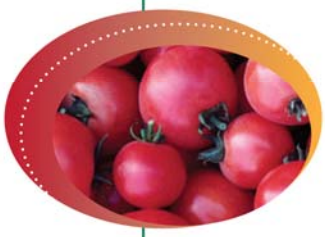
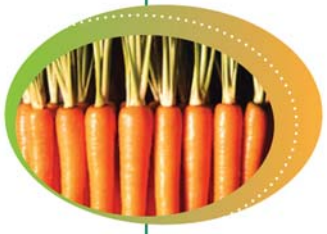
Recueil Bionovation

Édition 2008





Un inventaire des in**novations**
et de la recherche internationales
dans des secteurs ciblés de la production
végétale **bio**logique

CRAAQ

Centre de référence en agriculture
et agroalimentaire du Québec

Ce recueil s'adresse aux conseillers et aux chercheurs œuvrant dans le secteur de la production végétale biologique. Il permet, entre autres, d'effectuer un survol rapide de la recherche et de l'innovation récemment effectuées en production végétale biologique située hors Québec.

Cet outil se présente sous forme de fiches-référence complètes, lesquelles sont classées par ordre alphabétique d'auteur. Il contient en outre des tableaux récapitulatifs qui facilitent la consultation. En un coup d'œil, il est possible de sélectionner les éléments d'intérêt et d'accéder à la fiche-référence en naviguant avec la main active tout en utilisant les hyperliens. Chaque fiche présente un résumé de l'information disponible et des références bibliographiques. Elle indique aussi la disponibilité et le coût d'accès à l'information intégrale, s'il y a lieu. De plus, un lien vers la source Internet permet l'accès en un simple clic.

L'information traitée s'articule autour des priorités suivantes :

- Le traitement des semences;
- Les ravageurs spécifiques dans les petits fruits et les légumes de champ (altises, anthonome du fraisier, cécidomyie du chou-fleur, chrysomèle rayée du concombre, mouche du chou et de la carotte, pucerons dans la laitue, punaise terne dans la fraise);
- Les maladies bactériennes et cryptogamiques (blanc et moisissure grise chez le fraisier, tache, brûlure et flétrissure chez la tomate) et les solutions de rechange au cuivre utilisé pour le traitement de maladies en horticulture (en excluant la viticulture).

Des liens Internet utiles et des références sont présentés en annexe. Ceux-ci permettent d'accéder à de l'information complémentaire et de découvrir d'autres sources de renseignements. Bien que ce projet s'intéresse spécifiquement à la recherche et à l'innovation en production végétale biologique située hors Québec, nous avons cru bon d'y ajouter quelques liens québécois qui nous apparaissent incontournables.

En terminant, l'information a été recueillie au cours d'une veille technologique effectuée en début d'année 2008. Le comité consultatif, formé d'intervenants du milieu, a émis les recommandations de priorités pour cette veille et a orienté, en plusieurs étapes, le développement du projet. Les priorités identifiées, sans représenter les seuls besoins pour les différents secteurs de production, constituent certaines des problématiques majeures reconnues par le milieu et maintes fois soulignées[1].

[1] Voir le document « Priorités de recherche, d'adaptation et de transfert technologique en agriculture biologique », CRAAQ et intervenants du milieu, 2006.

Avertissements

Les recherches scientifiques répertoriées dans ce recueil ont été compilées à partir de la littérature disponible et des sites Internet des organismes concernés. Le classement proposé a pour but de faciliter la consultation.

L'information et les coordonnées des organismes se veulent les plus exactes possible, mais sont publiées sous réserve de modifications qui auraient pu survenir depuis la rédaction de ce document. Leur utilisation demeure sous l'entière responsabilité du lecteur.

Ce document a été réalisé dans le cadre du programme *Initiative d'appui aux conseillers agricoles*, selon les termes de l'entente Canada-Québec sur le Renouveau du Cadre stratégique agricole.

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Canada

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1-TRAITEMENTS PHYSIQUES

1.1-Fines herbes et maraîcher

Traitement	Culture	Maladie (Pathogène)	Auteurs
Eau chaude, air chaud, électrons	Carotte	Bactériose (*Xanthomonas* spp)	Roberts et *al*., 2006
Eau chaude, air chaud, électrons	Carotte, chou, céleri, persil, laitue	Alternariose (*Alternaria* spp) Bactériose (*Phoma, Pseudomonas syringae* spp) Verticilliose (*Verticillium* spp) Septoriose (*Septoria* spp)	Jahn et *al*., 2006
Eau chaude (40-55°C; 10-30 min)	Carotte, chou, céleri, persil, laitue	Alternariose (*Alternaria* spp) Bactériose (*Xanthomonas* spp) Mildiou (*Peronospora valerianella*) Septoriose (*Septoria* spp)	Nega et *al*., 2003
Rayonnement lumineux (rouge-rouge lointain)	Légumes, cultures ornementales	Augmente et accélère la germination	(*) Vasilenko et Carrier, 2004
Eau chaude, air chaud, électrons (+ huile de thym et effet sur germination)	Persil	Septoriose (*Septoria petroselini*)	Amein et *al*., 2006
Eau chaude, électrons, vapeur avec « vacuum » (+ approche de régie)	Persil, carvi, coriandre, fenouil	Alternariose (*Alternaria radicina*) Bactériose (*Pseudomonas syringae* spp) Cercosporose (*Mycocentrospora, Mycosphaerella* spp) Verticilliose (*Verticillium* spp)	Blum et *al*., 2006

1.2-Grandes cultures (céréales)

Traitement	Culture	Maladie (Pathogène)	Auteurs
Thermothérapie (air chaud humide)	Blé, autres	Carie (*Tilletia tritici*) Autre	Forsberg, 2004
Vapeur et ultrasons	Blé, épeautre	Carie (*Tilletia tritici*)	Borgen et *al*., 2005
Eau chaude + Utilisation de substances organiques et contrôle biologique	Blé, orge	Tache et fonte des semis (*Bipolaris sorokiniana*) *Fusarium* spp.	(*) Batura et *al*., 2004
Air chaud (50°- 70°C x 14 jours)	Blé, orge	Tache (*Cochliobolus sativus*) Rayure réticulée (*Pyrenophora* spp)	Clear et *al*., 2002
Eau chaude (45°et 55°C) + Utilisation de l'acide acétique	Orge	Charbon nu (*Ustilago nuda*) Rayure réticulée (*Pyrenophora* sp)	Nielsen et *al*., 2000

2-SUBSTANCES NATURELLES OU COMPOSÉS COMMERCIAUX

2.1-Fines herbes et maraîcher

Traitement	Culture	Maladie (Pathogène)	Auteurs
Acide lactique concentré	Carotte	Alternariose (*Alternaria dauci*)	Heller, 2002
Vinaigre, oligo-éléments, cannelle, huiles essentielles	Carotte	Alternariose (*Alternaria dauci*)	Lizot et *al*., 2002
Huile de thym (BioZell2000B)	Fenouil, carvi	Bactériose (*Pseudomonas syringae* spp) Verticilliose (*Verticillium dahliae*)	Blum et *al*., 2006
Acides organiques (jasmonique, salicylique, lactique); Composés commerciaux; Huiles essentielles (trèfle, origan, thym)	Légumes	Alternariose (*Alternaria dauci*) Anthracnose (*Colletotrichum* sp) Bactériose (*X. campestris*, *Clavibacter* sp)	(*) Schmitt et *al*., 2004
Huile de thym (comparaison avec Thiram et traitements physiques)	Persil	Septoriose (*Septoria petroselini*)	Amein et *al*., 2006
Solution de nitrite de sodium, extrait de moutarde	Tomate	Mycose-Chancre du collet (*Didymella lycopersici*)	Kasselaki et *al*., 2007

