

Residual study of metamifop 10 Ec in grain, straw and soil in direct seeded rice

Abstract

Field experiment was conducted to evaluate the efficacy of Metamifop in direct seeded rice. The treatments were metamifop at 50, 75, 100 and 125g a.i ha⁻¹ applied at 2-3 leaf stage of weeds; Metamifop was also applied at 50, 75, 100, 125 and 200g a.i ha⁻¹ at 5-6 leaf stage. The residue of metamifop was determined in soil, grain and straw from plots where it was applied at 200g a.i ha⁻¹ at 5-6 leaf stage (T₉) followed by the application of metamifop at 125g a.i ha⁻¹ at 5-6 leaf stage (T₈) and application of metamifop at 100g a.i ha⁻¹ at 5-6 leaf stage (T₇). Decrease in dose decreases the residue content. This might be due to the lesser degradation of the active substance. At the same time, for the same rate of application of 125g a.i ha⁻¹, the concentration of residue varies with the time of application i.e the mean residue of metamifop at post harvest soil was 0.031 and 0.048ppm respectively in the plots which received metamifop at 2-3 leaf and 5-6 leaf stage. Application the metamifop at lower dose of 50 and 75g a.i ha⁻¹ did not show any residues i.e non detectable level.

Volume 5 Issue 5 - 2016

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Received: May 31, 2016 | **Published:** December 28, 2016

Introduction

Rice is the staple food for more than half of the world's population. In Asia, more than 80% of the people live on rice, and their primary food security is entirely dependent on the volume of rice produced in this part of the world. However, increase in rice production is now lagging behind population growth. Overall, the total global rice production is declining gradually even with the extensive use of the high yielding modern varieties and hybrids. India is having the rice growing area of 42.63million ha with a production of 85.72million tonnes and a productivity of 2,011kg ha⁻¹. In Tamil Nadu, rice is cultivated in an area of 1.93million ha with a production of 6.61million tonnes and a productivity of 3,423kg ha⁻¹.¹ Direct seeding is practiced in areas of uncertain distribution of rainfall or inadequate availability of irrigation facilities. Direct seeded rice is gaining momentum in India due to high demand of labour during peak season of transplanting and availability of water for short periods. Herbicides are considered to be an alternative supplement to hand weeding.² Herbicide residue analysis is also important for the food safety.

Material and methods

Field experiment was conducted during kharif season at Tamil Nadu Agricultural University; Coimbatore to evaluate Metamifop for its residual effect direct seeded rice. The experimental field was situated in the North Western Agro- climatic Zone of Tamil Nadu at 110 North latitude, 77' East longitude and at an altitude of 426.7m above MSL. The normal weather conditions prevailed at the experimental location is briefed here under. A mean annual rainfall of 640mm was received in 43 rainy days (mean of 25years). The mean maximum and minimum temperature were 31.5°C and 27.2°C respectively. The relative humidity was 95%. During the growing season, Rice plants received a rainfall of 407mm in 23 rainy days. The mean maximum and minimum temperature were 31.1°C and 21.7°C respectively. The treatments were Metamifop at 50g a.i ha⁻¹ as POE at 2-3 leaf stage (T₁), Metamifop 10 EC at 75g a.i ha⁻¹ as

POE at 2-3 leaf stage (T₂), Metamifop 10 EC at 100g a.i ha⁻¹ as POE at 2-3 leaf stage (T₃), Metamifop 10 EC at 125g a.i ha⁻¹ as POE at 2-3 leaf stage (T₄), Metamifop 10 EC at 50g a.i ha⁻¹ as POE at 5-6 leaf stage (T₅), Metamifop 10 EC at 75g a.i ha⁻¹ as POE at 5-6 leaf stage (T₆), Metamifop 10 EC at 100g a.i ha⁻¹ as POE at 5-6 leaf stage (T₇), Metamifop 10 EC at 125g a.i ha⁻¹ as POE at 5-6 leaf stage (T₈), Metamifop 10 EC at 200g a.i ha⁻¹ as POE at 5-6 leaf stage (T₉). After the harvest of rice, the soil samples were collected for the estimation of herbicide residues. The collected samples were shade dried, powdered and sieved through a 2.0mm sieve. Besides, grain and straw samples were also analyzed for herbicide residues by using and High Performance Liquid Chromatography (HPLC).

Method for the Determination of the Metamifop Residues in Rice Extraction

Sample preparation

- Rice grain and straw samples were grinded prior to extraction. Rice straw was cut in to pieces of 0.5 to 1cm and then subjected to grinding.
- Soil was pounded and sieved to pass through 2mm sieve.

