(5-7-95)

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

OFFICE OF
PREVENTION, PESTICIDES
AND TOXIC SUBSTANCES

MEMORANDUM

SUBJECT: Review of Ground-Water Issues and the Florida Prospective Ground-Water Monitoring Study for cyromazine.
Chem. # 121301; DP Barcode 209089; Submission S476523
MRID #434212-00, -01, -02

FROM: James K. Wolf, Soil Scientist
Ground Water Technology Section
Environmental Fate and Ground Water Branch (7507C)

THRU: Elizabeth Behl, Section Head
Ground Water Technology Section
Environmental Fate and Ground Water Branch (7507C)

TO: Henry Jacoby, Chief
Environmental Fate and Ground Water Branch (7507C)

I. Recommendations.

Due to the mobility and persistence of the cyromazine and the degradate melamine and the potential to contaminate ground water under some conditions and has been detected in ground water the following recommendations are given:

1) Continue to require the ground-water label advisory.

2) Mitigation - Limit the number of applications 7 or 8 per year at the full label rate per field and reduce the application rate (full label rate).

   The registrant should propose, and test and evaluate other possible means of mitigation in areas where conditions suggest a high probability of cyromazine residues reaching ground water (e.g., loamy sand and sandy loam soils, soils with well-developed soil structure, shallow ground water, and detections of cyromazine or melamine residues in ground water).

2021004

An educational programs should be developed for operators desiring to use Trigard. Do the pests intended to be controlled by Trigard become resistant with continued use, and thus reducing its effectiveness? Would this necessitate crop rotation or different pest management methods so as to not allow the pest to develop resistance to cyromazine?

3) Develop a sampling program to monitor for cyromazine and melamine residues in water coming off fields (e.g., irrigation return flow water, drainage tile, drainage ditches) where Trigard is used in Texas.

4) It is recommended that the requirement for an additional small-scale prospective ground-water monitoring study (166-1) be reserved, where it may be required for an additional use sites (e.g., Michigan or Wisconsin for potatoes to control Colorado potato beetle).

5. EFGWB recommends that cyromazine and its degradate melamine be considered for regulation under State Management Plans.

6. Recommendation #6 still needs to be resolved. The registrant suggest that this issue be addressed in a follow up meeting. This is an acceptable condition.

Point of clarification. The document states on page 13 of Volume 2 of 3 that cyromazine is applied on average 7-8 per times per season at full label rate. Does this apply to one crop (e.g., fall or spring only) or two crops (fall and spring) per season? If a fall season crop is followed by a spring season crop as many as 16 cyromazine applications could occur within a single year. Please clarify.

II. Background

a) Use

Cyromazine is the active ingredient (ai) of Trigard insecticide which is used for leafminer control in celery, head lettuce, peppers, leafy vegetables, cucurbits, and field-grown chrysanthemums. Cyromazine is typically applied in multiple applications to foliage by aerial or ground equipment; up to eight times per year with application rates range between 0.125 and 0.25 lbs ai/acre (0.167 to 0.333 lb per acre) for a total of 0.75 lbs ai/acre (1 lb/acre). Although the Agency has previously issued Section 18s for some cyromazine use on peppers in Texas, the EFGWB has recommended several times that such requests in Florida, New York, and Texas not be granted due to ground-water concerns. A Section 18 request to use Trigard for control of Colorado potato beetle on potatoes in Michigan was also reviewed by the Branch.

2

b) Environmental Fate

Cyromazine is stable to hydrolysis and photolysis, and is also quite persistent as the aerobic soil metabolism half-life ($T_{½}$) ranged from 107 days in a muck to 142 days in sandy loam (EFGWB # 90679; 1990). Field dissipation values are quite variable, ranging from 75 days to more than 250 days. Soil adsorption coefficients are generally quite low. Freundlich adsorption coefficients (K_{ads}) were less than 5 for three mineral soils (sand, silty clay loam, and silt loam) (Appendix 1, Table 1). The K_{ads} values are not equal to K_d, because the slope (1/n) in the adsorption isotherm was less than 1 (0.77 to 0.85). A primary degradate of cyromazine is melamine, but at least two other degradates have also been identified. The registrant has indicated that certain plastics and fertilizers may also be potential sources of melamine in addition to cyromazine degradation.

Environmental fate data, submitted by the registrant, indicated that under certain conditions (sandy soils) cyromazine can be both mobile and persistent, and will leach in soil. The fate data and monitoring data also indicated that melamine is both mobile and persistent, and will leach in soil. The specific persistence ($T_{½}$), adsorption (K_d), and dissipation rate of melamine have not been specified; melamine has been shown to leach and remain in soil (0 to 6 inches) after one year at levels up to 1.3 µg/g. Aerobic metabolism studies indicated that melamine levels can be as much 33 percent of the parent.

c) Prospective Ground-Water Study

The registrant conducted a small-scale prospective ground-water monitoring study on tomatoes in Florida. The study was determined to meet the requirements of a small-scale prospective ground-water monitoring (166-1) study (D178192 - USEPA, 1993; D199290 - USEPA, 1994). The overall study results and conclusions were limited, due to the fact that the study was conducted at one site and reflects only the conditions of the one site.

