PAN Europe

Pesticide Action Network Europe

State of art of Integrated Crop Management/organic systems in Europe, with particular reference to pest management

Potato production

Briefing no.8 ***January 2007***

Despite pesticides currently used in conventional potato production in Europe have serious health and environmental hazards, the extent of Integrated Pest Management (IPM) and organic production is still very small. Organic potato producers face some difficulties in terms of dealing with adequate plant nutrients, especially nitrogen application; weed, insect and disease control issues and marketing issues but their profit margins seem to be equal or higher to conventional farmers due to the higher market price of organic potatoes. As for IPM, there are no figures for the extent of certified IPM potato production in Europe, although there are several standards being used in different countries in Europe. A holistic view, prevention, correct cultivation techniques, existence of systems for early warning and advise and preference of non-chemical crop protection are components in successful IPM systems and should be extended to all potato production systems in Europe. A review is also available at: http://www.pan-europe.info/publications/index.htm).

I. SOME INDICATORS OF CONVENTIONAL PRODUCTION AND PESTICIDE USE

According to Eurostat, production of potatoes in the 25 EU Member States in 2002, was 6.7 million tones, with an agricultural area engaged in potato production of 2 million hectares. The 10 new Member States made up 47% of this area. The average yield was 28.65t/ha, with an average yield of 37.14 t/ha in EU-15 countries *vs* an average yield of 18.9 t/ha in the 10 new Member States (1).

Indicators of conventional use of pesticide in potatoes are difficult to find in the scientific literature. We opted to provide one case study for Great Britain that might illustrate the current situation in conventional potation production in Europe (2). All potato production in Great Britain - both ware (grown for human consumption) and seed - is grown with application of fungicides. 62.6% of ware and 90% of seed potato area were treated with insecticides. Herbicides are used in more that 95% of the fields under seed and ware potatoes. 72% area of ware crop and 97.9% of seed potato received seed treatments. Only 0.1% ware and seed potato area received no pesticide treatments. During the vegetative phase ware potato receives 14.5 spray rounds of all pesticides and is treated with 19.4 different products. The biggest portion of those treatments accounts for fungicide spray. 10.7 spray rounds and 17.5 products are applied in seed potatoes, with highest percent of fungicides used.

Most commonly used pesticides

The five most commonly used **fungicides** (cymoxanil/maneb, fluazinam, cyazofamid, dimethomorph/mancozeb) are applied mostly for the control of late blight (*Phytophthora*

infestans). Fluazinam is also effective against white mold *(Sclerotinia sclerotiorum*). Dimethomorph is also used to control rot.

Among the five most commonly used **herbicides** in Great Britain, linuron is thought to be carcinogen, endocrine disruptor, developmental and reproductive toxin and ground water contaminant. Also according to PAN North America Pesticides Database (3), metribuzin is developmental and reproductive toxin, cholinesterase inhibitor and potential ground water contaminant and paraquat is acutely toxic.

As for **insecticides**, aldicarb, used until two years ago, is an extremely toxic nerve poison. The acute toxicity of aldicarb is one of the highest of currently used pesticides. It is classified by the World Health Organisation[1] as extremely hazardous (Ia group). Oxamil is listed as a highly hazardous pesticide (Ib) and with pirimicarb acts as a cholinesterase inhibitor. Pymetrozine is believed to have carcinogenic effects.

Pesticides used in conventional potato production in Great Britain have serious health hazards: 7 most commonly used pesticides are classified as carcinogenic. WHO classifies oxamil as highly hazardous (Ib group) and aldicarb as extremely hazardous (Ia group). Seven pesticides have been linked to endocrine disrupting effects and/or to act as a developmental or reproductive toxin. Six chemicals are considered ground water contaminants.

Residues of pesticides in conventionally grown food are also a serious threat to consumers. Conventionally grown potatoes are among the worst crops in terms of pesticides residues in the UK and other European countries (4).

II. SCALE OF ORGANIC PRODUCTION AND COMPARISON OF YIELD AND INCOME

There is a lack of comparable data of different countries because national statistics differ and the distinction between conventional and organic farming is not always clear. The production and yield of organic in comparison with conventional potato production is not available except for a few countries.

