BEESPOKE Frisian clay area: Insect profiles measured with sticky traps in flower strips, ditch sides and crops (rape seed, cereals, broad beans, flax, potato),.

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Introduction: Flower strips can help in supporting pollinators, pest control species and biodiversity in general. Many seed mixes exist, but not many aim for introducing flower strips with local landscape adapted flower species, aiming for a flower strip that delivers potential for the landscape's particular own biodiversity. Flower strips are generally known to enhance functional insects, such as pollinators and pest control species. Less is known about general biodiversity of flowers strips compared to crops and other surrounding landscape elements. We followed 4 questions that emerge from these considerations: 1) Can the BEESPOKE designed flower strip enhance pollinators, pest control species and biodiversity in general? 2) Are these BEESPOKE flower strips able to increase biodiversity more than other landscape elements in the immediate area? 3) What do the largely biologically grown BEESPOKE crops yield in terms of insect biodiversity? 4) How can these insect profiles be measured with easy and cheap measurements, that are insightful and feasible for farmers as end users?

In 2020, 2021, and 2022, we investigated these by measuring insect biodiversity with sticky traps, comparing the catches in flower strips with non-flowering (potato, cereal) and flowering (field beans, rape seed, flax) crops, as well as in the other border of the fields. We found that the most common field borders of our crop fields were ditches with some reed vegetations: this indeed is the most common field delimiter for crop fields in the Frisian clay area. We thus limited analyses of the landscape element insect profiles to those measured bordering ditches. We performed the measurements in a highly standardized way, following our BEESPOKE developed protocol and analysis pathways, which included automated visual analyses aided by machine learning (See Strijkstra et al. 2023a for a detailed description).

Methods: Insects were monitored with yellow sticky traps (10x25 cm) mounted on sticks 20-30cm above the ground, facing South to maximize light exposure. 51 Sticky traps were placed in the middle of the plot in a crop. 27 Sticky traps were placed in BEESPOKE flower strips (See Strijkstra et al. 2023b for detailed description of flower strips). 17 Sticky traps were placed in the borders of crop fields at the side of ditches, as a typical landscape element in the arable landscape of the Frisian clay area. Different crops were monitored in three subsequent years (2020-2022): 17 grassland fields (13 herb-rich fields, 4 intensive fields; see Strijkstra et al. 2023c for detailed descriptions), 11 cereal fields (5 wheat, 5 barley, 1 oats), 11 flax fields (4 with BEESPOKE flower strip, 7 without flower strip), 7 broad bean fields, 4 rape seed fields, and 3 potato fields. Plots were measured 1-2 times, grasslands early in the year in May and June, crops somewhat later in June and July. Flowering crops were measured when the crops were growing and flowering.

Sticky trap analysis was performed using visual analyses aided by machine learning algorithms developed for detection and segmentation of insects on sticky traps, followed by manual taxonomic assessments to the nearest easily achievable taxonomic unit (See Strijkstra et al. 2023a for a detailed description).

Since insect communities are expected to differ greatly in several aspects, different variables on the insect communities were quantified. High numbers of insects can be viewed as indicating chances for insects to occur in high numbers, potentially serving species richness and diversity, and trophic value to the sampled ecosystem. High biomass of insects can be viewed as indicating trophic value to the ecosystem, and also indicates high chances for large insects, which have a longer development time, requiring stable resources. High species richness (e.g. Chao-1) indicates high chances for a large set of species with different life histories to use the environment. High species diversity (e.g. Shannon entropy) indicates a more balanced abundance distribution of the species, indicating a more balanced community, as, for example, opposed to a community dominated by a few species combined with other species that only occur occasionally in low numbers. As other variables, measures of functional biodiversity were calculated (numbers of bees as pollinators, numbers of hoverflies as pollinators / pest control species, numbers of pest control insects / natural enemies of pest species) at the taxonomic level of family. Natural enemies were categorized as the sum of spiders *(order Aranae)*, lady bugs *(Coccinellidae)*, soldier beetles *(Cantharidae)*, parasitic wasps *(Ichneumonidae)*, green lacewings *(Chrysopidae)* , hoverflies *(Syrphidae)* and rove beetles *(Staphylinidae),* according to the protocols described by the Louis Bolk Institute and ANOG (Luske and Schultinga 2019a,b; Schultinga 2020). To compile these differing indicators of (functional) biodiversity, the values of the different variables were ranked for the different habitats (flower strips, ditch sides, and crops: cereals, rape seed, broad beans, flax, potato, grassland). To get an overall indication of the relative value of the different habitats compared to each other, an average ranking was calculated.

Results: In this comparison of biodiversity in flowers strips, crop border vegetation (ditches), and different crops, 76682 arthropods (of which 76144 insects) were caught at all the locations on 372 sticky traps (1-6 duplicate measurements at 95 different situations). In total 11104 (14.5%) insects could be assigned a taxonomic classification on at least the family level. In total, 13 insect orders were found, and 57 insect families, 2157 hoverflies, 18 bees, and 4173 natural enemy (pest control) species were identified. To make data inter-comparable between situations, data were averaged per sticky trap per year (season) per location (field).

