UPDATA OF ETHYL FORMATE ON NEW FORMULATION AND FIELD TRIALS IN AUSTRALIA

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Introduction

1. A new ethyl formate formulation - VAPORMATE® (ETHYL FORMATE+CO_2)

Laboratory studies – Greg/Kath

Seed store disinfestations trials with VAPORMATE®

In December 2002, a semi sealed seed store (260m^3 capacity), 30% loaded with newly harvested seeds of barley, wheat and sorghum, was treated with VAPORMATE® (ethyl formate+CO_2). In total, 40 kg of VAPORMATE® containing 6.85 kg of ethyl formate was applied in four doses (within 8 hours) to achieve a relevantly constant ethyl formate concentration of about 16-26g/m^3 for slightly more than two days (Figure 2). Two hours after application the ethyl formate was evenly distributed through out the seed store space and had penetrated into seed bags. All tested mixture aged insects such as *Callosobruchus phaseoli, Tribolium castaneum, Rhyzopertha dominica* and *Bruchus Pisorum* were controlled, but egg stage of *Sitophilus oryzae* (Table 1). During the fumigation period, the concentrations of ethyl formate in the adjacent stores and 1m and 3m from the front door of fumigated store were 5-25ppm lower than that TLV of 100ppm. Ethyl formate residues declined to natural of fumigation in sealed conditions. VAPORMATE® had no effect on the germination of the stored seeds.

The results indicate that VAPORMATE® is a highly effective formulation of ethyl formate for seed store disinfection, as its fast application, evenly distribution in the space and seed bags, and has no effect of germination and working environment

2. Field trials on the application of liquid ethyl formate to on-farm storage
Recently, SGRL has conducted several successful trials with ethyl formate on wheat (Harden, NSW), sorghum (milo) (Warwick, QLD) and split faba beans (Two Wells, SA) in unsealed farm bins. The liquid ethyl formate was applied as a pulsed, or double dose, to the top of the grain through a PVC probe (ϕ 4cm $\times$ 1.2m). This method of application was chosen to: maintain ethyl formate concentrations below the flamability level; reduce vapourisation and maintain an effective concentration of ethyl formate for >10 hours; and avoid liquid ethyl formate accumulating at the bottom of the bin. With wheat, the

concentration of ethyl formate was maintained at effective levels for about 2 days, all insects at all stages were killed rapidly (Table 2), and after another 3-5 days, the residues were reduced to natural levels without aeration. Faba beans sorbed ethyl formate strongly and the residues persisted longer, but full control was achieved. Control was high but not not 100% in the sorghum trials. Residues in the sorghum at 10ºC persisted significantly longer than at 20ºC. During application and fumigation, the levels of ethyl formate in the working environmental did not exceed the worker safety level of 100 ppm (TLV). Field trials have shown that ethyl formate has good potential as a fumigant in unsealed farm bins. Unlike phosphine, which takes days to kill insects, ethyl formate kills rapidly. Residues can be reduced to natural levels without aeration. It also has the added advantage of degrading to non-poisonous and naturally-occurring products (formic acid and ethanol).

Acknowledgements

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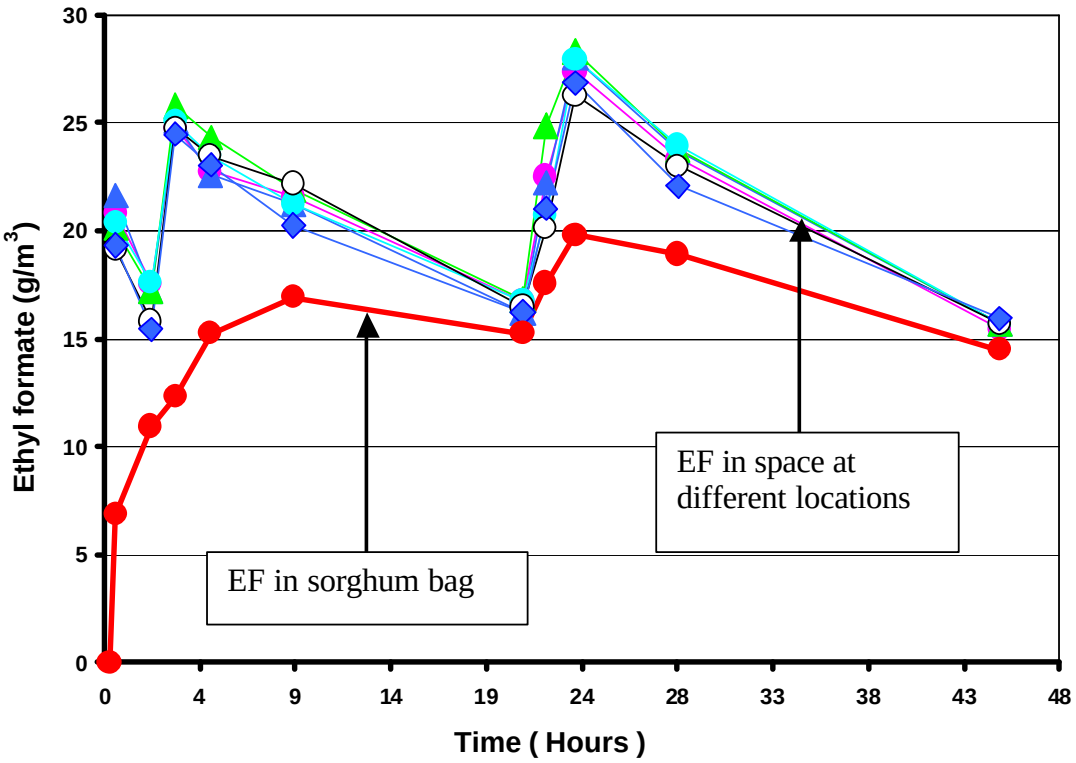

Figure 2. The concentration of ethyl formate at different locations in seed store and inside seed bag.

Table 1. Insects emerging after treatment with VAPORMATE®.

Strain	Insect	Before fumigation	After fumigation	Further live insects emerging after holding for (days):			
		Live	Live	1 day	7	28	56
QOS301	Sawtooth	124	0	124	0	0	0
QRD569	Lesser grain borer	102	0	102	0	0	0
QRD369	Lesser grain borer	67	0	67	0	0	0
QTC931	Flour beetle	54	0	54	0	0	0
QNCF037	Flat grain beetle	45	0	45	0	0	0
QSO335	Grain weevil	14	0	14	9	5	7
Bruchids	Cow pea weevil	224	0	224	0	0	0

Table 2. Control (%)of insects using ethyl formate in farm bins containing different commodities

	Bin	*Sitophilus oryzae*	*Rhyzopertha dominica*	*Tribolium castaneum*	*Callosobruchus phaseoli*
Wheat	1	100	100	100	-
	2	100	100	100	-
Faba bean	1	100	100	100	100
	2	100	100	100	100
Sorghum	1	84(68-100)	99(97-100)	100	-
	2	96(84-100)	100	100	-