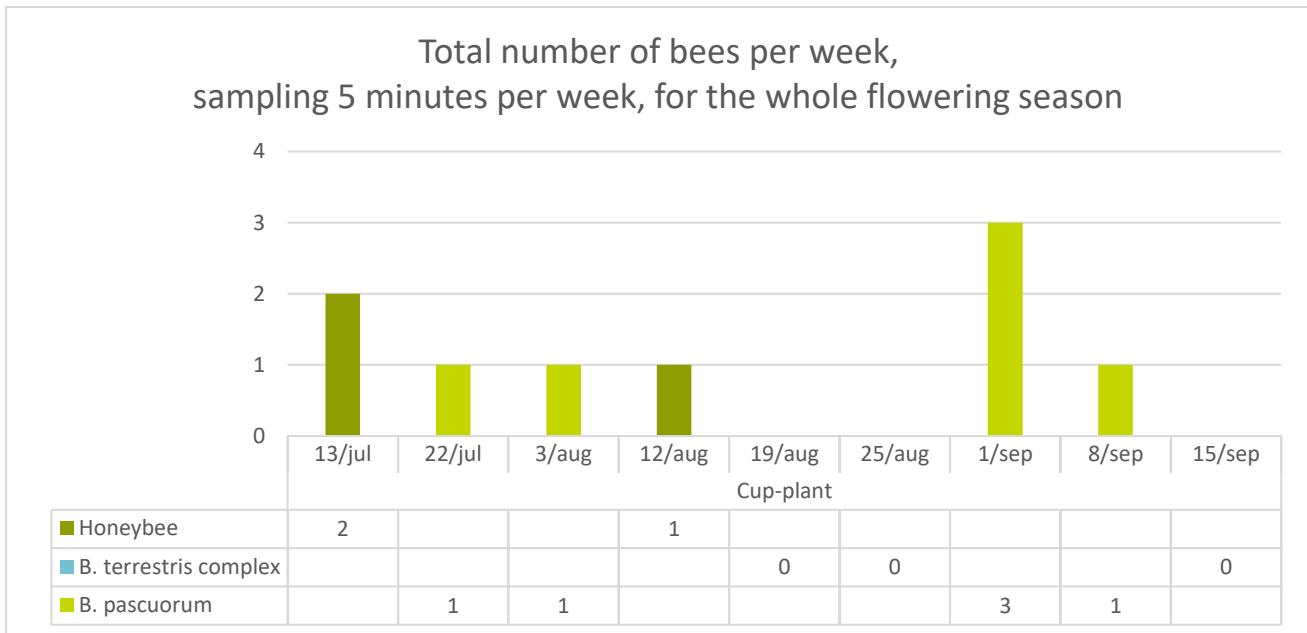
Variable	Plant part	Across all locations			Corn fresh (2022)		
		Average	Stdev	Number of samples	Average	Stdev	Number of samples
DVE (/kg ds)	Flowerhead	58,33	8,22	15			
DVE (/kg ds)	Stem	31,87	12,05	15			
DVE (/kg ds)	Whole plant	31,87	7,39	15	57,00		
FOS (/kg ds)	Flowerhead	498,27	21,89	15			
FOS (/kg ds)	Stem	531,33	73,43	15			
FOS (/kg ds)	Whole plant	519,47	49,99	15	474,00		
OEB (/kg ds)	Flowerhead	12,13	9,53	15			
OEB (/kg ds)	Stem	-53,20	14,72	15			
OEB (/kg ds)	Whole plant	-47,40	12,19	15	-46,00		
Structure value (/kg ds)	Flowerhead	2,26	0,21	15			
Structure value (/kg ds)	Stem	2,93	0,34	15			
Structure value (/kg ds)	Whole plant	2,65	0,51	15	1,70		
VEM (/kg ds)	Flowerhead	904,00	43,07	15			
VEM (/kg ds)	Stem	685,67	119,51	15			
VEM (/kg ds)	Whole plant	693,80	68,77	15	984,00		
VEVI (/kg ds)	Flowerhead	923,33	53,74	15			
VEVI (/kg ds)	Stem	663,93	149,02	15			
VEVI (/kg ds)	Whole plant	673,33	87,53	15	1029,00		
VOS (/kg ds)	Flowerhead	634,40	26,14	15			
VOS (/kg ds)	Stem	570,73	76,06	15			
VOS (/kg ds)	Whole plant	567,27	47,01	15	737,00		
Crude ash (g/kg ds)	Flowerhead	108,87	10,23	15			
Crude ash (g/kg ds)	Stem	95,33	12,57	15			
Crude ash (g/kg ds)	Whole plant	100,13	28,35	15	33,00		
Crude celwall (g/kg ds)	Flowerhead	265,60	20,54	15			
Crude celwall (g/kg ds)	Stem	331,27	40,50	15			
Crude celwall (g/kg ds)	Whole plant	305,20	49,65	15	176,00		
Crude fat (g/kg ds)	Flowerhead	86,13	6,58	15			
Crude fat (g/kg ds)	Stem	22,93	5,54	15			
Crude fat (g/kg ds)	Whole plant	30,13	6,02	15	30,00		
Crude protein (g/kg ds)	Flowerhead	142,07	18,34	15			
Crude protein (g/kg ds)	Stem	43,27	10,34	15			
Crude protein (g/kg ds)	Whole plant	49,87	10,71	15	68,00		
Digestibility of Organic Matter (%)	Flowerhead	71,18	2,78	15			
Digestibility of Organic Matter (%)	Stem	59,57	7,33	15			
Digestibility of Organic Matter (%)	Whole plant	61,79	3,83	15	76,30		
Dry matter ( g/kg)	Flowerhead	288,27	30,31	15			
Dry matter ( g/kg)	Stem	313,87	37,19	15			
Dry matter ( g/kg)	Whole plant	336,40	51,70	15	391,00		
Starch (g/kg ds)	Flowerhead	13,00	2,45	15			
Starch (g/kg ds)	Stem	20,77	11,49	15			
Starch (g/kg ds)	Whole plant	21,07	9,04	15	370,00		
Sugar (g/kg ds)	Flowerhead	43,60	3,78	15			
Sugar (g/kg ds)	Stem	139,43	48,10	15			
Sugar (g/kg ds)	Whole plant	158,43	32,87	15	50,00		
B (mg)	Flowerhead	40,57	5,82	15			
B (mg)	Stem	33,70	6,83	15			
B (mg)	Whole plant	33,79	9,42	15	5,90		
Ca (g)	Flowerhead	14,31	2,55	15			
Ca (g)	Stem	18,62	2,73	15			