On the order level, most identified insects were *Diptera/ flies* (74,2%), *Hymenoptera/* (10,8%), *Thysanoptera* (9,8%), *Hemiptera* (3,8%), *Coleoptera* (0,7%) and 8 other orders <0,5%. On the family level, most identified insects were *Syrphidae*/ hoverflies (17,7%), *Empididae*/dagger flies (17,7%), *Ichneumonidae*/ parasitic wasps (12,9%), *Sepsidae*/ black scavenger flies (9,0%), *Caliphoridae*/ Blowflies (6,5%), *Dolichopodidae*/ long legged flies (6,2%), *Tenthredinidae*/ sawflies (4,6%), *Asilidae*/ Robber flies (2,7%), *Scathophagidae*/ dung flies (2,2%), *Cantharidae*/ soldier beetles (1,7%), *Chrysididae*/ cuckoo wasps (1,7%), and 46 other families with <1%. (Data in Appendix 1)

Family richness: In flower strips, 47 families were found, followed by 39 in ditch sides. The flowering crops had 20 (broad bean), 21 (rape seed) or 22 (flax) families, non-flowering crops had 10 (potato) and 27 (cereals: wheat, barley, oats) families, and grasslands 13 (intensive) and 17 (herb-rich) families (see Table 1). Both the flower strips and the arable ditch sides appear very species rich compared to the crops and grassland. Indeed, estimated family richness (Chao-1) showed a similar pattern: 54,1 for flower strips, 47,1 for ditch sides, 21,0, 27,1 and 30,0 for flowering crops, 18,0-43,0 for the non-flowering crops, and 14,0-19,0 for grasslands. Since the coverage numbers were very close to 1, we may assume that these estimations are quite accurate, and not much may be gained by increasing numbers of sticky traps.

Family diversity: Family diversity showed a slightly different pattern, in that the highest values of diversity (Shannon entropy) were still attained by flower strips (2,29) and ditch sides (2,52), but now relatively high diversity was attained by grassland (2,03-2,09), close to some crops (broad beans: 2,27; flax: 2,45).

Table 1. *Summary of family richness and diversity data, for the flower strips, for ditch sides, for the flowering crops rape seed, broad bean and flax, for non-flowering crops cereal (wheat, barley, oats) and potato, and for grasslands (herb-rich and intensive).*

crop	observed families	coverage	Family richness (Chao-1) estimate	*sem*	Shannon entropy estimate	*sem*
flower strip	**47**	0.997	54.1	*5.9*	2.291	*0.019*
opposite edge *(ditch side)*	**39**	0.994	47.1	*7.1*	2.519	*0.030*
rapeseed	**21**	0.991	27.1	*6.1*	1.220	*0.057*
cereal	**27**	0.996	43.0	*16.5*	1.882	*0.026*
broad bean	**20**	0.997	21.0	*1.9*	2.267	*0.037*
flax	**22**	0.994	30.0	*11.6*	2.448	*0.030*
grass (herb rich)	**17**	0.999	19.0	*3.7*	2.094	*0.024*
grass (intensive)	**13**	0.993	14.0	*1.9*	2.028	*0.058*
potato	**10**	0.979	18.0	*11.6*	1.289	*0.082*

In contrast, rape seed (1,22) and both non-flowering crops (cereals: 1,88; potato: 1,29) appeared low in diversity. This may suggest that the last 3 crops probably are very attractive to relatively few families of *Diptera* (potato, cereals) and *Hymenoptera* (rape seed) families (see Appendix 1).

Insect numbers and insect biomass: Lengths and biomass could be automatically calculated for all arthropods, after the removal of *Lepidoptera* and *Odonata* from the analyses (see Strijkstra et al. 2023a for detailed description of methods and analyses). Number of insects appeared intermediate for flower strips at 250,47 insects/sticky trap and for crop field ditch sides at 226,29 insects/sticky trap. Cereals (312,05 insects/sticky trap), rape seed (412,19 insects/sticky trap), and broad beans (282,04 insects/sticky trap) had higher numbers, and flax (119,63 insects/sticky trap), grassland (herb-rich: 122,97 insects/sticky trap, intensive: 82,58 insects/sticky trap), and potato (73,42 insects/sticky trap) had lower numbers.

Biomass had high values in flower strips (294,45 mg/sticky trap), cereals (mg/sticky trap), and rape seed (372,62 mg/sticky trap), lower values for ditch sides (185,94 mg/sticky trap) and broad beans (182,75 mg/sticky trap), and further reducing values for flax (126,21 mg/sticky trap), grassland (156,66 herb-rich mg/sticky trap, intensive 116,51 mg/sticky trap) to potato (48,40 mg/sticky trap) as the lowest value. The patterns of numbers of individuals and biomass differed between situations. These differences are probably related to the number of large insects (e.g. *Syrphidae*/hoverflies, *Empididae*/dagger flies, large *Hymenoptera*), which was relatively high in flower strips, cereal and rapeseed, and relatively low in ditch sides and broad bean crops. Otherwise, the variation in biomass appeared to follow the variation in insect numbers quite well (Data shown in Appendix 2, figure 1.).

