

Complete List of Actions for Enhancing Natural Pest Control

	Num. of studies ¹
REDUCING AGRICULTURAL POLLUTION	
<i>Pesticides and herbicides</i>	
1 Reduce pesticide use *	404
2 Use more selective pesticides	225
3 Provide refuges from spraying for natural enemies	2
4 Leave headlands in fields unsprayed (conservation headlands)	8
5 Use chemical application techniques that reduce the impact on natural enemies	30
6 Use pesticides only when pests or crop damage reach threshold levels *^	29
7 Incorporate parasitism rates when setting thresholds for insecticide use ^	1
8 Alter the timing of insecticide use *^	13
9 Reduce herbicide use *	108
10 Delay herbicide use ^	4
11 Avoid using genetically modified insecticidal or herbicide-resistant crops	48
<i>Fertilizers</i>	
12 Reduce mineral fertilizer use *	266
13 Use organic rather than mineral fertilizers	90
<i>Reducing chemicals in general</i>	
14 Reduce pesticide, herbicide or fertilizer use generally (including integrated management methods) *	182
15 Convert to organic farming *^	82
ALL FARMING SYSTEMS	
<i>Manage habitat and food</i>	
16 Grow plants that provide nectar or pollen resources	128
17 Grow plants that provide supplementary prey for natural enemies	22
18 Grow plants that provide shelter, habitat or other resources for natural enemies *	106
19 Provide grass buffer strips/margins around arable or pasture fields *	31
20 Provide refuges for natural enemies	8
21 Use alley cropping ^	10
22 Plant new hedges ^	6
23 Include short rotation coppice in the agricultural landscape	2
24 Provide supplementary food for natural enemies	7
25 Use mass-emergence devices to increase natural enemy populations ^	1
<i>Manage crops</i>	
26 Increase whole-farm crop diversity	4
27 Plant more than one crop per field *	570
28 Change the density at which crops are planted	171
29 Use grafting to combine different crop varieties	6
30 Use crop varieties with different timings or rates of growth	29
31 Use crop varieties that resist or suppress pests, diseases or weeds *	383
32 Induce plant defences against pests and pathogens	59
33 Apply organic liquids (e.g. crop and compost extracts) to crop foliage	33

34	Add mulch to crops *	216
35	Reduce tillage *	375
36	Reduce mechanical weed control	74
37	Leave part of the crop or pasture unharvested or uncut ^	12
38	Reduce frequency of cutting on pasture, grassland or grass margins	23
39	Alter irrigation regime	129
Control insect distribution		
40	Plant and manage trap crops to attract pests away from crop	176
41	Use crop types and varieties that attract natural enemies or enhance their effectiveness	21
42	Grow non-crop plants that produce chemicals that attract natural enemies *^	6
43	Use chemicals to attract natural enemies ^	15
ARABLE FARMING		
Manage habitat		
44	Create uncropped field margins or plots by allowing natural regeneration *	25
45	Create beetle banks ^	18
46	Provide bird perches in fields	4
Manage crops		
47	Intercrop with plants that are repellent or suppressive to pests or weeds *	128
48	Grow one crop using a mixture of varieties within a field	6
49	Use crop rotation *^	252
50	Include plants that are repellent or suppressive to pests in crop rotations	62
51	Incorporate fallow periods into crop rotation	75
52	Incorporate leys into crop rotation	24
53	Use relay intercropping	8
54	Grow cover crops when the field is empty	83
55	Grow cover crops that are repellent or suppressive to pests when the field is empty	22
56	Grow crops in strips within a cover crop	3
57	Grow cover crops beneath the main crop (living mulches) or between crop rows *	103
58	Leave overwinter stubbles	1
59	Reduce burning of crop remains	15
60	Alter timing of sowing or harvesting	445
Control insect distribution		
61	Combine trap and repellent crops in a push-pull system ^	13
Soil mulch and amendments		
62	Mulch with plants that produce pesticidal fumes as they decay (such as mustard)	9
63	Incorporate pesticidal plant material into the soil	70
64	Incorporate plant remains into the soil that produce weed-controlling chemicals ^	10
65	Amend the soil with fresh plant material or crop residues	62
66	Amend the soil with crops grown as green manures	99
67	Amend the soil with processed plant materials	132
68	Amend the soil with manures and agricultural composts	227
69	Amend the soil with organic processing wastes or their composts	93
70	Amend the soil with municipal wastes or their composts	44

71	Amend the soil with composts not otherwise specified	126
72	Amend the soil with non-chemical minerals and mineral wastes	16
73	Amend the soil with formulated chemical compounds	39
74	Amend the soil with materials not otherwise specified	45

PERENNIAL FARMING

Manage crops and ground cover

75	Allow natural regeneration of ground cover beneath perennial crops [^]	13
76	Grow cover crops under perennial tree crops	50
77	Cut cover crops and place in perennial tree crops to move natural enemies into the canopy	2
78	Grow pest-suppressive crops prior to planting perennial crops	1

Manage ants

79	Exclude ants that protect pests [^]	8
80	Isolate colonies of beneficial ants [^]	1

LIVESTOCK FARMING AND PASTURE

Livestock breeds

81	Use resistant livestock breeds	1
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Manage pastures

82	Restore or create low-input grassland	0
83	Reduce management intensity on pasture or permanent grassland	4
84	Reduce grazing intensity on pasture or grassland	44
85	Delay mowing or first grazing date on pasture or grassland [^]	11
86	Raise mowing height on pasture or grassland	4
87	Use grazing instead of cutting for pasture or grassland management [^]	8
88	Cut noxious weeds to increase disease incidence	2
89	Grow plants that compete with damaging weeds [^]	13
90	Use mixed pasture [^]	10

Modify housing conditions

91	Modify flooring in poultry houses to benefit natural enemies	3
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Manage disease hosts

92	Cull wildlife hosts of livestock disease	7
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¹ Number of studies that have tested the action, identified by trawling relevant journals and a literature search of the CAB Abstracts and Web of Science databases. For more details see the synopsis (below).

* Featured in the top 10 actions as chosen by groups of experts in a replicated workshop exercise to prioritise the complete list. These actions were chosen by at least one of four groups.

[^] Summarised in the 2013 synopsis:

Wright, H.L., Ashpole, J.E., Dicks, L.V., Hutchison, J. & Sutherland, W.J. (2013) **Enhancing Natural Pest Control as an Ecosystem Service: Evidence for the Effects of Selected Actions**. University of Cambridge, Cambridge. Available from www.nercsustainablefood.com