APPENDIX 1 IMAGE ANALYSIS OF SPRAY DEPOSITION

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LEAFSPOT: A KONTRON-IBAS MACRO FOR MEASUREMENT OF CROP SPRAY DAMAGE IN LEAVES

N J Fortey

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LEAFSPOT: A KONTRON-IBAS MACRO FOR MEASUREMENT OF CROP SPRAY DAMAGE IN LEAVES[1]

N J Fortey

Contents:

[1] Actually, for measurement of spray drift deposition on leaves (B N K Davis)

1 Introduction

1.1 This report describes the application of the Kontron-IBAS image analyser to the measurement of crop spray damage in leaves. The work has been carried out at the request of and in collaboration with Dr BNK Davis and T Yates of the Institute of Terrestrial Ecology (NERC) in connection with their ongoing research programme.

1.2 Leaves affected by crop spraying are photographed in 35 mm colour transparency format by ITE using a luminescent dye to pick out damage spots. Precise details of the spraying and damage photographing are not within the scope of this report. However, measurement of the numbers and areas of spray damage spots are amenable to rapid automatic video-based image analysis systems such as the Kontron IBAS installed in the BGS Mineralogy and Petrology Group at Keyworth. For efficient operation, an IBAS interpreter macro is prepared using test photographs, and is then run routinely to measure each of a set of leaf photographs.

1.3 The 35 mm photographic transparencies are viewed on the stage of transmitted light microscope using a suitably low powered objective lens. In the present case a x1.25 magnification pol lens giving a field of view of 5 by 5 mm was employed. The magnified image is captured by a video camera mounted on the microscope, and the analogue signal is digitised by the Kontron Video-Multiplexer and stored in computer memory for manipulation and measurement. The image format used in this instance is 512 by 512 pixels and 256 grey levels. A single grey-level image proved to be suitable, as the damage spots are clearly defined in terms of brightness alone and colour discrimination was not found to be necessary.

1.4 The digital image is then normalised to the full 0-255 grey scale. Binary segmentation of the image can then be done with preset 130 and 255 grey level thresholds in most cases, although an option for interactive segmentation is provided for use with the few images whose high background grey level attains grey values above 130 in the normalised image. Pixels falling in the range defined by the threshold values are recorded as white in the binary image, and those outside the range as black. Thus the binary image shows the damage spots as white objects in the otherwise black image. The binary image is processed using the "binary fill" operation in which black areas enclosed within white features in the binary image are filled with white pixels. No other modifications are carried out.

1.5 The 'filled' binary image is used for measurement. Two sets of measurements are made. The first returns (i) the total area of spots as a percentage of the total image area, and (ii) the total number of binary features (damage spots) in the image. Note that for this purpose a binary feature is an area of white pixels surrounded by black pixels. Groups of two or more spots which merge or overlap are recorded as one binary feature.

1.6 The second set of measurements records the area, aspect ratio and orientation of each binary feature. Area is given in square millemetres using a scaling factor set at the start of the macro. Note that once set the scaling factor does not need to be reset or edited so long as the IBAS software is kept running and photographs taken at the same magnification are used. The aspect ratio is defined as the length of the shortest diameter in the object over the longest. The software measures diameters in 32 directions in steps of 5.7° rotation. In irregularly shaped features, the diameters may not be strictly perpendicular to each other. The orientation is defined as the direction of the longest diameter in terms of the angle it makes with the 'horizontal' X-direction on the image in an anticlockwise direction and at 5.7° steps.

1.7 The two sets of data are stored in two IBAS database files called respectively LEAF_1.D00 and LEAF_2.D00. These operate by appending new data to any data already present in them. All measurments made for multiple fields of view on the same photograph can thus be appended to the same database files, resulting on one composite set of data for each sample. There is an option to erase these files and recreate them as blank databases, which should be done at the start of work on a new sample.

1.8 The database files are in IBAS software format and are kept in the path D:\COLOUR\DATA. The data is lost whenever the files are erased, and it is therefore important that the files are copied to a different file name before they are erased. It is recommended that this be done by copying them to a 1.2 Mb 5.25" floppy disc in drive A, converting them to ASCII format and giving them a new unique name. For this purpose the macro provides an option to drop temporarily into DOS. In DOS the copying/conversion operation is done in two steps. Firstly the CONVERTA program is used by entering at the DOS prompt:-

```
CONVERTA -F D:\COLOUR\DATA\LEAF_*.D00 A:\
```

This generates two ASCII format files on the disc in drive A which have the names LEAF_1.FRE and LEAF_2.FRE. The second step is to use the DOS RENAME command to give them unique names such as SAMPNO_1.DAT and SAMPNO_2.DAT. By doing this unique files are saved for each sample, and the disc can be taken away and the data processed using other software.

1.9 The macro also provides graphical summarises of the data in LEAF_2.D00 for the area, aspect ratio and orientation measurments. These are in the form of histograms which are set to have a logarithmic x-scale in 40 classes, and have an arithmetic y-scale showing class scores as percentages of the total. The histograms also provide rudimentary statistical data on mean, median, variance, shewness, kurtosis. The software provides an option for a screen dump of the histograms on the dot-matrix printer or for a print out of the numerical class scores. However, it is anticipated that users will prefer to generate their own stats and graphical output based on the ASCII

files.

2 LEAFSPOT macro listing

2.1 The macro program listed below carries out the operations described above, and is given the name LEAFSPOT. It was written in Kontron Interpreter language by N.J. Fortey in September 1991. The macro runs on the Kontron computer under MS-DOS, and is saved under the path D:\COLOUR\MACROS.

