



Biofumigation by Brassicas materials as a sustainable alternative to the use of chemicals in plant defence

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THE USE IN PLANT DEFENCE OF NATURAL COMPOUNDS WITH A HIGH BIOLOGICAL ACTIVITY PRESENTS SEVERAL ENVIRONMENTAL (RENEWABILITY, BIODEGRADABILITY, POSITIVE CO₂ BALANCE) AND TECHNOLOGICAL ADVANTAGES OF GREAT INTEREST FOR CONVENTIONAL AND ORGANIC AGRICULTURE. IN PARTICULAR, IN THESE LAST TEN YEARS, INTERESTING RESULTS HAD BEEN PROVIDED BY THE ENZYMATIC HYDROLYSIS DERIVED PRODUCTS OF GLUCOSINOLATES (GLS), TYPICAL DEFENSIVE SYSTEM OF THE *BRASSICACEAE* AND OTHER MINOR FAMILIES. THE HIGH BIOCIDAL ACTIVITY OF SOME OF THESE COMPOUNDS, IN FACT, WAS OBSERVED *IN VITRO* AND *IN VIVO* LAB-SCALE TRIALS ON SEVERAL SOIL-BORNE PATHOGENIC FUNGI AND NEMATODES THUS PROMOTING THE DEVELOPMENT OF THE CONCEPT OF "BIOFUMIGATION" AS A LOW ENVIRONMENTAL IMPACT ALTERNATIVE TO CHEMICAL FUMIGANTS FOR LIMITING SOME SOIL BORNE PATHOGEN AND PESTS, IMPROVING SOIL FERTILITY.

BIOFUMIGATION CAN BE REALIZED AMENDING SOIL WITH BRASSICA VEGETABLE MATERIALS, ABLE TO RELEASE THESE BIOCIDAL COMPOUNDS, IN DIFFERENT WAYS:

A) CULTIVATION AND SOIL INCORPORATION OF PLANTS. WITH THIS AIM, SOME NEW GREEN MANURE ECOTYPES WERE RECENTLY SELECTED FOR THEIR ALLYLGLUCOSINOLATE (SINIGRIN) CONTENT. *BRASSICA JUNCEA* SEL. ISCI20 AND ISCI99 SHOWED GOOD RESULTS IN CONTROLLING SOME SOIL BORNE FUNGI (VIZ. *PYTHIUM* SPP. AND *SCLEROTINIA MINOR*). IN ADDITION OTHER ECOTYPES, SELECTED FOR THE ROOT CONTENT OF 4-METHYLTHIOGLUCOSINOLATE (ERUCIN), AS *ERUCA SATIVA* CV. NEMAT, SHOWED A CLEAR NEMATOCIDAL ACTIVITY

AS CATCH CROPS ON *HETERODERASCHACHTII*, THE SUGAR BEET CYST NEMATODE, AND MOREOVER ON *MELOIDOGYNE INCOGNITA*, THE ROOT KNOT NEMATODE.

B) SOIL INCORPORATION OF BIOCIDAL PELLETS BASED ON A PATENTED FORMULATION OF BRASSICA DEFATTED SEED MEALS TO MANAGE THE RELEASE RATE OF ISOTHIOCYANATE AFTER THE WATER ADDITION THAT USUALLY FOLLOW THE INCORPORATION. THESE PELLETS REPRESENT A SORT OF ORGANIC AMENDMENT ABLE TO REDUCE THE DAMAGES OF THE ABOVE REPORTED PATHOGENS AND IN THE SAME TIME TO IMPROVE PHYSICAL AND CHEMICAL SOIL FERTILITY.

THE PRODUCTION OF THESE MATERIAL PERMITS A BIOREFINERY APPROACH FOR THE SIMULTANEOUS PRODUCTION, STARTING FROM *B. CARINATA* SEEDS, OF INDUSTRIAL OIL (FOR THE USE AS BIOLUBRICANT OR IN BIOENERGY PRODUCTION) AND BIOCIDAL PELLETS.

C) LIQUID OIL EMULSIONS BASED ON VEGETABLE OIL WITH THE ADDITION OF SMALL AMOUNTS OF DEFATTED SEED MEALS. THIS OPTION, STUDIED BOTH FOR THE TREATMENT OF PLANT EPIGEAL PARTS AND FOR A DISTRIBUTION BY DRIP IRRIGATION, REPRESENTS AN INNOVATION RECENTLY PATENTED THAT COULD OPEN NEW PERSPECTIVES IN PLANT DEFENCE MANAGEMENT

D) FINALLY, STARTING FROM THE EXPERIMENTAL EVIDENCE OF BOTH *IN VITRO* AND *IN VIVO* TESTS THAT ISOTHIOCYANATES ARE EFFECTIVE IN CONTROLLING IMPORTANT FRUIT PATHOGENS DURING POSTHARVEST PHASE, A PRE-PILOT PLANT HAS BEEN BUILT UP REALIZING LARGE SCALE TRIALS TO CONTROL *MONILINIA LAXA* ON STONE FRUITS AND *PENICILLIUM EXPANSUM* ON PEARS BY BIOFUMIGATION OF FRUIT, BEFORE STORAGE, WITH ALLYLISOTHIOCYANATE PRODUCED IN SITU FROM WETTED DEFATTED MEALS OF *BRASSICA CARINATA*.

ALL THESE BIOFUMIGANT PRODUCTS AND APPLICATIONS WILL BE DESCRIBED AND DISCUSSED BOTH FROM A PRACTICAL AND ANALYTICAL POINT OF VIEW