Functional insects: Bees (as potential pollinators), hoverflies (as potential pollinators and pest control species), and number of individuals from known natural enemies of pests on the stick traps were used as indicators for functional agrobiodiversity.

Bees were caught in low numbers in cereal, crop land ditch sides, flower strips, rape seed and flax. The low number of caught bees, and the absence of bees caught in broad beans, where they were observed in large numbers (see Boerema et al. 2023 for data on pollination in broad beans), and caught in relatively high numbers in pan traps and with insect netting (see Strijkstra et al. 2023 for data) suggest that the used yellow sticky traps are not an effective tool to inventory bees in these Frisian clay area settings. Previous research using yellow sticky traps on Frisian sandy soils in hedgerow landscapes did yield usable numbers of bees, when densities of smaller wild bee species were considerably higher, and the setting in general had less high and closed crop vegetations (Ploeg and Diertens, 2019).

Hoverflies were caught in larger numbers in all situations. High numbers were found in flower strips (9,66 /sticky trap), cereals (8,84 /sticky trap) and rape seed (7,06 /sticky trap), lower numbers were caught in crop field ditch sides (3,57 /sticky trap), and broad beans (3,68 /sticky trap), followed by lower numbers for flax (2,47 /sticky trap), and grassland (herb-rich: 2,38 /sticky trap, intensive: 2,83 /sticky trap), and potato (1,0 /sticky trap).

Natural enemies that are beneficial for crops were calculated as the numbers of known natural enemy families (predators, parasitoids), as suggested as quantifiable pest control species for wheat (Luske and Schultinga, 2019a), potato (Luske and Schultinga, 2019b) and sugar beat (Schultinga 2020). Relatively high numbers of >10 /sticky trap were found for rape seed (21,56 /sticky trap), ditch sides (18,87 /sticky trap), flax (13,17 /sticky trap) and flower strips (10,75 /sticky trap). Lower numbers were found for cereals (9,61 /sticky trap), broad bean (8,68 /sticky trap), and herb-rich grassland (8,0 /sticky trap). Lowest numbers were found for intensive grassland (3,5 /sticky trap) and potato (5,75 /sticky trap).

Ranking biodiversity indicators: Biodiversity generally has beneficial stabilizing effects on ecosystem functioning. This is based on the diversity of functional roles and connections between players in the ecosystem community. Examples of important functional roles are pollination and trophic interactions (e.g. predation, parasitism). Besides measuring (observed individuals of taxonomic groups), or estimating numbers of individuals form certain species or species groups, or calculating their mathematical diversity, it also makes sense to look at numbers of functional groups of insects as quality measures of ecosystems.

In an attempt to combine different quality aspects of the investigated habitats, we ranked the situations /habitats for all the derived biodiversity or functional group indicators, and calculated an average rank as an overall estimation of apparent quality of the situation for insects. The data of this ranking exercise is shown in Table 2.

Flower strips rank highest at 2.6 on the scale of 1 (highest in all considered situations in all considered aspects) to 9 (lowest in all considered situations in all considered aspects). Also the crop field ditch sides rank high at 3.0. They both rank high in family richness and diversity, and in numbers and biomass of insects, which can be considered as the most important biodiversity indices.

Table 2. Summary of biodiversity indicators found with sticky traps in flower strips, ditch sides, crops, and grassland. Chao-1 estimate indicates the estimated richness in taxonomic families based on abundance data on families caught on yellow sticky traps. Shannon entropy indicates the estimated (bio)diversity in families diversity. Also excluding the rankings of functional insects, the same overall ranking occurred. Species richness

crop	rank (avg)	chao-1 estimate		shannon entropy		insect counts (nr/trap)		insect biomass (mg/trap)		bees (nr/trap)		hoverflies (nr/trap)		natural enemies (nr/trap)	
		value	rank	value	rank	value	rank	value	rank	value	rank	value	rank	value	rank
flower strip	**2.6**	54.10	1	2.29	3	250.47	4	319.64	2	0.07	3	9.66	1	10.75	4
opposite edge (ditch side)	**3.0**	47.10	2	2.52	1	226.29	5	185.89	4	0.08	2	3.57	5	18.87	2
cereal	**3.3**	43.00	3	1.88	7	312.05	2	294.62	3	0.14	1	8.84	2	9.61	5
rape seed	**3.4**	27.10	5	1.22	9	412.19	1	372.67	1	0.06	4	7.06	3	21.56	1
broad bean	**4.9**	21.00	6	2.27	4	282.04	3	182.79	5	0.00	6	3.68	4	8.68	6
flax	**5.0**	30.00	4	2.45	2	119.63	7	126.29	7	0.02	5	2.47	7	13.17	3
grass (herb rich)	**6.4**	19.00	7	2.09	5	122.97	6	156.62	6	0.00	6	2.38	8	8.00	7
grass (intensive)	**7.4**	14.00	9	2.03	6	82.58	8	116.39	8	0.00	6	2.83	6	3.50	9
potato	**8.1**	18.00	8	1.29	8	73.42	9	48.49	9	0.00	6	1.00	9	5.75	8

Comparing flower strips to ditch sides on the same crop fields is a meaningful way to assess the added value of a flowers strip. Flower strips were found to have 20,5% more families, and were estimated to have 14,9% more families (Chao-1) than ditch sides on the same crop fields. Flower strips had 10,7% more insects, and 71,9% more insect biomass than ditch sides on the same crop fields.