2.2 The following reproduces the macro in the version run on 25th September, 1991.

```
#########################################################################
#           #
# LEAFSPOT # N.J.Fortey: begun Aug.6th 1991
#           #
#           # macro to measure spray damage in leaves
#           # using 35 mm transparencies of damage spots in leaves
#           #
#########################################################################
#
# For full use ensure that a Bernoulli image library disc is loaded
# and that a formatted floppy disc is loaded for saving data files.
#
#
#
write "LEAFSPOT MACRO"
write " "
######### initialisation #########
vmcset 1,1
measstop
resetpar
for (im=1;im<=8;im=im+1): clearimovl im
tvoff
setframe "F512"
display 1
loadlut "grey"
setimpath "f:/images"
######## set up scaling factors #########
ans:=0
write " "
read "edit scaling (1/0) ",ans
if ans>=1
write " "
tvon
write "set up reference scale on microscope"
pause
tvinp 1
scalgeom 1,"leafspot",_ON,_ON
clovl 1
endif
######## create databases ########
ans1:=0
```

```
write " "
read "erase and recreate databases (1/0) ",ans1
if ans1>=1
DBerase "leaf_1"
DBerase "leaf_2"
InitObj AREAP, FIELDCOUNT
InitObj AREA, FSHAPE, ANGLEDMAX
global SAMPNO
SAMPNO:="              "
fvleaf_1[]=SAMPNO,AREAP, FIELDCOUNT
fvleaf_2[]=AREA, FSHAPE, ANGLEDMAX
DBcreate "leaf_1","fvleaf_1"
DBcreate "leaf_2","fvleaf_2"
write " "
write "old DBases erased, new DBases created"
else
SAMPNO:="              "
endif
######## setting up the image ########
ans1:=1
write " "
read "live image (1) or image from disc (0) ",ans1
if (ans1>=1)
######## obtain image from microscope #######
tvon
write " "
write "live image - check illumination and focus"
write " "
pause
tvaver 1,11,4,4
######## save image to Bernoulli ##########
ans2:=0
read "save image to Bernoulli (1/0) ",ans2
if ans2>0
im:="image"
read "enter image name ",im
storim im,1
endif
######## obtain image from Bernoulli disc ########
else
ans4:=0
read "print image directory (1/0) ",ans4
if ans4>=1:dos "DIR F:/IMAGES >PRN"
im:="image"
read "enter name of image", im
getim im,1
endif
######## set up image title (Samp + up to 8 chars) #########
read "enter sample no. <=8 chars ",SAMPNO
SAMPNO="Samp"+SAMPNO
######## revise scaling factor ########
# ans5:=0
# read "check scaling factor (1/0) ",ans5
# if ans5>=1
# scalgeom 1,"leafscale",_ON,_ON
# clovl 1
```

```
# endif
######## process image in plane 1 to binary result in plane 6 ########
normim 1,2,0
######## choose preset segment level or do interactively ########
ans7:=1
write " "
read "automatic thresholds (1/0) ",ans7
if ans7>=1
dis2lev 2,3,130,255,_ON,_OFF
else
dis2lev 2,3,130,255,_ON,_ON,1
endif
fill 3,6
# scrap 4,6,_OFF,0,9,_ON,_ON
identframe 6,7,_ON,0,480,480,16,16,_OFF,_OFF,_ON
display 7
# binary with holes filled
DBopen "leaf_1","fvleaf_1"
Measf 7
DBappend "leaf_1"
DBclose "leaf_1"
outlist "leaf_1",_OFF
identframe 6,7,_ON,4,488,488,12,12,_ON,_OFF,_ON
DBopen "leaf_2","fvleaf_2"
DBsetinfo "leaf_2",SAMPNO
measobj 7,"leaf_2",_ON
DBclose "leaf_2"
outlist "leaf_2",_OFF
outhist "leaf_2","AREA",40,_ON,_OFF,2,_ON,_ON,,,,,SAMPNO
outhist "leaf_2","FSHAPE",40,_ON,_OFF,2,_ON,_ON,,,,,SAMPNO
outhist "leaf_2","ANGLEDMAX",40,_OFF,_OFF,2,_ON,_ON,,,,,SAMPNO
display 1
loadlut "grey"
########## copy DB files to floppy ###########
ans4:=0
read "copy DB files to floppy (1/0) ",ans4
if ans4>=1
write " "
write "source files are D:/COLOUR/DATA/LEAF_1.D00 and ...LEAF_2.D00"
pause
dos
endif
write " "
write "program ended - set up new image field and press F9"
```

---

3. Operating instructions

3.1 The macro is intended to allow non-specialist staff to carry out counting of damage spots in a routine and automated fashion. However, a degree of familiarity with the image analyser is necessary, and therefore new operators must receive adequate training before proceeding to use the macro. For the purpose of the present report it will be assumed that the operator is able to switch on the Kontron Image Analyser and can set up the

petrological microscope and Bernoulli disc drive (if required). The macro is stored under the COLOUR directory on drive C, which must be chosen at the start up menu (enter 2 and press RETURN). After the start up menu, the IBAS first menu appears, at which press F2, which moves the software into IBAS program mode. Load the macro itself by pressing CONTROL-L, then highlighting **LEAFSPOT** and pressing ENTER.

3.2 The macro follows a sequence of steps, some of which require a response from the operator where a choice of options is available or data has to be entered from the keyboard. Numerical results (not the images themselves) are saved in ASCII format on the 5.25" floppy disc.

3.3 Once loaded, the macro is started by pressing F9. The sequence of user-interactions is then as follows. Screen messages are shown in italics. Where a yes/no response is needed the convention is that 1=yes and 0=no, and the screen message will show a default response which can be selected by simply pressing ENTER. The alternative is selected by overtyping the default and pressing ENTER.

(1) *edit scaling (1/0)*

LEAFSPOT allows the area of each damage spot to be measured in real units (mm). The default answer is 0. Entering 1 selects the scaling programme. The use of this general purpose utility should have been covered during training and is not described here; if problems arise help from the image analysis supervisor should be sought.

(2) *erase and recreate databases (1/0)*

Numerical data from LEAFSPOT is held in two IBAS database files which are stored on hard disc directory C:\COLOUR\DATA). When work on a new sample is begun these files should be cleared by the erase and recreate operation selected here by entering 1. The default is 0.

(3) *live image (1) or image from disc (0)*

LEAFSPOT allows work on a new image obtained via the video camera (enter 1, the default) or an old image stored on Bernoulli disc (0).

(3a) If 1 is entered, first the live video image is displayed and the program pauses, allowing you to check that the correct field of view is selected, the illumination is correct and the focus is sharp. The program then captures four consecutive scans of the image and divides the result by four to reduce random noise. You then have the option to save the digitised image on the Bernoulli. If you do this, ensure that you give the image an unique name to avoid the danger of overwriting a previously stored image.

(3b) If 0 is entered you will have to specify the name under which the image has been stored. To help do this an additional option will print the Bernoulli image directory "F:/IMAGES" on the dot-matrix printer (remember to set the printer up first).

(4) *enter sample no. <= 8 chars*

The label entered at this point as appended to the database files to identify them.

(5) *automatic thresholds (1/0)*

At this point the input digitised image is normalised (see Kontron User Handbook) and the normalised image is displayed. Entering the default 1 causes segmentation of this at pre-set grey levels 130 and 255. Entering 0 allows the operator to select segmentation grey levels using the mouse. The automatic option has proved adequate for most cases, but the interactive mode can be of help where unusually high background grey tones are encountered.

(6) The macro now automatically carries out field and object measurements and stores the data in the database files. These files are displayed in turn. At each data display, press ESCAPE to turn the display off. The program then goes on to show histograms and summary statistics of the AREA data (in units defined by the scaling), the FSHAPE data (aspect ratio), and the ANGLEDMAX data (orientation of longest diameter). In practise, displaying the histograms becomes slow as the data files become long, and a simple modification (not shown above) allows this part of the macro to be avoided if the user wishes.

(7) *copy DB files to floppy (1/0)*

The default 0 moves the program to its end with no further action. The data files are retained in RAM until they are erased or the computer is turned off. Entering 1 brings a pause at the message:

source files are D:/COLOUR/DATA/LEAF_1.D00 and ...LEAF_2.D00

The program then drops temporarily into DOS. At the DOS prompt the user enters

CONVERTA -F D:/COLOUR/DATA/LEAF_*.D00 A:/

This causes the database files to be written in ASCII format onto the floppy in drive A, changing the file ending from D00 to FRE. It is then necessary to **RENAME** these files with unique (e.g. sample number) names, remembering that the names must conform to DOS filename conventions. Once this has been done the user must enter EXIT to return to the macro.

(8) *program ended - set up new image field and press F9*

The macro ends by printing this message, prompting the user to move to a new image area and start the macro again. Remember that new data will be appended to the existing data files until the files are erased and recreated.

