

## CHANGES OF POTATO GROWING AREA AND PROTECTION SCALE IN THE YEARS 1977–2002

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**Abstract:** As compared to 1977 potato acreage in Poland has decreased by about 1.4 million hectares and amounted to 958 thousand hectares in 2002. Potatoes are protected mainly against *Leptinotarsa decemlineata* Say, *Phytophthora infestans* and weeds. Number of chemical treatments against Colorado potato beetle fluctuated between 1.1. to 1.7 per year, in average. In 1977–1987 mainly organophosphorous insecticides were applied, whereas in last years pyrethroids and nereistoxin were used. Chemical treatments against late blight fluctuated between 1.2 to 1.6 per year, in average. Observations performed in 1977–2002 showed that the application of contact fungicides considerably decreased. In weed control in potatoes only one treatment, in average, was performed using herbicides, mainly pre-emergence ones. Herbicides containing linuron and metribuzin were most frequently applied.

**Key words:** potato, chemical control, Colorado potato beetle, late blight, weeds

### INTRODUCTION

As compared to 1977 the acreage of potatoes in Poland decreased by about 1.4 million hectares and amounted to 968 thousand hectares in 2002. The decrease of potato acreage began in the sixties, on various levels in separate regions of the country. At first this processes took place in central and south-western macro-region and its rate was the fastest in western and northern regions of the country, increased after 1990 and was connected with the liquidation of state farms (Rembeza 1995).

In 2002 potato acreage amounted to only 957 thousand hectares and decreased, as compared to 1977, by 61% (Fig. 1). High input and the lack of price stability, inappropriate organisation of local Polish market as well as lack of integration with international market also influenced such a high reduction of potato growing area. Apart from occurring since many years of a tendency to reduce potato growing, it is still a very important crop (about 10% in the structure of agricultural crops). In the

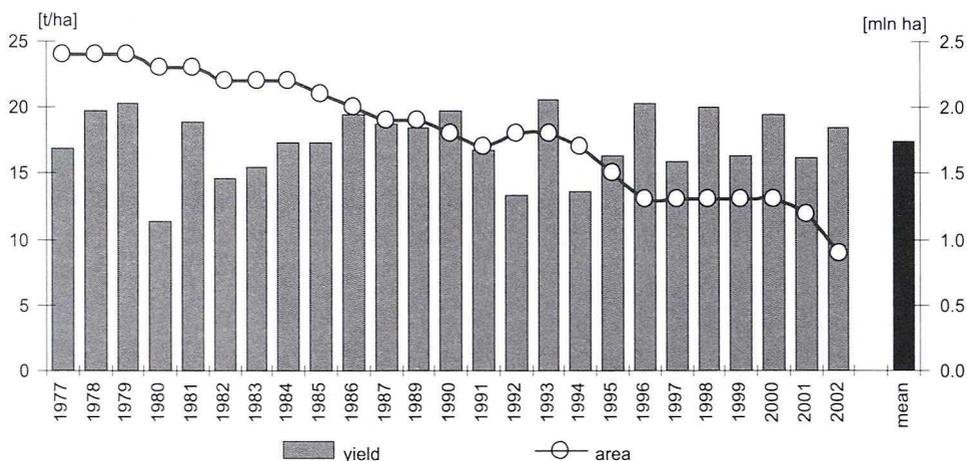


Fig. 1. Range of potato crop in 1977–2002

nineties its production amounted to 55% of potato production in European Union and could be compared to the production in Germany, the Netherlands and the United Kingdom (Chotkowski et al. 2000).

Reduction of potato growing had no direct effect on the quality and quantity of yield. In 1977–2000 obtained potato yield fluctuated between 11.3 t/ha in 1980 and 20.6 t/ha in 1993. Therefore total potato yield is highly differentiated in separate years and for example in last five years it fluctuated from about 20 to above 270 million tons (Chotkowski et al. 2000).

If potatoes are chemically protected it is mainly protection against potato late blight, Colorado potato beetle and weeds.

## MATERIALS AND METHODS

In 2002 twenty-five years have passed from the start of co-operation with the Voivodeship Stations of Quarantine and Plant Protection (in 1995 renamed the State Inspection of Plant Protection, now the Voivodeship Inspectorate of Plant Protection and Seed Science). This co-operation has been established by professor J. Pietkiewicz. The aim of the co-operation was to collect data on potato pests, diseases and weeds as well as on the methods of control.