Ca (g)	Whole plant	17,56	5,59	15	1,40
Co (µg)	Flowerhead	117,13	69,81	15	
Co (µg)	Stem	82,07	36,22	15	
Co (µg)	Whole plant	102,07	67,44	15	42,00
Cu (mg)	Flowerhead	9,63	2,57	15	
Cu (mg)	Stem	3,81	1,41	15	
Cu (mg)	Whole plant	4,51	1,88	15	3,10
Fe (mg)	Flowerhead	174,20	96,72	15	
Fe (mg)	Stem	213,07	67,55	15	
Fe (mg)	Whole plant	320,20	238,00	15	125,00
K (g)	Flowerhead	29,81	2,67	15	
K (g)	Stem	16,10	5,30	15	
K (g)	Whole plant	17,97	5,98	15	9,90
Mg (g)	Flowerhead	3,72	1,04	15	
Mg (g)	Stem	3,45	2,32	15	
Mg (g)	Whole plant	2,88	0,65	15	1,20
Mn (mg)	Flowerhead	19,40	9,52	15	
Mn (mg)	Stem	36,20	25,77	15	
Mn (mg)	Whole plant	31,33	13,62	15	15,00
Mo (mg)	Flowerhead	1,06	1,03	15	
Mo (mg)	Stem	0,57	0,54	15	
Mo (mg)	Whole plant	0,53	0,41	15	0,50
Na (g)	Flowerhead			15	
Na (g)	Stem			15	
Na (g)	Whole plant			15	
P (g)	Flowerhead	4,03	1	15	
P (g)	Stem	2,01	1	15	
P (g)	Whole plant	2,11	1	15	1,80
S (g)	Flowerhead	1,71	0	15	
S (g)	Stem	0,52	0	15	
S (g)	Whole plant	0,61	0	15	0,70
Se (µg)	Flowerhead	120,40	67	15	
Se (µg)	Stem	70,20	33	15	
Se (µg)	Whole plant	90,07	39	15	20,00
Zn (mg)	Flowerhead	24,67	7	15	
Zn (mg)	Stem	14,20	11	15	
Zn (mg)	Whole plant	17,67	9	15	26,00

## 6.6. ATTRACTIVENESS TO POLLINATORS

The figure below shows the total number of bees that were recorded during 5 minutes of observation per week on the flowers of cup-plants at Inagro.

Because of miscommunication, the strip had been mismanaged before, so only a couple of plants at the border of the strip reached the flowering stage. Thus, it was not possible to delineate a certain, fixed area in which to count bees. Observations come from about 5 plants that reached the flowering stage, but were situated some distance from one another.



Although the crop is being valued for its attractiveness for bees, it is striking that we cannot confirm this from our observations. Bear in mind however that there were only a couple of plants that were flowering. The "magnet"-effect for common pollinator species might be bigger, if a bigger area of plants would be flowering.

Furthermore, we had been making observations of pollinators in a different trial, on a couple of other flowering crops as well, and there too, we found a drastic decrease (to almost a complete absence of generalist bees) after the first half of July 2022. We have no explanation for this observation.

A nice observation, which is worth mentioning, is that we found a Small copper feeding on the cup-plants mid-September. This is not a threatened species, but a species which is not around in large numbers either.

## 7. Discussion

First of all, it has to be noted that the averaged values that are presented for corn represent fields which are heavily fertilized, whereas most of the cup-plant fields receive no fertilizer: 2 fields received fertilizer, 1 field is not fertilized at all, and 2 fields only receives the clippings of the crop itself.

Samples were not analyzed using the technique that uses the Near InfraRed spectrum, but instead were processed wet-chemically. The “calculated parameters” which are shown in the graphs and tables are calculated values, are based on the digestibility of wheat that is harvested in an immature stage to be ensilaged.

### 7.1. CALCULATED PARAMETERS

The “OEB” parameter is negative, and comparable to that of corn, so there is potential to increase the milk production by supplementing with another more protein rich crop with a higher OEB-value, like lucerne or a late cut of gras or gras-clover mixture.

