

## Dissipation of Monocrotophos From Mung Bean Under Arid Conditions

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**Abstract** Residues following application of 0.04 and 0.06 per cent monocrotophos on mung bean [*Vigna radiata* (L) wilczek] crop were estimated for two consecutive seasons at Jodhpur through bioassay method. The insecticide was found persisting upto three weeks in leaves, while in pods, it lasted for two weeks. Waiting periods of 8 and 7 days were estimated for foliage for higher and lower concentrations, respectively. On pods, the waiting periods were found to be 7 days for higher concentration and 6 days for the lower one. No residues were detected in the grains at harvest.

**Key words** Monocrotophos, mung bean, residues

Monocrotophos has been found to be effective against the insect pests of mung bean [*Vigna radiata* (L) Wilczek] (Yadav *et al.* 1979, Lal 1985). Dissipation of this insecticide from mung bean has been studied by Vyas (1977), Vyas *et al.* (1979), Dikshit (1986) and Verma (1986). No information is available about the dissipation of monocrotophos from mung bean under arid conditions, and therefore, the present study was undertaken.

### Materials and Methods

Mung bean [*Vigna radiata* (L) Wilczek] variety S-8 was sown in randomized block design in 3 x 3 m plots with 30 cm row to row and 10 cm plant to plant distance, following the recommended package of practices, for two consecutive *kharif* seasons in 1985 and 1986. First spray of 0.04 and 0.06 per cent concentrations was applied to the crop four weeks after germination, and the second, two weeks after the first one. Samples were drawn randomly at 0, 1, 3, 5, 7, 10, 14, 21 and 28 days after each spray.

Leaf and pod samples were extracted in chloroform, using 3 ml g<sup>-1</sup> of leaf; and 4 ml g<sup>-1</sup> of pods and grains. The cleaned extracts were analysed through bioassay, using *Musca domestica* as test insect. The culture of flies was raised following the method suggested by Gera & Gupta (1974). The flies were exposed to extracts using dry film technique. Mortality counts were made

after 24 hours, considering moribund flies as dead. The mortality data were used to get regression equations through probit calculations (Finney 1971). Recovery of insecticides from extracts was determined by fortifying the control samples with known amount of technical insecticide. Recovery ratios thus obtained (1.16 and 1.118 for leaves; 1.174 and 1.25 for pods; and 1.245 and 1.336 for grains in 1985 and 1986, respectively) were used as correction factors for calculating the actual residues.

### Results and Discussion

The first spray of 0.04 per cent monocrotophos on mung bean in the 1985 crop resulted in a deposit of 22.52 ppm on leaves, which got dissipated to 0.19 ppm after three weeks time, registering 99.2 per cent reduction. In 6.8 days, the deposit reached below the maximum permissible limit of 5 ppm. The deposit of 29.7 ppm from first spray of 0.06 per cent monocrotophos was reduced to 0.2 ppm after 21 days, undergoing 99.3 per cent reduction, while reaching below MRL in 7.7 days (Table 1). The deposit recorded, after the second spray of 0.04 per cent monocrotophos in 1985, was reduced from 24.31 ppm to 0.06 ppm, undergoing 99.7 per cent reduction after three weeks. The residues reached below tolerance limit in 5.9 days. The second spray of 0.06 per cent monocrotophos left a deposit of 29.7 ppm on leaves in 1985, which dissipated by 99.7 per cent to 0.76 ppm,

Table 1 Residues of monocrotophos in mung bean leaves-first trial (1985)

Days after treatment	Residue (ppm)			
	I spray		I + II spray	
	0.04%	0.06%	0.04%	0.06%
0	22.52	29.70 -	24.31 -	29.70 -
1	14.85(34.1)	18.04(39.3)	15.52(36.1)	18.04(39.3)
3	8.13(63.9)	9.02(69.6)	8.39(65.5)	9.02(69.6)
5	4.85(78.5)	5.78(80.6)	4.97(79.6)	5.32(82.1)
7	3.00(86.7)	2.89(90.3)	2.71(88.9)	3.01(89.9)
10	1.64(92.7)	1.62(94.6)	1.62(93.3)	1.62(94.6)
14	0.83(96.3)	0.83(97.2)	0.76(96.9)	0.83(97.2)
21	0.19(99.2)	0.20(99.3)	0.06(99.7)	0.08(99.7)
28	BDL (100)	BDL(100)		
RE	1.3526 - 0.0958x	1.4727 - 0.0999x	1.3858 - 0.1159x	1.4727 - 0.1157x
t <sub>1/2</sub>	3.1	3.0	2.6	2.6
t <sub>tol</sub>	6.8	7.8	5.9	6.7