This presentation refers to the years 1977–2002 and was elaborated on the background of observations performed in separate vegetative seasons by the staff of the Voivodeship Inspectorates of Plant Protection and Seed Science on the territory of the whole country. It is connected among others with the range of potato protection and applied plant protection products. Observations in the form of questionnaires were performed according to the method established in the Department of Diseases and Pests in Bonin (since 1990 the Department of Potato Protection).

Per cent of protected acreage was calculated in relation to protected acreage (on which chemical treatments were performed) and total potato acreage, whereas number of treatments was presented in relation to total acreage and protected acreage.

Thanks to the Ministry of Agriculture and Rural Development, Department of Plant Production in this presentation data concerning the performance of plant protection tasks (in separate years) prepared by the Main Inspectorate of Plant Protection and Seed Science were also taken into account.

## RESULTS AND DISCUSSION

### Weeds

In Poland number of weed species occurring in agricultural crops fluctuates between 300 and 400, and in potato amounts to about 50 (Sobótka 1999). Among grass weeds the most frequently cocksbur (*Echinochloa crus-galli*), couch grass (*Elymus repens*) and wild oats (*Avena fatua*) occurred, and their number fluctuated between 31 and 50 plants per one square meter. Cocksbur was the weed occurring in the most stable number in separate years. Among broad-leaved weeds most numerous fat-hen (*Chenopodium album*) and field pansy (*Viola arvensis*) occurred – their number amounted to above 50 plants per one square meter.

Most frequently weeds are controlled mechanically less frequently using mechanical-chemical method. Herbicides are applied mainly before potato sprouting. Among herbicides applied in 1977–2001 linuron and metribuzin predominated (Urbanowicz and Pawińska 2000).

Data obtained from the Ministry of Agriculture and Rural Development on the range of weed control in potatoes comprise the periods of 1977–1987 and 1999–2002 (Tab. 1). In 1977–1987 per cent of acreage protected against weeds fluctuated between 3.6 in 1980 to 9.6 in 1987 (about 6% in average) and one treatment was performed. Since 1999 per cent of acreage protected against weeds, has systematically increased ranging from 22.5 to 29.6 in 2002. Number of treatments

Table 1. Range of weeds control in 1977–2002

Year	Per cent of acreage protected	Number of treatments
1977	5.1	1.0
1978	5.2	1.0
1979	4.9	1.0
1980	3.6	1.0
1981	3.9	1.0
1982	4.3	1.0
1983	5.3	1.0
1984	5.7	1.0
1985	7.1	1.0
1986	8.0	1.0
1987	9.6	1.0
1988–1998		no information
1999	22.5	1.1
2000	23.8	1.1
2001	24.2	1.1
2002	29.6	1.1
Average	10.9	1.0

Source: the Ministry of Agriculture and Rural Development, Department of Plant Production

performed also increased and in average amounted to 1.1, which suggests that on some fields weeds were also controlled after potato sprouting.

### Colorado potato beetle (CPB)

Occurrence and development of CPB is, as in the case of other insects, connected with agrometeorological factors: soil and air temperature, date of potato planting and timing of control treatments. In the analysis of CPB occurrence (all development stages) in 1977–2002 it was stated, that the peaks of gradation (the highest numerousness) took place in 1983, 1992–1993 and 1996 (Fig. 2).

In table 2 the range of CPB control is presented. In 1977–1986, when the potatoes were grown on the acreage of above 2 million hectares, were chemically protected (73% of acreage) and 1.2 treatments using chemical plant protection products were performed. In 1987–1995 potato acreage decreased from 1.9 to 1.5 million hectares (1.7 million in average), average per cent of protected acreage amounted to 86.8% and 1.4 treatments were performed. In the further years (1996–2002) potato acreage still decreased amounting to less than one million hectares in 2002, and potatoes were protected in 83%, whereas average number of treatments also amounted to 1.4. These data confirm that the decrease of potato acreage has no effect on the range of CPB control.

In agricultural practice in 1977–2002 the use of organophosphorous insecticides (mainly of chlorfenvinphos) predominated, in 1988–1992 pyrethroids (mainly deltamethrin and cypermethrin were mostly applied), and in the last years a nereistoxin derivative (bensultap was used) (Pawińska 2000).

In the last years a general direction of observed changes included introduction of insecticides characterised by a lower toxicity, short pre-harvest interval, and also a low content of active ingredient.