The “VEM” value is clearly lower for cup-plant than for corn, because of the higher amount of crude cell wall. This might be lower when the crop is cut twice a year instead of only once and thus might result in a VEM which is higher. The crude protein content might be higher as well if the crop is cut twice, if the crop is well fertilized.

However, when the crop is cut twice, it will not flower and thus it is no longer of interest for insects that feed on its flowers.

In corn, VEM mainly comes from the starch, and partially from the digestible organic matter. In cup-plants, VEM is mostly a result of the high sugar content, which is also why the FOS-value has a good score.

### 7.2. MEASURED PARAMETERS

The sugar content is clearly higher than that of corn, and comparable to grass. Thus, it will probably be possible to ensilage the product, and it will probably be taste for the animals. Together with the findings that cup-plant is rich in structure, the product will probably be stable when ensilaged.

The protein content seems to be quite a bit lower than the average value of corn, but there is a lot of variation between the fields, with the levels from one of the cup-plant fields that has received fertilizer reaching almost as high values as corn. This is the only field which is being managed as a true arable field. The other field which received fertilizer is “Oud-Turnhout”, and has the lowest protein content of all. These plants were installed as a strip within a field of grass, on a sandy soil, so a possible explanation could be that these plants dried out much faster than the other fields. This is also represented in the observation that the dry matter content of the samples from this field are higher than from the other fields. From research that looks into cup-plants as an energy crop, it is known that the protein content declines, as the plants get older (and thus they also become drier).

To conclude, there is potential for cup-plant when using it as fodder, either as a fresh product, or ensilaged. The potential however also depends on whether ruminants like to eat it, and in what quantities. This too might be better when harvesting the crop twice a year, instead of only once.

### 7.3. MINERALS AND TRACE ELEMENTS

Concerning the minerals and trace elements, some elements reach clearly higher values than corn: Calcium (Ca) is about 10 times more abundant in cup-plants than in corn, irrespective of the sampled field. This element is of much interest for dairy cattle, although it should also be brought into account when feeding the product to dry cows.

Selenium (Se), Borium (B), Potassium (K) and Manganese (Mn) too are rather consistently available in much larger quantities in cup-plant than in corn.

There seems to be a lot of variation in the availability of Manganese, but still, almost all of the measurements came out higher than the average of corn.

The image is less clear for Cobalt (Co), Iron (Fe), and Copper (Cu), but they all tend to be higher than their respective averaged values for corn.

The amount of Molybdenum (Mo) and Sulphur (S) seems to be the same in corn and in cup-plants. Zink (Zn) on the other hand reaches less high levels in cup-plants.

### 7.4. DIFFERENT PLANT PARTS

Not unsurprisingly, flower heads show the best digestibility, whereas the stems show a lower digestibility because this product consists of much coarser material.

### 7.5. AGE OF THE PLANTS

The samples from "Zwalm" were taken from a field of cup-plants which have been growing for about 10 years, and which only receives its own clippings as fertilizer.

Interestingly, the values for all the investigated parameters are still very much comparable to the values from the other sampling locations. This confirms that the plant can be grown for many years.

### 7.6. ATTRACTIVENESS TO POLLINATORS

Although the crop is being valued for its attractiveness for bees, it is striking that we cannot confirm this from our observations. Bear in mind however that there were only a couple of plants that were flowering. The "magnet"-effect for common pollinator species might be bigger, if a bigger area of plants would be flowering.

Furthermore, we had been making observations of pollinators in a different trial, on a couple of other flowering crops as well, and there too, we found a drastic decrease (to almost a complete absence of generalist bees) after the first half of July 2022. We have no explanation for this observation.

A nice observation, which is worth mentioning, is that we found a Small copper feeding on the cup-plants mid-September. This is not a threatened species, but a species which is not around in large numbers either.

## 8. Conclusion

All in all, cup-plant shows potential to be used as feed for dairy cattle, although not as a single product: it should be supplemented with other products that are lower in structure, for instance with protein rich grass.

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## 10. Addendum: results per sampling location