21 October 1991

APPENDIX 2 VAPOUR PRESSURES OF PESTICIDES IN CURRENT USE

HERBICIDES

ALACHLOR

S V P (mPa)	Temperature (°C)	Reference
2.9	25	1
-	-	2
2.9	25	6
2.93	25	3
2670	100	3
2.9	25	5

Photodegradation
Miller and Crosby (1983) p.111

Notes
No reported cases of vapour drift.

ALLOXYDIM-SODIUM

S V P (mPa)	Temperature (°C)	Reference
0.133	25	1
0.133	25	5

Photodegradation
n/a

Notes
No reported cases of vapour drift.

AMITROLE

S V P (mPa)	Temperature (°C)	Reference
-	-	1
-	-	5

Photodegradation
Crosby (1976) p.872

AMMONIUM SULFAMATE

S V P (mPa)	Temperature (°C)	Reference
-		1
-		5

Photodegradation
n/a

ASULAM

S V P (mPa)	Temperature (°C)	Reference
-		1
-		2
-		5

Photodegradation
n/a

Notes
Extremely low S V P; no reports of vapour drift.

ATRAZINE

S V P (mPa)	Temperature (°C)	Reference
0.04	20	1
0.04	20	2
$4.0\ 10^{-2}$	20	6
0.0399	20	3
$7.60\ 10^{-3}$	10	7
0.040	20	7
0.187	30	7
3.07	50	7
0.04	20	5

Photodegradation
Marcheterre et al. (1988) pp.102-106
Crosby (1976) p.874

Notes
No reports of vapour drift.

AZIPROTRYNE

S V P (mPa)	Temperature (°C)	Reference
0.267	20	1
$2.67\ 10^{-3}$	20	2
0.267	20	5

Photodegradation
n/a

Notes
No reports of vapour drift damage in spite of high S V P.
Error in value for S V P given by reference (2).

AMINOTRIAZOLE

S V P (mPa)	Temperature (°C)	Reference
-		2

Photodegradation
n/a

BENAZOLIN

S V P (mPa)	Temperature (°C)	Reference
$396\ 10^{-6}$	20	1
trace	20	2
$396\ 10^{-6}$	20	5

Photodegradation
n/a

BENTAZONE

S V P (mPa)	Temperature (°C)	Reference
<0.01	20	1
-		2
<0.01	20	5

Photodegradation
n/a

BENZOYLPROP-ETHYL

S V P (mPa)	Temperature (°C)	Reference
0.0047	20	1
$4.67\ 10^{-3}$	20	2
0.0047	20	5

Photodegradation
n/a

BIFENOX

S V P (mPa)	Temperature (°C)	Reference
0.32	30	1
0.07	20	2
0.32	30	5

Photodegradation
Marcheterre et al. (1988)

BROMACIL

S V P (mPa)	Temperature (°C)	Reference
0.033	25	1
$4.27\ 10^{-3}$	20	2
$2.9\ 10^{-2}$	25	6
107	100	3
0.033	25	5

Photodegradation
Marcheterre et al. (1988) pp.106-109
Crosby (1976) p.875

BROMOXYNIL

S V P (mPa)	Temperature (°C)	Reference
-	-	1
0.29	20	2
-	-	5

Photodegradation
Crosby (1976) pp.870-871

Notes
Potential hazard of vapour drift.

CARBETAMIDE

S V P (mPa)	Temperature (°C)	Reference
trace	20	1
trace	-	2
-	-	5

Photodegradation
Meallier, Mamouni and Mansour (1990) p.267

CHLORAMBEN

S V P (mPa)	Temperature (°C)	Reference
930	100	1
0.1	20	2
930	100	5

Photodegradation
n/a

CHLORBUFAM

S V P (mPa)	Temperature (°C)	Reference
2.1	20	1
159960	20	2
2.1	20	5

Photodegradation
n/a

Notes
Error in S V P value given in reference (2).

CHLORIDAZON

S V P (mPa)	Temperature (°C)	Reference
<0.01	20	1
1599.6	20	2
<0.01	20	5

Photodegradation
n/a

Notes
Error in S V P value given in reference (2).

CHLOROTOLURON

S V P (mPa)	Temperature (°C)	Reference
0.017	20	1
$4.8\ 10^{-3}$	20	2
0.0048	20	5

Photodegradation
n/a

CHLORPROPHAM

S V P (mPa)	Temperature (°C)	Reference
-	-	1
-	-	2
1.33	25	3
1.33-0.1	25	3
-		5

Photodegradation
Marcheterre et al. (1988) pp.92-93,100-101
Miller and Crosby (1983) p.716
Crosby (1976) pp.863-864

Notes
No reports of vapour drift damage.

CHLORSULFURON

S V P (mPa)	Temperature (°C)	Reference
$3.0\ 10^{-6}$	25	1
$3.1\ 10^{-6}$	25	5

Photodegradation
n/a

CHLORTHAL-DIMETHYL

S V P (mPa)	Temperature (°C)	Reference
$<67\ 10^{3}$	40	1
13330	20	2
$<67\ 10^{3}$	40	5

Photodegradation
n/a

Notes
Highly volatile; soil incorporated.

CLOPYRALID

S V P (mPa)	Temperature (°C)	Reference
1.6	25	1
1.6	25	5

Photodegradation
n/a

Notes
Volatile, but no vapour damage reported.

CYANAZINE

S V P (mPa)	Temperature (°C)	Reference
$200\ 10^{-6}$	20	1
-		2
$213\ 10^{-6}$	20	5

Photodegradation
n/a

CYCLOXYDIM

S V P (mPa)	Temperature (°C)	Reference
-		1

Photodegradation
n/a

2,4-D

S V P (mPa)	Temperature (°C)	Reference
ester		
180-1690	25	3
acid		
$53\ 10^{3}$	160	1
0.125	20	2
isopropyl		
$1.4\ 10^{3}$	25	1
159.96	25	7
186.62	25	7
1399.65	25	7
butoxyethyl		
0.60	25	8
226.6	25	8
1-butyl		
0.46	16	8
1.27	25.4	8
2.68	34.6	8
7.78	44	8
519.87	25	8
>=13.33	38	8
52.12	25	8
ethyl		
114.64	25	8
1532.95	25	8
185.29	25	8
114.64	25	7
146.63	25	7
1532.95	25	7
33.0	25	9
1-heptyl		
179.96	25	8
3.33	25	8
methyl		
14.26	17.6	8
43.86	25	8
170.62	34.6	8
>=14.66	20	8
>=266.60	38	8
206.62	25	8
1692.91	25	8
302.59	25	8
15.46	17.6	7
43.32	25	7
158.63	34.8	7

267.93	39	7
91.44	28	7
206.62	25	7
306.59	25	7
1692.91	25	7
60.0	25	9
1-octyl		
>=3.60	38	8
2.0	25	8
2-propyl		
1399.65	25	8
159.96	25	8
190.62	25	8
5.85	25	8
2266100	187	8
2226110	187	8
2172790	187	8
n-butyl		
0.44	16	7
1.09	24.2	7
3.15	34.6	7
7.76	44.0	7
1.18	25	7
5.4	20	10
n-heptyl		
26.66	25	7
179.96	25	7
isobutyl		
9.7	25	9
butyl		
6.8	25	9
2-butoxyethyl		
0.613	25	9
2-ethylhexyl		
0.44	25	9
iso-octyl		
2.3	20	10

Photodegradation
Marcheterre et al. (1988) p.110
Crosby (1976) pp.853-856
Que Hee and Sutherland (1981) pp.159-162, 165-167, 170-173
Plimmer (1970) p.61,62

Notes
All esters are volatile, even though the SVP is low in some cases (Breeze & West (1987a,b); Breeze (1988a); Breeze (1990):Breeze & Rensburg (1992); Bennet (1990); Que Hee & Sutherland (1981); Rensburg & Breeze (1990); Savory (1973); Zimmerman, Hitchcock & Kirkpatrick (1953)). Salts are non-volatile, but the DMA salt may photodecompose in the same way as MCPA (Crosby & Bowers (1985)) to release the free acid. This is phytotoxic (Breeze & Rensburg (1991). Vapour concentrations in the air following spraying have been reported by Farwell, Robinson, Powell & Adams (1976), Grover, Shewchuk, Cessna, Smith & Hunter (1985), and Que Hee & Sutherland (1981).