The cyromazine degradate melamine was detected at levels ranging from 0.10 to 0.21 µg/L in shallow ground water at the study site in Florida. There have been no reported detections of cyromazine residues in the Pesticides in Ground Water Data Base (Hoheisel et al., 1992). This may be because very few ground-water samples have been analyzed for cyromazine (and melamine) residues in the United States and because it has limited usage areas and crops. Cyromazine and melamine were not included in the suite of analyses conducted in the USEPA's National Survey of Pesticides in Drinking Water Wells. Health Advisory (HA) levels have not been established for cyromazine or cyromazine degradates.

The Agency determined that agronomic practices and environmental conditions under which the prospective study was conducted in Florida on tomatoes, was similar to the conditions and practices used for the production of carrots, cucurbits, leafy vegetables, and peppers in Florida. Thus, the study, although representing a "worst-case" condition, would be applicable (to access potential ground-water contamination) to these other uses (crops) only in Florida, and not for use areas AZ, CA, and TX.

Several recommendations (2, 5, 6) were made in the final approval of the small-scale ground-water monitoring study (D199290 - USEPA, 1994). The other recommendations (1, 3, 4, and 7) were addressed by the registrant at the time that the studied was accepted (D199290 - USEPA, 1994). The specific recommendations were:

(2) Because this study indicated that cyromazine residues can leach in a worst-case environment, it is recommended that the registrant conduct one or more well-water monitoring surveys in a cyromazine use area, such as lettuce and celery rather than retrospective studies as previously stated in earlier reviews (memos C. Eiden, 7/26/89; Hutton, 1/4/90). The registrant could also consider conducting a prospective study in a use area in AZ, CA, or TX.

(5) A label advisory should be developed indicating that a potential exist for ground-water contamination. The label advisory should state:

> "Residues of cyromazine have been found in ground water as a result of agricultural use. Use of this product in areas where soils are permeable and water tables are shallow could result in contamination of ground water. The utilization of irrigation water in these areas will increase the likelihood of contamination".

Based upon the results of the additional analyses from the prospective ground-water monitoring study conducted in Florida, well monitoring studies in cyromazine use areas, and the results of the environmental and human risk assessment, use restrictions may be required under certain conditions.

(6) The potential for surface water contamination should be addressed by the registrant.

A meeting was held between Agency and Ciba personnel, on September 9, 1993, to discuss these and other issues. Temporary resolutions concerning some of these issues were developed at this meeting (Letter from N.B. Carroll, Ciba to P.O. Hutton, OPP; 6/27/94). In this letter, the registrant reports that a ground-water advisory has been added to the label (since February 1994).

The submittals associated with this review (DP Barcode 209089; Submission S476523; MRID #434212-00, -01, -02) are Ciba's formal responses to the above mentioned meeting, and are the registrants response to recommendation #2. Two specific issues are addressed: 1) the feasibility of conducting a monitoring study in pepper growing areas in Texas, and 2) the State of Florida's ground-water monitoring program.

III. Feasibility of Conducting a Ground-Water Monitoring Study for Cyromazine in Pepper Growing Areas in Texas (Volume 2 of 3; MRID 434212-03).

a) Background

As stated above, several methods were proposed by the registrant and discussed as a means to address Recommendation #2. One of the possible suggestions was to conduct a well-monitoring study in Texas where Section 18s for cyromazine use on peppers have been issued. Therefore, the registrant conducted an assessment to evaluate the feasibility of conducting a ground-water monitoring study in pepper growing areas in Texas.

The registrant indicated that the major pepper producing area in Texas is the Lower Rio Grande River Valley (LRGV). The LRGV is an intensively farmed region of the United States, where irrigated agriculture predominates. This area includes Starr, Hidalgo, Cameron, and Willacy Counties (Figure 1). The report also states that 90 percent of the Texas pepper production occurs in Starr and Hidalgo Counties and within three miles of the Rio Grande River. Other areas of less importance are Cameron and Willacy Counties and the Winter Garden area, which includes Uvalde, Medina, and Zavala Counties.

The assessment submitted by the registrant included a literature review of the hydrogeology, climate, and soils in current pepper growing areas, interviews with local experts (in agronomy, hydrology, and water resources) and pepper growers. Agricultural Extension agents and Soil Conservation Service personnel from the LRGV (Cameron, Hidalgo, Starr and Willacy Counties) and Winter Garden (Medina, Uvalde, and Zavala Counties) were also interviewed via telephone. Additionally, experts in agronomy and water resources from the Texas Department of Agricultural, Texas A&M University, Texas Natural Resource Conservation Commission, and the Austin, Texas USGS office were also consulted.

b. Discussion

The following are a number of important issues, information, or comments made by the registrant concerning cyromazine usage on peppers in Texas under Section 18 provisions and considered by EFGWB.

