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Weeds and weed management in cabbages - a review

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The EWRS Working Group "Weed Management Systems in Vegetables" was established with the aim of collecting and disseminating information and results on weeds and weed control strategies in vegetables, identifying gaps in knowledge and defining new research projects. So far the working group has published reviews on onions (Tei et al., 1999a), tomatoes (Tei et al., 1999b; 2002b), carrots (Tei et al., 2002a) and peas (Uludag et al., 2003a; 2003b).

Information about key weeds, new weeds or species that have recently become problematic, effect of competition, weed management programmes in integrated and organic production, approved herbicides and those currently undergoing registration for use in cabbages grown under field conditions in Croatia (HR), Finland (FIN), Germany (D), Hungary (H), Italy (I), The Netherlands (NL), Poland (PL), Portugal (P), Slovenia (SLO), Spain (E), Switzerland (CH) and United Kingdom (UK) was collected.

In 2003, the world production of cabbages (i.e. headed cabbages, savoy cabbage, cauliflower, broccoli, Brussels sprouts and Chinese cabbage) was 66 million tons on 3.2 million hectares. In the surveyed countries, cabbages were cropped on 436000 ha (PL 47000 ha, I 37000 ha, E 34000 ha, UK 33000 ha, D 19370 ha, HR 11000 ha, NL 10800 ha, P 8500 ha, H 6200 ha, FIN 1320 ha, SLO 1000 ha and CH 500 ha).

Information on organic production is very scarce: about 5-10% of total production in H, less than 5% in SLO, about 3% in FIN and a few hundred hectares in PL and UK.

Cabbages are mostly transplanted but Chinese cabbage is commonly direct seeded. The season of planting is extensive involving sequential cropping from spring through to autumn. Row distance is 0.50 to 0.80 m with a planting density 2 to 6 plants m⁻² depending on species and cultivar. Horticultural brassicas are usually grown on moisture retentive as well as well-drained soils (i.e. silty to silty-loam soils) but they can also be grown on heavy calcareous clay soils.

The weed communities are commonly very species rich and their composition is highly variable in relation to climate, soil and crop period. The most important and frequent species are *Digitaria* spp., *Echinochloa crus-galli*, *Elymus repens*, *Setaria* spp., *Amaranthus* spp., *Chenopodium* spp., *Datura stramonium*, *Mercurialis annua*, *Polygonum* spp., *Portulaca oleracea* and *Solanum nigrum* in spring-summer crops and *Stellaria media*, *Cirsium arvense*, *Matricaria* spp., *Senecio vulgaris*, *Sonchus* spp., *Fumaria officinalis* and cruciferous weeds in autumn-winter crops.

Chenopodium spp. and *Galinsoga parviflora* are key weeds in H, PL, CH and I, *Urtica urens* in NL and UK (locally). *Cruciferae* species (i.e. *Capsella bursa-pastoris*, *Diplotaxis erucoides*, *Sinapis arvensis*, *Thlaspi arvense*) are dominant species in FIN, UK, I and E. Further key weeds are: *Galium aparine* in some areas of the UK; *Sonchus* spp. in CH; *Cyperus esculentus*, *C. rotundus* and *Rumex* spp. in P; *P. oleracea* and *C. rotundus* in E; *Alopecurus myosuroides*, *Lolium* spp., *Papaver rhoeas*, *Veronica* spp. in I.

IWM can control most weeds but some species are becoming important: *C. album* and *Polygonum* spp. in FIN; *U. urens* in NL; *Ambrosia artemisiifolia* in H; *Rorippa sylvestris* in CH; *Abutilon theophrasti*, *Panicum* spp., *Setaria viridis*, *Xanthium strumarium* in HR; *Amaranthus* spp., *C. arvense*, *Convolvulus arvensis*, *Cruciferae* in SLO; *C. album*, *Cuscuta* spp., *G. parviflora* in P; *Calystegia sepium*, *Rumex* spp., *Sorghum halepense* in I.

Competitive ability of cabbages is generally greater than other vegetable crops (e.g. carrots, onions, lettuces...). Research has shown that no critical period of competition can be determined: a single weeding at 3-5 weeks after transplanting resulted in crop yield similar to those for weed-free cabbage.

Herbicides approved for use in the different cabbage species are very different among the countries. Taking into consideration only the “key” active ingredients, clopyralid is authorised in FIN, I, PL and UK; metazachlor is approved in all the countries except in H and P; napropamide in HR, H, I, PL, SLO, CH, and under registration in FIN; oxyfluorfen in HR, I, PL, P and SLO; pendimethalin in HR, D, H, I, PL, P, SLO and E; pyridate in FIN, D, SLO, E and UK; propachlor in I, PL, E, CH, and UK; trifluralin in all the countries except in FIN, NL and SLO. A wide range of post-emergence graminicides is registered in all the countries except in PL for cauliflower, broccoli and Chinese cabbage.

Conventional weed control involves a soil incorporated pre-emergence/pre-transplanting treatment (trifluralin, napropamide) or non-incorporated pre-emergence/pre-transplanting treatment (pendimethalin, oxyfluorfen, propachlor, metazachlor) followed by one to two post-emergence/post-transplanting treatments (metazachlor, pyridate, clopyralid, propachlor, graminicides).

Trifluralin has a narrow spectrum of activity and it requires moisture for optimum activity; moreover in dry seasons crop phytotoxicity may occur. Propachlor fails to control *Polygonum aviculare* and *Chenopodium album*. Pyridate may be applied for the control of *Galium aparine* in cabbage and Brussels sprouts while clopyralid controls *Cirsium arvense*, *Matricaria* spp., and *Sonchus* spp.

However, mechanical weed control (harrowing, hoeing, ridging) is often used to compensate for poor herbicide efficacy.

IWM generally involves: 1) false seedbed technique followed by shallow harrowings or by glyphosate or glufosinate-ammonium application; 2) pre-emergence or pre-transplanting herbicide application; 3) post-emergence inter-row hoeing or rotary cultivation combined with ridging for in-row weed control.

Both in conventional and integrated weed control, very early head cabbages and cauliflower can be grown in the open field under perforated polyethylene plastic flat cover or non-woven polypropylene to improve crop earliness and to control insects.

Common strategy for organic production is: 1) false seedbed technique followed by shallow harrowing; 2) transplanting; 3) repeated inter- and intra-row cultivation through the growing season sometime combined with ridging; 4) hand-weeding. Some growers also flame weeds under the cabbage leaves when the crop plants are big enough. False seedbed for early cabbage production or for very late varieties seems not feasible. In organic growing of cabbages the use of plastic covers is more common than in conventional and IWM systems but it stimulates weed emergence and growth and costs are high because it must be removed before each mechanical weed control. In Spain black plastic mulching combined with drip irrigation is widely used in summer crops.

Further and more detailed information can be found in the WG web site www.agr.unipg.it/ewrsveg/

References

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