DALAPON

S V P (mPa)	Temperature (°C)	Reference
-		1
-		2

Photodegradation
n/a

2,4-DB

S V P (mPa)	Temperature (°C)	Reference
-	-	1
-	-	2

Photodegradation
n/a

2,4-DES

S V P (mPa)	Temperature (°C)	Reference
trace	room	1

Photodegradation
n/a

DESMETRYN

S V P (mPa)	Temperature (°C)	Reference
0.133	20	1
0.133	20	2

Photodegradation
n/a

DICAMBA

S V P (mPa)	Temperature (°C)	Reference
4.5	25	1
493	20	2
4.9 10^2	20	6
493	-	3
4.54	25	3
2.67	25	3

Photodegradation
n/a

Notes
Reported S V P values vary greatly; lower figures are probably correct. This compound has the potential to cause vapour drift damage. May also release volatile material following plant uptake, by evapotranspiration (Anon., 1984).

DICHLOBENIL

S V P (mPa)	Temperature (°C)	Reference
0.073	20	1
37.3	20	2
73.3	-	3
0.4	20	3
66.6	20	3
38	20	10

Photodegradation
Plimmer (1970) p.54,61

Notes
Wide range of published S V P values suggests errors.

DICHLORPROP

S V P (mPa)	Temperature (°C)	Reference
trace	room	1
trace	20	2
iso-octyl		
3.3	20	10

Photodegradation
n/a

DICLOFOP-METHYL

S V P (mPa)	Temperature (°C)	Reference
0.034	20	1
-	-	2

Photodegradation
n/a

Notes
May have potential for vapour drift.

DIPENZOQUAT

S V P (mPa)	Temperature (°C)	Reference
-		1

Photodegradation
n/a

DIFLUFENICAN

S V P (mPa)	Temperature (°C)	Reference
-		1

Photodegradation
n/a

DIPHENAMID

S V P (mPa)	Temperature (°C)	Reference
trace	room	1
trace	20	2

Photodegradation
Marcheterre et al. (1988) p.113
Crosby (1976) pp.861-862

DIQUAT

S V P (mPa)	Temperature (°C)	Reference
<0.013	-	1
-	-	2

Photodegradation
Crosby (1976) pp.879-880
Akhavein and Linscott (1968) p.120

DIURON

S V P (mPa)	Temperature (°C)	Reference
0.41	50	1
$4.13\ 10^{-3}$	20	2
$2.1\ 10^{-4}$	25	6
0.413	50	3

Photodegradation
Marcheterre et al. (1988) pp.92-93
Crosby (1976) p.866

EPTC

S V P (mPa)	Temperature (°C)	Reference
$4.5\ 10^{3}$	25	1
1066.4	20	2
$2.8\ 10^{3}$	25	6
20000	20	3
4530	25	3
4660	25	3
1840	20	3
4670	20	3
19995	20	7

Photodegradation
Marcheterre et al. (1988) p.101
Crosby (1976) p.867

Notes
Highly volatile but soil-incorporated.

ETHOFUMESATE

S V P (mPa)	Temperature (°C)	Reference
0.086	25	1
0.037	20	2

Photodegradation
n/a

FENOXAPROP [-ETHYL]

S V P (mPa)	Temperature (°C)	Reference
$19\ 10^{-4}$	20	1

Photodegradation
n/a

FENURON

S V P (mPa)	Temperature (°C)	Reference
21	60	1
0.11	20	2
21.3	60	3

Photodegradation
Marcheterre et al. (1988) pp.91-92
Crosby (1976) p.863,866

FLAMPROP-M-ISOPROPYL

S V P (mPa)	Temperature (°C)	Reference
0.032	20	1
-		2

Photodegradation
n/a

FLUAZIFOP-P-BUTYL

S V P (mPa)	Temperature (°C)	Reference
0.54	20	1

Photodegradation
n/a

Notes
May have potential to cause vapour drift; herbicide for grass control.

FLUROXYPYR

S V P (mPa)	Temperature (°C)	Reference
0.014	25	1

Photodegradation
n/a

Notes
Possible unconfirmed report of vapour drift damage to glasshouse-grown tomatoes. Laboratory vapour phytotoxicity shown by Breeze (1988b) on tomato for a 48 h exposure to 6 pg l^{-1}.

FOSAMINE-AMMONIUM

S V P (mPa)	Temperature (°C)	Reference
0.53	25	1

Photodegradation
n/a

GLYPHOSATE

S V P (mPa)	Temperature (°C)	Reference
-		1
-		2

Photodegradation
n/a

Notes
Probably entirely free from risk of vapour drift.

HEXAZINONE

S V P (mPa)	Temperature (°C)	Reference
8.5	86	1
$8.0\ 10^{-4}$	20	2

Photodegradation
n/a

IMAZAPYR

S V P (mPa)	Temperature (°C)	Reference
-	-	1

Photodegradation
Mallipudi, Stout, daCunha and Lee (1991) pp.412-417

IOXYNIL

S V P (mPa)	Temperature (°C)	Reference
-		1
0.083	20	2

Photodegradation
Crosby (1976) pp.870-871

Notes
Has potential to cause vapour drift damage, although no confirmed reports. Savory (1973) found no effects in a laboratory study.

ISOPROTURON

S V P (mPa)	Temperature (°C)	Reference
0.0033	20	1
$3.33\ 10^{-3}$	20	2
$3.4\ 10^{-3}$	20	10

Photodegradation
n/a

ISOXABEN

S V P (mPa)	Temperature (°C)	Reference
-	-	1

Photodegradation
n/a

LENACIL

S V P (mPa)	Temperature (°C)	Reference
-		1
-		2

Photodegradation
n/a

LINURON

S V P (mPa)	Temperature (°C)	Reference
2.0	24	1
1.15	20	2
1.2	20	6
2.0	24	3
1.47	24	3

Photodegradation
Marcheterre et al. (1988) pp.92-93

Notes
Probably has potential to cause vapour damage, although no confirmed reports from the field.

MCPA

S V P (mPa)	Temperature (°C)	Reference
0.2	21	1
-	-	2
MCPA-thioethyl		
21	20	1
2-butoxyethyl		
639.84	25	8
1.07	25	9
2-propyl		
2879.28	25	8
methyl		
109.0	25	9
2-ethylhexyl		
0.760	25	9
iso-octyl		
3.8	20	10

Photodegradation
Crosby & Bowers (1985)

Notes
Esters have potential to cause vapour drift damage. Also see Crosby & Bowers (1985) for release of free acid from DMA salt.