Page 6 is not included in this copy.

Pages ___ through ___ are not included in this copy.

The material not included contains the following type of information:

_____ Identity of product inert ingredients.

_____ Identity of product impurities.

_____ Description of the product manufacturing process.

_____ Description of quality control procedures.

_____ Identity of the source of product ingredients.

_____ Sales or other commercial/financial information.

_____ A draft product label.

_____ The product confidential statement of formula.

_____ Information about a pending registration action.

✓ FIFRA registration data.

_____ The document is a duplicate of page(s) _______.

_____ The document is not responsive to the request.

The information not included is generally considered confidential by product registrants. If you have any questions, please contact the individual who prepared the response to your request.

1) The registrant indicated that the majority of the farms growing peppers are located in Starr and Hidalgo Counties and are within three miles of the Rio Grande River (Figures 2 and 3). It was further estimated that about 2500-2800 acres are planted annually in peppers. Data suggest that about 90 percent of the peppers grown and 95 percent of the cyromazine used was on six farms in Texas.

2) Two crops per "season" of peppers are typically grown in Texas. Fall crops are planted in July and harvested in October and November. The spring season crops are planted in January and harvested in May and June.

3) Peppers are typically not grown in successive seasons or successive years in the same block. The management blocks producing peppers are typically rotated over the entire farm.

4) Peppers are typically grown in rows with 40-inch centers and two lines of plants per been and 12 inches between lines. Most fields are leveled to have a 0.05 to 0.10 percent slope which allows excess irrigation and precipitation to run-off where it is removed by drain ditches.

5) The preferred method of cyromazine application was via ground boom spray directed from 12-18 inches above and onto the plant foliage. Aerial applications also occurred 10-30 percent of the time, when the plants are too tall or the ground too wet for ground applications.

6) Cyromazine was applied on average 7 to 8 times per season at maximum label rate. The highest use was during October and November and April to June which correspond to the maturation of the pepper crops and the maximum insect pressure.

7) The source of irrigation water for the growers interviewed by the registrant was the Rio Grande River. Farms in Starr County obtain water directly from the Rio Grande. The farmers in Hidalgo, Cameron, and Willacy Counties obtain their water from irrigation districts. Prior to the construction of the Falcon Reservoir, ground water had previously been used as a source of irrigation water during seasonal low flow periods of the Rio Grande. None of the farmers interviewed are currently using ground water for irrigation.

8) Most peppers grown in the LRGV are furrow irrigated. The timing and amounts are determined by field managers. Irrigation water is delivered to the furrows through pipes with a gate valve at every 40 inches which corresponds to the furrow spacing.

Page ___ is not included in this copy.

Pages 8 through 9 are not included in this copy.

The material not included contains the following type of information:

- ___ Identity of product inert ingredients.
- ___ Identity of product impurities.
- ___ Description of the product manufacturing process.
- ___ Description of quality control procedures.
- ___ Identity of the source of product ingredients.
- ___ Sales or other commercial/financial information.
- ___ A draft product label.
- ___ The product confidential statement of formula.
- ___ Information about a pending registration action.
- ✔ FIFRA registration data.
- ___ The document is a duplicate of page(s) ___.
- ___ The document is not responsive to the request.

The information not included is generally considered confidential by product registrants. If you have any questions, please contact the individual who prepared the response to your request.

Three methods of irrigation are used on peppers in the LRGV; two were types of furrow irrigation, the third was drip irrigation.

a) The "fast" method is where water flows rapidly through sloping furrows which allows only a small percentage of water to infiltrate into the soil. This methods results in fairly a shallow depth of wetting (8-9 inches). The tail-water (water running off the end of the furrows) is channeled into drainage ditches. This method minimizes the amount of water being added at a given time, thus necessitating frequent irrigations.

b) The second method of furrow irrigation is to pond water in the furrows until they are full. The water is held in the furrows for a short time period after which restraining dams are broken and the water is allowed to drain out of the furrows. Water is applied every 5-7 days when the temperatures are hot or the crops have fruited and every 10-14 days when temperatures are cool.

c) The third method uses drip irrigation with plastic mulch covering the plots. Currently this method has limited use in pepper production, but is used extensively in cucurbit production. Drip irrigation places the water in the root zone, reducing water losses from evaporation and eliminating the need for disposal of tail water (run-off water from the furrows).

All of these irrigation methods are ways to better manage water resources by minimizing the amount of water applied so as to reduce water losses to deep leaching, or ground-water recharge. However, the two furrow methods of irrigation have tail water (run-off) which may contain cyromazine and melamine residues. Thus, the tail water may contaminate surface water from run-off, or ground water through seepage. Also this type of irrigation method is more likely to result in preferential water flow.