Table 1 – Area under organic potato production, percentage of organic potato in total organic and total potato production and the percentage increase of organic potato in selected European countries for the period 1998-2000

	Area under organic potato (ha)	% of organic potatoes in total organic production	% of organic potatoes in total potato production	% increase of area under organic potato production
Denmark	755	1.95	2.10	146
France	579	1.61	0.35	120
Germany	4,700	3.36	1.58	111
Netherlands	749	15.14	0.59	130
Norway	125	11.96	0.74	189
Switzerland	500	11.45	3.61	113
United Kingdom	911	11.05	0.55	154

Source (5)

[1] WHO classification – The World Health Organization Recommended Classification of Pesticide by Hazard classifies all pesticide into four groups: Class Ia Extremely Hazardous, Class Ib Highly Hazardous, Class II Moderately Hazardous and Class III Slightly Hazardous

Despite the lower yields and the small percentage of organic potato production in comparison with conventional, the gross margin for the farmer is far higher in organic production. Data from Germany and the UK, compiled in Table 2, indicates much higher gross margins, even if the payment for organic farming is excluded (6).

Table 2 – Comparison of yields and gross margin between conventional and organic potato production in Germany, UK and Poland

	Yield (t/ha)	Variable costs (€/t)	Gross margin (€/ha)
United Kingdom			
Conventional potatoes for food processing – East Anglia	42.5	3446	2138
Conventional early potatoes – South West England	22.5	2461	2525
Organic potatoes	25.0	3037	7225
Germany			
Conventional potatoes for processing - Brunswick	41.9	1580	2275
Conventional early potatoes – North-west coastal area	27.2	2001	2813
Organic potatoes for processing - Brunswick	25.1	1645	5052
Organic early potatoes - Brunswick	16.3	2556	5816
Poland			
Best conventional farms intensive	44.7	1703	1077
Best conventional farms integrated crop management	24.5	912	281
Best organic farms	21.0	821	180 (without organic premium) 788 (with organic premium)

Sources (6,7)

The lower yields of organic potato are compensated for by higher prices and this is a key aspect of the profitability of the organic farming. Comparison between economic performance of conventional and organic potato in the UK, Germany and Poland indicates that in spite of lower yield harvested from the fields under organic potatoes, gross margins for organic production are two to three times higher that for conventional cropping in UK and Germany. In Poland the profit from organic farming greatly depends on the premiums. In Poland costs for organic potato are lower that for intensive and integrated conventional farm, in Germany costs of production are in generally higher that for conventional, whereas in the UK variable costs are somewhere in between the conventional early potato and potatoes for processing. The prices of early organic and organic potato for processing are approximately three time higher that the price of the conventional potatoes in both UK and Germany.

Costs are generally lower on organic tillage farms than on comparable conventional farms. Variable costs decline due to withdrawal of prohibited inputs but reseeding, fertility measures and higher labour inputs may reverse this tendency.

III EXAMPLES OF BEST PRACTISES IN INTEGRATED PEST MANAGEMENT POTATO PRODUCTION

Producers of organic potatoes use alternative approaches rather than artificial fertilizers and pesticides. These include: crop rotation, selecting resistant cultivars, good soil management, planting disease-free seed, non-chemical weed control, usage of blight warnings and decision support systems, correct storage, among other techniques. All these methods can and are

normally used in Integrated Pest Management (IPM) systems and are effective to reduce pesticide use. But while in organic production there are precise guidelines limiting the number of pesticide active substances and number of applications, in Integrated Pest Management the guidelines and the implementation of those guidelines in practice vary between countries.

IPM guidelines for potato production have been developed by a number of institutions in different countries. We will refer to two examples to highlight that an holistic view, focus on prevention (choice of cultivars, rotation), correct cultivation techniques (plant distance, nutrient management), existence of systems for early warning and advise and preference of non-chemical crop protection are components that should be part of any IPM system.

The first example is “best practises” developed by Wageningen University upon request of the Dutch Ministry of Agriculture, Nature and Food Quality. They have been adopted by a group of progressive producers in the Netherlands (Telen met Toekomst – Farming with Future) selling their produce to Laurus supermarket (8). Farmers participating in this scheme receive training and support from advisory services. The “best practices” guidelines establish a hierarchy of IPM measures and coding of subtypes. The measures are: prevention, technical measures for cultivation, systems for early warning and advise, non-chemical crop protection, chemical crop protection and application techniques and emission reduction. This example illustrates the importance of a good marketing strategy and coordination between good research and extension services, farmers, retailers and consumers.

