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Genotypic response of mango yield to persistence of paclobutrazol in soil

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Abstract

Persistence of paclobutrazol and its subsequent impact on the yield of different commercial cultivars of mango, viz. Chausa, Dashehari and Langra have been studied. Results based on 2-year averages indicate that trees treated with 6 g a.i./tree of paclobutrazol recorded maximum yield in Chausa and Langra, whereas only 4 g a.i./tree was most effective in Dashehari. The application of paclobutrazol, at half the above doses, was effective in inducing flowering as well as fruiting in the third year, but only in cv. Dashehari; still substantially higher yields (47.30 kg/tree) were recorded over control (26.20 kg/tree), but not so in cvs. Chausa and Langra. The trees which were not given paclobutrazol treatment in the third year showed residual effect only in cv. Dashehari, while cvs. Chausa and Langra did not show any residual response. The paclobutrazol residue in the soil collected during the third year from the root zone of trees was in the range of 0.4898–1.0005 μg/g by gas–liquid chromatography.

Keywords: Paclobutrazol; Persistence; Soil; Mango; Yield

1. Introduction

Mango (*Mangifera indica* L.) is one of the most important and economic fruit crops of India. Mango plant exhibits alternate bearing and the yield varies considerably in alternate years, the year of optimum or heavy fruiting (on year) is followed by little or no fruiting (off year) in the following year. However, certain plant growth regulators (PGRs)

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can effectively induce flowering in mango during the off years. Among various PGRs, paclobutrazol [(2RS,3RS)-1-(4-chlorophenyl)-4,4-dimethyl-2-(1*H*-1,2,4-triazol-1-yl) pentan-3-ol] has been found to be particularly effective (Kulkarni, 1988; Burondkar and Gunjate, 1993; Kurian and Iyer, 1993; Shinde et al., 2000). Paclobutrazol is a potent inhibitor of gibberellin biosynthesis (Hedden and Graebe, 1985) and can be applied as an overall spray, as a soil drench or by way of trunk painting; better results have been achieved when used as a soil drench, either in the root zone or the collar region of the tree. It is a broad-spectrum growth retardant and reportedly effective in inducing flowering in apple and pear (Williams and Edgerton, 1983) and reducing stem elongation in apple (Steffens and Wang, 1985; Sterrett, 1985), citrus (Aron et al., 1985) and peach (Erez, 1984).

Paclobutrazol was reportedly absorbed through the roots and transported primarily through stem (via xylem) before accumulating in the leaves (Wang et al., 1986). The amount of paclobutrazol residue left in the soil or plant parts would appear to depend on the methods of application, doses and the crop. Xi et al. (1995) reported that the highest paclobutrazol residues (0.107 ppm) were found in the roots of rapeseed from normally applied paclobutrazol solution (150 ppm), followed by the leaves, seed, stem and hull (0.070, 0.039, 0.034 and 0.027 ppm, respectively). They also reported substantial amounts of residue in the soil: 0.015 ppm (0–5 cm) and 0.01 ppm (5–10 cm) depending on the soil depth. However, Li and Pan (1997) did not detect residue in the soil after 230 and 130 days of application in rice and groundnut fields, respectively. It reportedly persisted upto 2–5 years in apple (Ma et al., 1990), 1–3 years in peach (Erez, 1986), 1–2 years in apricot (Jacyna et al., 1989), cranberry (McArthur and Eaton, 1989), citrus (Aron et al., 1985) and blueberry (Spiers, 1988). However, very little amount of paclobutrazol is required to promote flowering and fruiting in fruit crops (Browning et al., 1992).

Persistence of paclobutrazol in the soil can be determined by chromatographic methods. The present study was undertaken to analyse the persistence of paclobutrazol in the soil by a simple GLC method and to examine its long-term impact on mango yield in cvs. Chausa, Dashehari and Langra.

2. Materials and methods

A statistically laid out field trial in randomized block design (RBD) with three replications was carried out during 1997–2000 mango cropping season at the experimental farm of CISH, Lucknow, located at latitude 26–55°N and longitude 85–89°E. The average temperature was between 12.5 and 32.5 °C and the annual precipitation was 765 mm with 85–90% relative humidity during mango season. Twenty-year-old mango trees of cvs. Chausa, Langra and Dashehari were used for this trial. Paclobutrazol as an aqueous solution was procured from ICI Agrochemicals Ltd., UK. It was applied as a soil drench at 2, 4, 6 and 8 g a.i./tree in the month of September within the manuring ring at 10 cm depth during the first 2 years (on and off years) of experiment. During the third year the plants were divided into two sets, one set of plants received half the dose of paclobutrazol applied in the previous years, and no treatment was given to the second set of trees in order to study its long-term effect on mango production. Trees without paclobutrazol treatment were used