Conclusion: Flower strips harbored high numbers of insects, high numbers of insect families, high insect diversity of families, high numbers of pollinators and pest control species, and high biomass of insects, as compared to normal ditch sides without added flower richness. Some crops were also found to have high values in some of the variables we extracted from sticky trap catches. However, crops are temporarily rich, whereas flower strips carry biodiversity throughout the season.

We used yellow sticky traps as an accessible, small scale, affordable and highly standardized method to measure insect profiles, that is also directly insightful to farmers. We were able to catch and measure a diverse insect family profile with sticky traps, and extract meaningful and variable indices for interpretation of (functional) insect biodiversity. We did catch a low number of bees on sticky traps, even though observations in broad beans (Boerema et al 2023) and rapeseed indicated presence of substantial numbers of bees. This illustrates that vertical yellow sticky traps are not the optimal method for catching and quantifying bees, other methods (Strijkstra et al 2023d) appear more suited. However, in general sticky traps can be used as a meaningful and representative method for the analysis of (functional) insect biodiversity in the arable landscape, and also grasslands.

Landscape elements such as the BEESPOKE designed flower strips and ditch sides, as typical field margins in the Frisian clay area, come out as the most biodiverse habitats in terms of insect richness and diversity as measured with sticky traps. Flower strips produce significantly more insect biomass. Both flower strips and ditch sides also contain significant numbers of functional insects (pollinators and natural enemies) and can as such serve as a source of these insects for adjacent crops.

The investigated crops can also be valuable as temporary habitat for insects. Especially the (non-flowering) cereals (wheat, barley, oats) and (flowering) rape seed are relatively high in number of estimated insect families and very high in insect biomass produced, but the diversity of the insect communities observed was relatively low in these crops. The other flowering crops (broad bean, flax) were quite diverse in both estimated family richness and diversity, but lower in numbers. These crops still outperformed grassland and potato in terms of biodiversity value.

Flax is a special crop that was historically farmed a lot in the Frisian clay area but has mostly been replaced by other crops since. Active efforts are ongoing to bring it back in the crop rotation. It can be concluded that flax is not a top performer in our ranking, but it is still quite rich and diverse in insect families, and outperforms both grassland and potato. As such flax has value for supporting insect diversity and could be considered an important inclusion in the crop rotation also serving biodiversity.

Grassland can also be considered an important crop given the large area of dairy farms in the Frisian clay area (and in The Netherlands in general). Intensively farmed grasslands do not perform well in our biodiversity ranking, although still outperforming potato. Extensively maintained, somewhat more herb-rich grasslands are performing slightly better than intensive grasslands on most of the biodiversity indicators in our ranking. Seeing that grassland is not a temporary crop, and the prominence of grasslands in the Frisian clay area, improving grass land quality for biodiversity will be very important. Potato scores low in relative and absolute terms on all the biodiversity indicators measured. This crop with a high economic value, unfortunately has low value for supporting insect biodiversity. This is probably based on the intensity of the crop management, severely managing soil and suppressing weeds.

In summary, based on our ranking of several relevant biodiversity parameters, flower strips show on average a higher ranking of several combined relevant markers of (functional) insect biodiversity over ditch sides as a typical not farmed field margin, and, depending on the crop, a more or less pronounced higher ranking over typical flowering and non-flowering crops, planted in the Frisian clay area. Stable and well maintained BEESPOKE designed flower strips appear a useful and important asset in the arable landscape to support and sustain (functional) insect biodiversity.

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Appendix 1. Summary of numbers of individual insects caught with sticky traps in flower strips and ditch sides, and flowering (rape seed, broad bean, flax), non-flowering crops (cereals, potato) and grasslands (herb-rich, intensive) in the Frisian clay area. Subsets of insects were determined to order, and to family taxonomic levels. Numbers were expressed as number per sticky trap, averaged for the particular situation. Darker green colors indicate a higher number of a particula class/order/family per trap in comparison to the other crops.