Inagro				
Variable	Plant part	Average	Stdev	Number of samples
DVE ( /kg ds)	Flowerhead	53,33	0,58	3
DVE ( /kg ds)	Stem	28,33	16,65	3
DVE ( /kg ds)	Whole plant	29,00	2,00	3
FOS ( /kg ds)	Flowerhead	499,67	2,89	3
FOS ( /kg ds)	Stem	508,33	92,92	3
FOS ( /kg ds)	Whole plant	497,67	21,83	3
OEB ( /kg ds)	Flowerhead	2,00	0,00	3
OEB ( /kg ds)	Stem	-49,33	13,65	3
OEB ( /kg ds)	Whole plant	-42,67	6,11	3
Structure value ( /kg ds)	Flowerhead	2,17	0,06	3
Structure value ( /kg ds)	Stem	2,47	0,23	3
Structure value ( /kg ds)	Whole plant	2,23	0,15	3
VEM ( /kg ds)	Flowerhead	885,00	11,36	3
VEM ( /kg ds)	Stem	659,33	161,74	3
VEM ( /kg ds)	Whole plant	672,67	20,40	3
VEVI ( /kg ds)	Flowerhead	906,33	14,57	3
VEVI ( /kg ds)	Stem	634,33	204,77	3
VEVI ( /kg ds)	Whole plant	654,67	29,57	3
VOS ( /kg ds)	Flowerhead	624,33	4,93	3
VOS ( /kg ds)	Stem	549,67	101,80	3
VOS ( /kg ds)	Whole plant	546,00	16,52	3
Crude ash (g/kg ds)	Flowerhead	126,67	1,15	3
Crude ash (g/kg ds)	Stem	93,00	9,17	3
Crude ash (g/kg ds)	Whole plant	135,00	7,81	3
Crude celwall (g/kg ds)	Flowerhead	255,00	7,21	3
Crude celwall (g/kg ds)	Stem	274,67	49,94	3
Crude celwall (g/kg ds)	Whole plant	262,67	13,05	3
Crude fat (g/kg ds)	Flowerhead	80,33	1,53	3
Crude fat (g/kg ds)	Stem	22,67	3,06	3
Crude fat (g/kg ds)	Whole plant	29,67	4,62	3
Crude protein (g/kg ds)	Flowerhead	126,00	0,00	3
Crude protein (g/kg ds)	Stem	43,67	2,31	3
Crude protein (g/kg ds)	Whole plant	52,33	4,16	3
Digestibility of Organic Matter (%)	Flowerhead	71,50	0,61	3
Digestibility of Organic Matter (%)	Stem	60,53	10,70	3
Digestibility of Organic Matter (%)	Whole plant	63,10	2,41	3
Dry matter ( g/kg)	Flowerhead	260,00	17,69	3
Dry matter ( g/kg)	Stem	309,00	15,52	3
Dry matter ( g/kg)	Whole plant	302,33	20,21	3
Starch (g/kg ds)	Flowerhead	13,50	3,54	3
Starch (g/kg ds)	Stem	31,67	20,43	3
Starch (g/kg ds)	Whole plant	19,67	4,16	3
Sugar (g/kg ds)	Flowerhead	40,00	2,00	3
Sugar (g/kg ds)	Stem	184,00	28,58	3
Sugar (g/kg ds)	Whole plant	150,33	12,66	3
B (mg)	Flowerhead	49,17	3,63	3
B (mg)	Stem	39,33	7,52	3
B (mg)	Whole plant	34,63	2,58	3
Ca (g)	Flowerhead	18,23	1,76	3
Ca (g)	Stem	16,57	0,97	3
Ca (g)	Whole plant	23,00	2,93	3
Co (µg)	Flowerhead	241,00	60,92	3
Co (µg)	Stem	131,00	46,86	3
Co (µg)	Whole plant	213,00	44,71	3
Cu (mg)	Flowerhead	10,77	0,64	3

Cu (mg)	Stem	3,83	0,06	3
Cu (mg)	Whole plant	6,53	2,36	3
Fe (mg)	Flowerhead	352,67	55,18	3
Fe (mg)	Stem	300,33	37,22	3
Fe (mg)	Whole plant	737,33	43,00	3
K (g)	Flowerhead	28,37	1,06	3
K (g)	Stem	13,87	3,09	3
K (g)	Whole plant	16,70	0,62	3
Mg (g)	Flowerhead	3,70	0,17	3
Mg (g)	Stem	2,43	0,23	3
Mg (g)	Whole plant	2,83	0,21	3
Mn (mg)	Flowerhead	14,00	1,00	3
Mn (mg)	Stem	13,67	3,79	3
Mn (mg)	Whole plant	20,67	3,21	3
Mo (mg)	Flowerhead	0,50	0,00	3
Mo (mg)	Stem	0,20	0,00	3
Mo (mg)	Whole plant	0,20	0,00	3
Na (g)	Flowerhead			3
Na (g)	Stem			3
Na (g)	Whole plant			3
P (g)	Flowerhead	3,83	0,06	3
P (g)	Stem	2,00	0,56	3
P (g)	Whole plant	2,00	0,53	3
S (g)	Flowerhead	1,87	0,12	3
S (g)	Stem	0,57	0,15	3
S (g)	Whole plant	0,83	0,15	3
Se ( $\mu$ g)	Flowerhead	111,00	22,61	3
Se ( $\mu$ g)	Stem	44,00	12,53	3
Se ( $\mu$ g)	Whole plant	104,00	19,31	3
Zn (mg)	Flowerhead	23,67	1,15	3
Zn (mg)	Stem	11,00	2,00	3
Zn (mg)	Whole plant	24,00	5,20	3