2.2-Grandes cultures (céréales)

Traitement	Culture	Maladie (Pathogène)	Auteurs
Plusieurs extraits de plantes	Général	*Fusarium* sp. Moisissure rose (*Microdochium nivale*)	(*) Kuhn et *al*., 2004
Vinaigre	Blé	Carie (*Tilletia tritici*) Rayure réticulée (*Pyrenophora* sp)	Borgen et Nielsen, 2001
Chaux et poudre de basalte, chitosan, extrait de graines de pamplemousse	Blé, orge	Tache et fonte des semis (*Bipolaris sorokiniana*) *Fusarium* spp	(*) Batura et *al*., 2004
Poudre de moutarde, acide acétique	Blé, orge, seigle	Charbon du seigle (*Urocystis occulta*) Charbon nu (*Ustilago* spp) Carie (*Tilletia* spp) Rayure réticulée (*Pyrenophora* sp)	Borgen et Kristensen, 2000
Vitamines	Millet perlé	Mycoses (Mildiou) Augmente la croissance	Pushpalatha et *al*., 2007
Acide acétique	Orge	Charbon nu (*Ustilago nuda*) Rayure réticulée (*Pyrenophora* sp)	Nielsen et *al*., 2000

3-TRAITEMENTS PAR CONTRÔLE BIOLOGIQUE

3.1-Fines herbes et maraîcher

Traitement	Culture	Maladie (Pathogène)	Auteurs
Clonostachys	Carotte	Alternariose (*Alternaria* spp)	(*) Van der Bulk et *al*., 2004
Trichoderma harzianum, *Streptomyces griseovirides*	Carotte	Alternariose (*Alternaria dauci*)	Hermansen et *al*., 1999
Clonostachys rosea	Carotte	Alternariose (*Alternaria* spp)	Jensen et *al*., 2004
Souches commerciales (*Streptomyces* sp., *Pseudomonas chlororaphis*) et souches expérimentales non identifiées	Chou	Alternariose (*Alternaria* spp)	Amein et *al*., 2006
Bacillus subtilis, *Fusarium oxysporum*, *Streptomyces* sp., *Pseudomonas chlororaphis*. (Sélection de 87 organismes : bactéries, mycètes, streptomycètes et levures + essai de substances naturelles)	Crucifères	Alternariose (*Alternaria* spp)	(*) Schmitt et *al*., 2004
Isolats de bactéries antagonistes prélevées dans la rhizosphère (*Bacillus* spp., *Pseudomonas, fluorescens*). Six souches efficaces testées	Onion	Fusariose (*Fusarium oxysporum*)	Tehrani et Ramezani, 2003
Trichoderma viride Effets des matériaux d'enrobage sur *Rhizoctonia solani*	Radis, onion, persil, aneth, betterave	Non spécifié	Sadowski et *al*., 2006
Bactéries endophytiques	Tomates	Général	Nejad et Johnson, 2000

3.2-Grandes cultures (céréales)

Traitement	Culture	Maladie (Pathogène)	Auteurs
Trichoderma viride	Blé, orge	Tache et fonte des semis (*Bipolaris sorokiniana*) *Fusarium* spp	(*) Batura et *al*., 2004
Pseudomonas chlororaphis	Blé, orge, avoine, seigle	Carie (*Tilletia* spp) Moisissure rose (*Microdochium nivale*) Rayure réticulée (*Pyrenophora* spp) Tache et fonte des semis (*Bipolaris sorokiniana*) *Septoria* spp.	(*) Widen et Annas, 2004
Streptomyces spp.	Maïs	*Aspergillus* spp. *Curvularia lunata,* *Drechslera maydis* *Fusarium* spp.	Bressan, 2003

4-SÉLECTION ET PROPAGATION DE SEMENCES SAINES

4.1-Fines herbes et maraîcher

Approche	Culture	Effet	Auteurs
Culture de semence sous tunnel	Carotte	Améliore la qualité Contrôle l'alternariose (*Alternaria* spp)	Boelt et *al*., 2004

5-INTÉRÊT DES ÉLÉMENTS MINEURS POUR LA QUALITÉ DES SEMENCES

5.1-Fines herbes et maraîcher

Élément	Culture	Effet	Auteurs
Bore	Agrumes	Croissance	Han et *al*., 2008
Zinc	Orge	Croissance	Genc et *al*., 2000

SEMENCES–FICHES RÉFÉRENCES

(*) => réfère au lien général en bas de page où vous pouvez trouver le cahier de conférence complet du First World Conference on Organic Seed, Rome 2004 dont ces articles sont tirés.

(*) Batura, A., Lukanowski, A., Kus, J., 2004. Comparison of health status of winter wheat and spring barley grain cultivated in organic, integrate and conventional systems and monoculture. In Proceedings of the First World Conference on Organic Seed, Rome 2004. [contact: batura-a@atr.bydgoszcz.pl]

(*) Kuhn, K., Förster, K., Diepenbrock, W., 2004. Effects of plant extracts on seed-born pathogens. In Proceedings of the First World Conference on Organic Seed, Rome 2004. [contact: kuhn@landw.uni-halle.de]

(*) Paillán, H., Carrasco, G., Villalobos, H., 2004. Effect of fruit load array on melon (*Cucumis melo* L) seed production in greenhouse under organic cultivation: Yield and seed quality. In Proceedings of the First World Conference on Organic Seed, Rome 2004. [contact: hpaillan@utalca.cl]

(*) Schmitt, A., Amein, T., Tinivella, F., van der Wolf, J., Roberts, S., Groot, S., Gullino, M.L., Wright, S., Koch, E., 2004. Control of seed-born pathogens on vegetables by microbial and other alternative seed treatments. In Proceedings of the First World Conference on Organic Seed, Rome 2004. [contact: a.schmitt@bba.de]

(*) van der Bulk, R., Tylkowska, K., Grabarkiewicz-Szczêsna, J., Knudsen, I., Mohr Madsen, O., Driessen, R., Bosc, B., Langerak, K., Solfrizzo, M., 2000. Safe organic vegetables: the Carrot-Alternaria model. In Proceedings of the First World Conference on Organic Seed, Rome 2004. [contact: ruud.vanderbulk@wur.nl]

(*) Vasilenko, V., Carrier, J., 2000. Application of light and natural compositions in new technology of seed enhancement. In Proceedings of the First World Conference on Organic Seed, Rome 2004. [contact: v.vasilenko@perfectlynatural.ca]

(*) Widen, P., Annas, P., 2004. Cedomon® and Cerall® - biological seed treatments for cereals. In: Proceedings of the First World Conference on Organic Seed, Rome 2004. [contact: info@bioagri.se]

* **Proceedings of the First World Conference on Organic Seed**
IFOAM/FAO/ISF 2004, 188pp Challenges and Opportunities for Organic Agriculture and the Seed Industry. With over 70 articles and a focus on the scientific and technical aspects of organic seed production, this landmark publication provides key information about the current organic seed industry. July 5-7, FAO Headquarters, Rome, Italy.
http://shop.ifoam.org/bookstore/product_info.php?cPath=64_65&products_id=70

Accès au document : via le site IFOAM, achat au coût de 16 EUROS pour la version électronique.