The second example is from the International Organisation for Biological and Integrated Control of Noxious Animals and Plants (IOBC) (9). This institution has published crop specific Integrated Production guidelines for field grown vegetable including potato that have been adopted by many different farmers’ organisations as guidance for their IPM practices. For ware potato, IOBC sets preferred options and prohibitions for a set of functions: rotation, cultivars, cultivation, nutrient management, management of pest, diseases and weeds, destruction of foliage, habitat management and hygiene harvest.

The IOBC Working Group for Integrated Production in Orchards was also the first international IPM working group founded in Europe, as early as 1959, The IOBC continued to establish several IPM working groups for different crops and promoted IPM in Western and Eastern Europe in the 70’s and 80’s. Despite the original enthusiasm, IPM never developed as a system in Europe due to the co-existence of different descriptions and definitions.

IV CONCLUSIONS AND RECOMMENDATIONS

Organic potato production is very small in Europe and although it is steadily growing, it is not foreseen that a large number of conventional farms will convert to organic in the near future. Although many countries have introduced policies beyond the EU framework for organic agriculture (Council Regulation (EEC) No 2092/91) to increase the share of and stimulate organic farming such as ‘Green Financing’ in the Netherlands, new financial and fiscal instruments still need to be introduced.

We have seen that most seed and ware potato is produced using pesticides with serious health and environmental hazards. We need to change the bulk of the conventional production towards pesticide use reduction. Given the diversity of IPM guidelines in Europe (not only for potato), a set of minimum criteria should be laid out *per* crop.

But according to the new Framework Directive to achieve a Sustainable Use of Pesticides COM (2006) 373, adopted recently by the European Commission, general IPM standards should be adopted by all farmers from January 2014 onwards while crop specific standards shall be adopted on a voluntary basis (10). This is a major set-back because in this process the necessary level of detail will be lost. Therefore, PAN Europe calls for crop specific standards established at the national level and applied on a compulsory basis, following a set of key elements. The

introduction and implementation of crop-specific standards must be accompanied by adequate advice and training for farmers provided by an independent advisory system and funded by a pesticides levy.

Key elements for general IPM standards should be, at a minimum:
Key elements for general IPM standards should be, at a minimum:
1 – A soil structure serving as an adequate buffering system for agriculture;
2 – A crop rotation frequency enhancing a balanced population of soil organisms, preventing outbreak of soil-borne pests;
3 – Use of the best available pest-resistant (non-GMO) crop varieties;
4 – Optimal crop distance and crop management to prevent growth of fungi;
5 – Availability of refuges for natural enemies of pests and for the prevention of pesticide-resistant pests;
6 – Economical nutrient management on the basis of information of nutrients already present in the soil and of the soil structure, and dosage only on the crop;
7 – In principle only mechanical weeding (or other non-chemical methods like the use of heat); only exception in case of bad weather conditions;
8 – Use of pesticides based on information of presence of pests (scouting, traps, on-line forecasting services) and only the use of selective (not harming beneficial organisms) pesticides which are not persistent, bio-accumulative or toxic;
9 – Priority is given to the use of "green" (non-synthetic) pesticides and pest-preventive substances;
10 – Minimal material resources input (11).

These general standards would translate in a set of minimum standards for each crop. For ware potatoes, key elements for IPM standards are presented in Table 3.

Table 3. Key elements for an IPM system for ware potatoes

1. Soil structure	- Minimum clay % and humus %
2. Crop rotation	- One in 4; higher frequency wanted in future (1:6) - Analysis of nematodes on 25% of surface area per year
3. Varieties	- Priority to late blight resistance and early potato varieties - Nematode resistance
4. Fungal disease management	- A low number of plants grown per meter - Working remnants of former crop under the soil
5. Refugia	- 2% of surface area under wild herbs/flowers; could coincide with the non-spraying/nutrient zone-maintaining and creating hedges and grassy banks
6. Nutrient management	- In winter, sow green catch crop - Nitrogen-loss must be < 200 kg/ha; in two years lowered to 150 kg/ha - If P2O5 concentration > 60, no use of P-fertiliser - If P2O5 concentration < 60, maximum P2O5-loss 35 kg/ha
7. Weeding	- Mechanical weeding before and during the crop season; only exemption weather conditions by written authorisation certifying organisation
8. Pesticide use	- Use of Phytopthora alert system - Maximum use of 10 kg/ha of active ingredient; in two years lowered to 8 kg/ha
9. Non-chemical pesticides	- Use of plant reinforcing substances, bentonite, citrex
10. Resource management	- No use of groundwater as water supply

Source (11)

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