			flower strip		opposite edge (ditch side)		rapeseed		cereal		broad bean		flax		grass (herb rich)		grass (intensive)		potato		all
			n=27		n=17		n=4		n=11		n=7		n=9		n=13		n=4		n=3		n=95
Order	**Name**	**rank**	nr/trap	*sem*	nr/trap	*sem*	nr/trap	*sem*	nr/trap	*sem*	nr/trap	*sem*	nr/trap	*sem*	nr/trap	*sem*	nr/trap	*sem*	nr/trap	*sem*	nr/trap
	insects *(Insecta)*	Class	250.47	*20.32*	226.29	*25.27*	412.19	*78.34*	312.05	*53.68*	282.04	*59.74*	119.63	*24.90*	122.97	*15.34*	82.58	*11.71*	73.42	*22.35*	219.906
	arachnida *(Arachnida)*	Class	0.23	*0.06*	0.45	*0.13*	0.25	*0.25*	0.11	*0.07*	0.21	*0.09*	0.31	*0.13*	0.62	*0.13*	0.96	*0.25*	0.75	*0.63*	0.363
	flies *(Diptera)*	Order	138.56	*15.89*	129.52	*20.38*	283.13	*76.31*	213.43	*43.67*	141.89	*25.10*	80.07	*17.41*	70.90	*11.62*	43.29	*10.18*	38.08	*13.97*	129.962
	hymenoptera *(Hymenoptera)*	Order	13.35	*1.82*	27.20	*5.45*	50.50	*31.52*	23.09	*10.29*	15.82	*4.46*	15.37	*1.81*	15.26	*1.92*	12.38	*3.05*	7.58	*3.48*	18.932
	thrips *(Thysanoptera)*	Order	30.65	*5.11*	24.37	*7.90*	10.38	*3.86*	18.91	*7.74*	11.75	*2.74*	1.37	*1.03*	1.46	*0.19*	1.54	*0.34*	5.67	*2.20*	17.137
	true bugs *(Hemiptera)*	Order	8.81	*1.16*	7.49	*1.40*	3.56	*1.54*	10.75	*2.99*	10.50	*1.21*	1.19	*0.55*	2.14	*0.40*	2.33	*0.47*	3.00	*2.88*	6.610
	beetles *(Coleoptera)*	Order	1.72	*0.31*	1.12	*0.21*	1.31	*0.34*	1.00	*0.29*	1.43	*0.36*	0.64	*0.25*	0.86	*0.30*	2.17	*0.56*	0.08	*0.08*	1.239
	butterflies *(Lepidoptera)*	Order	0.88	*0.14*	0.37	*0.10*	1.31	*0.81*	0.23	*0.09*	0.11	*0.07*	0.12	*0.04*	0.65	*0.16*	0.29	*0.08*	0.25	*0.14*	0.526
	odonata *(Odonata)*	Order	0.25	*0.07*	1.11	*0.56*	0.75	*0.31*	0.45	*0.21*	0.00	*0.00*	0.43	*0.28*	0.04	*0.03*	0.00	*0.00*	0.17	*0.17*	0.405
	net-winged insects *(Neuroptera)*	Order	0.48	*0.16*	0.34	*0.15*	0.00	*0.00*	0.25	*0.13*	0.32	*0.14*	0.16	*0.11*	0.00	*0.00*	0.00	*0.00*	0.08	*0.08*	0.268
	earwigs *(Dermaptera)*	Order	0.04	*0.02*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.011
	mayflies *(Ephemeroptera)*	Order	0.04	*0.04*	0.01	*0.01*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.013
	orthoptera *(Orthoptera)*	Order	0.01	*0.01*	0.01	*0.01*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.02	*0.02*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.007
	caddisflies *(Trichoptera)*	Order	0.01	*0.01*	0.00	*0.00*	0.00	*0.00*	0.02	*0.02*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.005
	megaloptera *(Megaloptera)*	Order	0.02	*0.02*	0.01	*0.01*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.008
Diptera	hover flies *(Syrphidae)*	Family	9.66	*2.42*	3.57	*0.76*	7.06	*2.39*	8.84	*4.19*	3.68	*1.29*	2.47	*0.74*	2.38	*0.61*	2.83	*1.34*	1.00	*0.58*	5.687
Diptera	empididae *(Empididae)*	Family	6.81	*2.01*	4.82	*2.37*	2.44	*1.48*	18.89	*9.46*	4.71	*1.97*	0.70	*0.44*	0.81	*0.25*	0.38	*0.18*	1.75	*1.63*	5.682
Hymenoptera	Ichneumon wasps *(Ichneumonidae)*	Family	2.54	*0.47*	4.04	*0.87*	35.63	*27.79*	3.34	*0.90*	5.46	*1.64*	2.56	*0.81*	0.00	*0.00*	0.00	*0.00*	4.92	*3.20*	4.132
Diptera	black scavenger flies *(Sepsidae)*	Family	4.30	*1.72*	2.79	*2.20*	2.56	*0.80*	1.23	*0.55*	3.39	*1.97*	2.26	*2.04*	3.06	*1.32*	0.83	*0.39*	0.33	*0.17*	2.899
Diptera	blow flies *(Calliphoridae)*	Family	4.51	*1.15*	1.21	*0.40*	2.00	*0.67*	1.27	*0.54*	2.25	*1.46*	1.20	*0.47*	0.59	*0.10*	0.08	*0.05*	0.00	*0.00*	2.093
Diptera	long-legged flies *(Dolichopodidae)*	Family	1.21	*0.43*	1.21	*0.35*	0.63	*0.63*	0.66	*0.30*	1.04	*0.45*	1.17	*0.20*	5.58	*0.89*	2.38	*0.44*	8.50	*8.00*	1.982
Hymenoptera	saw flies *(Tenthredinidae)*	Family	0.26	*0.08*	0.56	*0.32*	0.19	*0.12*	9.91	*9.74*	0.32	*0.21*	0.00	*0.00*	0.59	*0.13*	0.79	*0.32*	0.00	*0.00*	1.467