MCPB

S V P (mPa)	Temperature (°C)	Reference
-	-	1
-	-	2

Photodegradation
n/a

Notes
Esters are volatile and may cause vapour damage.

MECOPROP

S V P (mPa)	Temperature (°C)	Reference
-	-	1
-	-	2
iso-octyl		
4.5	20	10

Photodegradation
n/a

Notes
Although esters have low S V P, the iso-octyl has caused severe vapour damage to oilseed rape crops. Other esters have been introduced (Campbell & Jones (1985)).

MEFLUIDIDE

S V P (mPa)	Temperature (°C)	Reference
<13	25	1
<6.67	20	2

Photodegradation
n/a

METAMITRON

S V P (mPa)	Temperature (°C)	Reference
13	->70	1
-	-	2

Photodegradation
n/a

METAZACHLOR

S V P (mPa)	Temperature (°C)	Reference
0.049	20	1

Photodegradation
n/a

METHABENZTHIAZURON

S V P (mPa)	Temperature (°C)	Reference
0.133	20	1
0.133	20	2

Photodegradation
n/a

METOXURON

S V P (mPa)	Temperature (°C)	Reference
4.3	20	1
$4.3\ 10^{-3}$	20	2

Photodegradation
n/a

METRIBUZIN

S V P (mPa)	Temperature (°C)	Reference
<1.3	20	1
0.147	20	2

Photodegradation
n/a

METSULFURON-METHYL

S V P (mPa)	Temperature (°C)	Reference
77	25	1

Photodegradation
n/a

Notes
Reported S V P may be incorrect.

MONOLINURON

S V P (mPa)	Temperature (°C)	Reference
6.4 10^{3}	65	1
16	20	2

Photodegradation
n/a

Notes
High S V P but soil incorporated.

NAPROPAMIDE

S V P (mPa)	Temperature (°C)	Reference
0.53	25	1
-	-	2

Photodegradation
n/a

OXADIAZON

S V P (mPa)	Temperature (°C)	Reference
<0.133	20	1
<0.133	20	2

Photodegradation
n/a

PARAQUAT

S V P (mPa)	Temperature (°C)	Reference
trace	room	1
-	-	2

Photodegradation
Crosby (1976) p.877
Akhavein and Linscott (1968) p.120

PENDIMETHALIN

S V P (mPa)	Temperature (°C)	Reference
4.0	25	1
2.0	20	2

Photodegradation
Marcheterre et al. (1988) pp.68-69

Notes
Detected in atmospheric fog (Glotfelty, Seiber & Liljedahl (1987)), although no reports of vapour damage in the field.

PENTACHLOROPHENOL

S V P (mPa)	Temperature (°C)	Reference
16 10^{3}	100	1
8.13	20	2

Photodegradation
Marcheterre et al. (1988) p.71,75-80
Miller and Crosby (1983) p.716
Crosby (1976) pp.860-869
Plimmer (1970) pp.63-64

PENTANOCHLOR

S V P (mPa)	Temperature (°C)	Reference
-	-	1
-	-	2

Photodegradation
n/a

PHENMEDIPHAM

S V P (mPa)	Temperature (°C)	Reference
1.3 10^{-4}	25	1
-	-	2

Photodegradation
n/a

PICLORAM

S V P (mPa)	Temperature (°C)	Reference
0.082	35	1
7.33 10^{-3}	20	2
7.3 10^{-4}	20	6
0.0821	35	3
0.0813	35	3

Photodegradation
Marcheterre et al. (1988) pp.113-114
Crosby (1976) p.860
Plimmer (1970) pp.58-60

PROMETRYN

S V P (mPa)	Temperature (°C)	Reference
0.133	20	1
0.21	20	2
0.133	20	3

Photodegradation
Marcheterre et al. (1988) p.106

PROPACHLOR

S V P (mPa)	Temperature (°C)	Reference
30.6	25	1
0.32	20	2
30.6	25	3

Photodegradation
n/a

PROPHAM

S V P (mPa)	Temperature (°C)	Reference
-	-	1

Photodegradation
Marcheterre et al. (1988) p.101
Crosby (1976) p.864

PROPYZAMIDE

S V P (mPa)	Temperature (°C)	Reference
11.3	25	1
5.87	20	2

Photodegradation
n/a

Notes
High S V P but not known to cause vapour phytotoxicity.

PYRIDATE

S V P (mPa)	Temperature (°C)	Reference
133 10^{-4}	-	1

Photodegradation
n/a

QUIZALOFOP-ETHYL

S V P (mPa)	Temperature (°C)	Reference
0.04	20	1

Photodegradation
n/a

Notes
May have potential to cause vapour damage, but no reported cases.

SETHOXYDIM

S V P (mPa)	Temperature (°C)	Reference
-	-	1

Photodegradation
n/a

SIMAZINE

S V P (mPa)	Temperature (°C)	Reference
810 10^{-9}	20	1
8.13 10^{-4}	20	2
2.0 10^{-3}	25	6
8.13 10^{-4}	20	3
8.13 10^{-4}	20	7
1.23 10^{-4}	10	7
4.80 10^{-3}	30	7
0.120	50	7
8.3 10^{-4}	20	10

Photodegradation
Marcheterre et al. (1988) pp.105-106
Crosby (1976) pp.874-875

SODIUM CHLORATE

S V P (mPa)	Temperature (°C)	Reference
-	-	1

Photodegradation
n/a

TCA

S V P (mPa)	Temperature (°C)	Reference
-	-	1
13330	20	2
1.73	25	3

Photodegradation
n/a

TEBUTAM

S V P (mPa)	Temperature (°C)	Reference
-	-	1

Photodegradation
n/a

TEBUTHIURON

S V P (mPa)	Temperature (°C)	Reference
0.27	25	1

Photodegradation
n/a

TERBACIL

S V P (mPa)	Temperature (°C)	Reference
0.0625	29.5	1
-	-	2
0.064	29.5	3

Photodegradation
Marcheterre et al. (1988) pp.108-109

TERBUTHYLAZINE

S V P (mPa)	Temperature (°C)	Reference
0.15	20	1
0.15	20	2

Photodegradation
n/a

TERBUTRYN

S V P (mPa)	Temperature (°C)	Reference
0.128	20	1
0.128	20	2
0.128	20	3

Photodegradation
n/a

TRI-ALLATE

S V P (mPa)	Temperature (°C)	Reference
16	25	1
-	-	2
26	20	6
16	25	3
14.1	20	3

Photodegradation
n/a

Notes
Highly volatile but soil incorporated.

TRICLOPYR

S V P (mPa)	Temperature (°C)	Reference
0.168	25	1
0.079	20	2

Photodegradation
n/a

Notes
Reported to cause vapour damage, especially on woody perennials. Great care needed in use.

