



Persistence of imazethapyr residues in soybean and soil

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Imazethapyr belonging to imidazolinone group is a systemic pre-plant incorporated, pre-emergence and post emergence herbicide. Imazethapyr is mainly used in soybean, however, it is also used in crops like corn, oilseed rape and vegetables for control of many major annual and perennial grasses and broad-leaved weeds (Sondhia and Varshney 2010). It inhibits acetolactate synthetase (ALS), a key enzyme in the biosynthesis of the branched chain amino acids isoleucine, leucine and valine, leading to disruption of protein and DNA synthesis.

Microbial degradation and photodegradation have been suggested as major dissipation mechanism for imazethapyr (Stougaard *et al.* 1990). Imazethapyr incorporated in the soil persisted longer than imazethapyr applied to the soil surface (Patel *et al.* 2009). Hollaway *et al.* (2004) reported that 10% residues of applied imazethapyr persisted for 24 and 5 months after treatment in clay soil and sandy soil respectively. Soil pH affects its sorption-desorption, which in turn may affect its persistence and bioavailability

Venktesh *et al.* (2008) found post-emergence application of herbicide imazethapyr most effective in minimizing weed growth and enhancing the grain yield of soybean. At the recommended dose of herbicide application, generally the problem does not arise and it selectively kill the weeds. But when the dose is more than recommended rates due to indiscriminate use and improper calibration and method of application, there is possibility of residual hazards in soil and crop produced. Therefore an experiment was conducted to study the persistence of imazethapyr residues applied to soybean in soil, grain and straw of soybean.

A field experiment was conducted in *Kharif* 2006 at research farm, College of Agriculture, Gwalior in randomized block design with 14 treatments replicated thrice. The treatments consisted of recommended and double the recommended doses of imazethapyr, alachlor, pendimethalin,

fenoxaprop, chlorimuron-ethyl and quizalofop with weedy check and weed free (two hand weeding). The experimental soil was sandy clay loam with 55.2% sand, 19.4% silt, 25.4% clay and 0.34% organic carbon, having 7.5 pH. The soil samples from the imazethapyr 200 g/ha (double the recommended dose) applied 20 days after sowing and control (weed free) plots were collected at 15, 30, 45, 60 and 75 days after herbicide application and after harvest of crop. The samples (0-15 cm depth) were bulked, air dried, powdered and passed through 2 mm sieve. The soybean grains and straw were sampled at harvest. The straw samples were cut in small pieces and air dried. The grain and straw samples were then ground in mechanical shaker. The residues of imazethapyr in soil, grain and straw samples were extracted and analysed by HPLC method as per Sondhia (2008), in residue laboratory of Directorate of Weed Science Research, Jabalpur.

The samples were extracted with 0.5 N NaOH solution for 1 h on a horizontal shaker. Methanol was added to the solution and shaken vigorously. The pH was adjusted to 2 with 6 N HCl and partitioned with methylene chloride. The lower methylene chloride layer was collected, dried on anhydrous Na₂SO₄, passed through activated charcoal and evaporated to dryness at 40°C.

No clean up was required for soil samples. Soybean grains and straw sample extracts were cleaned on a glass adsorption column packed with a mixture of celite (1g) and activated charcoal (0.25 g) between anhydrous sodium sulfate (2 g) at each end. The concentrated extract was added to the top after pre-washing with methanol and eluted with methanol and water (60:40). Elutes were collected and solvent of elutes was evaporated to dryness at 40°C. Finally residues were dissolved in 2 mL of methanol. Imazethapyr residues were analyzed on a Shimadzu high-performance liquid chromatography equipped with diode array detector at 250 nm using Phenomenex C-18 (ODS) column (250 x 4.6 mm). The mobile phase was mixture of methanol and water (70:30) at a flow rate of 0.8 mL/min. 20 µl of the aliquot of sample and standard was injected using micro syringe. The retention time of imazethapyr was found to be 3.5 minutes.

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The residue level of imazethapyr in soil, soybean grain and straw are presented. The concentration of imazethapyr in soil decreased with time and at harvest, residues were below the detectable limit. The residue level of imazethapyr in soil was found 0.017, 0.016, 0.015, 0.012 and 0.011 $\mu\text{g/g}$ at 15, 30, 45, 60 and 75 days after herbicide application. At harvest the residue was below detectable limit. However the residue level of 0.082 and 0.023 $\mu\text{g/g}$ were detected in soybean grains and straw, respectively which were below the maximum residue limit of 0.1 mg/kg (Anonymous 2006). Sondhia (2008) reported 0.008, 0.102 and 0.301 $\mu\text{g/g}$ residues in post harvest soil, grains and straw of soybean crop respectively at 100g/ha application rate.

SUMMARY

A field experiment was conducted to study the persistence of imazethapyr applied to soybean in sandy clay loam soil. The herbicide was applied as post-emergence 20 days after sowing at 100 and 200 g/ha. The residue analysis of imazethapyr 200 g/ha applied as post-emergence 20 days after sowing was carried out in soil samples collected at 15, 30, 45, 60 and 75 days after application and in soil, grain and plant samples after harvest. The residue level of imazethapyr in soil was found 0.017, 0.016, 0.015, 0.012 and 0.011 $\mu\text{g/g}$ at 15, 30, 45, 60 and 75 days after

herbicide application. At harvest the residue was below detectable limit. However the residue level of 0.082 and 0.023 $\mu\text{g/g}$ were detected in soybean grains and straw, respectively which were below the maximum residue limit

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