UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

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OFFICE OF
PREVENTION, PESTICIDES AND
TOXIC SUBSTANCES

MEMORANDUM

SUBJECT: **Paraquat.** (061601) Confined Accumulation Study on Rotational Crops (Wheat, Lettuce, and Carrot).
DP Barcode: D214471; CBRS No. 15458; MRID No.: 416456-01; Rereg. Case No.: 0262

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CBRS has been requested to review a confined crop rotation study for paraquat (MRID 41645601). The study is entitled "Paraquat: Rotational Crop Study". Paraquat is the active ingredient of Gramoxone®, Cyclone®, Starfire®, and Surefire®, commercial herbicides/desiccants produced by Zeneca for use on a wide variety of crops.

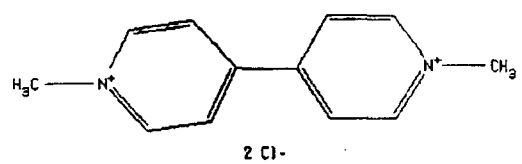
The data provided by the Zeneca study allow the evaluation of the nature and amount of paraquat-derived residues taken up from soil by leafy vegetable-, root crop-, and small grain-rotational crops following field-use of paraquat at a nominal application rate of 1.05 kg

ai/hectare (0.93 lbs ai/A)[1]. Lettuce, carrot, and wheat were the representative crops used in the study. Plant-back intervals of approximately 1 month, 3 months, and 12 months were tested.

Tolerances are established for residues of paraquat in 40 CFR 180.205. Tolerances are established at levels of up to 30 ppm in bean straw.

The nature of the residue of paraquat in plants is currently under review in CBRS (DP Barcode DP Barcode 211013, CBRS No. 14980). The 1991 Reregistration Standard Update concluded that while the qualitative nature of the residue is not understood, the available plant metabolism studies (although incomplete) suggest that paraquat is not measurably metabolized by plants and that it is degraded by light into 4-carboxy-1-methyl-pyridinium ion (QINA) which itself is subsequently degraded by light into methylamine hydrochloride. Presently paraquat *per se* is considered to be the sole residue of concern in plants.

The chemical structure of paraquat is shown below:



CONCLUSIONS

1. The preparation of the treatment solutions was adequately described. The application rate used was 1.05 kg ai/ha (or 0.93 lbs ai/A)

2. Total radioactive residue (TRR) in the various crop parts was determined by combustion, followed by liquid scintillation counting (LSC). Total radioactive residues ranged from <LOD (in the majority of samples tested) to 0.003 ppm in immature wheat. Since Chemistry Branch trigger values were not exceeded for all crop and crop commodities, characterization/ identification of the metabolites was not required.

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[1] This rate compares to the labeled maximum rate of application of up to 1.00 lbs ai/A, although in some cases higher seasonal rates of application are permitted.

3. The confined rotational crop study is adequate and GDLN 165-1 is satisfied. The information provided by the registrant shows that no plant-back restriction is required. Under these circumstances, the registrant is not required to conduct any 165-2 field trials, and the tested commodities suffice to cover all crops and crop groups.

RECOMMENDATIONS

CBRS recommends that the registrant be informed that the submitted study adequately fulfills the data requirement for a Confined Rotational Crop Study (165-1). CBRS concludes that no plant-back restrictions are necessary and that no field rotational crop study (165-2) is required.

DETAILED ANALYSIS

Zeneca Inc. (Zeneca) has submitted confined crop rotation study data for paraquat to the Agency for review. Lettuce, carrot, and wheat (representing the leafy vegetable, root, and grain crop groups, respectively) were used as rotational crops in order to characterize and identify any significant ^{14}C-paraquat derived residues which might be found in rotational crops.

