Field vegetables: Supervised control of caterpillars and aphids according to control thresholds

Supervised control helps reducing insecticides

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OBJECTIVES

On cabbage crops several different pest species request an intensive plant protection. In the framework of the PURE project experiments were run to get information about the efficacy of different insecticides and contribution to pesticide reduction. Here, broad spectrum insecticides were compared with selective insecticides and biological ones. One focus was laid on supervised control of caterpillars (mainly cabbage moth (Mamestra brassicae), cabbage white butterfly (Pieris rapae) and diamond back moth (Plutella xylostella)) and cabbage aphids (Brevicoryne brassicae) according to control thresholds. Based on regular monitoring control of insect pests after control thresholds are exceeded is a successful tool in reducing insecticide applications. Control thresholds need to be adapted to the particular farm conditions and production aims.

APPROACH (EXPERIMENTS, ASSESSMENT TOOLS, …)

Two on-station experiments were conducted in white cabbage in 2012 and 2013, respectively. Thereby broad spectrum (lambda-cyhalothrin (Karate Zeon®) against caterpillars, dimethoate (Perfekthion®) against aphids), selective (indoxacarb (Steward®) against caterpillars, pirimicarb (Pirimor®) against aphids) and biological insecticides (spinosad (SpinTor®) against caterpillars, Bacillus thuringiensis ssp. aizawai (XenTari®) against caterpillars and rape oil (Micula®) against aphids) were compared to untreated plants. Fifty plants of each treatment were monitored weekly and treated fortnightly if control thresholds were exceeded. Control thresholds of on-station experiments were 20% infested plants with less than 100 cabbage aphids or 10% infested plants with more than 100 cabbage aphids. For caterpillars it was dependent on cabbage growth stage: 25% infested plants until 8-leaf stage, 50% infested plants from 9-leaf stage to start of head building, 5% infested plants during head performance until harvest.

In accordance with growers thresholds for on-farm trials were simplified. Here, 25 plants of each treatment were monitored weekly and treated fortnightly if control were exceeded.

PESTS

In North and Central Europe main leaf insect pests in cabbage growing are caterpillars such as cabbage moth (Mamestra brassicae), cabbage white butterfly (Pieris rapae) and diamond back moth (Plutella xylostella) as well as aphids (Brevicoryne brassicae).