Amein, T., Wikstrom, A., Schmitt, A., Koch, E., van der Wolf, J., Groot, S.P.C., Forsberger, G., Werner, S., Krauthausen, H.J., Kromphardt, C., Jahn, M., Wright, S.A.I., 2006. Non- chemical methods of seed treatment for control of seed- borne pathogens on vegetables. In proceedings of the European joint organic congress "Organic Farming and European Rural Development", Odensee, 2006. [contact: thasein.amein@maselab.se]

The aim of EU-project "Seed Treatments for Organic Vegetable Production" (STOVE) was to evaluate non-chemical methods for control of seed-borne pathogens in organic vegetable production. Physical (hot air, hot water and electron) and biologi-cal (microorganisms and different agents of natural origin) methods have been investigated. Trials have been carried out with different patho-systems such as cabbage / Alternaria spp and parsley / Septoria pet-roselini. Good control was generally obtained with the physical methods. In field trials, the yield of parsley naturally infested by S. petroselini was increased by 20% when the seeds were treated with hot air. In trials performed under controlled conditions, also thyme oil treatment increased the number of germinated seedlings of this crop compared to the untreated control. Treatments with different commercialised microbial preparations reduced incidence of disease caused by Alternaria spp. in cabbage seedlings to a level similar to that achieved after chemical treatment. Many of the non-commercialised microoganisms also reduced disease incidence clearly.

{Recherche appliquée}

Accès au document : limité avec inscription, via le site orgprints.org (document msword)

Blum, H., Fausten, G., Nega, E., Jahn, M., Garber, U., Aedtner, I., 2006. Improvement of seed quality of medicinal plants and herbs in organic farming. Paper presented at Joint Organic Congress, Odense, Denmark, May 30-31, 2006. [contact: hanna.blum@dir.rip.de]

As in vegetable growing or grain cropping the seed quality is an important factor for the successful cultivation of medicinal plants and herbs. In spite of intensive efforts made by specialised seed producers there are recurring problems with important quality parameters (e.g. germination capacity, emergence or seed health). The lack of sufficient study results is typical for special purpose crops, also concerning the particular host-parasite relationship and its methodical verification. Few experiences with the improvement of seed quality of medicinal plants and herbs are available. The intention of the study is to test physical and biological methods of seed treat-ment for their practicability in medicinal plants and herb cultivation. Fundamental information on the pathogens is also examined. Moreover there is a focus on further aspects of the production techniques (e.g. harvesting time) as a means to improve the seed quality.

{Recherche appliquée}

Accès au document : via le site orgprints.org (document pdf)

Boelt, B., Jensen, A., Mette, D., Bjørn, G. K., 2004. Seed quality in organic carrot seed production. Does tunnel production in Denmark provide sufficient seed quality?. Paper presented at First World Conference on Organic Seed: Challenges and Opportunities for Organic Agriculture and the Seed Industry, FAO Headquarters, Rome, Italy, July 5-7, 2004; Published in Lammerts van Bueren, Edith; Ranganathan, Radha and Sorensen, Neil, Eds. *Proceedings of the First World Conference on Organic Seed: Challenges and Opportunities for Organic Agriculture and the Seed Industry*, p. 164. [contact: birte.boelt@agrsci.dk]

In vegetable species the supply of organic seed is very limited and the supply of seed from varieties that has been identified as suitable for growing in Denmark or for specific products are limited. The report '*The consequences of gene-modified-organisms (GMO) on organic farming'* identifies the lack of organic seed as a potential source for GM-dispersal to organic farming (Kjellsson & Boelt, 2002) if/when GM-varieties are approved for cultivation. Development of an organic vegetable seed production is the focus of the DARCOF-project '*Vegetable and Forage Seed – development of an organic, GMO-free seed production*'. A number of vegetable species such as carrot use to be seed multiplied in Denmark in relatively large quantities. However, the production has been moved to France and Italy, in order to obtain a higher seed quality, since the seed ripen earlier and the prevalence of quality-deteriorating fungi thereby diminished.

Seed production in tunnels is an important tool to maintain genetically purity. This production method is already used today by the Danish seed industry in the production of spinach hybrids. Screening of an organic vegetable seed production in tunnels was initiated in 2000 at the Danish Institute of Agricultural Sciences, Research Centre Flakkebjerg. A part of the project is to investigate seed quality and health status of carrot seed produced in open field and in tunnels.

{Recherche appliquée}

Accès au document : via le site orgprints.org (document msword)

Borgen, A., Krebs, N., Langkjær, C., 2005. Novel development of heat treatment techniques for seed surface sterilisation. Paper presented at 5th SHC Seed Health Symposium, Angers France, 10th -13th May 2005. Publ. in Cockerell, Valerie, Eds. *Abstrac Booklet*, p. 28.
[contact: borgen@agrologica.dk]

(texte intégral)

Heat treatment to prevent seed borne diseases, e.g. in the form of hot water or warm humid air, will normally heat up the entire seed. Heat treatment of the seed embryo will always have a negative side-effect on seed vigour and the duration of several minutes are difficult to implement in seed plans treating huge volumes of seed. However, in the case of common bunt in wheat and similar diseases, where the inoculum is transmitted as fungal spores on the surface of the seed, an uniform and efficient surface sterilisation will be sufficient to prevent the transmission of the disease.

To test the effect of surface heat sterilisation of seed, an equipment was developed, where seeds were exposed to a combination of steam and ultrasound. The principle is that the ultrasound will create a fluctation of the air molecules in the chamber, and thereby increase the access of the hot steam to the surface of the seed.

In this equipment, common bunt in wheat was eliminated after 4 sec. treatment and in spelt after 8 seconds. A 16 times increase of the duration of the treatment did not decrease germination speed of the seed, tested in a cold sand test. This demonstrates that surface transmitted diseases can be controlled efficiently and environmentally friendly by equipment adaptable to commercial seed plans.

{Recherche appliquée}

Accès au document : via http://www.agrologica.dk/publist-ramme.html

Borgen, A., Kristensen, L., 2001. Effect of seed treatment with milk powder and mustard flour in control of common bunt (*Tilletia tritici*) in wheat and stem smut (*Urocystis occulta*) in rye. Publ. in Biddle, A.J., Eds. *Proceedings from BCPC Symposium No. 76: "Seed Treatment: Challenges & Opportunities"*. British Crop Protection Council 76. Farnham.

In field trials mustard flour was able to control seed borne infection by common bunt (*Tilletia tritici*) in wheat without decreasing the germination vigour of the treated seeds. Full control of common bunt by coating the seeds with milk powder could only be achieved at doses which reduced germination vigour of the seeds. Mustard flour can be recommended as a seed treatment in organic agriculture while a treatment based on milk powder should be developed in combination with biological control. Both milk powder and mustard flour can be used to control stem smut in rye (*Urocystis occulta*).

