

## ALTERNATIVES FOR NEONICOTINOIDS IN A RANGE OF AGRICULTURAL CROPS (collected from national extension services in Italy, UK and NL)

Neonic	Crop	Pests	Type of use	Chemical alternatives	More sustainable solutions
Clothianidin, Thiamethoxam	Maize	Click beetles (wireworm)	Seed coating	Methiocarb, Tefluthrin, Zeta-cypermethrin, Cypermethrin	Very regional problem; pest does not cause much economic damage (only in 1% exceedance of economic threshold)
Imidacloprid	Maize	Noctuid moths, European corn borer (ostrinea), Root worm (Diabrotica)	Seed coating	Tefluthrin, Dianem, Alfa- Cypermethrin, Deltamethrin, Lambda-cyhalothrin	Root worm is a crop rotation problem. European corn borer prevented by accurate tillage of maize harvest residues and/or use of Trichogramma Applications of Bacillus thuringiensis; for Diabrotica Entomopathogenic nematodes are available
Imidacloprid Thiamethoxam Acetamiprid	Peas/beans	Aphids, thrips, Noctuid moths, European corn borer	Spraying	Deltamethrin Pirimicarb Lambda-cyhalothrin, Spinosad, Spyrotetramat,	Alternatives for moths (use economic thresholds, <i>B.thuringiensis</i> subsp. <i>kurstaki</i> and <i>aizawai</i> ) Aphids can be controlled by azadirachtin application (neem extract)
Thiacloprid Acetamiprid	Oil seed rape	Pollen beetle	Seed coating	Indoxacarb Pymetrozine Cypermethrin	Beetle resistant to pyrethroid insecticides, Monitoring for thresholds necessary, use of entomopathogenic fungi, natural enemies

				L-cyhalothrin	
Clothianidin, Thiamethoxam	Oil seed rape	Cabbage stem flea beetle, aphids, etc.	Seed coating	Fluvalinate, Deltamethrin, Cypermethrin	Natural predators, spaying only after monitoring with yellow traps
Imidacloprid, Thiamethoxam Clothianidin, Acetamiprid, Thiacloprid	Apple	Aphids, leaf-rolling moths	Spraying	Azadirachtin Abamectin, Pirimicarb, Spinosad Spyrotetramat Flonicamid	Natural predators Aphids can be easily controlled by azadirachtin application; Leafrollers can be easily controlled by BT or granulovirus (vs Adoxophies orana)
Imidacloprid, Thiamethoxam, Clothianidin, Acetamiprid, Thiacloprid	Peach	Aphids, leaf-rolling moths, leafhoppers	Spraying	Pirimicarb, Spyrotetramat, Flonicamid, Buprofezin	Aphids can be easily controlled by azadirachtin application; Leafrollers can be easily controlled by BT or granulovirus (vs Adoxophies orana); leafhoppers can be controlled by natural pyrethrum
Thiamethoxam	Grapevine	Leafhoppers and <i>S. titanus</i>	Spraying	Indoxacarb, Chlorpyrifos-ethyl	leafhoppers can be controlled by natural pyrethrum; Crucial the monitoring before spraying
Imidacloprid	Cabbage	Thrips. Moth	Seed coating/spraying	Spinosad, Lamba-cyhalothrin, Pyrethroid+piperonylbuto xide Deltamethrin Esfenvalerate	Alternatives for moths (use economic thresholds, <i>B.thuringiensis</i> subsp. <i>kurstaki</i> ) and for thrips (minute pirate bug: <i>Orius</i> <i>spp.</i> ). Thrips are a minor problem on cabbages; no treatments needed
Thiamethoxam	Cabbage	Aphids	Seed coating/spraying	Pirimicarb, Spyrotetramat, Piperonylbutoxide/pyrethr inen Pymetrozine	Aphids can be easily controlled by azadirachtin application
Imidacloprid	Leek (for seed)	Thrips	Seed coating	Spinosad, Abamectine, Deltamethrin, Piperonylbutoxide/pyrethr inen	Alternatives for thrips (minute pirate bug: <i>Orius spp.</i> ), entomopathogenic nematodes Azadirachtin and natural pyrethrum (without piperonylbutoxide) are realistic alternatives
Imidacloprid, Acetamiprid,	Eggplant	Aphids, Colorado beetle, Whiteflies, Flies ( <i>Liriomyza</i> )	Spraying	Spyrotetramat, Etofenprox	Aphids can be controlled by azadirachtin application

Thiamethoxam					Colorado Beetle can be controlled by bacillus thuringiensis sv. Tenebrionis of Azadiracthin as well as whiteflies. For whiteflies there are many beneficial insects to be released and Beauveria bassiana and other entomopatogenic fungi are registered
Imidacloprid, Acetamiprid, Thiamethoxam	Melon	Aphids	Spraying	Flonicamid, Spirotetramat, Pymetrozine	Alternatives (aphid predators) Aphids can be controlled by azadiracthin application
Imidacloprid, Clothianidin, Acetamiprid, Thiamethoxam	Potato	Aphids, Colorado beetle	Spraying	Novaluron, Metaflumizone	Alternatives for Colorado beetle ( <i>B. thuringiensis</i> subsp. <i>tenebrionis</i> )
Imidacloprid, Thiamethoxam	Tomato	Aphids, Whiteflies	Spraying	Flonicamid, Spirotetramat, Azadiractine, Fluvalinate,	Alternatives for whiteflies in greenhouse (Predator mite, entomopathogenic fungus) Aphids can be controlled by azadiracthin application (already included)
Thiamethoxam, Imidacloprid	Trees (nursery)/flowers	Aphids	Spraying	Azadirachtin, Flonicamid, Pyrethroids, Pirimicarb, Pymetrozine, Spirotetramat	Azadiracthin already included
Imidacloprid	Flower bulbs	Aphids, Thrips, Cicades, div. flies	Spraying	Pirimicarb, Esfenvaleraat, Deltamethrin, Pymetrozine, Lambda-cyhalothrin, Spirotetramat, Flonicamid, Pymetrozine	Azadiracthin