SEED-COATINGS AS CONTROLLED RELEASE FORMULATIONS : evaluation by radioisotopic techniques and yield estimation for the control of the stem nematode in field beans.

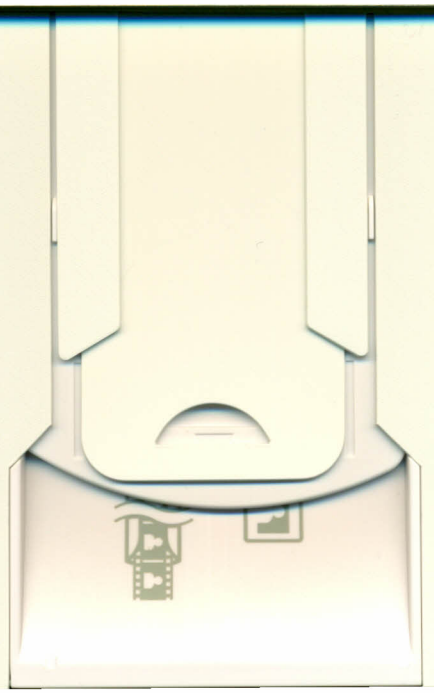
B. C. SCHIFFERS, Ph. DREZE, J. FRASELLE and M.C. GASIA

Chaire de Phytopharmacie and Chaire de Chimie-Physique,
Faculté des Sciences Agronomiques de l'Etat,
B-5800 Gembloux (Belgium).

Systemic insecticides granules applied over seed furrows during sowing prevented much of the damage resulting from insects and nematodes affecting a wide range of crops (sugar beet, corn, onions, peas and field beans) (4,5,6). Granules were found more effective when placed close to the seeds. As the pesticides (aldicarb, carbofuran, oxamyl) in the soil have half-lives of only a few weeks, results obtained were often better when granules were applied several times. However, this practice greatly increased residues in harvested products, often beyond authorized levels (4).

Previous studies (1,2) showed that the incorporation of systemic insecticides in seed-coatings, designed as controlled release formulations, is a combined operation (sowing + treatment) which allows to reduce the dose applied per ha and/or increases efficiency time. Carbofuran incorporated in corn coated-seeds, at the rate of 3 mg active ingredient/seed, reduced markedly the number of wireworms and frit flies attacks. Incorporation in field bean coated seeds of carbofuran or carbosulfan at the rate of 3 mg a.i./seed reduces up to 90% stem nematode populations in plants. As might be expected for a systemic pesticide incorporated to the soil, carbofuran has no effect against pollinators and pest's predators or parasites.

Calibrated seeds of field beans were coated by the rolling technique (1,3). By alternative additions of small amounts of water (or sticker), dust and hydrosoluble stickers (polyols) a hard matrix around the seeds can be obtained. Tritiated carbofuran can be homogeneously incorporated to the matrix; binding then occurs between chemical and sticker. Tritiated carbofuran can also be previously incorporated in a resin or encapsulated in a wide range of matrices which are scratched in a suitable dimension, mixed to other pelleting adjuvants and added to the seeds. We call this 'two steps' formulations.



The controlled-release effect of all these formulations has been characterized using radioisotopic techniques. In a laboratory test, carbofuran appeared to be released up to 3 times more slowly from coatings than when formulated as commercial microgranules.

The infestation in field bean plants after the growing season has been appreciated by comparing the number of stem nematode (Ditylenchus dipsaci) found in treated and untreated plants at different dates. Incorporation of carbofuran in an urea-formaldehyde resin formulation provides the best protection against D.dipsaci (95.8% of control 4 months after sowing) and the best yield (+58%). Carbofuran markedly improved yields of treated plots. The size of grains harvested on treated plots and their amount of proteins are significantly higher than for untreated plots.

3 mg of carbofuran per seed correspond to 0.9-1.2 kg a.i./ha according to sowing density. The long persistence of nematicide activity for such a quantity of a.i. is obtained by the slow release of carbofuran from seed-coatings.

Residues of carbofuran in flour of harvested grains, determined by a gas-liquid chromatographic method, were always found below the authorized level (0.50 ppm). They attained 0.38 ppm for plants treated with an urea-formaldehyde formulation. This result illustrates the risk of over prolonging the release period.

REFERENCES

(1) FRASELLE, J., SCHIFFERS, B. (1982)., Meded. Fac. Landbouww. Rijksuniv. Gent **47/2** , 665-673.

(2) SCHIFFERS, B.C., FRASELLE, J. et JAUMIN L. (1985). Meded. Fac. Landbouww. Rijksuniv. Gent **50/3a** , 797-807.

(3) SCHIFFERS, B.C., FRASELLE, J., GASIA M.C. et DREZE Ph.(1985). Symposium on Controlled Release Formulations, Second FAO/IAEA Coordination Meeting, Vienna, **IAEA-SR-114/025**.15 p.

(4) WHITEHEAD, A.G., TITE, D.J. , FRASER, J. E. AND FRENCH, E. M. (1979). Ann. Appl. Biology **93**, 213-220.

(5) WHITEHEAD, A.G.,TITE, D.J. AND FRASER, J.E. (1983). Ann. Appl. Biology **103**, 291-299.

(6) WINDRICH, W.A. (1985). Crop Protection **4** , 458-463.