Herent				
Variable	Plant_part	Average	Stdev	Number of samples
DVE ( /kg ds)	Flowerhead	59,67	3,06	3
DVE ( /kg ds)	Stem	43,00	3,00	3
DVE ( /kg ds)	Whole plant	28,33	13,65	3
FOS ( /kg ds)	Flowerhead	508,67	3,21	3
FOS ( /kg ds)	Stem	606,00	10,15	3
FOS ( /kg ds)	Whole plant	495,00	77,16	3
OEB ( /kg ds)	Flowerhead	9,67	5,51	3
OEB ( /kg ds)	Stem	-67,67	1,15	3
OEB ( /kg ds)	Whole plant	-41,67	10,69	3
Structure value ( /kg ds)	Flowerhead	2,47	0,06	3
Structure value ( /kg ds)	Stem	3,03	0,23	3
Structure value ( /kg ds)	Whole plant	3,03	0,35	3
VEM ( /kg ds)	Flowerhead	909,33	37,50	3
VEM ( /kg ds)	Stem	778,00	28,62	3
VEM ( /kg ds)	Whole plant	654,33	118,16	3
VEVI ( /kg ds)	Flowerhead	929,33	46,01	3
VEVI ( /kg ds)	Stem	779,67	35,92	3
VEVI ( /kg ds)	Whole plant	623,67	152,80	3
VOS ( /kg ds)	Flowerhead	642,33	13,65	3
VOS ( /kg ds)	Stem	640,67	14,01	3
VOS ( /kg ds)	Whole plant	543,00	77,44	3
Crude ash (g/kg ds)	Flowerhead	107,67	1,53	3
Crude ash (g/kg ds)	Stem	88,67	7,64	3
Crude ash (g/kg ds)	Whole plant	105,67	9,87	3
Crude celwall (g/kg ds)	Flowerhead	285,67	2,52	3
Crude celwall (g/kg ds)	Stem	344,33	19,66	3
Crude celwall (g/kg ds)	Whole plant	344,00	33,00	3
Crude fat (g/kg ds)	Flowerhead	84,33	9,61	3
Crude fat (g/kg ds)	Stem	21,33	3,06	3
Crude fat (g/kg ds)	Whole plant	29,33	3,21	3
Crude protein (g/kg ds)	Flowerhead	140,67	9,02	3
Crude protein (g/kg ds)	Stem	37,67	3,51	3
Crude protein (g/kg ds)	Whole plant	53,00	2,65	3
Digestibility of Organic Matter (%)	Flowerhead	72,00	1,61	3
Digestibility of Organic Matter (%)	Stem			3
Digestibility of Organic Matter (%)	Whole plant	55,40	1,27	3
Dry matter ( g/kg)	Flowerhead	271,00	3,46	3
Dry matter ( g/kg)	Stem	333,33	4,93	3
Dry matter ( g/kg)	Whole plant	326,00	4,36	3
Starch (g/kg ds)	Flowerhead			3
Starch (g/kg ds)	Stem	18,00	0,00	3
Starch (g/kg ds)	Whole plant	16,00	5,00	3
Sugar (g/kg ds)	Flowerhead	44,00	2,00	3
Sugar (g/kg ds)	Stem	165,33	13,80	3
Sugar (g/kg ds)	Whole plant	126,33	9,61	3
B (mg)	Flowerhead	39,40	2,31	3
B (mg)	Stem	36,93	1,86	3
B (mg)	Whole plant	44,00	9,24	3
Ca (g)	Flowerhead	15,33	1,32	3
Ca (g)	Stem	16,93	1,34	3
Ca (g)	Whole plant	19,10	3,28	3
Co (µg)	Flowerhead	84,67	5,51	3
Co (µg)	Stem	55,00	9,54	3
Co (µg)	Whole plant	58,33	4,93	3
Cu (mg)	Flowerhead	10,47	0,67	3
Cu (mg)	Stem	3,47	0,61	3
Cu (mg)	Whole plant	5,57	0,86	3
Fe (mg)	Flowerhead	126,33	18,01	3

Fe (mg)	Stem	175,67	27,93	3
Fe (mg)	Whole plant	200,00	12,17	3
K (g)	Flowerhead	32,70	1,97	3
K (g)	Stem	19,57	4,63	3
K (g)	Whole plant	26,43	2,50	3
Mg (g)	Flowerhead	2,93	0,15	3
Mg (g)	Stem	1,87	0,15	3
Mg (g)	Whole plant	2,27	0,21	3
Mn (mg)	Flowerhead	15,00	1,00	3
Mn (mg)	Stem	25,00	8,89	3
Mn (mg)	Whole plant	19,00	4,36	3
Mo (mg)	Flowerhead	0,43	0,06	3
Mo (mg)	Stem	0,27	0,06	3
Mo (mg)	Whole plant	0,47	0,06	3
Na (g)	Flowerhead		3	
Na (g)	Stem		3	
Na (g)	Whole plant		3	
P (g)	Flowerhead	4,30	0,26	3
P (g)	Stem	1,77	0,71	3
P (g)	Whole plant	2,57	0,25	3
S (g)	Flowerhead	1,37	0,15	3
S (g)	Stem	0,30	0,00	3
S (g)	Whole plant	0,60	0,00	3
Se ( $\mu$ g)	Flowerhead	85,00	11,36	3
Se ( $\mu$ g)	Stem	58,33	11,59	3
Se ( $\mu$ g)	Whole plant	90,33	5,86	3
Zn (mg)	Flowerhead	25,33	2,52	3
Zn (mg)	Stem	8,00	1,00	3
Zn (mg)	Whole plant	10,67	0,58	3

