Table 1 *Average chemical composition of different rock types of the Malani Volcanics* (Major element oxides as wt. % and trace elements in ppm)

	1	2	3	4	5
SiO_2	50 86	61 41	67 89	71.54	76.28
TiO_2	1 57	1.22	0 67	0 46	0.19
Al_2O_3	16.79	15 91	15.31	14 60	13 59
Fe_2O_3	2.26	3.83	2.73	2 85	1.38
FeO	7.40	2.60	1.58	0 63	0 25
MnO	0.17	0 16	0.11	0.11	0 04
MgO	5.04	1.71	0 72	0.27	0 10
CaO	8.75	4.85	2.53	1 78	0.79
Na_2O	2.46	4.06	2.90	2 72	2 62
K_2O	0.98	1.52	3.35	3 61	3.94
P_2O_5	0 33	0 66	0.32	0.13	0.06
L O I.	2.60	1.60	0.96	1.03	0.71
Total	99 21	99 53	99 07	99.74	99.95
Cr	58	55	52	15	12
Ni	81	50	34	6	17
Cu	42	12	12	3	6
Co	61	15	5	2	7
Rb	36	55	109	144	181
Sr	346	243	226	101	40
Ba	510	287	1095	969	610
Li	39	20	16	11	8
Zn	89	82	81	83	67

Index to samples: 1—Basalt; 2—Andesite; 3—Dacite; 4—Rhyodacite; 5-Rhyolite

in western and southwestern Rajasthan. The rocks of Malani Volcanic suite range in composition from basic to acidic and among the various rock types, the exposures of rhyolite are most dominant.

The Malani Volcanics exposed around the Gurapratap Singh and Diri villages (latitude 25° 35′–25° 40′ N and longitude 73°–73° 10′ E) is represented by basalt, andesite, dacite, rhyodacite and rhyolites. The average chemical data of various rock types (table 1) reveal a systematic variation in major and trace elements' content with an increase in SiO_2. The pronounced linearity in the trends obtained by variation diagrams, linear regression analysis and principal component analysis[1] demonstrate the close geochemical relationship among these rocks and supports the hypothesis of crystallization differentiation.

The mixing line calculations[2] of the present suite of rocks also show the operativeness of fractional crystallization process in the evolution of these rocks. The data on the mean square reduced residuals (MSRR) and the partial samplewise MSRR reveal a very good linear fit for the suite of the samples as the MSRR value is much below unity. Thus it can be concluded that the present rocks define a straight evolution line in R^n composition space (where n is the number of components) and the differentiation process involved is a simple two-pole mixing process.

The author is grateful to Dr R. K. Srivastava and Dr (Mrs.) R. Upadhaya for their valuable guidance. Financial assistance from UGC, New Delhi is also acknowledged.

24 October 1986, Revised 13 January 1987

1. Le Maitre, R. W., *J. Petrol.*, 1968, **9,** 220.
2. Provost, A. and Allegre, C. J., *Geochim. Cosmochim. Acta*, 1979, **43,** 487.

EFFECT OF PESTICIDE FORMULATION SOLVENT ON ISOMALATHION FORMATION IN MALATHION SOLUTIONS

V. IYER and B. S. PARMAR
Division of Agricultural Chemicals, Indian Agricultural Research Institute, New Delhi 110 012, India.

It was earlier reported[1] that the 1976 epidemic malathion poisoning in Pakistan from handling of its water dispersible powder was due to the formation

of its S-methyl isomer [Syn. isomalathion; O, S-dimethyl-S-(1,2-dicarboethoxy) ethyl phosphorodithioate] existing in various malathion products[1–4]. This subject has created widespread interest[3–6] and has been recently reviewed[7]. Subsequently, attention was only focussed on the solid malathion formulations. However, information on the isomalathion content of liquid preparations is lacking. It was therefore considered worthwhile to ascertain the effect of the common pesticide formulation solvents on the isomalathion content of the liquid products.