Borgen, A., Nielsen, B., 2001. Effect of seed treatment with acetic acid in control of seed borne diseases. Paper presented at BCPC Symposium No. 76: "Seed Treatment: Challenges & Opportunities", Birmingham; Published in Biddle, A.J., Eds. *Proceedings of the BCPC Symposium No. 76: "Seed Treatment: Challenges & Opportunities"* 76. British Crop Protection Council 76. Farnham.

In field trials, seed treatment with acetic acid has reduced common bunt (*Tilletia tritici*) in winter wheat by 91.5-96.2% and by 83% in spring wheat without negative effects on germination vigour of the seeds. Leaf stripe (*Pyrenophora graminea*) in spring barley was reduced by 93.4%. Acetic acid is a cheap and environmental friendly fungicide with a possible scope of application especially in organic agriculture, where conventional pesticides are prohibited.

{Recherche appliquée}

Accès aux documents : via http://www.agrologica.dk/publist-ramme.html

Bressan, W., 2003. Biological control of maize seed pathogenic fungi by use of actinomycetes. *BioControl*, 2003. Vol. 48 (2): pp. 233-240. [contact: bressan@cnpms.embrapa.br]

The effectiveness of two *Streptomyces* spp. strains to control pathogenic fungi was studied in stored maize grain. The treatments included seed disinfection and inoculation with *Streptomyces* spp. strains previously isolated from maize rhizosphere. Actinomycete inoculum consisted of filtered suspension and total suspension of fermentor-produced *Streptomyces* spp. strains biomass. Treatments with *Streptomyces* spp. strains alone effectively suppressed the development of *Aspergillus* spp., *Curvularia lunata*, and *Drechslera maydis* and significantly ($p < 0,05$) reduced the incidence of *Fusarium subglutinans* and *Cephalosporium acremonium*. Among the inoculation treatments, non disinfested seed inoculated with filtered suspension was the only treatment that did not suppress the development of *Penicillium spp.* Maize seed inoculation with total suspension of strains was the most effective treatment to control the incidence of seed pathogenic fungi. The development of the *Diplodia maydis* was only suppressed by the combination of seed disinfection and inoculation with total suspension of strains. Although, the strain DAUFPE 11470 showed the greatest effectiveness for controlling the fungi pathogenic to seed, root and shoot development was reduced by treatment with this strain. The results indicate that *Streptomyces* spp. strains reduce the incidence of seed pathogenic fungi and have potential as a biological control agent. However, an efficient method of seed treatment with the biological control agent must be developed before it can become an agricultural practice.

{Recherche appliquée}

Accès au document : via springerlink.com

Coût de l'article : 32,00 $

Clear, R.M., Patrick, S.K., Turkington, T.K., Wallis, R., 2002. Efffect of dry heat treatment on seedborn *Fusarium graminearum* and other cereal pathogens. *Canadian Journal of Plant Pathology*, 2002. Vol. 24 (4): pp. 489-498. [contact: rclear@grainscanada.gc.ca]

La fréquence des agents pathogènes et la viabilité des grains de deux échantillons d'orge (*Hordeum vulgare*) (B1, B2), de blé (*Triticum aestivum*) roux de printemps de l'Ouest canadien (RS1, RS2) et de blé ambré dur de l'Ouest canadien (AD1, AD2) furent évaluées après chauffage des grains à 50 ou 70°C durant des périodes allant jusqu'à 14 jours. RS2 et B2, avec des taux initiaux de présence du *Fusarium graminearum* de 23 et 84%, respectivement, furent aussi chauffés à 60°C durant 24 jours ou à 80°C durant 10 jours. La fréquence des agents pathogènes et la viabilité des grains furent évaluées par ensemencement sur gélose dextrosée à la pomme de terre et sur papier filtre imbibé, respectivement. Le *F. graminearum* fut éliminé de RS2 après 15 jours à 60°C, 5 jours à 70°C ou 2 jours à 80°C. Dans B2, le *F. graminearum* fut éliminé après 21 jours à 60°C, 9 jours à 70°C ou 5 jours à 80°C. Après chauffage à 50 ou 70°C, la présence du *Cochliobolus sativus* dans B1 diminua légèrement mais significativement avec le temps, alors qu'elle augmenta substantiellement dans B2. Une diminution significative de la présence du *C. sativus* fut observée dans B2 après chauffage à 80°C. Le *Pyrenophora teres* fut observé significativement plus souvent dans B1 après chauffage à 50 ou 70°C, alors que le *P. tritici-repentis* dans AD1 et AD2 ne fut pas affecté par le chauffage à 50°C. Cependant, la détection du *P. tritici-repentis* augmenta significativement avec le temps dans AD2 chauffé à 70°C. Dans AD1, le chauffage à 70°C augmenta au début, puis diminua la présence de cet agent pathogène. Le *Cochliobolus sativus,* le *P. teres* et le *P. tritici-repentis* étaient toujours viables dans les échantillons après 14 jours de chauffage à 70°C, mais le *C. sativus* ne fut pas détecté après 10 jours à 80°C. La germination du blé amené à 12, 14 ou 16% d'humidité ne fut pas affectée par le chauffage à 70°C durant 7 jours, alors que celle de l'orge amenée aux mêmes pourcentages d'humidité fut légèrement diminuée. Le taux de germination dans la plupart des échantillons ne fut guère affecté par les durées et les températures de traitement suffisantes pour éradiquer le *F. graminearum*, mais une diminution significative de viabilité fut notée dans AD2 et B1 chauffés à 70°C. La germination de B2 augmenta lorsque chauffé à 70°C, mais diminua lorsque chauffé à 80°C. Il est suggéré d'utiliser la thermothérapie pour contrer le transport aux niveaux national et international du *F. graminearum* et d'autres agents pathogènes sensibles à la chaleur dans les germoplasmes utilisés pour la recherche et pour fins d'amélioration génétique.

{Recherche appliquée}

Accès au document : via la Revue canadienne de phytopathologie

Forsberg, G. 2004. Control of cereal seed-borne diseases by hot humid air seed treatment (Thermothérapie à la vapeur de semences céréalières contre les maladies séminicoles). Dissertation de doctorat. Université de Suède, Uppsala. Plant Pathology and Biocontrol Unit, SLU. Acta Universitatis agriculturae Suecia. Agraria, Vol. 443.
[contact: mailto:Gustaf.Forsberg@lt.slu.se]

Le traitement de semences céréalières par de l'air chaud et humide a été défini comme un méthode pouvant combattre les maladies séminicoles. L'influence de paramètres importants sur la vitalité de la semence et des champignons pathogènes a été déterminée. En optimisant la durée de traitement et l'humidité de l'air, la semence est désinfectée tout en préservant sa germination. L'analyse du transfert de chaleur et d'eau entre l'air de traitement et la semence montre que le chauffage rapide et court à la vapeur d'eau, immédiatement suivi d'un refroidissement rapide, donne lieu à un traitement sélectif des couches externes de la semence, d'où se trouve la majorité des microbes pathogènes. En prenant en compte ces relations physiques, l'équation améliorée de Ellis et Roberts a été modifiée pour précisément prédire la germination post-traitement et le taux d'infestation.

La tolérance aux températures élevées, testée sur de nombreux lots de semence, varie entre les espèces testées. Due aux variations des conditions de croissance de la plante et celles liées au stockage, cette tolérance diffère entre les lots individuels. Du fait de ces différents facteurs, la tolérance aux traitements thermiques varie également au sein d'un même lot. Il est néanmoins possible de trouver la température optimale d'un lot défini en effectuant un test de prétraitement.

