cisions. The presented material is best used as a guide for evaluating the anticipated economic returns from producing either strawberries, blueberries, or grapes in North-central Florida. Although profits can be realized by following recommended production practices, sound management dictates careful economic planning and marketing by the efficient fruit grower.

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GLYPHOSATE RESIDUES ON AVOCADO[1]

NEAL P. THOMPSON
ALICE A. LYNCH
PROMODE C. BARDALAYE
University of Florida, IFAS,
Pesticide Research Laboratory,
Gainesville, FL 32611
AND

RICHARD L. PHILLIPS
University of Florida, IFAS,
Fruit Crops Department,
Gainesville, FL 32611

Additional index word. Roundup[R].

Abstract. **Glyphosate [N-(Phosphonomethyl) glycine] was used for weed control in avocado (varieties "Meya" and "Lula"), and samples were taken at maturity. Whole fruit was analysed for glyphosate and the metabolite aminomethylphosphonic acid using flame photometric gas chromatography. The maximum residue found was 0.08 ppm.**

The herbicide glyphosate has been shown to give excellent weed controls. The purpose of this research was to supply residue data in support of a registration for use on avocado.

Materials and Methods

Glyphosate (41% isopropylamine salt) was used for weed control in avocado (varieties "Meya" and "Lula"). Two different rates were used, the recommended rate (X) of 4 lb ai/acre and a higher rate (2X) of 8 lb ai/acre. Each plot consisted of 4 trees per row in 4 rows spread 30 feet apart. The spray was boom directed in a 6 feet wide strip on each side of a row of trees. Weed control applications were made three times, the first interval being 13 weeks and the second 11 weeks. Avocado samples were taken at maturity, 1 and 14 days following the final treatment. The fruit was hand picked and frozen whole prior to analysis for glyphosate and the metabolite aminomethylphosphonic acid.

For residue analysis, the fruit was partially thawed and cut open to remove the pit and chopped in a Hobart food chopper. A representative 25 g sample was blended with 50 ml deionized distilled water and 25 ml chloroform in a Polytron[R] (Brinkmann Instruments) ultra-sonic homogenizer and centrifuged to separate the two layers. The aqueous layer was decanted and the process was repeated. The aqueous layers were pooled, diluted to 1000 ml and passed through a Diamond Shamrock A-101D anion exchange resin (25 ml resin on a 2.2 x 30 cm column prewashed with 100 ml 1M ammonium bicarbonate solution and then with three 100 ml rinses of deionized water) at the rate of ca 800 ml per hour followed with three 100 ml portions of deionized water. All of the preceding volumes were discarded. The parent herbicide and the metabolite were eluted from the column with 100 ml 0.5 M ammonium bicarbonate solution. The eluate was evaporated to dryness using a flash evaporator at 50°C. Evaporation was done twice, each time the flask was rinsed with 50 ml deionized water. The final residue was dissolved in 5 ml deionized water and transferred to a Bio-Rad cation exchange resin AG 50W-X8 column (1.0 x 20 cm filled with resin to 14.5 cm, prewashed with 75 ml deionized water) and eluted with water. The fractions to be collected were determined by using ^{14}C-labeled gly-