Test Material

The radiolabeled paraquat was obtained from the Radiochemical Group at Jealott's Hill Research Station, with carbon-14 placed at the 2,6-pyridyl positions in each of the two rings. The radiochemical purity was determined by TLC and found to be greater than 98%. Following dilution, the specific activity was 1714 dps/μg (or 102,840 dpm/μg) for 0- and 30 DAT applications and 2167 dps/μg (or 130,020 dpm/μg) for all other (i.e., 120 DAT) applications.

Radioanalytical Procedures and Radiovalidation Studies

Liquid Scintillation Counting (LSC) was the primary radioanalysis done in this study. The study used an LKB 1219 Rackbeta counter linked to a LKB microcomputer and printer. Each group of samples was preceded by two background samples. Samples were counted in duplicate for 5 minutes or until the accumulation of 10^4 counts. Combustion of samples occurred in a Harvey Biological Oxidizer. Evolved radiolabeled CO_2 was trapped in 2-methoxyethylamine and quantified by LSC.

Storage Stability Data

Information was provided by the registrant regarding dates of harvest (i.e., sample collection), but no information was supplied concerning dates of sample preparation or combustion. Since TRR residue levels were all <0.01 ppm (see below), the Agency concludes that degradation of residues is not an issue and this information is not required.

Field Study/Experimental Design

The field phase of the study was conducted with soil collected from "East Jubilee" field located at Jealott's Hill Farm, Bracknell, Berks, UK. The soil was classified as a sandy loam and sampled to a depth of 10 cm after removal of turf. Radiolabeled paraquat was uniformly applied at a nominal rate of 1.05 kg ai/hectare (the maximum field rate suggested) to soil contained in pots.

At each of 0-, 30-, 120-, and 360- days after soil treatment, wheat, carrot, and lettuce were sown into individually treated and control pots. For each sowing interval, one treated and one control pot of soil were left unsown. All pots were kept in a greenhouse and top-watered, as necessary.

For each sowing time, six carrots, three lettuce, and half of the wheat (or nine to ten plants) were allowed to grow to maturity for both treated and control plots. The other half of the what was harvested while immature.

Crop Sampling Procedures

The wheat was harvested by cutting just above the soil level. Mature wheat was separated into straw, grain, and chaff.

Lettuce was harvested by cutting the stem at the soil level, and washing to remove soil. Any dead lettuce leaves were left on the soil surface.

Carrots were harvested by digging soil away from the root and twisting the plant. Each carrot was washed to remove soil and separated into root and carrot top.

Measurement of TRR and Radiolabel Recovery

The harvested crops, separated into raw agricultural commodities as specified by EPA guidelines, were processed and analyzed by combustion to determine the total radioactive residue in ^{14}C-paraquat equivalents. These results are presented in Table 1, below:

Table 1. Total Radioactive Residues in Treated Crop Samples After 0-, 30- and 120- Soil Aging Intervals.

Crop		Total Radioactive Residues (ppm)		
		0 DAT*	30 DAT*	120 DAT*
Lettuce	Edible Leaves	0.003	0.003	<0.0010
Carrots	Leaves	0.0005	0.0010	<0.0003
	Edible Roots	0.0009	0.0003	0.0005
Wheat	Immature	<0.0006	<0.0003	0.003
	Grain	<0.0023	<0.0023	<0.0018
	Chaff	<0.0043	<0.0044	<0.0018
	Straw	0.0040	0.009	0.0030

* DAT: Days After Treatment

As can be seen in Table 1, total radioactive residue levels in the treated crops at 0 days, 30 days, and 120 days following treatment were less than Chemistry Branches' 0.01 ppm trigger value in lettuce, carrot (tops and roots), and wheat (immature forage, straw, grain, and

chaff). Thus, it is not necessary to determine the nature of the residue in these test crops. There is no apparent significant uptake of residues into the crops sown after 0, 30, and 120 days since at all harvesting times, residue levels were less than 0.01 ppm. CBRS concludes that no plant-back restrictions are necessary and that no field rotational crop study (165-2) is required.

cc: RF, SF, List A Rereg. Std. F., Circ., DJM
RDI: SHummel:5/3/95; FSuhre:5/5/95.