

PESTICIDE RESIDUE DISCHARGE DYNAMICS IN WHEAT GRAIN

M. JOLÁNKAI –Zs. SZENTPÉTERY – Z. HEGEDŰS

Szent István University, Gödöllő

Introduction

All along the history of mankind grain crops were the main objectives of agriculture. Grain crops are a chief source of the world's bread supply as well as that of animal feeding. Grain can be stored, transported and marketed easily; therefore its production has been a characteristic economic term in the wealth of nations.

The utility of a grain is much influenced by its quality. Quality parameters can be assessed by various aspects. (i) Threshold limits (characteristics indicating borders, ranges and margins that may obstruct or exclude crop products to be sold regardless to any other quality parameters of that - size, uniformity, standard requirements etc). (ii) Quality features (characteristics which carry chemical, physical or technical information of an item and can be defined - protein content, vitreousness, gluten, farninographic value etc). (iii) Purity (the presence and magnitude of alien matter or non identical components in an item -pollutants, contaminants, residues, infections, damages etc). Food chain element transport has always been a major source of certain physiological phenomena influencing quality manifestation.

Chemical inputs are seen by the public to be a primary cause of food contamination and environmental pollution arising from agriculture. Efficient and environmentally sound field crop production requires the adequate use of pesticides: fungicides, herbicides and insecticides. The present study is dedicated to investigate the accumulation and discharge of active ingredients of some major agrochemicals in winter wheat *Triticum aestivum* L. samples.

Materials and methods

In a four years study run at the experimental field of the Szent István University, Gödöllő-Nagygyombos, winter wheat varieties representing different genotypes were grown under appropriate conditions in replicated small plot field trials.

The pesticides used were as follows:

Fungicide (tebukonazol+triadimefon) a.i. terc.buthyl-(para-chlor-phenethyl)-1H-1,2,4-triazol-1-ethanol + 1-(4-chlor-phenoxy)-1-(1H-1,2,4-triazol-1-il)-3,3,-dimethyl-2-butanon in a 1,0 l/ha dose spray dispensed after heading.

Herbicide (fluroxipir) a.i. 4-amino-3,5-dichlor-6-fluor-2-piridoxyl-acetic-acid; (bromoxynil) a.i. 3,5-dibrom-4-hidroxybenzonitril; (dicamba) a.i. 2-methoxy-3,6-dichlor-benzoeacid salt sprayed in 0,8, 1,5, 0,2 l/ha doses respectively.

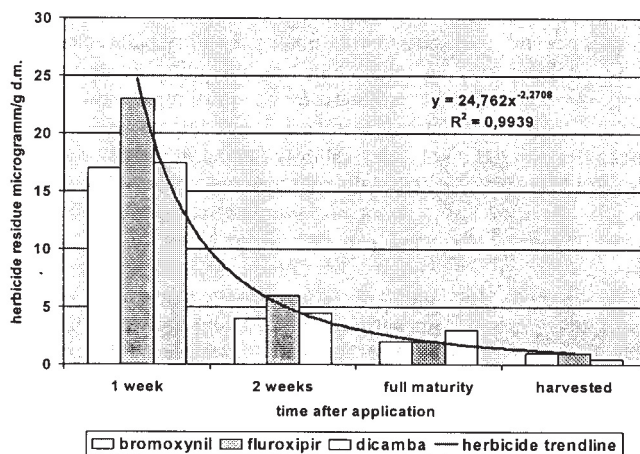
Insecticide (benszultap) a.i. S,S'[2-(dimethyl-amino)-trimethylen]bis-(benzol-tiosulphonate) sprayed after heading in 0,75 l/ha doses.

All treatments were applied in accordance with their technological characteristics during the vegetative phenophases prior to flowering. Each year pesticide residues were detected in samples taken one week, two weeks after application during the grain filling period as well as at full maturity and in harvested grain samples. The quantity of residues were analysed with HPLC device at the food chemistry lab of the Budapest Technical University.

Results

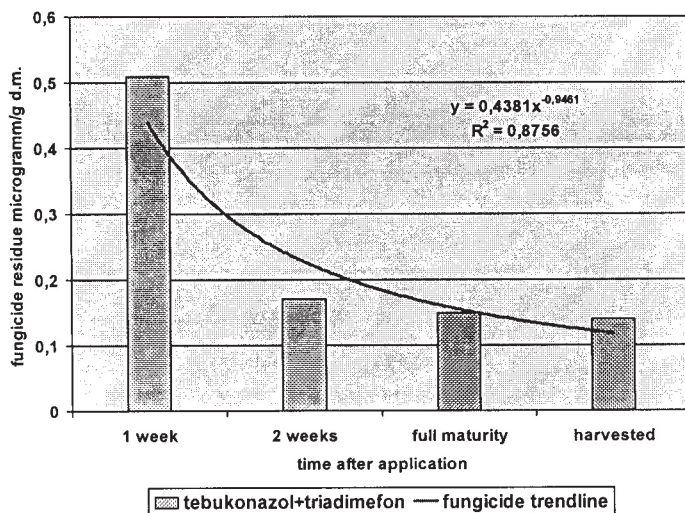
The results have shown evidence that pesticide residues were present in majority of the samples in the beginning of the grain filling period. Full maturity samples had no significant amount of pesticide residues, only traces of insecticide were found in some cases. The magnitude of residues had a strong negative correlation with the amount of spring precipitation of the experimental years.