(Values within parentheses represent percent reduction of initial deposit)

BDL : below detectable level

RE : Regression Equation

in three weeks, reducing to tolerance limit in 6.7 days (Table 1).

In 1986, the first spray of 0.04 per cent monocrotophos left a deposit of 20.38 ppm on leaves, which was reduced to 0.11 ppm in three weeks, reaching below tolerance level in 6.1 days. The first spray of 0.06 per cent monocrotophos imparted an initial deposit of 28.24 ppm to mung

bean leaves, which was degraded by 99.8 per cent to 0.07 ppm in three week's time, attaining safety level after 6.4 days (Table 2).

The cumulative deposit, after second spray of 0.04 per cent monocrotophos on the 1986 crop, was 22.45 ppm, which dissipated by 99.8 per cent to 0.04 ppm after 21 days, crossing below the safety level in 5.4 days. From the

Table 2 Residues of monocrotophos in mung bean leaves-second trial (1986)

Days after treatment	Residue (ppm)			
	I spray		I + II spray	
	0.04%	0.06%	0.04%	0.06%
0	20.38 -	28.24 -	22.45 -	31.13 -
1	12.67 (37.8)	17.97 (36.4)	14.12 (37.1)	20.38 (34.5)
3	7.51 (63.2)	11.23 (60.3)	8.37 (62.7)	11.72 (62.4)
5	3.92 (80.8)	5.05 (82.1)	5.05 (77.5)	5.41 (82.6)
7	3.06 (85.0)	2.78 (90.2)	3.28 (85.4)	2.89 (90.7)
10	1.80 (91.2)	1.64 (94.2)	1.52 (93.2)	1.68 (94.6)
14	0.96 (95.3)	0.93 (96.7)	0.80 (96.5)	0.72 (97.7)
21	0.11 (99.5)	0.07 (99.8)	0.04 (99.8)	0.05 (99.8)
28	BDL (100)	BDL (100)	-	-
RE	1.3092 - 0.0998x	1.4509 - 0.1169x	1.3512 - 0.1219x	1.4932 - 0.1254x
t <sub>1/2</sub>	3.0	2.6	2.5	2.4
t <sub>tol</sub>	6.1	6.4	5.4	6.3

higher concentration, the deposit of 31.13 ppm degraded to 0.05 ppm in 21 days, registering 99.8 per cent dissipation, reaching below tolerance limit in 6.3 days (Table 2).

The deposits from the second spray have been reported to be less from those of the first spray in mung bean by Vyas *et al.* (1979) and Verma (1986). In the present investigation, however, a marginal increase in the deposits from second spray was observed. This may have been due to the cumulative effect of the residues of first spray which persisted beyond two weeks, that being the time interval between the two sprays.

The half-life figures presented in Tables 1 and 2, being less than 3.2 days, indicated dissipation of 50 per cent of the residues within this period. The low half-life values ( $t_{1/2}$ ) represent faster dissipation of residues under arid conditions of western Rajasthan characterised by high temperature and low humidity.

The  $t_{to1}$  values in Tables 1 and 2, which represent the time required by the residues to reach below the maximum permissible limit or the tolerance limit, indicated that a safety period of 8 days was sufficient for either concentration

applied. Vyas (1977) suggested a waiting period of 10 to 15 days, for the residues of 0.04 per cent monocrotophos spray on mung bean. Verma (1986) suggested a waiting period of 9 days for the summer crop of mung bean. Under arid conditions of western Rajasthan, the dissipation being faster, the safety period of 8 days appeared sufficient for the treated foliage of short duration variety like S-8.