TRIETAZINE

S V P (mPa)	Temperature (°C)	Reference
-	-	1
-	-	2

Photodegradation
n/a

TRIFLURALIN

S V P (mPa)	Temperature (°C)	Reference
13.7	25	1
7.2	20	2
15	20	6
6.46	20	3
32.3	30	3
16.8 10^{4}	80	7
26.53	29.5	7
29.19	29	7
7.3	20	10

Photodegradation
Marcheterre et al. (1988) pp.68-70
Miller and Crosby (1983) p.721,727
Crosby (1976) pp.872-873
Probst et al. (1975) pp.465-468
Woodrow, Crosby and Seiber (1983) pp.111-125
Mangar and Miller (1988) pp.2183-2188
Woodrow, Crosby and Seiber (1983) pp.111-125

Notes
Highly volatile but soil incorporated.

FUNGICIDES

BENALAXYL

S V P (mPa)	Temperature (°C)	Reference
0.67	25	1

Photodegradation
n/a

BENODANIL

S V P (mPa)	Temperature (°C)	Reference
<0.01	20	1
trace	20	2

Photodegradation
n/a

BENOMYL

S V P (mPa)	Temperature (°C)	Reference
trace	room	1
trace	20	2

Photodegradation
n/a

BORDEAUX MIXTURE

S V P (mPa)	Temperature (°C)	Reference
-		1

Photodegradation
n/a

BUPIRIMATE

S V P (mPa)	Temperature (°C)	Reference
0.067	20	1
0.067	20	2

Photodegradation
n/a

CAPTAFOL

S V P (mPa)	Temperature (°C)	Reference
trace	room	1
trace	20	2

Photodegradation
n/a

CAPTAN

S V P (mPa)	Temperature (°C)	Reference
<1.3	25	1
0.67	20	2
<1.33	15	3
trace	-	4

Photodegradation
Schwack and Flosser-Muller (1990)

CARBENDAZIM

S V P (mPa)	Temperature (°C)	Reference
$<100\ 10^{-6}$	20	1
-		2

Photodegradation
n/a

CARBOXIN

S V P (mPa)	Temperature (°C)	Reference
$<133\ 10^{3}$	20	1
-	-	2

Photodegradation
n/a

CHLOROTHALONIL

S V P (mPa)	Temperature (°C)	Reference
$1.3\ 10^{3}$	40	1
159.96	20	2

Photodegradation
n/a

COPPER OXYCHLORIDE

S V P (mPa)	Temperature (°C)	Reference
-		1

Photodegradation
n/a

CYMOXANIL

S V P (mPa)	Temperature (°C)	Reference
0.08	25	1

Photodegradation
n/a

DICHLOFLUANID

S V P (mPa)	Temperature (°C)	Reference
0.133	20	1
0.133	20	2
0.133	20	4

Photodegradation
n/a

DICHLOROPHEN

S V P (mPa)	Temperature (°C)	Reference
$13\ 10^{-6}$	25	1
$4.67\ 10^{-6}$	20	2

Photodegradation
n/a

DICLORAN

S V P (mPa)	Temperature (°C)	Reference
0.16	20	1
0.16	20	4

Photodegradation
n/a

DINOCAP

S V P (mPa)	Temperature (°C)	Reference
-	-	1
trace	-	4

Photodegradation
n/a

DITHIANON

S V P (mPa)	Temperature (°C)	Reference
0.66	25	1
trace	-	4

Photodegradation
n/a

DODEMORPH

S V P (mPa)	Temperature (°C)	Reference
0.48	20	1
-	-	2

dodemorph acetate

2.5	20	1

Photodegradation
n/a

DODINE

S V P (mPa)	Temperature (°C)	Reference
-	-	1
-	-	2
trace	-	4

Photodegradation
n/a

ETHIRIMOL

S V P (mPa)	Temperature (°C)	Reference
0.267	25	1
0.125	20	2

Photodegradation
n/a

ETRIDIAZOLE

S V P (mPa)	Temperature (°C)	Reference
13	room	1
13.33	20	2

Photodegradation
n/a

FENARIMOL

S V P (mPa)	Temperature (°C)	Reference
0.012	25	1
0.013	20	2

Photodegradation
n/a

FENPROPIDIN

S V P (mPa)	Temperature (°C)	Reference
-	-	1

Photodegradation
n/a

FENPROPIMORPH

S V P (mPa)	Temperature (°C)	Reference
-	-	1

Photodegradation
n/a

FENTIN ACETATE

S V P (mPa)	Temperature (°C)	Reference
1.9	60	1
0.04	20	2
0.18	30	4

Photodegradation
n/a

FENTIN HYDROXIDE

S V P (mPa)	Temperature (°C)	Reference
0.047	20	1
-	-	4

Photodegradation
n/a

FERBAM

S V P (mPa)	Temperature (°C)	Reference
trace	room	1

Photodegradation
n/a

FLUTRIAFOL

S V P (mPa)	Temperature (°C)	Reference
$400\ 10^{-6}$	20	1

Photodegradation
n/a

FOSETYL

S V P (mPa)	Temperature (°C)	Reference
trace	room	1

Photodegradation
n/a

FUBERIDAZOLE

S V P (mPa)	Temperature (°C)	Reference
-	-	1
-	-	2

Photodegradation
n/a

FURALAXYL

S V P (mPa)	Temperature (°C)	Reference
0.07	20	1
0.07	20	2

Photodegradation
n/a

HYMEXAZOL

S V P (mPa)	Temperature (°C)	Reference
<133	25	1

Photodegradation
n/a

IMAZALIL

S V P (mPa)	Temperature (°C)	Reference
0.0093	20	1
$9.33\ 10^{-3}$	20	2

Photodegradation
n/a

IPRODIONE

S V P (mPa)	Temperature (°C)	Reference
<0.133	20	1
<0.133	20	2

Photodegradation
n/a

MANCOZEB

S V P (mPa)	Temperature (°C)	Reference
trace	-	1
trace	-	4

Photodegradation
n/a

MANEB

S V P (mPa)	Temperature (°C)	Reference
trace	-	1
trace	-	4

Photodegradation
n/a

MERCUROUS CHLORIDE

S V P (mPa)	Temperature (°C)	Reference
-	-	1
-	-	2

Photodegradation
n/a

METALAXYL

S V P (mPa)	Temperature (°C)	Reference
0.293	20	1
0.293	20	2

Photodegradation
n/a

MYCLOBUTANIL

S V P (mPa)	Temperature (°C)	Reference
213	25	1

Photodegradation
n/a

NABAM

S V P (mPa)	Temperature (°C)	Reference
-	-	1
trace	-	4

Photodegradation
n/a

NITROTHAL-ISOPROPYL

S V P (mPa)	Temperature (°C)	Reference
<0.01	20	1

Photodegradation
n/a

NUARIMOL

S V P (mPa)	Temperature (°C)	Reference
<0.0027	25	1
$1.12\ 10^{-3}$	20	2

Photodegradation
n/a

OFURACE

S V P (mPa)	Temperature (°C)	Reference
<0.13	20	1

Photodegradation
n/a

OXADIXYL

S V P (mPa)	Temperature (°C)	Reference
3.3	20	1

Photodegradation
n/a

OXYCARBOXIN

S V P (mPa)	Temperature (°C)	Reference
$<133\ 10^{3}$	20	1
-	-	2

Photodegradation
n/a

PENCONAZOLE

S V P (mPa)	Temperature (°C)	Reference
0.21	20	1

Photodegradation
n/a

PENCYCURON

S V P (mPa)	Temperature (°C)	Reference
<1	20	1

Photodegradation
n/a

PENTACHLOROPHENOL

S V P (mPa)	Temperature (°C)	Reference
$16\ 10^{3}$	100	1
8.13	20	2
$16\ 10^{3}$	100	5