9) Tail water and excess precipitation are channeled from fields by drainage ditches to depressions, arroyos, or the Rio Grande River in Starr County. In the other LRGV counties, drainage from the fields is into ditches that drain into the main floodway which empties into Laguna Madre, a back bay of the Gulf of Mexico. The tail water is generally not reused for irrigation. There are also no irrigation return wells used on any of the farms considered by the registrant. Drainage tiles are not commonly used by the growers interviewed.

10) Soil series, textural classification, hydrologic grouping, permeability, and available water capacity of the dominant soils in the pepper growing areas were provided and are summarized in Table 1 (registrant Table 2). These soils predominately belong to Hydrologic soil groups B, C, and D, have a moderate

Page 11 is not included in this copy.

Pages ___ through ___ are not included in this copy.

The material not included contains the following type of information:

_____ Identity of product inert ingredients.

_____ Identity of product impurities.

_____ Description of the product manufacturing process.

_____ Description of quality control procedures.

_____ Identity of the source of product ingredients.

_____ Sales or other commercial/financial information.

_____ A draft product label.

_____ The product confidential statement of formula.

_____ Information about a pending registration action.

✓ FIFRA registration data.

_____ The document is a duplicate of page(s) _______.

_____ The document is not responsive to the request.

The information not included is generally considered confidential by product registrants. If you have any questions, please contact the individual who prepared the response to your request.

permeability (0.6 to 2.00 inches per hour or less), an available water holding capacities of 0.1 to 0.2 inches of water per inch of soil, and soil organic matter contents in the surface horizon of 0.5 to 1.0 percent. Textural classes for these soils range from clay to fine sandy loam. Although many of these soils appear to have properties unfavorable to pesticide leaching, several soils do exhibit soil properties of which are favorable pesticide leaching. For example, a number of soils have fairly light soil textures (e.g., fine sandy loam) and rapid permeability (2.0 to 20.0 inches per hour), and several soils (e.g., Cameron) indicate high shrink-swell potential which may result in conditions susceptible to preferential water flow.

11) Climatological data are also reported. Precipitation ranges between 22 and 26 inches year and lake surface evaporation ranges from 62.5 to 77.5 inches per year.

12) Four Texas well data bases were used by the registrant to obtain information pertaining to the presence of wells near or within pepper producing areas in Texas. The first source of the data used was the Texas Water Well Drillers Board (TWWDB) data base. The TWWDB was created in 1965 and is responsible for determining the qualifications for the licensing of all persons drilling water wells and enforcing well completion standards in Texas. Well drillers are required to submit a water well report upon the completion of a well. These reports include the name and address of the well owner, location of the well by county and distance from nearest town, well use, date drilled, well construction log, lithologic log, and depth to water. A map showing the location of the well sometimes maybe included with a report.

All wells with completed reports are assigned a well number based upon the division of the state (Texas) into a one-degree grid defined by degrees of latitude and longitude. This grid is subdivided into sixty-four 7½-minute quadrangles, each of which is further subdivided into nine 2½-minute sections. An example is provided as Figure 4 (Registrant Figure 5).

The registrant provided (from the TWWDB data base) several tables which list a well's identification number, depth, use, and date drilled. The registrant also stated whether a well was or was not near a pepper producing farm in Hidalgo and Starr Counties. These wells are characterized as less than 60 feet in depth, between 61 feet and 150 feet in depth, and wells greater than 150 feet in depth. The number of wells by depth grouping in areas with pepper farms in Starr or Hidalgo Counties within a 2½-minute or 7½- minute quadrangle are summarized in Table 2. Wells within a 2½-minute section containing a farm would generally be nearer a pepper area than wells within a 7½-minute section containing a pepper farm. For example, three shallow (0 to 60 feet deep) wells in Starr county were located (Table 2) within a 7½-minute

12

Page 13 is not included in this copy.

Pages ___ through ___ are not included in this copy.

The material not included contains the following type of information:

_____ Identity of product inert ingredients.

_____ Identity of product impurities.

_____ Description of the product manufacturing process.

_____ Description of quality control procedures.

_____ Identity of the source of product ingredients.

_____ Sales or other commercial/financial information.

_____ A draft product label.

_____ The product confidential statement of formula.

_____ Information about a pending registration action.

✓ FIFRA registration data.

_____ The document is a duplicate of page(s) _______.

_____ The document is not responsive to the request.

The information not included is generally considered confidential by product registrants. If you have any questions, please contact the individual who prepared the response to your request.

quadrangle, but only one was within a 2½-section. Thus a well within a 2½-minute section would be more likely impacted by the pepper farm than wells the other eight 2½-minute sections. The three closest shallow wells, in Starr County, were 0.70, 2.19, and 3.69 miles from the nearest pepper farm. Figures 4 and 5 (Registrant Figures 5 and 6) show the relationship between the wells in the TWWDB data base and pepper producing farms.

Table 2. Well breakdown by depth and county from the TWWDB data base located with 2½- and 7½-minute of USGS Quadrangle Map a pepper producing farm.