Diptera	robber flies *(Asilidae)*	Family	0.48	*0.38*	3.13	*2.79*	0.00	*0.00*	0.55	*0.55*	0.00	*0.00*	1.09	*0.64*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.864
Diptera	dung flies *(Scathophagidae)*	Family	0.28	*0.22*	0.37	*0.14*	0.00	*0.00*	0.07	*0.07*	0.36	*0.36*	1.51	*0.63*	2.50	*0.55*	1.25	*0.72*	0.00	*0.00*	0.717
Coleoptera	soldier beetles *(Cantharidae)*	Family	0.96	*0.27*	0.34	*0.12*	0.19	*0.12*	0.73	*0.27*	1.14	*0.36*	0.17	*0.08*	0.08	*0.03*	0.08	*0.08*	0.00	*0.00*	0.541
Hymenoptera	cuckoo wasps *(Chrysididae)*	Family	0.69	*0.32*	0.87	*0.51*	0.00	*0.00*	0.86	*0.48*	0.93	*0.55*	0.17	*0.07*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.537
Coleoptera	rove beetles *(Staphylinidae)*	Family	0.23	*0.10*	0.11	*0.04*	0.19	*0.12*	0.05	*0.03*	0.14	*0.07*	0.07	*0.05*	0.71	*0.30*	1.92	*0.55*	0.00	*0.00*	0.293
Diptera	soldier flies *(Stratiomyidae)*	Family	0.53	*0.14*	0.11	*0.06*	0.00	*0.00*	0.70	*0.63*	0.00	*0.00*	0.00	*0.00*	0.17	*0.08*	0.04	*0.04*	0.00	*0.00*	0.276
Neuroptera	green lacewings *(Chrysopidae)*	Family	0.48	*0.16*	0.34	*0.15*	0.00	*0.00*	0.25	*0.13*	0.32	*0.14*	0.16	*0.11*	0.00	*0.00*	0.00	*0.00*	0.08	*0.08*	0.268
Diptera	lake flies *(Chironomidae)*	Family	0.31	*0.08*	0.21	*0.09*	0.44	*0.44*	0.16	*0.08*	0.43	*0.32*	0.56	*0.41*	0.00	*0.00*	0.00	*0.00*	0.08	*0.08*	0.248
Diptera	flesh flies *(Sarcophagidae)*	Family	0.25	*0.09*	0.35	*0.22*	0.06	*0.06*	0.39	*0.23*	0.00	*0.00*	0.20	*0.12*	0.01	*0.01*	0.00	*0.00*	0.00	*0.00*	0.203
Diptera	drain flies *(Psychodidae)*	Family	0.03	*0.02*	0.83	*0.58*	0.00	*0.00*	0.02	*0.02*	0.11	*0.05*	0.30	*0.28*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.196
Lepidoptera	nymphalidae *(Nymphalidae)*	Family	0.20	*0.09*	0.15	*0.07*	0.13	*0.13*	0.02	*0.02*	0.00	*0.00*	0.05	*0.03*	0.59	*0.15*	0.21	*0.08*	0.00	*0.00*	0.186
Diptera	tachinid flies *(Tachinidae)*	Family	0.38	*0.23*	0.03	*0.02*	0.00	*0.00*	0.55	*0.43*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.176
Diptera	snipe flies *(Rhagionidae)*	Family	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.02	*0.02*	0.00	*0.00*	0.00	*0.00*	0.87	*0.45*	0.00	*0.00*	0.00	*0.00*	0.122
Odonata	pond damselflies *(Coenagrionida)*	Family	0.03	*0.02*	0.29	*0.16*	0.25	*0.18*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.04	*0.03*	0.00	*0.00*	0.00	*0.00*	0.075
Lepidoptera	fungus moths *(Tineidae)*	Family	0.19	*0.09*	0.03	*0.03*	0.00	*0.00*	0.05	*0.05*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.063
Coleoptera	lady bugs *(Coccinellidae)*	Family	0.14	*0.06*	0.03	*0.02*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.09	*0.06*	0.00	*0.00*	0.00	*0.00*	0.08	*0.08*	0.056
Hymenoptera	apidae *(Apidae)*	Family	0.07	*0.03*	0.08	*0.04*	0.06	*0.06*	0.14	*0.05*	0.00	*0.00*	0.02	*0.02*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.055
Lepidoptera	pieridae *(Pieridae)*	Family	0.10	*0.04*	0.04	*0.02*	0.13	*0.07*	0.02	*0.02*	0.07	*0.05*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.050
Diptera	march flies *(Bibionidae)*	Family	0.04	*0.03*	0.01	*0.01*	0.88	*0.88*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.050
Diptera	crane flies *(Tipulidae)*	Family	0.02	*0.02*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.04	*0.04*	0.03	*0.03*	0.17	*0.05*	0.25	*0.14*	0.00	*0.00*	0.044
Coleoptera	click beetles *(Elateridae)*	Family	0.02	*0.01*	0.06	*0.03*	0.00	*0.00*	0.02	*0.02*	0.00	*0.00*	0.19	*0.12*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.037
Diptera	dark-winged fungus gnats *(Sciaridae)*	Family	0.05	*0.02*	0.00	*0.00*	0.06	*0.06*	0.02	*0.02*	0.07	*0.07*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.17	*0.17*	0.029
Hemiptera	flower bugs *(Anthocoridae)*	Family	0.02	*0.02*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.29	*0.29*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.026
