Table I. Typical Residues of Phorate and Aldicarb in Soybean Leaves

Days posttreatment	Aldicarb, ppm	Phorate, ppm
3		24–113
10	50–150	70–257
20	35–143	81–265

sentially the same as described by Lindquist *et al.* (1972). Analytical standards of aldicarb, aldicarb sulfoxide, and aldicarb sulfone were supplied by Union Carbide Corp., South Charleston, W. Va.

RESULTS AND DISCUSSION

Table I shows typical residues of aldicarb and phorate. Aldicarb and its toxic oxidation products are expressed as aldicarb sulfone. The phorate results are represented as the total of phorate and the five oxidation products. A typical breakdown of the phorate data would be as follows: 0.28 ppm of POA, 1.4 ppm of phorate, 92 ppm of PSO + PSO_2, and 14 ppm of POASO + $POASO_2$. None of the plant growth regulators tested changed this metabolic pattern to any great extent. Under the conditions used in this experiment, there were no significant differences in the uptake or degradative metabolism of either phorate or aldicarb when used in combination with plant growth regulators. Inasmuch as the chromatographic procedures used in this study did not separate the aldicarb oxidation products or the several phorate oxidation products, we were not able to determine whether the various plant growth regulators had any effect on that portion of the aldicarb or phorate metabolic pattern.

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Identification of Compounds Responsible for Baked Potato Flavor

The volatile flavor compounds in baked Idaho Russet Burbank potatoes were isolated and separated into acidic, neutral, and basic fractions. The basic and neutral fractions had odors reminiscent of that of baked potato. They were each fractionated by repeated gas chromatography. The odor of each of the gas chromatographic fractions was evaluated by organoleptic means and those fractions with interesting odors were collected and identified by infrared and mass spectrometry. Among the compounds identified, it was believed that a combination of 2-isobutyl-3-methylpyrazine, 2,3-diethyl-5-methylpyrazine, and 3,5-diethyl-2-methylpyrazine had an odor closer in character to baked potato aroma than did any single compound.

Baked potato flavor has not been extensively studied. Very recently, Buttery *et al.* (1973) reported the identification of 45 compounds, mostly pyrazines and aliphatic aldehydes, as voltatile flavor components of Washington Russet Burbank potatoes. The authors consider the following compounds to be the most important to baked potato aroma: 2-ethyl-3,6-dimethylpyrazine, methional, deca-*trans,trans*-2,4-dienal, and possibly 2-ethyl-3,5-dimethylpyrazine. It is interesting to note that these compounds have been previously identified by Deck *et al.* (1973) as components of potato chip aroma.

We have also studied the flavor of baked potatoes using Idaho Russet Burbank potatoes. The volatile flavor compounds were isolated from a water slurry made from 68 kg of freshly baked potatoes by flash evaporation and vaporization from a continuous thin heated film using the apparatus of Herz and Chang (1966). The isolated volatile flavor compounds did have the characteristic baked potato aroma. They were separated into acidic, neutral, and basic fractions. The neutral fraction was separated into broad fractions by gas chromatography with a Carbowax 20M column. The chromatography was repeated many times and each fraction was cumulatively collected in one trap. The odor of each collected broad fraction was evaluated by an organoleptic evaluation panel.

The broad fractions which had an odor related to the baked potato aroma were further gas chromatographed into subfractions by using a Silicone SE-30 column. The odor of each subfraction was again assessed organoleptically. When necessary, subfractions were gas chromatographed a third time to obtain pure fractions. Finally, the pure gas chromatographic fractions were identified by infrared and mass spectrometry. A similar procedure was used for the basic group except that a Silicone SE-30 column was used first, followed by a Carbowax 20M column. The acidic fraction possessed odors reminiscent of those of lower fatty acids. It was not further studied.

Among the compounds identified are those listed in Table I. Eight other pyrazines were tentatively identified. They were 2-ethyl-3,5,6-trimethylpyrazine, isoamylmethlypyrazine, trimethylisobutylpyrazine, a diethylmethylpyrazine, two alkylpyrazines of mol wt 164, a tetra-substituted alkylpyrazine of mol wt 178, and olefinic pyrazines of mol wt 148 and 178.