Extraction

Macerate samples (for soil 50g, for grains, use 20g and for straw, use 20g) in a 500ml conical flask with 40 ml of distilled water for 2minutes. Shake the macerated samples for 30 minutes in 100ml of acetonitrile then filter through filter paper. Rinse filters cake twice with 50ml each of acetonitrile. Concentrate combined filtrates at 40°C under reduced pressure. Transfer the concentrated solution to a 500ml separatory funnel, add 50ml of water, 50ml of saturated sodium chloride solution and then partition in 100ml of ethyl acetate by shaking. Allow phases to separate, and let upper ethyl acetate fraction pass through a bed of anhydrous sodium sulfate into a 300 ml round bottom flask. Re-extract aqueous portion with an additional 100ml of ethyl acetate and filter organic layer through anhydrous sodium sulfate

into the same 300ml round bottom flask. Evaporate organic layers in water bath then dissolve the concentrate in 5ml of acetonitrile/water (40/60, v/v) and labeled "solution A".

Clean-up

The "solution A" was filtered through Flurosil layer and add 10 ml of hexane/acetone (90/10). Evaporate in water bath. And make up the volume to 5 ml by hexane/ acetone (90/10).

Chromatographic conditions

Column	: C 18- column
Mobile phase	: Acetonitrile/Water (75/25, v/v)
UV wavelength	: 240 nm
Flow rate	: 1.0 ml /min
Attenuation	: 2 ⁴
Sample size	: 15µl
Flow rate	: 1 ml per minute
Detector	: Photo Diode Array
Software	: Class - VP

Result and discussion

The highest concentration of metamifop active substance was determined in soil from plots where it was applied at 200g a.i ha⁻¹ at 5-6 leaf stage (T₉) and followed by 125g a.i ha⁻¹ at 5-6 leaf stage (T₈) and 100g a.i ha⁻¹ at 5-6 leaf stage (T₇). Decrease in dose decreases the residue content. This might be due to the lesser degradation of the active substance Kim et al.,³ At the same rate of application of 125g a.i ha⁻¹, the concentration of residue varies with the time of application i.e the mean residue of metamifop at post harvest soil was 0.031 and 0.048ppm respectively in the plots which received metamifop at 2-3 leaf and 5-6 leaf stage. The mean residue concentration varied from 0.005 to 0.075ppm across different treatments. Lower rates (50 & 75g a.i ha⁻¹) of application the metamifop did not have any residue in soil, grain and straw of direct seeded rice (Table 1).

Table 1 Residue of metamifop (mg kg⁻¹) in soil and plant parts of direct seeded rice

Treatments	Soil	Grain	Straw
T ₁ - Metamifop 10 EC at 50g ai ha ⁻¹ as POE	BDL	BDL	BDL
T ₂ - Metamifop 10 EC at 75g ai ha ⁻¹ as POE	BDL	BDL	BDL
T ₃ - Metamifop 10 EC at 100g ai ha ⁻¹ as POE	0.005	BDL	BDL
T ₄ - Metamifop 10 EC at 125g ai ha ⁻¹ as POE	0.031	0.001	0.010
T ₅ - Metamifop 10 EC at 50g ai ha ⁻¹ as POE	BDL	BDL	BDL
T ₆ - Metamifop 10 EC at 75g ai ha ⁻¹ as POE	0.035	BDL	BDL
T ₇ - Metamifop 10 EC at 100g ai ha ⁻¹ as POE	0.042	0.004	0.025
T ₈ - Metamifop 10 EC at 125g ai ha ⁻¹ as POE	0.048	0.060	0.037
T ₉ - Metamifop 10 EC at 200g ai ha ⁻¹ as POE	0.075	0.221	0.096

(T₁ to T₄ – application at 2-3 leaf stage and T₅ to T₉ at 5 -6 leaf stage) PE, pre- emergence; POE, post emergence BDL, below detectable level Data not statistically analyzed.

Similar to the soil, the residue of metamifop concentration was higher at higher rates of application in grain and straw and again the concentration detected was varied with the time of application. The highest concentration of metamifop active substance was determined in grain and straw samples from plots where it was applied at 200g a.i ha⁻¹ at 5-6 leaf stage (T₉) and followed by T₈ and T₇ where metamifop was applied at 125g a.i and 100g a.i ha⁻¹ at 5-6 leaf stage and 100g a.i and 100g a.i ha⁻¹ at 5-6 leaf stage. The metamifop concentration varied from 0.001 to 0.221ppm and 0.01 to 0.096ppm in grain and straw respectively. The concentration of metamifop was high in grain than in straw. The low concentration of metamifop has no residual effect so it is safer for food grains to consume.

Acknowledgements

None.

Conflict of interest

The author declares no conflict of interest.

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