Diptera	peacock flies *(Tephritidae)*	Family	0.00	*0.00*	0.12	*0.12*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.03	*0.02*	0.00	*0.00*	0.00	*0.00*	0.025
Coleoptera	ground beetles *(Carabidae)*	Family	0.01	*0.01*	0.07	*0.04*	0.13	*0.07*	0.00	*0.00*	0.04	*0.04*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.024
Hemiptera	capsid bugs *(Miridae)*	Family	0.03	*0.02*	0.01	*0.01*	0.00	*0.00*	0.00	*0.00*	0.14	*0.14*	0.02	*0.02*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.023
Diptera	opomyzidae *(Opomyzidae)*	Family	0.02	*0.02*	0.06	*0.04*	0.00	*0.00*	0.02	*0.02*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.04	*0.04*	0.00	*0.00*	0.021
Diptera	house flies *(Muscidae)*	Family	0.05	*0.05*	0.01	*0.01*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.016
Coleoptera	snout beetles *(Curculionidae)*	Family	0.00	*0.00*	0.06	*0.04*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.011
Diptera	marsh flies *(Sciomyzidae)*	Family	0.03	*0.02*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.008
Diptera	signal flies *(Platystomatidae)*	Family	0.03	*0.02*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.008
Hymenoptera	torymidae *(Torymidae)*	Family	0.02	*0.02*	0.01	*0.01*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.008
Megaloptera	alder flies *(Sialidae)*	Family	0.02	*0.02*	0.01	*0.01*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.008
Lepidoptera	diamondback moths *(Plutellidae)*	Family	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.02	*0.02*	0.00	*0.00*	0.00	*0.00*	0.17	*0.17*	0.007
Hymenoptera	ants *(Formicidae)*	Family	0.00	*0.00*	0.03	*0.02*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.005
Diptera	phantom crane flies *(Ptychopteridae)*	Family	0.00	*0.00*	0.03	*0.03*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.005
Odonata	skimmers *(Libellulidae)*	Family	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.05	*0.05*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.005
Coleoptera	false blister beetles *(Oedemeridae)*	Family	0.01	*0.01*	0.01	*0.01*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.005
Lepidoptera	geometer moths *(Geometridea)*	Family	0.01	*0.01*	0.01	*0.01*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.005
Orthoptera	short-horned grasshoppers *(Acrididae)*	Family	0.01	*0.01*	0.01	*0.01*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.005
Diptera	thick-headed flies *(Conopidae)*	Family	0.01	*0.01*	0.00	*0.00*	0.06	*0.06*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.005
Diptera	fruit flies *(Drosophilidae)*	Family	0.02	*0.01*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.005
Diptera	dance flies *(Hybotidae)*	Family	0.01	*0.01*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.003
Coleoptera	longhorn beetles *(Cerambycidae)*	Family	0.01	*0.01*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.003
Hemiptera	seed bugs *(Lygaeidae)*	Family	0.01	*0.01*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.003
Lepidoptera	erebidae *(Erebidae)*	Family	0.01	*0.01*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.003
Lepidoptera	owlet moths *(Noctuidae)*	Family	0.01	*0.01*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.003
Coleoptera	leaf beetles *(Chrysomelidae)*	Family	0.00	*0.00*	0.00	*0.00*	0.06	*0.06*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.003
Hymenoptera	eulophidae *(Eulophidae)*	Family	0.00	*0.00*	0.00	*0.00*	0.06	*0.06*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.003
Coleoptera	water scavenger beetles *(Hydrophilidae)*	Family	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.01	*0.01*	0.00	*0.00*	0.00	*0.00*	0.002