B. brassicae


M. brassicae

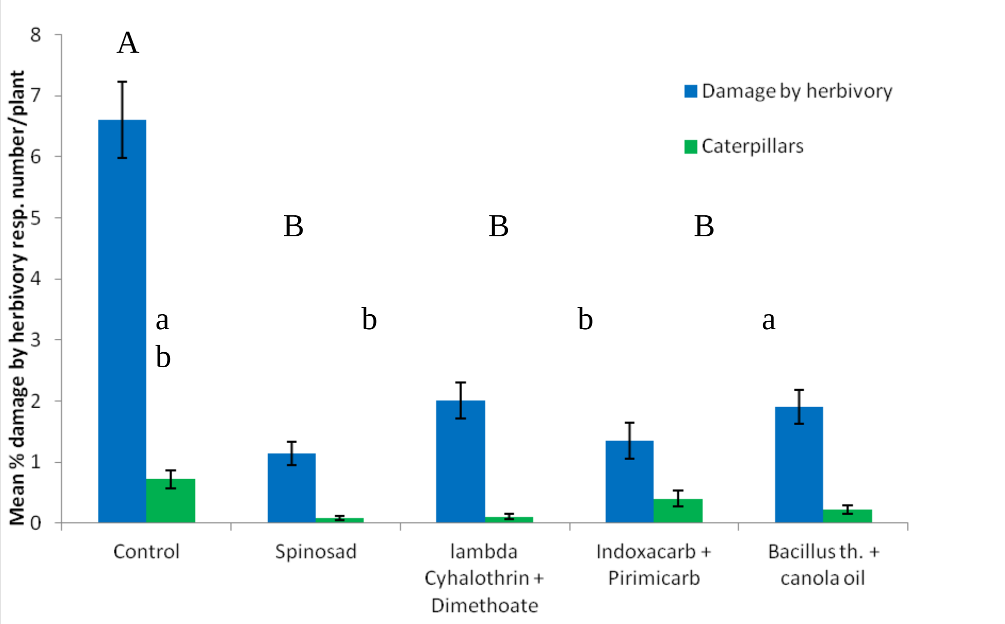

P. rapae


P. xylostella

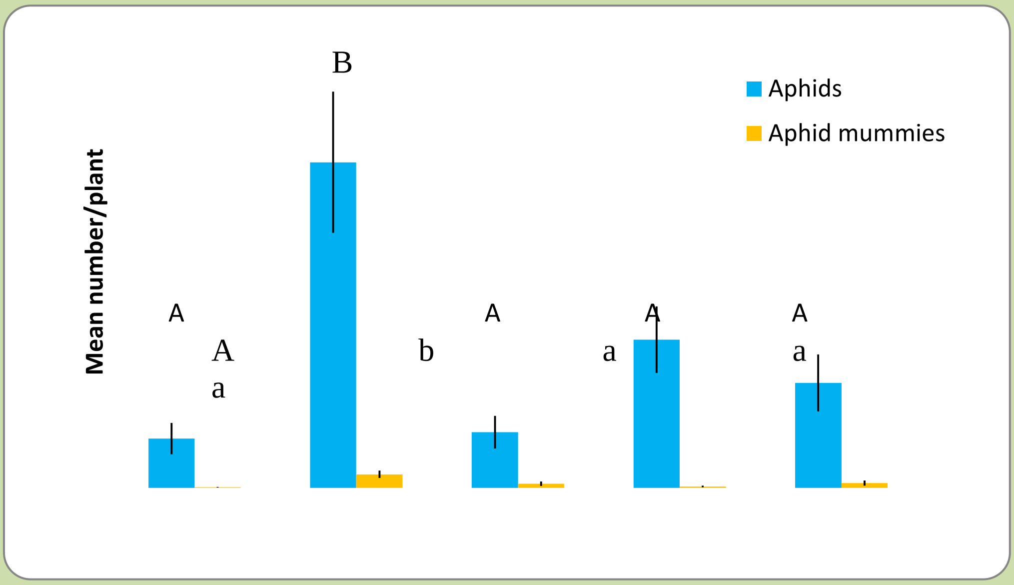
TECHNICAL RESULTS

Insect pest infestation was very low in the last years. At harvest all plant protection products reduced the number of caterpillars as well as damage by herbivory considerably.

In 2012 numbers of aphids at harvest were lowest in the untreated control. Higher numbers of aphids and parasitized aphids were found on plants treated with plant protection products and especially when spinosad was used against caterpillars. This result could indicate that insecticides may harm aphid predating insects. However this finding needs to be confirmed.



Mean percentage of damage by herbivory as well as number of caterpillars (± SE) per white cabbage plant in relation to different treatments at harvest in 2012 (n=50, Tukey HSD Test, α=0.05).



Mean number of aphids and aphid mummies (± SE) on white cabbage plants in relation to different treatments at harvest in 2012 (n=50, Tukey HSD Test, α=0.05).

White cabbage field in 2012

SUSTAINABILITY OF IPM SOLUTIONS

During on-farm trials in 2014 insecticides were sprayed 10 times on the conventional part of the field compared to five applications on the field sprayed only when thresholds were exceeded. On conventional fields two more treatments were applied against caterpillars, one against aphids and two against thrips. Data about cost-benefit-efficacy are not yet available since cabbage heads are still in the cold warehouse.

As example data, spraying data from 2014 were assessed with SYNOPS. Table 1-4 shows that by choosing biological or selective insecticides rather than broad spectrum insecticides and by using spraying less often, the risk on different aquatic and terrestrial and non-target organisms is reduced. Therefore, regarding the complete strategy, spraying after action thresholds are exceeded and using selective or biological plant protection products is a good way to minimize the risk on the environment and especially aquatic organisms.

Table 1. Risk potential of the different insecticide sprays against aphids and caterpillars for acute effects on aquatic, terrestrial, non-target organisms and groundwater in Germany.

	aquatic						terrestrial		non-target organism	Groundwater
	Aquatic	Algae	Daphnia	Fish	Lemna	Chironomus	Terrestrial	Earthworm	Bee	
complete strategy	0,623091	0,000688	0,623091	0,358277	0,000083	0,452894	0,320556	0,015361	0,320556	0
alpha-cypermethrin	0,275342	0,000688	0,275342	0,051627	0	0	0,027166	0,00006	0,027166	0
dimethoate	0,001792	0,00004	0,001792	0,000119	0	0	0,14247	0,015361	0,14247	0
lambda-cyhalothrin	0,623091	0,000119	0,623091	0,358277	0	0,095541	0,004339	0,000014	0,004339	0
pirimicarb	0,167562	0,000014	0,167562	0,000032	0	0,000168	0,010139	0,001284	0,010139	0
spinosad	0,000117	0,000013	0,000063	0,000117	0,000083	0	0,320556	0,000065	0,320556	0
thiacloprid	0,452894	0,000028	0,000012	0,000046	0,000009	0,452894	0,001234	0,000363	0,001234	0