Well Depth (ft)	Starr County		Hidalgo County	
	within 2½	within 7½	within 2½	within 7½
0 to 60	1	3	61	166
61 to 150	8	13	52	159
> 150		45		118
Total	9	61	113	443

The registrant describes a second procedure which relates well location (latitude and longitude) to a street address so that a specific farm pepper farm could be related to a specific well. The registrant found only five wells 60 feet or less in depth near pepper farms in Starr County, and all are greater than 0.5 miles from the nearest pepper producing farm (Figure 4). In Hidalgo County, latitude and longitude were determined for seventy-five of the 166 wells with depths of 60 feet or less and then combined with street locations to relate a specific well location to a pepper producing farm (Figure 5). Eight of these wells are located within 0.25 miles from a pepper farm (4 wells are located within a farm unit). The uses of these wells were identified by the registrant as irrigation, domestic, and industrial.

A second data base was obtained from the Texas Water Development Board (TWDB). The TWDB maintains an electronic data base of a network of water quality observation wells which covers the major ground-water producing areas of Texas. The purpose of this data base is to determine the quality and quantity of ground water in Texas. The same method used to locate the TWWDB wells was used to locate the wells in the TWDB data base. Only a small number of the wells on file with TWWDB were in the TWDB well data base. None of the wells 60 feet or less in depth, located in the TWDB for the registrants assessment, were included in the TWWDB file, because of their age (drilled prior to 1965).

Page 15 is not included in this copy.

Pages ___ through ___ are not included in this copy.

The material not included contains the following type of information:

_____ Identity of product inert ingredients.

_____ Identity of product impurities.

_____ Description of the product manufacturing process.

_____ Description of quality control procedures.

_____ Identity of the source of product ingredients.

_____ Sales or other commercial/financial information.

_____ A draft product label.

_____ The product confidential statement of formula.

_____ Information about a pending registration action.

✓ FIFRA registration data.

_____ The document is a duplicate of page(s) _______.

_____ The document is not responsive to the request.

The information not included is generally considered confidential by product registrants. If you have any questions, please contact the individual who prepared the response to your request.

Information for each well in the TWDB data base included owner, latitude and longitude, date of completion, depth, casing and screen depth, water-bearing unit in which the well was completed, altitude of land, water level measurements, use of well, and method of retrieval. Well construction and water level measurements were missing for many wells.

The wells 60 feet or less in depth and located near farms with pepper production in Starr and Hidalgo Counties are summarized in Table 3 (Registrants Table 10). Two wells 60 feet or less were found within 0.50 miles of a pepper producing farm in Hidalgo County. Sixty-one wells 60 feet or less were found near pepper producing farms in Starr County. Twenty-five wells were at distances greater than 0.50 miles, 14 were between 0.01 and 0.50 miles from farms producing peppers; 22 were within farms producing peppers.

The registrant makes note that of the 63 shallow (<60 feet) wells located by the TWDB none were found in the TWWDB records, because all but one were drill before 1958. They concluded that because of the age of the wells, and lack of construction information, owners, and exact location, these wells "are not considered to be satisfactory for use in a well-monitoring study". The farm supervisors interviewed also indicated that there were no wells in operation on their farms. Consequently, the registrant concluded that many of these wells have probably been abandoned.

Two additional data bases were also evaluated by the registrant. The first of these is the Texas Natural Resources Information Systems data base, which is the same as the TWDB data base. The second of these is the data base of public water supply wells. Hidalgo County has 25 public wells; one well is 120 feet deep and 23 are greater than 240 feet deep. Starr County has five public water wells with depths of greater than 365 feet. None of these public wells are located within 20 miles of the pepper producing farms.

Sources of Water: The registrant reports that 98 percent of the irrigation and drinking water used in LRGV, during the 1980's, was from surface water. The majority of this water came from the Falcon International Reservoir which is located at the western border of Starr County. Ground-water supplies about two percent of the water needs in the valley. During drought conditions, when the Rio Grande River flow rates are low, more ground water is used. After the drought ended, ground-water levels are reported to quickly recover to "pre-drought levels". The use of ground water is increasing, because all of the Rio Grande water has been allocated. Increased use of ground water may, however, reduce water flow in the Rio Grande.

Page ___ is not included in this copy.

Pages 17 through 18 are not included in this copy.

The material not included contains the following type of information:

_____ Identity of product inert ingredients.

_____ Identity of product impurities.

_____ Description of the product manufacturing process.

_____ Description of quality control procedures.

_____ Identity of the source of product ingredients.

_____ Sales or other commercial/financial information.

_____ A draft product label.

_____ The product confidential statement of formula.

_____ Information about a pending registration action.

✓ FIFRA registration data.

_____ The document is a duplicate of page(s) _______.

_____ The document is not responsive to the request.

The information not included is generally considered confidential by product registrants. If you have any questions, please contact the individual who prepared the response to your request.

HYDROLOGY

Surface Water: Surface-water flow in the LRGV is minimal as there are no large tributaries flowing to the Rio Grande River. Ephemeral streams flow into the river in Starr County and the western part of Hidalgo County. In south-central Hidalgo County, there are no surface drainage ways to the Rio Grande; surface drainage flow east into Laguna Madre.