Photodegradation
Marcheterre et al (1988) p.71,75-80
Miller and Crosby (1983) p.716
Crosby (1976) pp.860-869
Plimmer (1976) pp.63-64

PHENYLMERCURY ACETATE

S V P (mPa)	Temperature (°C)	Reference
1.2	35	1
-	-	2
1.2	35	3
1.20	35	4

Photodegradation
n/a

PROCHLORAZ

S V P (mPa)	Temperature (°C)	Reference
$80\ 10^{-6}$	20	1
$8.0\ 10^{-6}$	20	2

Photodegradation
n/a

PROPAMOCARB

S V P (mPa)	Temperature (°C)	Reference
800	25	1

Photodegradation
n/a

PROPICONAZOLE

S V P (mPa)	Temperature (°C)	Reference
0.133	20	1

Photodegradation
n/a

PYRAZOPHOS

S V P (mPa)	Temperature (°C)	Reference
0.22	50	1
$2.0\ 10^{-3}$	20	2

Photodegradation
n/a

QUINTOZENE

S V P (mPa)	Temperature (°C)	Reference
$1.8\ 10^{3}$	20	1
1106.39	20	2
17.73	25	4

Photodegradation
n/a

SULPHUR

S V P (mPa)	Temperature (°C)	Reference
0.527	30.4	1

Photodegradation
n/a

TECNAZENE

S V P (mPa)	Temperature (°C)	Reference
volatile	room	1
-	-	4

Photodegradation
n/a

THIABENDAZOLE

S V P (mPa)	Temperature (°C)	Reference
non-volatile	room	1
trace	20	2

Photodegradation
n/a

THIOPHANATE

S V P (mPa)	Temperature (°C)	Reference
-	-	1
thiophanate-methyl		
-	-	1

Photodegradation
n/a

TRIFORINE

S V P (mPa)	Temperature (°C)	Reference
0.027	25	1
0.012	20	2

Photodegradation
n/a

VINCLOZOLIN

S V P (mPa)	Temperature (°C)	Reference
<10	20	1
-	-	2

Photodegradation
n/a

ZINEB

S V P (mPa)	Temperature (°C)	Reference
trace	room	1

Photodegradation
n/a

THIRAM

S V P (mPa)	Temperature (°C)	Reference
trace	room	1
-	-	2
trace	-	4

Photodegradation
n/a

TOLCLOFOS-METHYL

S V P (mPa)	Temperature (°C)	Reference
57	20	1

Photodegradation
n/a

TRIADIMEFON

S V P (mPa)	Temperature (°C)	Reference
<0.1	20	1
$<1.0\ 10^{-5}$	20	2

Photodegradation
n/a

TRIADIMENOL

S V P (mPa)	Temperature (°C)	Reference
<1.0	20	1

Photodegradation
n/a

TRIDEMORPH

S V P (mPa)	Temperature (°C)	Reference
40	20	1
39.99	20	2

Photodegradation
n/a

INSECTICIDES

ALDICARB

S V P (mPa)	Temperature (°C)	Reference
13	25	1
7.06	20	2
13.3	25	3
6660	20	3
6670	20	3
7.07	20	3

Photodegradation
n/a

AMITRAZ

S V P (mPa)	Temperature (°C)	Reference
0.051	20	1
-		2

Photodegradation
n/a

AZAMETHIPHOS

S V P (mPa)	Temperature (°C)	Reference
0.0049	20	1

Photodegradation
n/a

AZINPHOS

S V P (mPa)	Temperature (°C)	Reference
azinphos-ethyl		
<0.029	20	1
0.029	20	2
azinphos-methyl		
<1	20	1
trace	20	2
<50.654	20	4

Photodegradation
n/a

BENDIOCARB

S V P (mPa)	Temperature (°C)	Reference
0.66	25	1
0.32	20	2

Photodegradation
n/a

BENFURACARB

S V P (mPa)	Temperature (°C)	Reference
-		1

Photodegradation
n/a

BIFENTHRIN

S V P (mPa)	Temperature (°C)	Reference
0.024	25	1

Photodegradation
n/a

BIOALLETHRIN

S V P (mPa)	Temperature (°C)	Reference
(rs)-cyclopentenyl isomers		
16	30	1
(s)-cyclopentenyl isomer		
-		1

Photodegradation
n/a

CARBARYL

S V P (mPa)	Temperature (°C)	Reference
<5.3	25	1
2.80	20	2
<667	26	3
0.187	30	3
17.3	30	3
0.346	30	3
<667	26	3
2.8	20	3

Photodegradation
n/a

CARBOFURAN

S V P (mPa)	Temperature (°C)	Reference
2.7	33	1
0.87	20	2
1.1	25	6
2.67	33	3
2.67	33	3

Photodegradation
Raha and Das Asit (1990) pp.99-106

CARBOSULFAN

S V P (mPa)	Temperature (°C)	Reference
0.041	25	1

Photodegradation
n/a

CHLORFENVINPHOS

S V P (mPa)	Temperature (°C)	Reference
0.53	20	1
0.40	20	2
0.0227	25	3
0.533	20	3
0.023	23	4

Photodegradation
n/a

CHLOROPICRIN

S V P (mPa)	Temperature (°C)	Reference
$3.2\ 10^{4}$	25	1
$24\ 10^{3}$	20	2
$22.5\ 10^{4}$	20	3
$31.7\ 10^{4}$	50	3
$32.73\ 10^{3}$	25	4
$3.2\ 10^{4}$	25	5

Photodegradation
Woodrow, Crosby and Seiber (1983) pp.111-125

CHLORPYRIFOS

S V P (mPa)	Temperature (°C)	Reference
2.5	25	1
1.20	20	2
2.49	25	3
2.53	25	3
1.2	20	3
chlorpyrifos-methyl		
5.6	25	1
2.67	20	2

Photodegradation
n/a

CYFLUTHRIN

S V P (mPa)	Temperature (°C)	Reference
<1	20	1

Photodegradation
n/a

CYPERMETHRIN

S V P (mPa)	Temperature (°C)	Reference
$190\ 10^{-6}$	20	1
$5.20\ 10^{-7}$	20	2
cypermethrin (s 1r-cis- and r 1s-cis-isomers)		
$170\ 10^{-6}$	20	1

Photodegradation
n/a

DAZOMET

S V P (mPa)	Temperature (°C)	Reference
0.37	20	1
-		2

Photodegradation
n/a

DELTAMETHRIN

S V P (mPa)	Temperature (°C)	Reference
0.002	25	1

Photodegradation
n/a

DEMETON

S V P (mPa)	Temperature (°C)	Reference
38	20	1
37.32	20	2
34.6	20	3
33.1	20	3
33.1	20	3
97.3	20	3
37.3	20	3
98.7	30	3
34.7	20	3
demeton-s-methyl		
48	20	1
47.99	20	2
47.99	20	4
demeton-s-methyl sulphone		
0.66	20	1
0.67	20	2
0.67	20	4