Oud-Turnhout				
Variable	Plant_part	Average	Stdev	Number of samples
DVE ( /kg ds)	Flowerhead	64,67	1,15	3
DVE ( /kg ds)	Stem	41,33	3,79	3
DVE ( /kg ds)	Whole plant	35,67	8,96	3
FOS ( /kg ds)	Flowerhead	504,00	8,89	3
FOS ( /kg ds)	Stem	585,00	22,52	3
FOS ( /kg ds)	Whole plant	572,33	53,41	3
OEB ( /kg ds)	Flowerhead	21,67	3,06	3
OEB ( /kg ds)	Stem	-62,00	4,58	3
OEB ( /kg ds)	Whole plant	-64,67	10,07	3
Structure value ( /kg ds)	Flowerhead	2,17	0,06	3
Structure value ( /kg ds)	Stem	2,77	0,06	3
Structure value ( /kg ds)	Whole plant	3,20	0,20	3
VEM ( /kg ds)	Flowerhead	935,67	11,55	3
VEM ( /kg ds)	Stem	799,67	35,92	3
VEM ( /kg ds)	Whole plant	726,00	75,66	3
VEVI ( /kg ds)	Flowerhead	959,00	13,89	3
VEVI ( /kg ds)	Stem	803,67	47,71	3
VEVI ( /kg ds)	Whole plant	705,33	96,88	3
VOS ( /kg ds)	Flowerhead	651,00	7,55	3
VOS ( /kg ds)	Stem	633,00	20,07	3
VOS ( /kg ds)	Whole plant	609,33	51,78	3
Crude ash (g/kg ds)	Flowerhead	97,00	2,00	3
Crude ash (g/kg ds)	Stem	85,33	10,97	3
Crude ash (g/kg ds)	Whole plant	54,00	2,65	3
Crude celwall (g/kg ds)	Flowerhead	257,33	5,51	3
Crude celwall (g/kg ds)	Stem	318,67	5,13	3
Crude celwall (g/kg ds)	Whole plant	357,33	23,03	3
Crude fat (g/kg ds)	Flowerhead	91,00	2,65	3
Crude fat (g/kg ds)	Stem	34,50	0,71	3
Crude fat (g/kg ds)	Whole plant	24,67	1,15	3
Crude protein (g/kg ds)	Flowerhead	159,00	3,61	3
Crude protein (g/kg ds)	Stem	42,33	4,93	3
Crude protein (g/kg ds)	Whole plant	34,33	6,51	3
Digestibility of Organic Matter (%)	Flowerhead	72,07	0,75	3
Digestibility of Organic Matter (%)	Stem	68,05	2,90	3
Digestibility of Organic Matter (%)	Whole plant	61,30	1,27	3
Dry matter ( g/kg)	Flowerhead	323,33	4,04	3
Dry matter ( g/kg)	Stem	364,00	10,15	3
Dry matter ( g/kg)	Whole plant	405,33	64,39	3
Starch (g/kg ds)	Flowerhead			3
Starch (g/kg ds)	Stem	16,00	4,58	3
Starch (g/kg ds)	Whole plant	18,00	10,44	3
Sugar (g/kg ds)	Flowerhead	49,67	2,08	3
Sugar (g/kg ds)	Stem	104,00	104,65	3
Sugar (g/kg ds)	Whole plant	206,67	12,06	3
B (mg)	Flowerhead	39,80	1,51	3
B (mg)	Stem	36,07	3,82	3
B (mg)	Whole plant	22,93	3,95	3
Ca (g)	Flowerhead	12,20	1,11	3
Ca (g)	Stem	20,03	2,06	3
Ca (g)	Whole plant	8,00	1,44	3
Co (µg)	Flowerhead	68,67	3,79	3
Co (µg)	Stem	75,33	19,60	3
Co (µg)	Whole plant	44,00	1,41	3
Cu (mg)	Flowerhead	12,73	0,06	3
Cu (mg)	Stem	5,93	0,72	3
Cu (mg)	Whole plant	3,33	0,61	3
Fe (mg)	Flowerhead	110,33	4,93	3

Fe (mg)	Stem	193,33	46,52	3
Fe (mg)	Whole plant	104,33	10,02	3
K (g)	Flowerhead	27,37	0,55	3
K (g)	Stem	8,37	0,71	3
K (g)	Whole plant	9,20	0,26	3
Mg (g)	Flowerhead	5,53	0,12	3
Mg (g)	Stem	7,83	0,81	3
Mg (g)	Whole plant	3,97	0,25	3
Mn (mg)	Flowerhead	37,33	3,06	3
Mn (mg)	Stem	83,00	1,73	3
Mn (mg)	Whole plant	50,67	11,55	3
Mo (mg)	Flowerhead	0,80	0,00	3
Mo (mg)	Stem	0,33	0,06	3
Mo (mg)	Whole plant	0,30	0,10	3
Na (g)	Flowerhead			3
Na (g)	Stem			3
Na (g)	Whole plant			3
P (g)	Flowerhead	4,50	0,10	3
P (g)	Stem	2,70	0,69	3
P (g)	Whole plant	1,90	0,46	3
S (g)	Flowerhead	2,17	0,06	3
S (g)	Stem	0,80	0,10	3
S (g)	Whole plant	0,37	0,12	3
Se ( $\mu$ g)	Flowerhead	37,67	5,51	3
Se ( $\mu$ g)	Stem	37,33	9,29	3
Se ( $\mu$ g)	Whole plant	23,33	3,79	3
Zn (mg)	Flowerhead	37,33	0,58	3
Zn (mg)	Stem	35,00	4,36	3
Zn (mg)	Whole plant	30,67	3,51	3