L'influence du stockage, sur l'efficacité du traitement thermique, a été examiné pour à la fois les traitements effectués après le stockage et le stockage post-traitement. Le stockage à long-terme de semences infestées de microbes pathogènes résistent au stockage a réduit le taux de désinfection obtenu par le traitement aussi bien pour les semences stockées avant ou après celui ci. Lorsqu'un stockage à long-terme est nécessaire avant ou après traitement, un stockage aux températures et teneurs en eau réduites des semences est recommandé.

L'évaluation étendue dans 6 pays européens de la méthode optimisée a montré que la méthode peut combattre la plupart des maladies séminicoles céréalières équivalant aux traitements chimiques, à la seule exception près, lorsque le microbe pathogène est situé en profondeur de la graine. Le travail a montré que la méthode est aussi efficace pour d'autres cultures que les céréales.

{Thèse de doctorat}

Accès au document : http://diss-epsilon.slu.se/view/author/Forsberg,_Gustaf.html

Genc, Y., McDonald, G.K., Graham, R.D., 2000. Effect of seed zinc content on early growth of barley (Hordeum vulgare) under low and adequate soil zinc supply. *Australian Journal of Agricultural Research*, Vol. 51 (1): pp. 37-45.

Worldwide, barley is often grown on zinc (Zn) deficient soils. Screening for varieties tolerant of low soil Zn (Zn-efficient varieties) generally involves assessing growth or yield of plants grown at different levels of Zn supply. Seed nutrient reserves can influence the growth of the plant; however, there have been no reports on the effect of seed Zn content on the growth of barley. In 2 experiments, we studied the effect of seed Zn content on early growth of barley in 2 genotypes, Amagi Nijo and Tantangara. In Expt 1, the amounts of Zn in the seed ranged from 0.4 to 0.7 µg/seed, whereas in Expt 2, seed Zn ranged from 0.7 to 5.0 µg/seed. The plants were grown in a Zn-deficient siliceous sand with Zn added at 0, 0.04, 0.2, 0.8, and 3.2 mg Zn/kg soil in Expt 1 and at 0, 0.04, and 0.8 mg Zn/kg soil in Expt 2, and harvested at tillering. Growth and expression of visual symptoms were measured.

Plants grown from seed with low Zn content developed symptoms of Zn deficiency by the 2-leaf stage in soil with no soil-applied Zn. Symptoms were reduced markedly as seed Zn content increased. Shoot and root growth increased as the amount of Zn in seed increased, but the effect was most evident when soil Zn supply was limiting plant growth (≤0.04 mg Zn/kg soil). For instance, when no Zn was added to the soil, shoot dry weight of plants grown from high-Zn seed was 108% greater than that of plants grown from low-Zn seed, whereas at 0.04 and 0.8 mg Zn/kg soil, the increases were only 52% and 18%, respectively. Soil Zn application significantly increased tissue Zn concentrations. However, the effect of seed Zn content on tissue Zn concentrations was significant only at very high levels of seed Zn. The results presented showed that seed Zn improves vegetative growth in barley, especially when Zn supply is deficient for plant growth. Seed Zn content also affected the determination of Zn efficiency of genotypes, and comparisons of dry matter production of seedlings grown from seed with a wide range in Zn content may alter their rankings for Zn efficiency as determined in this pot assay. The results indicate that seed of similar Zn content needs to be used when comparing genotypes for determination of Zn efficiency.

{Recherche appliquée}

Accès limité au document : via csiro publishing
Coût : 25,00 $

Han, S., Chen, Li-S., Jiang, Huan-X., Smith, B.R., Yang Lin-T., Xie, Cheng-Y., 2008. Boron deficiency decreases growth and photosynthesis, and increases starch and hexoses in leaves of citrus seedlings. *Journal of Plant Physiology*, In press. [contact: lisongchen2002@hotmail.com]

Seedlings of sweet orange (Citrus sinensis) were fertilized for 14 weeks with boron (B)-free or B-sufficient (2.5 or 10 μM H_3BO_3) nutrient solution every other day. Boron deficiency resulted in an overall inhibition of plant growth, with a reduction in root, stem and leaf dry weight (DW). Boron-starved leaves showed decreased CO_2 assimilation and stomatal conductance, but increased intercellular CO_2 concentrations. Activities of ribulose-1,5-bisphosphate carboxylase/oxygenase (Rubisco), NADP-glyceraldehyde-3-phosphate dehydrogenase (NADP-GAPDH) and stromal fructose-1,6-bisphosphatase (FBPase) were lower in B-deficient leaves than in controls. Contents of glucose, fructose and starch were increased in B-deficient leaves while sucrose was decreased. Boron-deficient leaves displayed higher or similar superoxide dismutase (SOD), ascorbate peroxidase (APX), monodehydroascorbate reductase (MDAR) and glutathione reductase (GR) activities, while dehydroascorbate reductase (DHAR) and catalase (CAT) activities were lower. Expressed on a leaf area or protein basis, B-deficient leaves showed a higher ascorbate (AsA) concentration, but a similar AsA concentration on a DW basis. For reduced glutathione (GSH), we found a similar GSH concentration on a leaf area or protein basis and an even lower content on a DW basis. Superoxide anion ($O_2^{\bullet-}$) generation, malondialdehyde (MDA) concentration and electrolyte leakage were higher in B-deficient than in control leaves. In conclusion, CO_2 assimilation may be feedback-regulated by the excessive accumulation of starch and hexoses in B-deficient leaves via direct interference with chloroplast function and/or indirect repression of photosynthetic enzymes. Although B-deficient leaves remain high in activity of antioxidant enzymes, their antioxidant system as a whole does not provide sufficient protection from oxidative damage.

{Recherche appliquée}

Accès au document : via le site Science Direct (document pdf ou html)
Coût : 30,00 $ US

Heller, W., 2002. Switzerland: New Treatment for disinfection of carrot seed. *Newsletter on organic seeds and plant breeding*, Issue April 2002. [contact: Werner.Heller@faw.admin.ch] http://www.eco-pb.org/07/nops_04_02.pdf

(texte intégral)

In the federal research station for fruit, vegetables and wine, Wädenswil, an effective and at the same time unproblematic treatment against alternaria fungi, the most important causes of carrot diseases, was found: lactic acid for disinfection of carrot seed. By closely looking at the regular pattern in affected carrot fields, experts from the research station concluded that the fungi must be seed borne to a large extent. The hypothesis was confirmed: A high proportion of the carrot seed is contaminated with alternaria fungi on the surface as well as inside the seed coat. Disinfection has to penetrate as deep as possible into the seed in order to be effective enough. However, it must not disturb sprouting ability of the seed. These requirements are met with concentrated lactic acid. According to the Swiss regulation on organic agriculture, lactic acid is allowed as food additive and therefore unproblematic for all users. The laboratory in Wädenswil reached about 90% effectiveness with the treatment. Researchers are now working at optimising the treatment and testing it for other vegetables and their specific contaminations.