Technical malathion (96.68%) and its 50% W/W solutions in purified commercial grade aromex (a mixture of aliphatic and aromatic hydrocarbons), cyclohexanone and xylene [purified by eluting on silicagel column (30 g, MeOH washed and activated at 80–90°C, 2 hr) with cyclohexane containing 0.75% isopropanol; 50 ml in the case of aromex and 150 ml in the case of cyclohexanone and xylene; yield 92–97% of purer solvents] were incubated in stoppered glass bottles at 55 ± 1°C for 12 days. Samples (1 g malathion equiv.) taken at the start and after 1,3,6,9 and 12 days of incubation, were eluted through 5 g silica gel glass columns (i.d. 12 mm) with 70 ml cyclohexane containing 0.75% isopropanol and the eluate rejected. Subsequently, each column was washed with 30 ml isopropanol, the eluate collected, a pinch of anhydrous Na_2SO_4 added, filtered through Whatman No. 42 filter paper, isopropanol removed under reduced pressure at 50–55°C, the residue taken in isooctane containing 10% isopropanol (isomalathion recovery around 90%) and analyzed by HPLC [Spectra Physics 8000B, Lichosorb Si-100 (10 μm) stainless steel column (25 cm × 2.5 mm i.d.), loop injector and UV detector set at 225 nm] employing isooctane containing 5% isopropanol as mobile phase at 1.5 ml/min and sensitivity 0.16 aufs. The analysis parameters were adjusted based on various runs with reference to malathion and isomalathion and the isomalathion content of the samples was calculated employing a microprocessor-controlled data system.

The results revealed a maximum isomalathion content of 0.035% in different solutions. It was not only far below the permitted 1.8% level[4,5] but also for most part of the study, was below the level found in technical malathion (0.023–0.032%). The lower values of isomalathion obtained in this investigation suggest that it undergoes transformation to other products, as reported in earlier studies[6]. With the solid malathion formulations it has been reported that the employed carrier and the storage temperature and period etc influenced their isomalathion content[6]. These parameters played a subdued role in transforming malathion into isomalathion in solutions. Apparently, the liquid formulations offer a safer alternative to the solid malathion products.

The authors thank Dr J. W. Miles, Centre for Disease Control, Atlanta, Georgia, U.S.A. and M/s Hindustan Insecticides Ltd. Rasayani-410207 for providing a reference sample of isomalathion and technical malathion respectively and to Dr R. Khazanchi, IARI, New Delhi for help in the HPLC analysis.

20 October 1986; Revised 24 December 1986

1. Baker, E. L., Zack, M., Miles, J. W., Alderman, L., Warren, Mc.W., Dobbin, R. D., Miller, S. and Teeters, W. R., *Lancet*, 1978, p. 31.
2. Umetsu, N., Grose, F. H., Allahyari, R., Abu El-Haj, S. and Fukuto, T. R., *J. Agric. Food Chem.*, 1977, **25**, 946.
3. Aldridge, W. N., Miles, J. W., Mount, D. L. and Verschoyle, R. D., *Arch. Toxicol.*, 1979, **42**, 95.
4. Miles, J. W., *23rd Annual Meeting of the CIPAC*, Baltimore, Maryland, USA, 1979.
5. Miles, J. W., Mount, D. L., Straiger, M. A. and Teeters, W. R., *J. Agric. Food Chem.*, 1979, **27**, 421.
6. Halder, A. K. and Parmar, B. S., *J. Pesticide Sci.*, 1984, **9**, 147.
7. Iyer, V. and Parmar, B. S., *Int. J. Trop. Agri.*, 1984, **2**, 199.

FREQUENCY AND EFFECTIVENESS OF *Lr13* IN CONFERRING WHEAT LEAF RUST RESISTANCE IN INDIA

A. K. GUPTA and R. G. SAINI
Department of Genetics, Punjab Agricultural University, Ludhiana 141 004, India.

MANY leaf rust resistant wheats in Australia, Canada and Mexico are reported to carry *Lr13*, the gene which confers adult plant resistance to many leaf rust races[1,2]. In India, some *Lr13*-bearing wheats have been resistant to leaf rust since the last 15 years[3]. However, some wheats like WL711 and Inia-66 are highly susceptible while Manitou, HD2009, Swati, VL421 and HD2329 have shown