Ground Water: The registrant briefly describes the hydrogeology of the region. The most important ground-water resources in the LRGV are the Evangeline and Chicot aquifers. The Evangeline contains three separate stratigraphic units: the upper Pliocene Goliad sand, the lower Pleistocene Lissie formation, and Beaumont clay. The Chicot aquifer directly overlies the Evangeline and contains an unnamed fluvial deposit, recent Rio Grande flood plain deposits, and recent aeolian sands.

The interbedding of confining and permeable strata creates hydrogeologic conditions where the hydraulic connection between the two aquifers depends upon local geology. For example, where the Beaumont clay is present vertical conductivity is low. The confining layers are not regionally continuous, so the boundary between the two aquifers is semi-permeable.

Unconfined portions of the Evangeline aquifer occur where the Evangeline outcrops in Hidalgo and Starr Counties. Recharge of the Evangeline is through precipitation, surface water infiltration, and irrigation return flows directed down drainage channels and wells. In some areas in the Evangeline, where low permeability layers (clay pan) occur, perched water tables develop. Some farmers drill drainage wells (through the restricting layer) into the Evangeline to dispose of irrigation return flow water.

The Pleistocene and Holocene sediments of the Chicot aquifer are the dominate outcrops in the LRGV and are recharged by precipitation. Within the Rio Grande floodplain, the hydraulic gradient is away from the river, so that the Chicot is recharged directly by the river along the river channel. The water table level of the unconfined Chicot aquifers response rapidly to surface water flow, precipitation, and pumping. The water table depth in the productive areas is between 20 and 40 feet below ground surface. Nearer the Rio Grande the water table is about the same elevation as the river's base level, 8 to 15 feet from the ground surface. Depth to the water table in Cameron County is between 6 to 7 feet in western Cameron County.

The local ground water quality generally tends to be high in soluble salts. Fresh to slightly saline ground water areas of the Chicot and Evangeline Aquifers usually occur close to the Rio Grande. The registrant provides a Figure 6 (their Figure 13), which shows the major sources of ground water in the Lower Rio

Grand Valley. They further suggest that the developed ground water has remained relatively constant over the previous thirty-five year period.

The registrant indicates that the Texas State Management Plan emphasizes the maintenance of usable and potentially usable ground-water resources. This plan contains a differential protection clause which considers both the chemical quality of the water and aquifer vulnerability in determining how to regulate chemical discharges to ground water. According to the registrant, the Texas Natural Resource Commission will be responsible for determining how the differential protection will apply to cyromazine and other pesticides used in the LRGV. Limited data has been collected, to date, to evaluate the impact of pesticides on ground water in the region.

c) Registrant's Conclusions

Pursuant to the September 9, 1993 meeting between Ciba (registrant) and Agency personnel, it was determined that one option for the registrant to address Agency concerns about cyromazine-use and ground-water contamination was to conduct a well-monitoring study in pepper growing areas with cyromazine (Trigard) use in Texas. The second option was to conduct an additional small-scale prospective ground-water monitoring study. It was further agreed that the registrant would evaluate the feasibility of conducting a well-monitoring study in Texas.

Four major points (pages 29 - 30) concerning the feasibility of conducting a ground-water monitoring study for cyromazine in pepper producing areas (under Section 18) in Texas are listed by the registrant. Although the Branch agrees with some of their points, it does not agree with all of their conclusions.

1) The first conclusion suggested by the registrant is that soil properties and irrigation methods are such to minimize leaching. Although soils are generally not coarse textured (as typically considered vulnerable to leaching), several of the soils suggest a potential (e.g., Hydrologic Soil Group D - potential for shrink-swell) for preferential flow conditions. The flood irrigation (fast flow and furrow) methods would also encourage preferential flow, especially if the water had a direct connection with any macropores (developed soil structure, root channels or animal burrows, desiccation cracks, etc. at surface) (Flury et al., 1994). Additionally, the run-off into drainage ditches, depressions, and arroyos could transport and concentrate cyromazine residues to recharge areas, or to surface water bodies.

2) In their conclusions, the registrant appears to over emphasis the poor water quality ("and a barrier to significant development"), while at the same time down playing the good

90

Page 21 is not included in this copy.

Pages ___ through ___ are not included in this copy.

The material not included contains the following type of information:

_____ Identity of product inert ingredients.

_____ Identity of product impurities.

_____ Description of the product manufacturing process.

_____ Description of quality control procedures.

_____ Identity of the source of product ingredients.

_____ Sales or other commercial/financial information.

_____ A draft product label.

_____ The product confidential statement of formula.

_____ Information about a pending registration action.

✓ FIFRA registration data.