Source: Der Gemüsebau, No. 4/2002
Translation by Christine Arncken
{Transfert technologique}

Accès au document : limité à la newsletter (document pdf)

Hermansen, A., Brodal G., Balvoll G., 1999. Hot water treatments of carrot seeds: effects on seed-bornfungi, germination, emergence and yield. *Seed Science and Technology*, 1999, Vol. 27 (2): pp. 599-613. [contact: arne.hermansen@planteforsk.no]

Accès au document : non disponible sur Internet. Seulement version papier.

Jahn M., Nega, E., Kromphardt, C., Forsberg, G., Werner, S., 2006. Optimisation of different physical methods for control of seed-borne pathogens in organic vegetable production.
Paper presented at Joint Organic Congress, Odense, Denmark, May 30-31, 2006.
[contact: m.jahn@bba.de]

In the last decade, a lot of work has been done to develop new measures or to optimize existing seed treatment methods for use in organic farming. In the field of vegetable seed protection, national research projects as well as the EU-funded project "STOVE" ("Seed Treatments for Organic Vegetable Production") are currently carried out. Among the physical methods, hot water, humid hot air and electron treatment are being investigated. All three physical treatment methods show clear reducing effects on pathogens of infested vegetable seeds. Degree of effectiveness connected with a good compatibility depends on the treatment method and on the host-pathogen-system, but also on the cultivar and even on the seed lot.

{Recherche appliquée}

Accès au document : via le site orgprints.org (document msword7)

Jensen, B., Knudsen, I.M.B., Madsen, M., Jensen, D.F., 2004. Biopriming of infected carrot seed with an antagonist, *Clonostachys rosea*, selected for control of seedborne *Alternaria* spp. Phytopathology, 2004. Vol. 94 (6), pp. 551-560. [contact: bje@kvl.dk]
http://apsjournals.apsnet.org/doi/pdf/10.1094/PHYTO.2004.94.6.551

An ecological approach was used to select fungal antagonists effective against the seedborne pathogens *Alternaria dauci* and *A. radicina* on carrot. Twenty-five and 105 isolates originating from cereal and carrot habitats were screened against the pathogens in planta, respectively. Irrespective of isolate origin, fungal isolates belonging to *Clonostachys rosea* controlled pre-and postemergence death caused by *A. dauci* and *A. radicina* as effectively as the fungicide iprodione. Isolate IK726 of *C. rosea* was used in biopriming a seed lot with 29% *A. radicina* and 11% *A. dauci* (highly infected), and a seed lot with 4% *A. radicina* and 7% *A. dauci* (low infection). Seeds were primed with water alone (hydropriming) or with addition of *C. rosea* IK726 (biopriming). The occurrence of *A. radicina* and *A. dauci* increased twofold and fivefold, respectively, during 14 days hydropriming, irrespective of the initial infection level. On highly infected seed, biopriming reduced the incidence of *A. radicina* to <2.3% and that of *A. dauci* to <4.8% while the level of both pathogens was <0.5% on bioprimed seed with a low initial infection rate. In sand stand establishment tests, hydroprimed seeds had a lower healthy seedling stand than nonprimed seeds, mainly due to a high degree of postemergence seedling death. In contrast, biopriming resulted in a seedling stand that was better than that of both nonprimed and hydroprimed seeds. *C. rosea* IK726 multiplied fivefold to eightfold, and microscopic observations using *C. rosea* IK726 transformed with a green fluorescent protein (GFP) reporter gene showed that seeds were covered with a fine web of sporulating mycelium of *C. rosea*. The positive effect of biopriming on healthy seedling stand remained after 5 months of storage at 4°C and IK726 survived at high numbers on these seed. In this study, we demonstrated that biopriming with the biocontrol strain *C. rosea* IK726 facilitates priming of infected seeds without risking adverse effects on seedling establishment.

{Recherche appliquée}

Accès au document : via APS (document pdf)

Kasselaki, A. M.; Malathrakis, N. E.; Goumas, D. E. and Leifert, C., 2007. Effect of alternative seed treatments on seed-borne fungal diseases in tomato. Poster presented at 3rd QLIF Congress: Improving Sustainability in Organic and Low Input Food Production Systems, University of Hohenheim, Germany, March 20-23, 2007.

The fungus *Didymella lycopersici* infects tomato seed and results in great losses before and after germination. To control the disease, seed companies use thiram preventively, although human allergy problems have been reported. For this reason as well as to address needs in organic agriculture, this study has focused on the effects of alternative methods of control. Nitrite solutions and resistance inducers were tested in a growth chamber. Results showed that soaking the seed in a nitrite solution with a concentration of 300mM (in citric acid buffer, pH 2) for 10 minutes reduced losses due to low seed germination and disease incidence in the germinated seedlings completely. When applied for longer intervals sodium nitrite proved phytotoxic whereas in shorter intervals it was not as effective. The resistance inducer Tillecur (mustard seed extract) at the rate of 0.05g/ml was as much effective as sodium nitrite inhibiting disease incidence in germinated seedlings. None of the above treatments was significantly different to thiram and they could replace the fungicide in the control of seedborne *D. lycopersici* in tomato.

{Recherche appliquée}

Accès au document : via le site orgprints.org (document pdf)

Lizot, J.F., Griboval, B., Guénard, M., 2002a. Mise au point d'une technique de désinfection des semences applicable en agriculture biologique - *Alternaria dauci* sur semences de carottes. In 2ème Conférence Internationale sur les Moyens Alternatifs de Lutte contre les Organismes Nuisibles aux Végétaux. Lille –March 2002. [contact: lizot.itab@wanadoo.fr]

Organic farming seed offer is increasing, but still remains insufficient. European organic regulation dispensation allows until 12/31/20003 to use conventional seeds of varieties if organic seeds of the same varieties are not available. Carrot seed production is the main vegetable specie seed production in France. Wet climate promotes disease on carrot which is caused by pathogenous fungus *Alternaria dauci*. The main source of primary inoculum is seed. Fungicid efficiency of combinations of vinegar, cinnamon and micro-nutrients have been evaluated on seeds hard contaminated by *Alternaria dauci,* in order to find disinfection techniques compatible with organic regulation. Results give efficiency of 90.5% without phytotoxicity.

Lizot, J.F., Griboval, B., Guénard, M., 2002b. Désinfection des semences : des produits naturels pour le bio. Alter-Agri. N° 53.

Le rendement en carottes de consommation peut être affecté de 40 à 60 % par des attaques d'*Alternaria dauci*. Comme la semence est ici la principale source de contamination, le contrôle de la maladie repose essentiellement sur l'utilisation de semences de carottes saines. Les produits sélectionnés pour l'étude étaient le vinaigre, quatre oligo-éléments (fer, zinc, cuivre, manganèse) et une huile essentielle de cannelle. La désinfection au moyen de produits à base de vinaigre diminue statistiquement les fortes contaminations et le niveau général de contamination. L'adjonction au vinaigre d'oligo-éléments améliore encore statistiquement l'état sanitaire des semences, la meilleure combinaison étant celle avec sulfate de Fer et de Zinc.

{Recherche appliquée et transfert technologique}

Accès au document : article de l'Alter-Agri, archives ITAB
http://www.ktok.net/_itab/publications/archives-alter-agri.php#aa-complets (n° 53)

Autre Accès : Publication intégrale dans les Actes de la conférence.