Sart-à-Rêves				
Variable	Plant_part	Average	Stdev	Number of samples
DVE ( /kg ds)	Flowerhead	67,67	1,53	3
DVE ( /kg ds)	Stem	21,00	3,00	3
DVE ( /kg ds)	Whole plant	33,00	2,65	3
FOS ( /kg ds)	Flowerhead	519,00	11,79	3
FOS ( /kg ds)	Stem	447,33	12,50	3
FOS ( /kg ds)	Whole plant	500,00	11,27	3
OEB ( /kg ds)	Flowerhead	22,00	7,55	3
OEB ( /kg ds)	Stem	-32,00	11,27	3
OEB ( /kg ds)	Whole plant	-36,00	1,73	3
Structure value ( /kg ds)	Flowerhead	2,00	0,10	3
Structure value ( /kg ds)	Stem	3,17	0,29	3
Structure value ( /kg ds)	Whole plant	2,57	0,06	3
VEM ( /kg ds)	Flowerhead	945,33	9,07	3
VEM ( /kg ds)	Stem	552,67	8,33	3
VEM ( /kg ds)	Whole plant	684,67	33,53	3
VEVI ( /kg ds)	Flowerhead	976,33	10,60	3
VEVI ( /kg ds)	Stem	498,33	9,71	3
VEVI ( /kg ds)	Whole plant	661,67	37,63	3
VOS ( /kg ds)	Flowerhead	661,00	3,61	3
VOS ( /kg ds)	Stem	486,67	6,66	3
VOS ( /kg ds)	Whole plant	556,00	13,86	3
Crude ash (g/kg ds)	Flowerhead	105,67	2,08	3
Crude ash (g/kg ds)	Stem	112,00	8,54	3
Crude ash (g/kg ds)	Whole plant	109,67	11,50	3
Crude celwall (g/kg ds)	Flowerhead	240,33	11,02	3
Crude celwall (g/kg ds)	Stem	356,00	25,24	3
Crude celwall (g/kg ds)	Whole plant	295,33	1,15	3
Crude fat (g/kg ds)	Flowerhead	84,67	5,51	3
Crude fat (g/kg ds)	Stem	19,00	2,65	3
Crude fat (g/kg ds)	Whole plant	33,33	11,59	3
Crude protein (g/kg ds)	Flowerhead	163,00	9,54	3
Crude protein (g/kg ds)	Stem	57,33	15,95	3
Crude protein (g/kg ds)	Whole plant	64,00	2,65	3
Digestibility of Organic Matter (%)	Flowerhead	73,90	0,56	3
Digestibility of Organic Matter (%)	Stem	54,80	0,36	3
Digestibility of Organic Matter (%)	Whole plant	62,43	0,91	3
Dry matter ( g/kg)	Flowerhead	265,00	7,94	3
Dry matter ( g/kg)	Stem	262,67	9,07	3
Dry matter ( g/kg)	Whole plant	317,67	63,22	3
Starch (g/kg ds)	Flowerhead			3
Starch (g/kg ds)	Stem	14,50	4,95	3
Starch (g/kg ds)	Whole plant	29,67	14,47	3
Sugar (g/kg ds)	Flowerhead	43,33	1,53	3
Sugar (g/kg ds)	Stem	136,00	15,39	3
Sugar (g/kg ds)	Whole plant	139,00	9,00	3
B (mg)	Flowerhead	32,73	0,06	3
B (mg)	Stem	22,97	1,27	3
B (mg)	Whole plant	26,43	4,21	3
Ca (g)	Flowerhead	13,27	0,15	3
Ca (g)	Stem	21,60	4,10	3
Ca (g)	Whole plant	20,07	0,85	3
Co (µg)	Flowerhead	82,33	12,06	3
Co (µg)	Stem	87,00	12,12	3
Co (µg)	Whole plant	112,00	18,52	3
Cu (mg)	Flowerhead	5,47	0,55	3
Cu (mg)	Stem	1,87	0,21	3
Cu (mg)	Whole plant	2,27	0,21	3
Fe (mg)	Flowerhead	125,67	21,36	3

Fe (mg)	Stem	260,00	34,87	3
Fe (mg)	Whole plant	376,33	93,87	3
K (g)	Flowerhead	28,13	0,51	3
K (g)	Stem	17,53	1,60	3
K (g)	Whole plant	18,17	3,33	3
Mg (g)	Flowerhead	2,70	0,10	3
Mg (g)	Stem	2,50	0,44	3
Mg (g)	Whole plant	2,47	0,15	3
Mn (mg)	Flowerhead	13,00	1,00	3
Mn (mg)	Stem	23,00	6,08	3
Mn (mg)	Whole plant	27,33	7,51	3
Mo (mg)	Flowerhead	0,53	0,06	3
Mo (mg)	Stem	0,47	0,06	3
Mo (mg)	Whole plant	0,40	0,10	3
Na (g)	Flowerhead			3
Na (g)	Stem			3
Na (g)	Whole plant			3
P (g)	Flowerhead	3,03	0,15	3
P (g)	Stem	0,77	0,06	3
P (g)	Whole plant	1,30	0,10	3
S (g)	Flowerhead	1,87	0,06	3
S (g)	Stem	0,63	0,12	3
S (g)	Whole plant	0,80	0,10	3
Se (µg)	Flowerhead	149,33	38,73	3
Se (µg)	Stem	110,67	15,57	3
Se (µg)	Whole plant	122,67	18,18	3
Zn (mg)	Flowerhead	16,33	1,53	3
Zn (mg)	Stem	5,67	0,58	3
Zn (mg)	Whole plant	8,00	1,00	3