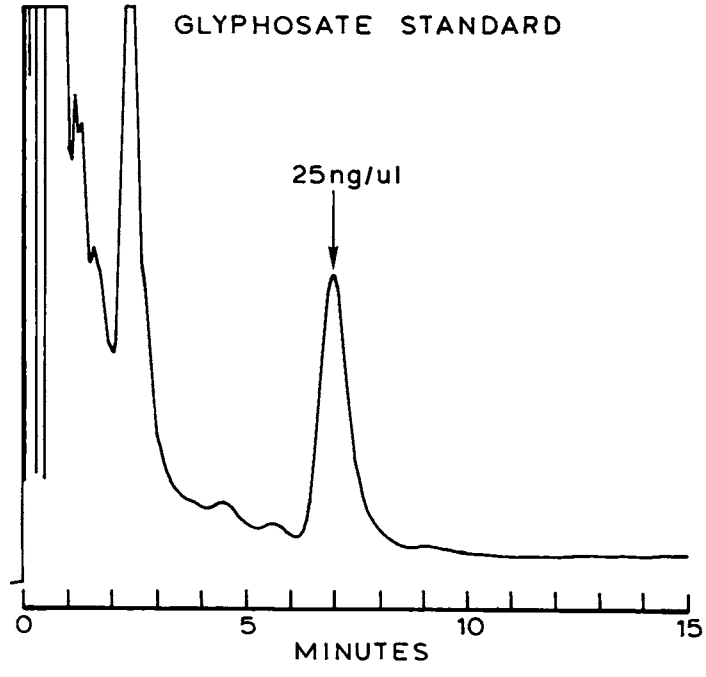

Fig. 1. Chromatogram of glyphosate standard.

[1]Florida Agricultural Experiment Station Journal Series No. 2829.

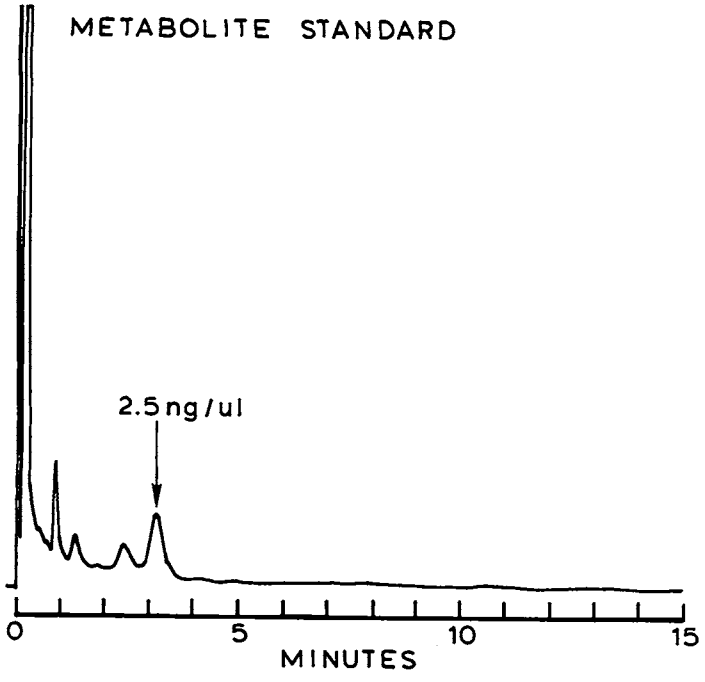

Fig. 2. Chromatogram of the metabolite, aminomethylphosphonic acid.

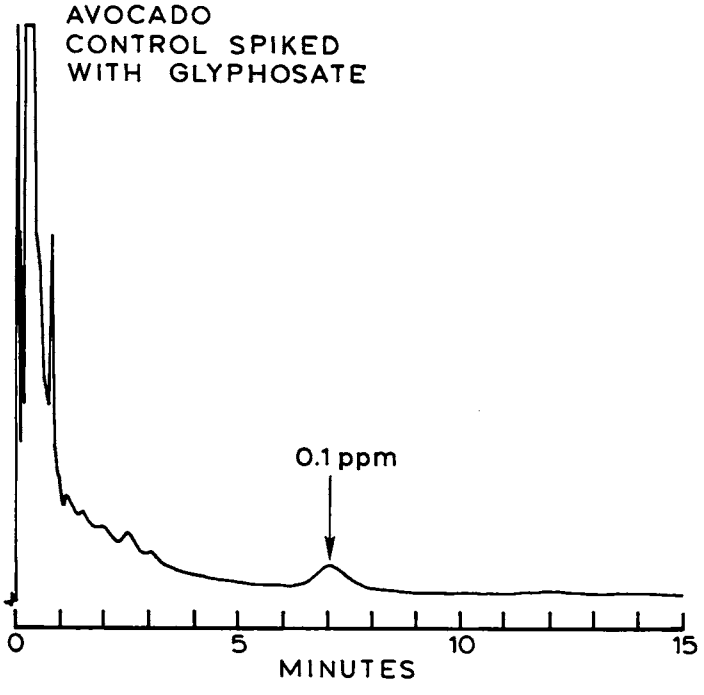

Fig. 3. Chromatogram of avocado control sample fortified with 0.1 ppm glyphosate.

