

Study on Toxicity of Aerial Spray of Quinalphos on Livestock and Poultry

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Quinalphos (Ekalux EC 25) was diluted to 4.4% (1.1% a. i.) and sprayed aerially on cotton fields affected with pests. Simultaneously, for toxicological evaluation of the product, cattle, goats and birds were placed in the field during spraying and directly exposed to the spray. The plasma cholinesterase enzyme estimation and haematological studies were conducted in these animals and birds at pre-exposure, 24 hours and 48 hours post-exposure time. Quinalphos did not produce any toxic symptoms or any toxicity indicative deviations in the plasma cholinesterase levels or haematological parameters.

Among the modern insecticides organophosphate group is being used very extensively for the protection of various crops from various pests. The organophosphorus pesticides possess higher biological efficacy and less persistency. Quinalphos (Ekalux EC 25) is a wide spectrum organophosphorus insecticide and has good penetrating properties and quick knock-down action. Whenever extensive cropping areas are to be covered, the pesticides are applied on the crops from air using helicopters or fixed-wing aircrafts. During the aerial spraying operations, the human population, domestic animals and birds in the fields may be accidentally exposed and hence may be affected by the pesticides used in such sprays.

A Special Committee appointed by the I.C.A.R. (Anon, 1967) on "Harmful Effects of Pesticides" has given in its

reports certain guidelines regarding the current methods for the control hazards from the pesticides. The Government of India also has promulgated the "Insecticides Act" in 1968, making it mandatory for all pesticide manufacturers to submit information on toxicological evaluation of their products for the purpose of aerial application before it is permitted to be used on large scale.

The toxicological evaluation of aerial spray of Ekalux EC 25 was carried out in cattle, goats and poultry under Indian field conditions at Phaltan in Maharashtra State.

MATERIALS AND METHODS

i) Selection of animals and birds: The cattle and goats were selected from the local farms in the village. White leghorn birds were

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brought from the poultry farm, Poona. The experimental groups were consisting of 4 adult cattle (2 males and 2 females) of nondescript breed, 4 goats (2 males and 2 females) of nondescript breed and 5 white leghorn birds. The experimental animals were numbered on the horns with oil paint and the birds were numbered with leg bands. All the animals and birds were examined for general health and were found apparently normal. The experimental group was given adequate food and water throughout the pre-exposure and post-exposure period. The animals and birds under study were placed in the cotton field which was to receive aerial spray of quinalphos and were subsequently transferred to the respective farms.

ii) **Pesticide spray:** The pesticide formulation Ekalux EC 25 was applied at the rate of 400 ml of formulation per acre diluted with water to form 9 litres (i.e., 4.4% of formulation or 1.1% of a.i.). Cotton field of 20 acres was sprayed aeriaily. The field was free from trees and bushes. The experimental group was placed in the cotton field (animals tied and birds in open baskets with legs tied) at the time of aerial spray. The helicopter flew at the height of 1.5 to 2 metres above the crop. The wind velocity was 5.67 KPH and the helicopter flew at a speed of 75 to 80 km/hour. The pressure of the spray was 45 PSI through Tee-Jet 4 type of nozzle. The atmospheric temperature was 25 C.

iii) **Collection of material:** The blood samples (4-5 ml) in case of

cattle and goats were collected from the jugular vein in the heparinised test tubes using 20G needles. The wing vein or jugular vein was used in the case of poultry for blood collection with 22 G needle. The blood samples were collected before exposure to spray and at 24 and 48 hours after exposure.

iv) **Toxicological investigations:**

a) **Toxic effects:** The animals and birds were observed for toxic effects, if any, in respect of food intake, behaviour, salivary secretion, faecal consistency, etc.

b) **Plasma cholinesterase enzyme activity:** The cholinesterase enzyme activity in plasma was estimated by pH method of Michel (1949). The cholinesterase activity was expressed as Δ pH/hour (delta pH/hour) which is based on enzymatic hydrolysis and change in pH due to acetic acid produced.

c) **Haematological studies:** Total red blood corpuscles (RBC), white blood corpuscles (WBC) and packed cell volume (PVC; Wintrobe method) were studied on blood samples of the cattle only.

OBSERVATIONS AND RESULTS

a) **Toxic effects:** The cattle, goats and birds under study did not show any toxicity symptoms upto 48 hours post exposure period. The food intake, behaviour, etc., were apparently unchanged.

TABLE I. Field Trials with Quinalphos

Plasma cholinesterase activity in cattle, goats and poultry exposed to aerial spray of Ekalux EC 25
(Figures are for the mean values with \pm standard deviation)

Species	Plasma cholinesterase activity (Δ pH/hour)		
	Pre-exposure	24 hours post-exposure	48 hours post-exposure
Cattle (4)	36.10 \pm 3.68	37.80 \pm 1.75	38.10 \pm 3.30
Goats (4)	37.10 \pm 1.93	36.20 \pm 5.77	38.90 \pm 3.19
Poultry (4)	44.00 \pm 4.40	43.50 \pm 9.50	44.20 \pm 3.68

b) Plasma cholinesterase activity (Table I): Plasma cholinesterase enzyme activity at pre-exposure and 24 and 48 hours post-exposure were within normal limits and not indicative of any toxicity. According to the standards of safety limits the deviations in the cholinesterase enzyme levels were within limits and did not exceed the limits.

c) Haematological studies (Table II): The RBC count and PCV were within normal limits and did not indicate any toxic effect after exposure to the aerial spray.

DISCUSSION

From the observations recorded in this trial with Quinalphos (Ekalux EC25)

aerial spray, it was found that the cattle, goats and poultry exposed to the spray did not show any symptom of organophosphate toxicity indicated by parasympathetic stimulation such as salivation, running nose, sweating, abdominal pain, micturition and diarrhoea, contraction of pupil (pin-point pupil), CNS effects, muscular weakness, cramps, twitching of skeletal muscles etc., during the period of observation.

Plasma cholinesterase activity studies (Table I), 24 hours post-exposure showed slight inhibition of the enzyme in goats and poultry only, whereas 48 hours post-exposure studies indicated quick recovery to normal levels of the enzyme in all species of the animals. The individual plasma

TABLE II. Field trials with Quinalphos
Haematology in cattle exposed to aerial spray of Quinalphos
(Figures are for the mean values with \pm standard deviation)

Blood samples	PCV %	RBC $\times 10^6$ /cu. mm	WBC $\times 10^3$ /cu. mm
Pre-exposure	27.50 \pm 3.9	6.06 \pm 0.66	12.92 \pm 1.63
24 hours post-exposure	29.00 \pm 2.53	5.25 \pm 0.83	14.55 \pm 3.07
48 hours post-exposure	28.50 \pm 3.85	5.13 \pm 0.36	12.20 \pm 1.63

cholinesterase level did not exceed the limit prescribed by the International Standards (20-25% depression).

The haematological studies carried out in cattle (Table II) also showed variations within normal limits and were not indicative of any toxicity of Quinalphos. It can be concluded from the above that Quinalphos when sprayed aerially in the above prescribed concentration for the protection of crops, will not induce any toxic effect in farm animals and poultry and is quite safe for use.

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