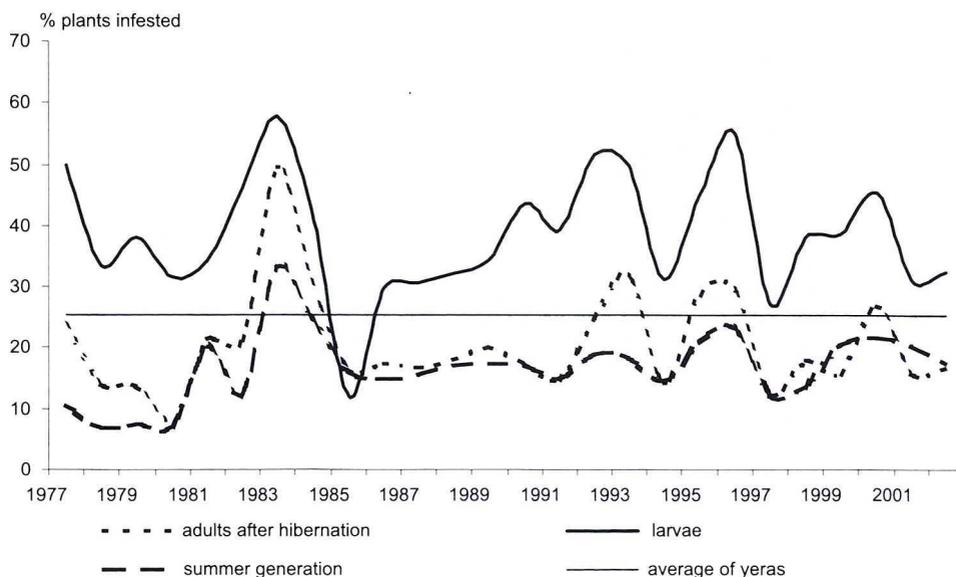


Fig. 2. Occurrence of Colorado potato beetle in 1977–2002

Table 2. Range of Colorado potato beetle control in 1977–2002

Year	Per cent of acreage protected	Number of treatments
1977	93.6	1.4
1978	76.0	1.2
1979	78.1	1.2
1980	49.9	1.1
1981	71.7	1.2
1982	77.7	1.2
1983	96.3	1.6
1984	78.2	1.1
1985	37.2	1.1
1986	70.0	1.1
1987	75.2	1.1
1988		no information
1989	89.0	1.3
1990	87.2	1.4
1991	83.7	1.4
1992	89.0	1.7
1993	89.5	1.4
1994	82.9	1.4
1995	97.5	1.6
1996	97.6	1.6
1997	67.6	1.3
1998	no information	1.3
1999	82.8	1.4
2000	85.3	1.5
2001	80.9	1.3
2002	83.7	1.5
Average	80.0	1.3

Source: the Ministry of Agriculture and Rural Development, Department of Plant Production

### Potato late blight

Potato late blight presents the highest risk to potato production causing considerable losses of yield quantity and its quality. Growing resistant potato varieties and application of fungicides can reduce these losses.

The range of potato protection against potato late blight is presented table 3 . In 1977–1986, when potatoes were grown on above 2 million hectares, only 5% of acreage were treated with fungicides and 1.4 treatments were yearly performed. In 1987–1995 potato acreage still decreased from 1.9 to 1.5 million hectares (1.7 million hectares in average), and per cent of protected acreage increased to 21.3. In this period in average 1.5 treatments were performed. Similar tendency was maintained in further years (1996–2002): the acreage still decreased amounting to less than one million hectares in 2002 and number of treatments amounted to 1.7 in average. The increase of number of treatments is still unsatisfactory, because in Polish conditions potato protection against potato late blight should be performed during 2 to 3 months depending on weather conditions and cultivated varieties (Kapsa 2000).

Potato late blight control was for a long time unpopular in Poland, as it was in many other countries. Observations performed in 1977–2002 showed that the ap-

Table 3. Range of potato late blight control in 1977–2002

Year	Per cent of acreage protected	Number of treatments
1977	2.2	1.4
1978	2.4	1.4
1979	2.1	1.4
1980	2.4	1.3
1981	2.4	1.4
1982	3.0	1.3
1983	2.4	1.3
1984	6.8	1.4
1985	11.7	1.6
1986	14.6	1.5
1987	18.0	1.6
1988		no information
1989	34.5	1.7
1990	30.6	1.6
1991	20.0	1.4
1992	14.6	1.2
1993	18.9	1.4
1994	12.3	1.3
1995	21.5	1.5
1996	28.5	1.6
1997	39.0	1.7
1998	no information	1.7
1999	39.8	1.7
2000	38.9	1.8
2001	42.3	1.8
2002	48.8	1.9
Average	19.1	1.5

Source: the Ministry of Agriculture and Rural Development, Department of Plant Production

plication of contact fungicides considerably decreased. Since 1984 the range of chemical control of potato late blight has increased, mainly due to the introduction of systemic fungicides, which gave spectacular effectiveness and high yield increase.