The residues of monocrotophos in pods were detected in the samples collected after two weeks of first spray on foliage applied before pod formation, during both the experimental seasons. The residues were found to be 0.08 ppm from 0.04 per cent spray, and 0.09 ppm from 0.06 per cent spray in 1985 (Table 3), while residues of 0.1 ppm and 0.14 ppm, respectively, were detected in the pods in 1986, after the first spray.

An initial deposit of 2.57 ppm was recorded on pods in 1985 after the second spray of 0.04 per cent monocrotophos on mung bean. It was degraded by 82.8 per cent to 0.44 ppm in 10 days, reducing to half in about 4 days and reaching below tolerance limit after 5.4 days. The deposit from 0.06 per cent spray was 3.2 ppm, which dissipated to 0.28 ppm in two weeks, undergoing

Table 3 Residues of monocrotophos in mung bean pods

Days after treatment	Residue (ppm)			
	First trial		Second trial	
	0.04%	0.06%	0.04%	0.06%
	<b>I spray</b>			
14	0.08	0.09	0.10	0.14
21	BDL	BDL	BDL	BDL
	<b>I + II spray</b>			
0	2.57 —	3.20 —	2.63 —	3.00 —
1	2.21(14.1)	2.57(19.8)	1.76(33.1)	2.43(189)
3	1.91(25.6)	2.21(31.1)	1.46(44.6)	1.83(39.1)
5	1.24(51.8)	1.80(43.8)	1.42(46.2)	1.07(64.4)
7	0.86(66.7)	1.46(54.5)	0.78(70.5)	0.93(68.9)
10	0.44(82.8)	0.74(76.8)	0.35(866)	0.65(78.4)
14	BDL(100)	0.28(91.4)	0.03(99.0)	0.09(96.9)
21	BDL(100)	BDL(100)	BDL(100)	BDL(100)
RE	0.4096 — 0.0761x	0.5054 — 0.0721x	0.4205 — 0.1277x	0.4768 — 0.0971x
$t_{1/2}$	4.0	4.2	2.4	3.1
$t_{to1}$	5.4	7.0	3.3	4.9

91.4 per cent reduction. The residues reached below tolerance level in 7 days (Table 3). The following year, the deposits from second spray of 0.04 and 0.06 per cent concentrations were 2.63 and 3 ppm, respectively, which were degraded by 99 and 96.9 per cent to 0.03 and 0.09 ppm, respectively. These deposits reached below tolerance level in 3.3 and 4.9 days, while reducing to half in 2.4 and 3.1 days, respectively (Table 3).

The residues of first spray, appearing in the pods after two weeks, indicated translocation of the toxicant from leaves and other parts to the pods, as the spray was done prior to pod formation. Monocrotophos being a systemic insecticide, translocation within the plant is a usual phenomenon. However, the residues of the first spray were lost soon after and could not be detected in pod samples collected a week later, i.e., 21 days after the first spray.

Low half-life values indicated faster degradation of the insecticide from the pods too (Table 3). Dikshit (1986) reported a half-life of 8.5 days, while Verma (1986) found the deposits of 0.04 per cent monocrotophos to have a half-life of 6.6 days. In the present investigation the half-life of the higher concentration was 4.2 days, the value for 0.04 per cent concentration being still lower. This may have been afforded by the dry and warm conditions of the arid zone.

Considering 1 ppm as the maximum residue limit for monocrotophos on pods, the  $t_{01}$  data in Table 3 indicate a waiting period of 6 days for the lower concentration and 7 days for the higher one. Dikshit (1986) suggested a waiting period of 25 days, taking 0.2 ppm to be the tolerance limit. Verma (1986) found a period of 16 days to be safe for consumption of mung bean pods treated with 0.04 per cent monocrotophos. The waiting periods estimated in the present investigation were low principally, because of the

low level of the initial deposits on comparatively younger pods, and also because of the faster dissipation under warm and dry conditions.

No detectable residues from either concentration of monocrotophos were found in the grains of mung bean at harvest time during both the experimental seasons. It may be presumed, that monocrotophos could be applied to short duration mung bean variety like S-8 even at pod formation stage, to control the pests.

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