Photodegradation
n/a

DIAZINON

S V P (mPa)	Temperature (°C)	Reference
0.097	20	1
18.66	20	2
19	20	6
18.66	20	3
2.36	20	3
4.69	20	3
6.40	20	3
9.75	20	3
11.2	20	3
18.6	20	3
11.2	20	3
18.66	20	4

Photodegradation
n/a

DICHLORVOS

S V P (mPa)	Temperature (°C)	Reference
$1.6\ 10^{3}$	20	1
1599.6	20	2
1599.6	20	4

Photodegradation
n/a

DIFLUBENZURON

S V P (mPa)	Temperature (°C)	Reference
<0.013	20	1

Photodegradation
n/a

DIMETHOATE

S V P (mPa)	Temperature (°C)	Reference
1.1	25	1
0.55	20	2
1.13	25	3
3330	25	3
0.674	25	3
0.373	20	3
1.13	20	3
11330	20	3
1706	20	3
8.85	20	3
4.48	20	3
13.33	40	4

Photodegradation
n/a

DISULFOTON

S V P (mPa)	Temperature (°C)	Reference
24	20	1
24.0	20	2
23.99	20	4

Photodegradation
Miller and Crosby (1983) pp.712-713

ENDOSULFAN

S V P (mPa)	Temperature (°C)	Reference
$1.2\ 10^{3}$	30	1
0.65	20	2
1.33	25	3
trace		4

Photodegradation
n/a

ETHOPROPHOS

S V P (mPa)	Temperature (°C)	Reference
46.5	26	1
22.66	20	2

Photodegradation
n/a

ETRIMFOS

S V P (mPa)	Temperature (°C)	Reference
8.6	20	1
6.53	20	2

Photodegradation
n/a

FENITROTHION

S V P (mPa)	Temperature (°C)	Reference
18	20	1
0.80	20	2
$8.0\ 10^{-1}$	20	6
0.8	20	3
7.2	20	3
0.107	20	3
0.426	25	3

Photodegradation
Miller and Crosby (1983) p.712

FENVALERATE

S V P (mPa)	Temperature (°C)	Reference
0.037	25	1
<1.33	20	2

Photodegradation
Miller and Crosby (1983) p.716

FONOFOS

S V P (mPa)	Temperature (°C)	Reference
28	25	1

Photodegradation
n/a

GAMMA-HCH

S V P (mPa)	Temperature (°C)	Reference
5.6	20	1

gamma-BHC

1.25	20	4

Photodegradation
n/a

HEPTENOPHOS

S V P (mPa)	Temperature (°C)	Reference
170	25	1
99.98	20	2

Photodegradation
n/a

IODOFENPHOS

S V P (mPa)	Temperature (°C)	Reference
0.106	20	1
0.107	20	2

Photodegradation
n/a

LINDANE

S V P (mPa)	Temperature (°C)	Reference
1.25	20	2
8.6	25	6
4.4	-	3
2.8	20	3
1.25	20	3
21.3	20	3
4.13	20	3
4000	20	3
4.35	20	3
2.8	20	3
1.25	20	3
1.25	20	3
1.25	20	3
5.6	20	3
1.25	20	3
1.24	20	3
3.68	20	3
3.21	20	3
2.6	20	3
1.25	20	7

Photodegradation
n/a

MEPHOSFOLAN

S V P (mPa)	Temperature (°C)	Reference
-	-	1
$3.73\ 10^{-4}$	20	2

Photodegradation
n/a

METHACRIFOS

S V P (mPa)	Temperature (°C)	Reference
160	20	1

Photodegradation
n/a

METHIOCARB

S V P (mPa)	Temperature (°C)	Reference
15	60	1
trace		4

Photodegradation
n/a

METHOMYL

S V P (mPa)	Temperature (°C)	Reference
6.65	25	1
3.47	20	2
6.66	25	3
162	30	3
1.33	30	3

Photodegradation
n/a

NICOTINE

S V P (mPa)	Temperature (°C)	Reference
$5.65\ 10^{3}$	25	1
3465.8	20	2
665.25	25	4

Photodegradation
n/a

OMETHOATE

S V P (mPa)	Temperature (°C)	Reference
3.3	20	1
3.33	20	2

Photodegradation
n/a

OXAMYL

S V P (mPa)	Temperature (°C)	Reference
31	25	1
16.0	20	2
30.6	25	3

Photodegradation
n/a

OXYDEMETON-METHYL

S V P (mPa)	Temperature (°C)	Reference
3.8	20	1
-		2

Photodegradation
n/a

PENTACHLOROPHENOL

S V P (mPa)	Temperature (°C)	Reference
$16\ 10^{3}$	100	1
8.13	20	2

Photodegradation
Marcheterre et al. (1988) p.71,75-80
Miller and Crosby (1983) p.716
Crosby (1976) pp.868-869
Plimmer (1970) pp.63-64

PERMETHRIN

S V P (mPa)	Temperature (°C)	Reference
0.0013	20	1
0.02	20	2

Photodegradation
n/a

PETROLEUM OILS

S V P (mPa)	Temperature (°C)	Reference
-	-	1

Photodegradation
n/a

PHENOTHRIN ((R) ISOMERS)

S V P (mPa)	Temperature (°C)	Reference
0.16	20	1
0.04	20	2

Photodegradation
n/a

PHORATE

S V P (mPa)	Temperature (°C)	Reference
85	25	1
111.97	20	2
112	20	3
520	36	3
73.8	25	3
118	20	3
525	20	3
111.97	20	4

Photodegradation
n/a

PHOSALONE

S V P (mPa)	Temperature (°C)	Reference
trace	room	1
trace	20	2
trace		4

Photodegradation
n/a

PRIMIPHOS

S V P (mPa)	Temperature (°C)	Reference
primiphos-ethyl		
29	25	1
38.66	20	2
primiphos-methyl		
13	30	1
3.6	20	2

Photodegradation
n/a

PROPOXUR

S V P (mPa)	Temperature (°C)	Reference
$1.3\ 10^3$	120	1
0.04	20	2
1333	20	3

Photodegradation
n/a

PYRETHRINS

S V P (mPa)	Temperature (°C)	Reference
-		1

Photodegradation
n/a

PIRIMICARB

S V P (mPa)	Temperature (°C)	Reference
4.0	30	1
1.01	20	2

Photodegradation
n/a

QUINALPHOS

S V P (mPa)	Temperature (°C)	Reference
0.346	20	1
$5.20\ 10^{-7}$	20	2

Photodegradation
n/a

RESMETHRIN

S V P (mPa)	Temperature (°C)	Reference
0.0015	30	1
-		2

Photodegradation
n/a

TAR OILS

S V P (mPa)	Temperature (°C)	Reference
-		1

Photodegradation
n/a

TETRAMETHRIN

S V P (mPa)	Temperature (°C)	Reference
0.944	30	1
$4.67\ 10^{-7}$	20	2

Photodegradation
n/a

THIOMETON

S V P (mPa)	Temperature (°C)	Reference
23	20	1
26.66	20	2

Photodegradation
n/a

TRIAZOPHOS

S V P (mPa)	Temperature (°C)	Reference
13	55	1
0.09	20	2

Photodegradation
n/a

TRICHLORFON

S V P (mPa)	Temperature (°C)	Reference
1.0	20	1
1.04	20	2
1.04	20	3
1.04	20	3
0.946	20	3
1.04	20	4

Photodegradation
n/a

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