## CONCLUSIONS

1. In the year 2002 potato acreage amounted only to 957 thousand hectares and comparing to 1977 it decreased by 61%.
2. The number of treatments against Colorado potato beetle fluctuated yearly between 1.1 to 1.7 in average. In 1977–1987 mainly organophosphorous insecticides were applied, whereas in last years pyrethroids and nereistoxin were used.
3. Number of chemical treatments against potato late blight fluctuated between 1.2 to 1.9 per year, in average.
4. Observations performed in 1977–2002 showed that the application of contact fungicides considerably decreased. Since 1984 the range of chemical control of potato late blight increased, mainly due to the introduction of systemic fungicides, which gave spectacular effectiveness and high yield increase.

5. Weeds were controlled mainly mechanically and mechanically/chemically and herbicides were first of all applied as pre-emergence treatments. Most frequently herbicides containing linuron and metribuzin were applied.

## REFERENCES

- Chotkowski J., Rembeza J., Kowalczyk S. 2000. Rynek ziemniaka. p. 353–372. In "Strategiczne opcje dla polskiego sektora agrobiznesu w świetle analiz ekonomicznych" (E. Majewski, G. Dalton, eds.). SGGW, Warszawa.
- Kapsa J. 2000. Wykorzystanie nowych elementów ochrony upraw ziemniaka przed zarazą. Prog. Plant Protection/Post. Ochr. Roślin 40 (1):169–176.
- Pawińska M. 2000. Colorado Potato Beetle with emphasis on problems in Central and Eastern Europe. Proceeding of the fourth World Potato Congress. Amsterdam, Wageningen Pers.: 195–202.
- Rembez J. 1995. Produkcja i rynek ziemniaków w krajach europejskich. Instytut Ziemniaka, Bonin: 6–12.
- Sobótka W. 1999. Herbicydy – wczoraj i dziś. Prog. Plant Protection/Post. Ochr. Roślin 39 (1): 218–223.
- Urbanowicz J., Pawińska M. 2000. Zmiany w dynamice występowania chwastów w uprawie ziemniaka oraz w zakresie ich zwalczania. Materiały. Konf. Ochrona ziemniaka. Kołobrzeg, IHAR Oddz. Bonin: 20–26.

## POLISH SUMMARY

### ZMIANY W UPRAWIE I OCHRONIE ZIEMNIAKA W LATACH 1977–2002

Proces zmniejszania uprawy ziemniaków rozpoczął się w latach sześćdziesiątych, w różnym zasięgu na terenie Polski. W roku 2002 powierzchnia uprawy ziemniaków wynosiła 957 tys. ha i w porównaniu do roku 1977 uległa zmniejszeniu o 61%. Ziemniaki chroniono środkami chemicznymi głównie przed stonką ziemniaczaną, zarazą ziemniaka i chwastami.

W latach 1977–1986 ochroną przed stonką objęto około 73% upraw ziemniaków i wykonywano 1,2 zabiegi rocznie, głównie insektycydami fosforoorganicznymi. Natomiast w latach 1987–1995 średni procent powierzchni chronionej (głównie przy zastosowaniu pyretroidów) wynosił około 87%, a w latach 1996–2002 – 83%, także pyretroidami oraz pochodną nereistoksyny. Średnia liczba zabiegów w latach 1987–2002 wynosiła 1,4.

W latach 1977–1986 ziemniaki chroniono przed zarazą ziemniaka tylko na 5% powierzchni i wykonywano średnio 1,4 zabiegi. Natomiast w latach 1987–1995 zakres ochrony wzrósł do 21%, przy zbliżonej liczbie zabiegów (średnio 1,5). W następnych latach (1996–2002) ziemniaki chroniono w 34%, a średnia liczba zabiegów wynosiła 1,7. Do roku 1984 stosowano fungicydy o działaniu kontaktowym (głównie mankozeb), a w następnych latach notowano systematyczny wzrost zastosowania fungicydów o działaniu układowym (systemicznym). Od 1986 roku do 2002 stanowiły one do 50% wszystkich fungicydów.

Chwasty najczęściej zwalczano w sposób mechaniczny (zabiegi agrotechniczne), a w mniejszym zakresie metodą mechaniczno-chemiczną. Herbicydy stosowano głównie przed wschodami ziemniaka, a dominowało stosowanie linuronu i metrybuzyny. Procent powierzchni chronionej przed chwastami wynosił od 3,6 w roku 1980 do 29,6 w roku 2002. W tym okresie zwiększyła się liczba wykonywanych zabiegów i średnio wynosiła 1,1.