Nega, E., Ulrich, R., Werner, S., Jahn, M., 2003. Hot water treatment of vegetable seed – an alternative seed treatment method to control seed borne pathogens in organic farming. *Journal of Plant Diseases and Protection,* 2006. Vol. 110 (3): pp. 220-234. (anglais)

Eau chaude
(40°C et 50 à 55°C, 10 à 30 minutes)

Five important vegetable crops (carrot, cabbage, celery, parsley, lamb's lettuce) and their most important seed-borne pathogens (*Alternaria* spp., *Phoma* spp., *Septoria* spp., *Peronospora valerianellae, Xanthomonas* spp) have been investigated in laboratory, model and field trials.

Hot water treatments were made at temperatures of 40°C and 50 to 55°C for 10 to 30 minutes, in some cases to 60 minutes. In most cases, seed health tests were conducted according to ISTA guidelines. In case of seed infestation with *Septoria* species and *P. valerianellae*, the number of spores or oospores were counted in order to assess efficacy.

Seed-borne pathogens could be reduced without significant losses of germination by hot water treatments at 50°C for 20 to 30 minutes up to 53°C for 10 to 30 minutes. At higher temperature, however, treatment time must be lowered to avoid reduced germination of sensitive crops.

In most cases efficacy of hot water treatments against *Alternaria* species (*A. dauci, A. radicina, A. alternata, A. brassicicola)* was high (efficacy >95%). Treatment was also very efficient against *Phoma* species (*Ph. lingam, Ph. valerianella*) (80-95%). The reduction of *Ph. valerianella* on the seed of lambs lettuce correlated in the first test year with the reduction of the disease in the field. The number of spores in the pycnidia of *S. apiicola* and *S. petroselini* was significantly reduced by hot water treatment. This correlates with the reduction in disease incidence and yield increase. The hot water treatment reduced the number of oospores of *P. valerianellae* in trials on weakly infected seed, but was ineffective on highly infected seed.

For *Xanthomonas campestris* on carrot and cabbage, laboratory trials yielded good effects at 50°C for 30 minutes.

{Recherche appliquée}

Accès complet au document : via le site orgprints.org (document msword)

Nejad, P., Johnson, P.A., 2000. Endophytic Bacteria Induce Growth Promotion and Wilt Disease Suppression in Oilseed Rape and Tomato. *Biological Control*, Vol. 18 (3): pp. 208-215.

To determine whether bacteria isolated from within plant tissue can have plant growth-promotion potential and provide biological control against soilborne diseases, seeds and young plants of oilseed rape (*Brassica napus* L. cv. Casino) and tomato (*Lycopersicon lycopersicum* L. cv. Dansk export) were inoculated with individual bacterial isolates or mixtures of bacteria that originated from symptomless oilseed rape, wild and cultivated. They were isolated after surface sterilization of living roots and stems. The effects of these isolates on plant growth and soilborne diseases for oilseed rape and tomato were evaluated in greenhouse experiments. We found isolates that not only significantly improved seed germination, seedling length, and plant growth of oilseed rape and tomato but also, when used for seed treatment, significantly reduced disease symptoms caused by their vascular wilt pathogens *Verticillium dahliae* Kleb and *Fusarium oxysporum* f. sp. *lycopersici* (Sacc), respectively.

{Recherche appliquée}

Accès au document : via le site Science Direct (document pdf ou html)
Coût de l'article : 30,00 $ US

Nielsen, B., Borgen, A., Kristensen, L., 2000. Control of seed borne diseases in production of organic cereals. In Proceedings of the Brighton Conference 2000 – Pest and Diseases. Brighton 2000. pp. 171-176. [contact: Bent.Nielsen@agrsci.dk]

In production of organic seed it is important to have some control measures on seed borne diseases to avoid propagation and spread of serious diseases. Due to lack of acceptable treatment methods the only way for the moment is to discard seed lots with unacceptable infections. Experiments have been started to find new and alternative methods for controlling seed borne diseases. In spring barley the results show good effect with 5% acetic acid on leaf stripe (*Pyrenophora graminea*) but problems with unacceptable effects on seed germination have to be solved. The old method with hot water treatment can be used and the results indicate good results against leaf stripe using water at 55°C. The effect of hot water was enhanced by first soaking the seeds in water at 20°C. Controlling loose smut (*Ustilago nuda*) is more complicated and here pre treatment with soaking seeds in water at 45°C succeeded by short treatment in water at 50°C gave good results.

{Recherche appliquée}

Accès au document : via http://www.agrologica.dk/publist-ramme.html

Pushpalatha, H.G., Mythrashree, S.R., Shetty, R., Geetha, N.P., Sharathchandra, R.G., Amruthesh, K.N., Shetty, H.S., 2007. Ability of vitamins to induce downy mildew disease resistance and growth promotion in pearl millet. *Crop Protection*, Vol. 26 (11): pp. 1674-1681. [contact: hss@appbot.uni-mysore.ac.in]

The use of biotic and abiotic inducers for the development of host resistance is a sustainable approach for plant disease management. In the present study, vitamins, pyridoxine, folic acid, riboflavin, niacin, D-biotin and menadione sodium bisulphite (MSB) were used to treat pearl millet seeds to test their ability to induce resistance to downy mildew disease caused by Sclerospora graminicola. A 6 h seed-soak treatment with vitamins at 20 mM enhanced germination and seedling vigour significantly and also induced downy mildew disease resistance. Among them, MSB treatments offered 73% protection while niacin and riboflavin gave 63% and 62% protection, respectively. The vitamins offering promising protection were used in combination to treat the seeds, but no synergistic action was evident with either combination treatment. Vitamin seed treatment and foliar spray application showed similar results when applied individually. However, seed treatment followed by a foliar spray with a combination treatment of MSB and niacin at 7 d after seedling emergence offered higher protection (74%) against downy mildew disease. Seeds treated with vitamins induced maximum resistance in the seedlings by the fourth day after pathogen inoculation and the resistance persisted till the end of the growth period of the crop. The vitamin treatments had a growth promotional effect and significantly increased the yield compared with the untreated control. Possibilities for controlling downy mildew disease of pearl millet with vitamins are discussed.

{Recherche appliquée}

Accès au document : via le site Science Direct (document pdf ou html)
Coût : 30,00 $ US

Robert, S.J., Amein, T., Forsberg, G., Kromphardt, C., Koch, E., Schmitt, A., Werner, S., 2006. Physical and biological seed treatments for control of bacterial disease of carrots and brassicas caused by Xanthomonas spp. Poster presented at 11th International Conference on Plant Pathogenic Bacteria, Edinburgh, 10-14 July 2006. [contact: roberts@planthealth.eu] http://www.stove-project.net/STOVE_Poster-Roberts.pdf

As a part of an EU-project (Seed Treatments for Organic Vegetable Production, STOVE, QLK5-2002-02239), three physical treatments (hot water, hot air, electron bombardment) and a number of potential biocontrol agents (BCAs) were examined for their efficacy in controlling seedborne *Xanthomonas hortorum pv. carotae* and *X. campestris pv. campestris*, the causal agents of bacterial blight of carrot and black root of brassicas, respectively. All of the physical treatments gave significant reductions in seed infestations levels and reduced or eliminated transmission from seed to seedling. However, the reduction may not be adequate to avoid damaging disease levels in the field, depending on the initial seed infestation level. Although promising *in vitro*, and initial transmission tests, the selected BCA failed to give significant reductions in the final trials.