Acute risk	very low risk	low risk	medium risk	high risk
	ETR<0.01	0.01<ETR<0.1	0.1<ETR<1.0	ETR>1.0

Table 2. Risk potential of the different insecticide sprays against aphids and caterpillars for chronic effects on aquatic, terrestrial, non-target organisms and groundwater in Germany.

	aquatic						terrestrial		non-target organism	Groundwater
	Aquatic	Algae	Daphnia	Fish	Lemna	Chironomus	Terrestrial	Earthworm	Bee	
complete strategy	59,71184	0,000866	59,71184	2,469489	0,00069	1,384257	1,428681	0,074171	1,428681	0
alpha-cypermethrin	2,203779	0,000661	2,203779	2,203779	0	0	0,162127	0,000296	0,162127	0
dimethoate	0,06564	0,00008	0,06564	0,006564	0	0	0,139571	0,064604	0,139571	0
lambda-cyhalothrin	56,92513	0,000113	56,92513	0,450847	0	0,867014	0,038296	0,000166	0,038296	0
pirimicarb	1,937315	0,000035	1,937315	0,000121	0	0,000174	0,077791	0,012279	0,077791	0
spinosad	0,849391	0,00017	0,849391	0,000609	0,000689	0	1,312594	0,000066	1,312594	0
thiacloprid	0,678236	0,000057	0,000068	0,001404	0,000014	0,678236	0,009492	0,009492	0,001217	0

Chronic risk	very low risk	low risk	medium risk	high risk
	ETR<0.1	0.1<ETR<1	1<ETR<10	ETR>10

Table 3. Risk potential of the different insecticide sprays against aphids and caterpillars for acute effects on aquatic, terrestrial, non-target organisms and groundwater in Germany.

	aquatic						terrestrial		non-target organism	Groundwater
	Aquatic	Algae	Daphnia	Fish	Lemna	Chironomus	Terrestrial	Earthworm	Bee	
complete strategy	0,167562	0,003145	0,167562	0,000519	0,004151	0,000168	0,320556	0,001284	0,320556	0
indoxacarb	0,004151	0,003145	0,000692	0,000519	0,004151	0	0,023419	0,00002	0,023419	0
pirimicarb	0,167562	0,000014	0,167562	0,000032	0	0,000168	0,010139	0,001284	0,010139	0
spinosad	0,000117	0,000013	0,000063	0,000117	0,000083	0	0,320556	0,000065	0,320556	0

Chronic risk	very low risk	low risk	medium risk	high risk
	ETR<0.1	0.1<ETR<1	1<ETR<10	ETR>10

Table 4. Risk potential of the different insecticide sprays against aphids and caterpillars for chronic effects on aquatic, terrestrial, non-target organisms and groundwater in Germany.

	aquatic						terrestrial		non-target organism	Groundwater
	Aquatic	Algae	Daphnia	Fish	Lemna	Chironomus	Terrestrial	Earthworm	Bee	
complete strategy	2,788597	0,022624	2,788597	0,00206	0,029837	0,000174	1,3904	0,012348	1,3904	0
indoxacarb	0,029837	0,022604	0,003978	0,001989	0,029837	0	0,071151	0,000028	0,071151	0
pirimicarb	1,937315	0,000035	1,937315	0,000121	0	0,000174	0,077791	0,012279	0,077791	0
spinosad	0,849391	0,00017	0,849391	0,000609	0,000689	0	1,312594	0,000066	1,312594	0

Chronic risk	very low risk	low risk	medium risk	high risk
	ETR<0.1	0.1<ETR<1	1<ETR<10	ETR>10

INNOVATIVE METHODS”

Some participants of WP4 also contributed to WP13 “Co-innovation of IPM”. Here trials were conducted together with growers on commercial farms. The overall aim was to build a bridge between research and farming practice. Results from on-farm trials showed that the reduction of pesticide use is basically possible. However control thresholds have to be adapted to the respective farm.

LIMITS AND CONDITIONS OF SUCCESS, ADAPTATIONS

Spraying plant protection products after control thresholds are exceeded is a very good option for reducing the amount of insecticides. Biological and selective insecticides performed as well as broad spectrum insecticides.
However an adaption of thresholds is needed to the respective farm due to occurrence of insect pests, environmental conditions, production goals and market demands. Furthermore the establishment of control thresholds for all pests of one crop is important.

REFERENCES

Links with deliverables and reports on the PURE website
http://www.pure-ipm.eu/publication/29