AKTION 2012 – FINAL REPORT

Number of the project: 63p4

Name: The study of cadmium uptake from the soil and the effect on agronomic and quality of different soybean varieties

Duration of the project: 01.03. – 31.12.2012

Project partners (cooperating people): Tomáš Lošák, Ass. Prof., Ph.D.; Ludmila Musilová, Dipl. Ing., Mendel University in Brno

Johann Vollmann, Ao.Univ. Prof. Dr.; Martin Pachner, Ing., University of Natural Resources and Life Sciences, Vienna (BOKU), workplace A-3430 Tulln an der Donau

Approved sum: CZK 21,000.00 (fully spent as prescribed) and EUR 500

Business trips: 3 visits to Tulln – Tomáš Lošák, Ludmila Musilova (18 May, 8 October, 10 December), and 2 visits to Brno – Johann Vollmann (11-13 November and 16-18 December 2012). During the business trips we consulted the experiment, the achieved results, the publication being prepared and lectures were held for the students and teachers.

Description of the project: Cadmium (Cd) is one of the most hazardous metal pollutants to the environment and human health because plants growing on contaminated soil can absorb and accumulate Cd in edible tissues at significant quantities thus entering the food chain. In soybean, varieties are characterised by differences in Cd uptake. High and low Cd-absorbing genotypes will be characterized through genetic markers at Tulln, Austria. Subsequently, a pot experiment will be established in Brno to explore the effect of soil-applied Cd on yield and qualitative parameters of soybean: Cd content in seeds; in residues of the aboveground plant parts; and in roots. The experiments will include 4 different varieties. The soil and biomass will be analysed at both universities with regard to the respective laboratory facilities.

Realized work programme (Material and Methods):

At both workplaces (Brno, Tulln) the respective experiments were established in the spring of 2012. From a genotype screening with 6 different SSR markers linked to Cd uptake, four soybean genotypes were selected for pot experiments. The four genotypes were sown into vegetation pots. The experiment included 3 treatments for each variety and each treatment was repeated 4 times. The total number of pots for one variety was 4 x 3 = 12 pots. The total number of pots for 4 varieties was 12 x 4 = 48 pots. The experiment included the following 3

treatments:

1. Untreated control (without cadmium application)
2. Cadmium application – dose 1
3. Cadmium application – dose 2

Cadmium was applied to the soil in the form of cadmium acetate dihydrate ($C_4H_6CdO_4 \cdot 2H_2O$). During vegetation the pots were kept free of weeds and watered on a regular basis. At harvest the quantitative and qualitative parameters of soybean were monitored.

The soil and plant samples were analysed jointly according to valid methods dependent on the current laboratory facilities at both workplaces.

Results:

Considering the limited extent of the final report we selected the most important conclusions. Basing on the achieved results we see a considerable effect of genetic markers for the detection of soybean varieties more or less capable of accumulating cadmium. In our experiments the Cd content was found to be higher in seeds of the varieties Merlin and Gallec, and lower in varieties ES Mentor and OAC Erin. On top of that it was proved that compared to the roots and stems the amount of cadmium was the lowest in soybean seeds. With higher demands for high-quality foodstuffs and feeds and stricter standards in terms of the contents of hazardous elements, the importance of selecting appropriate varieties will increase. With the choice of the variety the farmer will have the opportunity to select varieties which have a lower ability to accumulate Cd in the seeds. Further research into this area is imperative.

Presentation of results:

Some results were published in the popular journal Agromanuál, Issue 8 (1), page 26 (manuscript of the article is attached to the final report) in January 2013. Two other manuscripts for scientific journals are being worked out (will be presented later}. The results have also been presented to students and teachers at both universities and were included in teaching – in the subject Fertilisation Systems of Field Crops (at Mendel University in Brno)

and in the subject Aspects of Product Quality in Plant Production (at BOKU University Vienna).

Conclusion:

In terms of many aspects both parties consider the project as successful, meaningful and beneficial. The allotted finances were well spent (statement of costs is attached). Co-operation of both organisations will continue.

Brno 21 January 2013

Ass. Prof. Tomáš Lošák, Ph.D.

Mendelova univerzita v Brně
Agronomická fakulta
Ústav [illegible] půdoznalství,
mikrobiologie a výživy rostlin
Zemědělská 1, 613 00 Brno

Tulln 24 January 2013

Assoc. Prof. Dr. Johann Vollmann

Universität für Bodenkultur Wien
Department für Nutzpflanzenwissenschaften
Abteilung Pflanzenzüchtung
3430 Tulln a. d. Donau, Konrad Lorenz Str. 24
Tel.: ++43 (0)1 47654 3300
E-mail: pflanzenzuechtung@boku.ac.at