Appendix 2. Overview of the insect counts, biomass and indicators of biodiversity of insects observed in several crops, BEESPOKE flower strips and ditch sides.

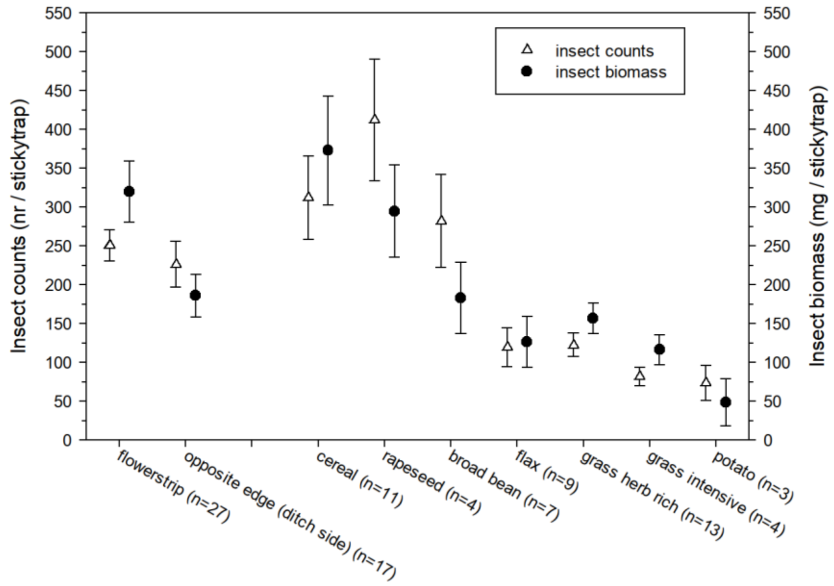

__Figure 1.__ Insect numbers (average nr / sticky trap, open triangles) and insect biomass (mg / sticky trap, closed circles) for flower strips, ditch sides and the different crops.

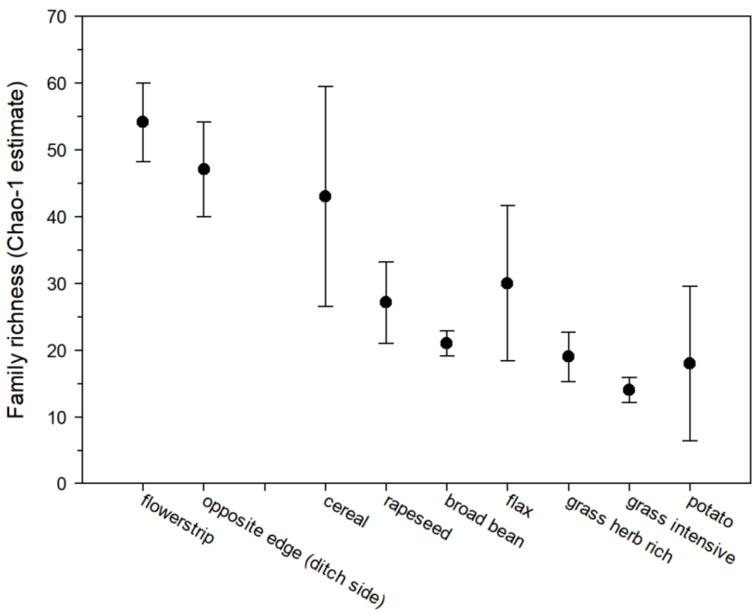

__Figure 2.__ Estimated family richness (Chao-1) based on all families observed, for flower strips, ditch sides and the different crops.

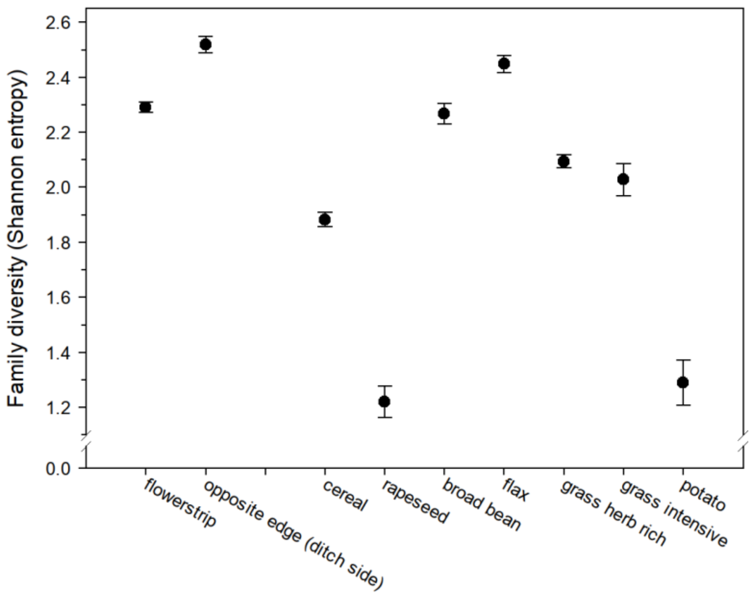

Figure 3. Estimated diversity of the insect communities (Shannon entropy) based on all families observed, for flower strips, ditch sides and the different crops.