Figure 1: Herbicide residue discharge values



Herbicide treatments caused an initial residue level of 11-25 µg/g d.m. right after application, which decreased until harvest time to a value of 0-2 µg/g (Fig 1). The type of herbicides had an impact on the speed of residue discharge. In descending order: (1) fluroxipir, (2) bromoxynil, (3) dicamba. The tebukonazol+triadimefon a.i. fungicide had non significant residue values. Less than 1 µg/g amount was detected right after treatment (Fig 2). The level of insecticide residues was higher compared to other pesticides. Bensultap values from 38-74 µg/g d.m. ranged to 8-17 µg/g levels (Fig 3). Some non significant varietal differences were observed in certain years. There were differences in the discharge dynamics of pesticides; the strongest discharge was detected in the case of fungicide treatments.

Figure 2 :Fungicide residue discharge values



Conclusions

All pesticide treatments resulted in detectable amounts of residues after application in the examined wheat samples. The amount of pesticide residues was affected by the

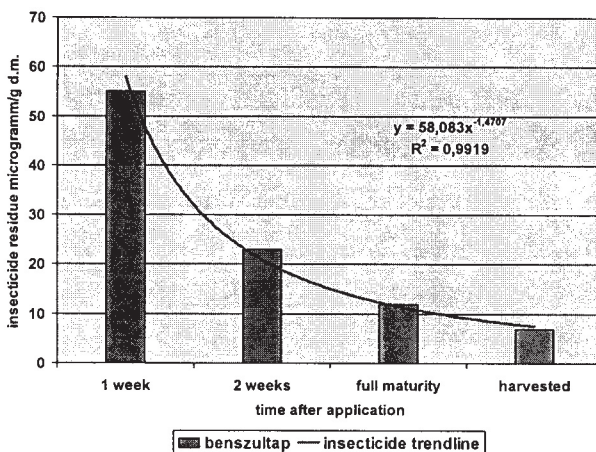
- length of time after application;
- type of pesticide;
- experimental years' conditions;
- wheat varieties tested.

The danger represented by the use of pesticides can be ranked as follows:

- insecticide
- herbicide
- fungicide.

Pesticide residue amounts of harvested grain samples never exceeded food safety standard levels.

Figure 3
Insecticide residue discharge values



Acknowledgement

This research was supported by the Hungarian National Research Fund (OTKA) and the Hungarian Academy of Sciences

References

- Hegedűs Z. – Szentpétery Z. – Kassai K. – Jolánkai M. (2002): Protein and wet gluten contents in winter wheat grain samples. *Acta Agron. Hun.*, 50 (3), 383-387 pp.
- Kádár, I. (2004): Szennyvíziszap-adagok hatása a növény (*Triticum vulgare* L.)-talaj rendszer néhány mikrobiológiai és biokémiai tulajdonságára (Impact of sludge treatments on some microbiological and biochemical properties of plant (*Triticum vulgare* L.)-soil system. – in *Hungarian*). *Agrokémia és Talajtan*. 53. 3-4. 331-342 pp
- Kassai K. – Szentpétery Zs. – Hegedűs Z. – Jolánkai M. (2002): Specific weed tolerance of wheat (*Triticum aestivum* L.) varieties – a key to non chemical weed control. *Agrokémia és Talajtan*. 51. 1-2. 219-222 pp.
- Szentpétery Zs. – Hegedűs Z. – Jolánkai M. (2005): Impact of agrochemicals on yield quality and pesticide residues of winter wheat varieties. *Cereal Res. Commun.* 33 (2-3): 635-640 pp
- Svetková, K.; Henselová, M.; Morvová, M. (2005): Effects of a carbonization product as additive on the germination, growth and yield parameters of agricultural crops. *Acta Agron. Hun.* 53. (3). 241-250 pp
- Tanács, L., Matuz, J., Gerő, L., Petróczi, I.M. (2005): Effect of NPK Fertilizers and Fungicides on the Quality of Bread Wheat in Different Years. *Cereal Res. Commun.* 33 (2-3): 627-634 pp
- Tuba, Z. (2005): Ecological Responses and Adaptations of Crops to Rising Atmospheric Carbon Dioxide. Haworth Press Inc., New York, USA, p. 414.