_____ The document is a duplicate of page(s) _______.

_____ The document is not responsive to the request.

The information not included is generally considered confidential by product registrants. If you have any questions, please contact the individual who prepared the response to your request.

quality ground water. The registrant indicated that ground-water quality was "fresh" in the Chicot aquifer near the Rio Grande River. Thus the potential to degrade ground-water quality should be considered and mitigation methods considered and evaluated which will minimize or prevent ground-water contamination.

3) The registrant primarily used two sources of data concerning existing wells in the LRGV. Many of these wells were found to be either quite deep (> 60 feet in depth), not located near pepper fields or fields with cyromazine use, have incomplete data concerning well completion information (date, depth, etc), and not knowing whether the wells are located down-gradient from a cyromazine use area. Although suitable existing wells for monitoring no doubt exist, the Branch agrees with the registrant that the probability of finding wells with all the desired characteristics would be low.

4) The registrant concludes that the impact of pesticides on ground-water quality in the LRGV has not been studied. They further suggest that the Texas State Management Plan has a differential protection clause, but how this would pertain to cyromazine (Trigard) use in the LRGV is not know and would need to be established. Currently, there are no EPA approved State Management Plans, thus this is not currently an viable option.

d) Conclusions

The registrant does not state whether it is feasible to conduct a well-monitoring study in Texas where Trigard has been used under Section 18 provisions. The information supplied by the registrant suggests that it would be feasible to conduct such a study. However, it would appear that the availability and quality of data (e.g., lack of adequate hydrogeologic data and well completion data) could hinder finding appropriate study sites, thus limiting any conclusions derived from this type of study.

Overall, the pepper growing areas in Texas do not generally appear to highly vulnerable to ground-water contamination from cyromazine use on peppers. This is due to several factors; generally low recharge potential (low rainfall and high evapotranspiration), generally deep ground water, soils not highly vulnerable to pesticide leaching, and warm soil temperatures which would tend to promote rapid pesticide degradation. Certain sites may, however, have soil properties which are susceptible to preferential flow, and shallow water tables. Irrigation, which is necessary for pepper production in Texas, would also increase EFGWB's concern for the potential to contaminate ground water at all pepper sites. The commonly used "furrow-type" irrigation methods would then provide a water source for preferential flow to occur. These conditions suggest the need for concern. Also the nearness to the Rio Grande River and it's ground-water recharge areas is also reason for concern.

Based upon the difficulty to conduct an adequate ground-water monitoring study in areas with a history of cyromazine use in Texas and the relatively limited acres impacted each year (< 3000 acres), it is recommended that the requirement for an additional prospective study or ground-water monitoring study be reserved.

The following specific recommendations will be made in light of the above conclusions:

The Agency believes that mitigation methods should be developed to reduce the risk of contaminating ground water through the use of cyromazine. Therefore, the registrant should propose, and test and evaluate other possible means of mitigation in areas where conditions suggest a high probability of cyromazine residues reaching ground water (e.g., loamy sand and sandy loam soils, soils with well-developed soil structure, shallow ground water, and detections of cyromazine or melamine residues in ground water). Different irrigation techniques or innovative scheduling methods may also provide a means of mitigation.

Educational programs could also be developed for operators desiring to use Trigard. Alternative agricultural practices could also be considered for the different uses and regions where cyromazine is used.

The registrant should develop a sampling program to monitor for cyromazine and melamine residues in water coming off fields (e.g., irrigation return flow water, drainage tile, drainage ditches) where Trigard is used in Texas and/or Florida.

Finally, it is recommended that the requirement for an additional small-scale prospective ground-water monitoring study (166-1) be reserved, where it may be required for an additional use sites (e.g., Michigan or Wisconsin for potatoes to control Colorado potato beetle).

A complete set of recommendations are presented at the beginning of this memorandum.

IV. Review of Ground-Water Sample Collection by Florida Department of Agriculture and Consumer Services for Cyromazine Residue Analysis (Volume 3 of 3; MRID 434212-02).

a) Background

Several avenues were discussed to address Recommendation #2 (see page 3 of this review) from the previous review (D199290 - USEPA, 1994). One of the suggestions was to use ground-water monitoring data being collected by two state agencies in Florida.

73

The Florida Department of Agriculture and Consumer Services (FDACS) and the South-West Florida Water Management District (SWFWMD) collected ground-water samples from thirteen irrigation and drinking water and four monitoring wells in Hillsborough and Manatee Counties from May 25 to 27, 1993 to analyze for cyromazine and melamine. The document submitted by the registrant characterizes the wells and hydrogeology of the sampling region to help the interpretation of the monitoring data collected in the FDACS study.

Eleven irrigation, two drinking water wells, and 4 monitoring wells in or near tomato fields in Hillsborough and Manatee Counties, FL, where section 18 permit for cyromazine use on tomatoes had been in effect, were sampled. Information concerning the wells and cyromazine usage history in the vicinity was obtained when possible (Table 4) (registrants Table 1). Of the thirteen non-monitoring wells, cyromazine usage information was available on nine wells and not applicable on two wells. Cyromazine use history around the monitoring wells was not known. The well depths ranged from between 28 feet to 1100 feet. Three well depths were not known and two wells were 100 feet deep or less, the remaining twelve were all greater than or equal to 350 feet.