Zwalm				
Variable	Plant_part	Average	Stdev	Number of samples
DVE ( /kg ds)	Flowerhead	46,33	3,51	3
DVE ( /kg ds)	Stem	25,67	11,50	3
DVE ( /kg ds)	Whole plant	33,33	6,81	3
FOS ( /kg ds)	Flowerhead	460,00	7,94	3
FOS ( /kg ds)	Stem	510,00	60,02	3
FOS ( /kg ds)	Whole plant	532,33	38,28	3
OEB ( /kg ds)	Flowerhead	5,33	4,93	3
OEB ( /kg ds)	Stem	-55,00	7,00	3
OEB ( /kg ds)	Whole plant	-52,00	5,29	3
Structure value ( /kg ds)	Flowerhead	2,50	0,10	3
Structure value ( /kg ds)	Stem	3,23	0,15	3
Structure value ( /kg ds)	Whole plant	2,23	0,64	3
VEM ( /kg ds)	Flowerhead	844,67	36,12	3
VEM ( /kg ds)	Stem	638,67	92,09	3
VEM ( /kg ds)	Whole plant	731,33	71,25	3
VEVI ( /kg ds)	Flowerhead	845,67	43,84	3
VEVI ( /kg ds)	Stem	603,67	112,15	3
VEVI ( /kg ds)	Whole plant	721,33	95,85	3
VOS ( /kg ds)	Flowerhead	593,33	15,82	3
VOS ( /kg ds)	Stem	543,67	63,00	3
VOS ( /kg ds)	Whole plant	582,00	39,95	3
Crude ash (g/kg ds)	Flowerhead	107,33	3,51	3
Crude ash (g/kg ds)	Stem	97,67	10,97	3
Crude ash (g/kg ds)	Whole plant	96,33	10,50	3
Crude celwall (g/kg ds)	Flowerhead	289,67	6,51	3
Crude celwall (g/kg ds)	Stem	362,67	15,57	3
Crude celwall (g/kg ds)	Whole plant	266,67	63,57	3
Crude fat (g/kg ds)	Flowerhead	90,33	7,09	3
Crude fat (g/kg ds)	Stem	21,00	2,65	3
Crude fat (g/kg ds)	Whole plant	33,67	2,52	3
Crude protein (g/kg ds)	Flowerhead	121,67	8,14	3
Crude protein (g/kg ds)	Stem	35,33	3,51	3
Crude protein (g/kg ds)	Whole plant	45,67	4,16	3
Digestibility of Organic Matter (%)	Flowerhead	66,43	1,70	3
Digestibility of Organic Matter (%)	Stem	56,80	3,96	3
Digestibility of Organic Matter (%)	Whole plant	64,43	5,01	3
Dry matter ( g/kg)	Flowerhead	322,00	4,36	3
Dry matter ( g/kg)	Stem	300,33	25,48	3
Dry matter ( g/kg)	Whole plant	330,67	23,12	3
Starch (g/kg ds)	Flowerhead	12,50	2,12	3
Starch (g/kg ds)	Stem	20,67	9,07	3
Starch (g/kg ds)	Whole plant	22,00	6,56	3
Sugar (g/kg ds)	Flowerhead	41,00	0,00	3
Sugar (g/kg ds)	Stem	96,00	15,13	3
Sugar (g/kg ds)	Whole plant	175,50	33,23	3
B (mg)	Flowerhead	41,77	2,84	3
B (mg)	Stem	33,20	2,39	3
B (mg)	Whole plant	40,97	1,65	3
Ca (g)	Flowerhead	12,50	1,21	3
Ca (g)	Stem	17,97	0,90	3
Ca (g)	Whole plant	17,63	1,33	3
Co (µg)	Flowerhead	109,00	13,23	3
Co (µg)	Stem	52,00	4,24	3
Co (µg)	Whole plant	63,67	11,55	3
Cu (mg)	Flowerhead	8,73	0,59	3
Cu (mg)	Stem	3,97	0,51	3
Cu (mg)	Whole plant	4,83	0,67	3
Fe (mg)	Flowerhead	156,00	16,52	3

Fe (mg)	Stem	136,00	8,89	3
Fe (mg)	Whole plant	183,00	9,00	3
K (g)	Flowerhead	32,47	2,20	3
K (g)	Stem	21,17	2,46	3
K (g)	Whole plant	19,33	2,20	3
Mg (g)	Flowerhead	3,73	0,23	3
Mg (g)	Stem	2,60	0,20	3
Mg (g)	Whole plant	2,87	0,46	3
Mn (mg)	Flowerhead	17,67	0,58	3
Mn (mg)	Stem	36,33	4,16	3
Mn (mg)	Whole plant	39,00	2,65	3
Mo (mg)	Flowerhead	3,03	0,12	3
Mo (mg)	Stem	1,60	0,10	3
Mo (mg)	Whole plant	1,30	0,10	3
Na (g)	Flowerhead		3	
Na (g)	Stem		3	
Na (g)	Whole plant		3	
P (g)	Flowerhead	4,50	0,10	3
P (g)	Stem	2,80	0,17	3
P (g)	Whole plant	2,80	0,17	3
S (g)	Flowerhead	1,30	0,17	3
S (g)	Stem	0,30	0,00	3
S (g)	Whole plant	0,43	0,15	3
Se ( $\mu$ g)	Flowerhead	219,00	37,36	3
Se ( $\mu$ g)	Stem	100,67	17,01	3
Se ( $\mu$ g)	Whole plant	110,00	27,87	3
Zn (mg)	Flowerhead	20,67	1,15	3
Zn (mg)	Stem	11,33	4,93	3
Zn (mg)	Whole plant	15,00	1,73	3