phosate and metabolite. The first 10 ml eluate was discarded, the second 19 ml was collected (glyphosate), the third 15 ml was discarded and the fourth 15 ml fraction was again collected (metabolite). The first collected fraction contained the glyphosate while the second collected fraction contained the metabolite. To each of the collected fractions 1 ml 1M ammonium bicarbonate solution was added. Each was evaporated to dryness using a flash evaporator, esterified with

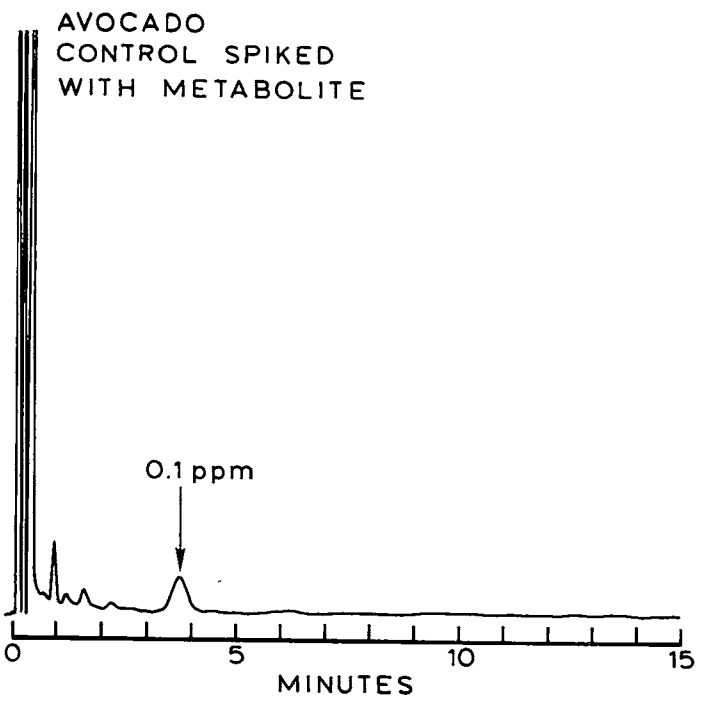

Fig. 4. Chromatogram of avocado control sample fortified with 0.1 ppm of the metabolite aminomethylphosphonic acid.

diazomethane and N-trifluoroacetylated with trifluoroacetic acid and trifluoroacetic anhydride. The derivatized glyphosate residue was diluted to 1 ml with methylene chloride and the derivatized metabolite residue was brought up to 1 ml with benzene. This analytical procedure follows that supplied by the manufacturer and contained in Pesticide Analytical Manual of the Food and Drug Administration (1). Aliquots were analyzed by gas liquid chromatography on a Hewlett Packard 5730 A gas chromatograph equipped with a flame photometric (phosphorus mode) detector and using a 1.83 meter x 4 mm I.D. glass column packed with 1% Reoplex 400 on 100/120 mesh Gas Chrom Q operated at 130°C with a nitrogen carrier gas flow of 150 ml/min. Detector gas flows were: hydrogen 140 ml/min, air 50 ml/min. and oxygen 10 ml/min. Injection port and detector temperatures were maintained at 210°C. Recoveries of glyphosate and metabolite from fortified avocado ranged 52-75% and 48-79% respectively at 0.01-0.5 ppm level.

Results and Discussion

The chromatographic conditions used in this analysis separate both the parent glyphosate and the metabolite after derivatization and each can be quantitated individually having retention times of 7.11 and 3.40 minutes respectively (Fig. 1, 2). Recoveries averaged about 50 percent; fortified controls are illustrated in Fig. 3 and 4. Glyphosate residues found ranged from <0.02-0.08 ppm and the metabolite residues were less than <0.01 ppm. The low residues associated with adequate weed control indicate that glyphosate would perform well as a herbicide in avocado.

Literature Cited

1. Pesticide Analytical Manual Vol. II, Sec. 180. 364, Food and Drug Administration.