Our organoleptic data confirm the assertion of Buttery *et al.* that 2-ethyl-3,6-dimethylpyrazine is one of the most important odorants in baked potato flavor. However, we have found that 2-isobutyl-3-methylpyrazine, 2,3-diethyl-5-methylpyrazine, and 3,5-diethyl-2-methylpyrazine, taken as a mixture, have an odor closer in character to

Table I. Some Compounds Identified as Volatile Flavor Components of Baked Potatoes[a]

Compounds	Identified by
Neutral	
1,1-Diethoxyethane (acetal)	Ir
2-Furaldehyde	Ir, ms
2-Phenylcrotonic acid	Ir
5-Methyl-2-furaldehyde	Ir, ms
Benzaldehyde	Ms
Phenylacetaldehyde	Ms
Basic	
2,5-Dimethylpyrazine	Ir, ms
2,6-Dimethylpyrazine	Ms
2-Ethyl-3-methylpyrazine	Ms
2-Ethyl-5-methylpyrazine	Ms
2-Ethyl-6-methylpyrazine	Ms
2-Ethyl-3,6-dimethylpyrazine	Ms
2-Isobutyl-3-methylpyrazine	Ms
2,3-Diethyl-5-methylpyrazine	Ms
3,5-Diethyl-2-methylpyrazine	Ms
2-Isobutyl-3,6-dimethylpyrazine	Ms

[a] Identifications were based on comparison of sample spectra with spectra of authentic compounds.

baked potato aroma than does the former single compound. This conclusion was based upon the fact that these three compounds eluted as one peak from the Silicone SE-30 column. This peak, when collected, had the characteristic odor of baked potatoes. They were subsequently identified by fractionation on a Carbowax 20M column and again on a Silicone SE-30 column attached directly to the mass spectrometer. In addition to the three compounds mentioned above, there is some mass spectral evidence that 2-ethyl-3,5,6-trimethylpyrazine was also present in the peak.

Beside the pyrazine compounds, the compound 5-methyl-2-furaldehyde, identified in our investigation, might also contribute to the total flavor of baked potatoes.

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Ametryne Metabolite in Transpired /Guttated Water from Sugarcane Shoot

An unknown ^{14}C metabolite was found in the collected water from sugarcane grown in soil or nutrient solution treated with ametryne (ring-^{14}C). This metabolite was not $^{14}CO_2$ or bicarbonate, but was polar, basic, and water soluble. Plants were periodically enclosed in divided air-tight chambers separating soil/root and shoot to allow collection of $^{14}CO_2$ and the transpired/guttated water. $^{14}CO_2$ evolved from the shoot was minor relative to both $^{14}CO_2$ from soil/root and the unknown metabolite from the shoot.

Ametryne (2-ethylamino-4-isopropylamino-6-methylthio-*s*-triazine) is applied for selective pre- and postemergence weed control in sugarcane, pineapple, and bananas in Hawaii. Specific studies on soil or plant metabolism of ametryne in these crops are lacking. Metabolism of *s*-triazine herbicides has been shown to involve biological N-dealkylation (Bakke *et al.*, 1971; Kaufman and Blake, 1970; Muller and Payot, 1966; Oliver *et al.*, 1969; Shimabukuro and Swanson, 1970), chemical hydrolysis (Hamilton, 1964; Shimabukuro, 1967), amino acid conjugation (Lamoureux *et al.*, 1970), insolubilization (Shimabukuro and Swanson, 1969; Sikka and Davis, 1968), and degradation to CO_2 (Kaufman and Kearney, 1970; Knuesli *et al.*, 1969). Most studies have been conducted with the chloro-*s*-triazines. The only specific study on ametryne degradation in sugarcane (Hilton *et al.*, 1970) suggested absence of ametryne and hydroxyametryne (equivalent to hydroxyatrazine, 2-ethylamino-4-isopropylamino-6-hydroxy-*s*-triazine) in the leaf and root extracts, while more than half of the applied ametryne (ring-^{14}C) remained unaccounted for at 13 weeks. It appears that a large proportion of the ^{14}C disappeared, possibly in some volatile form.

In this communication we report, for the first time, the appearance and measurement of a ^{14}C-labeled metabolite in the transpired/guttated water derived from the shoot of sugarcane plants growing in ametryne (ring-^{14}C) treated soil or nutrient solution.

MATERIALS AND METHODS

Sugarcane plants of variety H50-7209 were grown from seed pieces in aerated nutrient solution. When the plants (with the seed pieces removed) were 7 weeks old, each plant was transferred to 400-g Molokai soil (Typic Torrox, clayey, kaolinitic, isohyperthermic soil) in a plastic container. After transplanting, the plants were allowed to grow for 5 weeks prior to ametryne treatment. During this period, irrigation was regulated to avoid drainage from the soil. This irrigation pattern was maintained throughout the experimental period. The growth chamber was set for 12 hr of day at 30° and 12 hr of night at 19°. When the plants were 12 weeks old an aqueous solution of ametryne (ring-^{14}C), specific activity 29.6 μCi/mg, was applied at 5 μg/g of soil in triplicate pots and was followed by irrigation. Plants grown in untreated soil were employed for background measurements. The purity of the applied ametryne (ring-^{14}C) was assessed by liquid–liquid parti-