The wells sampled were located in the "Flatwoods" soils area, which are characterized by a high water table and spodic soil horizon which limits vertical hydraulic conductivity. The registrant's report indicates (page 11) that FDACS considered these soils "worst-case" with respect for cyromazine leaching in the Flatwoods physiographic province.

The surface- and ground-water resources for the tomato growing areas in Florida were discussed by the registrant. A surficial, unconfined aquifer of unconsolidated sediments between 25 and 50 feet thick, overlays a confined unconsolidated intermediate aquifer at depths to about 300 feet below the ground surface. Below this depth is the top of the limestone Floridan aquifer, which is the source of most drinking and irrigation water in the SWFWMD. Recharge areas to the intermediate and upper Floridan aquifers occur where these units outcrop. There are also several unconfined ares for these aquifers, but they are not in the tomato growing areas.

b) Discussion

The results reported by FDACS indicated that of the seventeen wells sampled there were no detections of cyromazine or melamine residues at the detection limit of 1.00 µg/L (ppb) in sixteen wells. Results from the remaining well was not reported.

The registrant suggests that the wells sampled were not useful for assessing the leaching of pesticides from fields into ground

Page 25 is not included in this copy.

Pages ___ through ___ are not included in this copy.

The material not included contains the following type of information:

_____ Identity of product inert ingredients.

_____ Identity of product impurities.

_____ Description of the product manufacturing process.

_____ Description of quality control procedures.

_____ Identity of the source of product ingredients.

_____ Sales or other commercial/financial information.

_____ A draft product label.

_____ The product confidential statement of formula.

_____ Information about a pending registration action.

✓ FIFRA registration data.

_____ The document is a duplicate of page(s) _______.

_____ The document is not responsive to the request.

The information not included is generally considered confidential by product registrants. If you have any questions, please contact the individual who prepared the response to your request.

water, because of the deep depths of most of the wells and that all but the shallowest wells were in confined aquifers. Data also indicated that the depths of the wells and lack of recharge prevents leaching from directly above. Additionally, cyromazine usage on tomato fields adjacent could not be documented by the registrant for the monitoring wells. The lack of detections in ground-water samples show that the Floridan aquifer, which is an import water resource in the SWFWMD, has not yet been affected by cyromazine.

c) Conclusions

The Branch generally agrees with most of the conclusions reached by the registrant concerning the thirteen wells sampled. The FDACS study does not meet the needs of the Agency; because of the confined nature of aquifers, the deep depths to ground-water in most of the wells, and potential that there is no hydrologic continuity between the fields where the cyromazine was applied and the wells sampled. The Ground Water Technology Section's is still concerned that cyromazine and its primary degradate melamine may contaminate ground-water resources in Florida.

IV. REFERENCES

Flury, M., J. Leuenberger, B. Studer, H. Fluhler, W.A. Jury, and K. Roth. 1994. Pesticide transport through unsaturated field soils: Preferential flow. Soil Physics. Institute of Terrestrial Ecology. Swiss Federal Institute of Technology. Zurich, Switzerland.

Hoheisel, C., J. Karrie, S. Lees, L. Davies-Hilliard, P. Hannon, R. Bingham, E. Behl, D. Wells, and E. Waldman. 1992. Pesticides in Ground Water Database. A compilation of monitoring studies: 1971 - 1991 National Summary. EPA 734-12-92-001. U. S. Environmental Protection Agency: Arlington, VA.

Appendix 1, Table 1. Physical and Chemical Characteristics[1] of CYROMAZINE Relative to EPA Leaching Criteria[2].

CHARACTERISTIC	LEACHING CRITERIA	CYROMAZINE PARAMETERS
Water Solubility	> 30 mg/L	1.35×10^5
Henry's Law Constant	$<10^{-2}$ atm-m^3/mol	5.83×10^{-7} atm-m^3/mol
Hydrolysis half-life	> 25 weeks	pH5 - stable pH7 - stable pH9 - stable
Photolysis half-life	> 1 week (water)	stable
Soil adsorption: K_d	< 5 (usually <1-2) [listed as K not K_d]	kads 1/n clay %OM 0.52 0.83 2.8 2.2 2.37 0.85 22.6 5.6 3.87 0.77 12.6 3.6 17.0 0.81 - 22.9
Soil adsorption: K_{oc}	<300-500	81, 208, 970, 1800
Aerobic soil metabolism half-life	> 2-3 weeks	150 days (21 wks)
Field dissipation half-life	> 2-3 weeks	83-284 days
Depth of leaching in field dissipation study	> 75-90 cm	46-91[3] cm

1 USEPA One-liner Data Base.
2 Cohen et al., 1984.

Indicates exceeds leaching criteria (environmental fate data are not complete).

3 Depth of leaching may in some instances may have been deeper than sampling depth.