{Recherche appliquée}

Accès au document : poster, via le site stove-project (document pdf)

Sadowsky, Cz., Lenc, L., Donoradzki, M., Korpal, W., Weiner, W., Lukanowski, A., 2006. Studies on plant health in organic production of vegetable seeds. Paper presented at Joint Organic Congress, Odense, Denmark, May 30-31, 2006. [contact: fitopato@atr.bydgoszcz.pl]

Research covered investigation of efficacy of biopreparations in vegetable protection (onion, carrot, parsley, red beet, dill, radish) against fungal diseases. Seeds were coated with a biopreparation formulated on the basis of Trichoderma viride prior to sowing. After a series of experiments it was found that proper technology enables coating with biopreparation. This process should be as short as possible because of the need to maintain enough number of living colony forming units (cfu). Coated seeds may be stored for a period of several months. Microbiological cleanliness of coat components is also of great importance. Biopreparation in coats to some extent limited the occurrence of rot diseases during germination. During growing season plants were sprayed with Biosept, Chitosan and Bioczos. Effectiveness of these treatments was differentiated. The best results were observed with the use of Biosept. In a year favourable for development of downy mildew of onion (*Peronospora destructor*) spraying with this biopreparation significantly limited disease compared with the control.

{Recherche appliquée}

Accès au document : via le site orgprints.org (document rtf)

Tehrani, A. S., Ramezani, M., 2003. Biological control of *Fusarium oxysporum*, the causal agent of onion wilt by antagonistic bacteria. *Communications in Agricultural and Applied Biological Sciences,* Vol. 68 (4b): pp. 543-547

Fusarium wilt, caused by *F. oxysporum*, is one of the most important diseases of onion in Iran. Application of chemicals, especially as soil drench, increased cost of onion production and may be dangerous to the environment. One of the effective techniques to suppress soil-borne diseases in biological control with antagonistic rhizobacteria. Experiments were carried out with 120 bacterial isolates that were collected from onion rhizosphere. Six highly effective isolates were selected from these antagonists for subsequent studies. These strains were used to investigate their biological control traits *in vitro* and their ability to suppress the onion wilt *in vivo* (soil and seed treatments). According to the biochemical, physiological and morphological test, isolates 22, 38, 46 and 52 were identified as *Bacillus* spp., while isolates 16 and 48 were identified as *Pseudomonas fluorescens*. The isolates of *Bacillus* spp. produced volatile metabolites that inhibited the mycelial growth of *Fusarium oxysporum*. In the soil treatments, isolates 22 and 52, which reduced 56 and 51% of the disease, respectively, had the highest effect in reducing the Fusarium wilt of onion; the mixture of these isolates reduced 60% the disease. In the seed treatments, isolate 22, which reduced 41% of the disease, had the greatest effect on reducing the onion Fusarium wilt.

{Recherche appliquée}

Accès limité au document (résumé): via cab Abstracts ou CABI (avec inscription)

RAVAGEURS–TABLEAUX RÉCAPITULATIFS

1- ÉCOLOGIE DU PAYSAGE ET PRATIQUES CULTURALES			
Approche	**Culture**	**Ravageurs**	**Auteurs**
Lutte intégrée appliquée au bio, modèle prévisionnel	Carotte	Mouche de la carotte (*Psila rosae*)	Anon., 2002
Utilisation du vermicompost comme terreau - Réduction significative de l'infestation (en serre)	Crucifères (général?)	Pucerons (*Myzus persicae*)	Arancon et *al*., 2007
Compagnonnage et effet des monocultures environnantes	Crucifères	Mouche du navet (*Delia floralis*)	Bjorkman et *al*., 2007
Compagnonnage avec : Chénopode (*C. album*); Stellaire (*S. media*); Matricaire (*T. inodorum*)	Crucifères	Mouche du chou (*Delia radicum*)	Grundy, 2006
Compagnonnage avec : Lotier (*L. corniculatus*); Luzerne (*M. lupulina*); Trèfle (*T. pratense*)	Crucifères	Mouche du chou (*Delia radicum*)	Rosenfeld et *al*., 2006
Compagnonnage, perturbations aromatiques et visuelles	Crucifères, Oignons	Mouche du chou (*Delia radicum*) Mouche de l'oignon (*Delia antiqua*)	Finch et *al*., 2003
Lutte intégrée et plusieurs approches biologiques	Curcubitacées	Chrysomèle rayée du concombre (*Acalymma vittatum*)	Bellows et Diver, 2002 (ATTRA)
Paillis de plastique-aluminium	Curcubitacées	Chrysomèle rayée du concombre (*Acalymma vittatum*)	Caldwell et Clarke, 1998
Aspirateur à insectes	Fraise	Punaise terne (*Lygus lineolaris)*	Cambell, 2005
Agroécologie, aménagement du paysage	Général	Général	Altieri,1999
Agroécologie, aménagement du paysage	Général	Général	Bianchi et *al*., 2006
Aménagement du paysage, stratégie de répulsion-attraction (push and pull)	Général	Général	Cook et *al*., 2007

1- ÉCOLOGIE DU PAYSAGE ET PRATIQUES CULTURALES			
Approche	**Culture**	**Ravageurs**	**Auteurs**
Aménagement du paysage (Farmscaping)	Général	*Général*	Dufour, 2000 (ATTRA)
Général	Général	Altises	Kuepper, 2003 (ATTRA)
Agroécologie, aménagement du paysage	Général	Général	Landis et *al.*, 2000
Général	Général	Général	Letourneau et *al.*, 2006
Cultures pièges (trap cropping)	Général	Général	Shelton et Badenes-Perez, 2005
Une revue des biopesticides, de leur mode d'action et de leur efficacité	Général	Général	Singh, 2005
Explorations de stratégies de gestion des arthropodes	Général	Général	Zehnder et *al.*, 2007
Lutte intégrée et plusieurs approches biologiques	Laitue	Pucerons (*Nasonovia ribisnigri, Macrosiphum euphorbiae, Pemphigus bursarius, Myzus persicae*)	Parker et *al.*, 2002

2- CONTRÔLE BIOLOGIQUE : PRÉDATEUR, PARASITOÏDE OU ANTAGONISTE

Approche	Culture	Ravageurs	Auteurs
Étude sur des ennemis naturels potentiels pour l'Est du Canada (nématodes entomopathogènes et coccinelles prédatrices)	Crucifères	Cécidomyie du chou-fleur (*Contarinia nasturtii*)	Corlay et *al.*, 2007
Chauve-souris Guêpe parasitoïde (*Braconidae*) Nématodes entomopathogènes	Curcubitacées	Chrysomèle rayée du concombre (*Acalymma vittatum*)	Bellows et Diver, 2002 (ATTRA)
Guêpe parasitoïde (*Braconidae*)	Fraise	Punaise terne (*Lygus lineolaris*)	Tilmon et Hoffmann, 2003
Composées volatiles pour attirer les insectes bénéfiques	Général	Général	Holopainen, J.K. 2005
Guêpe parasitoïde (*Braconidae*) Nématodes entomopathogènes	Général	Altises	Kuepper, 2003 (ATTRA)
Champignon entomopathogène (*Beauveria bassiana*)	Général	Punaise terne (*Lygus lineolaris*)	Leland et McGuire, 2006
Effet de la présence d'une ou de plusieurs espèces prédatrices - Effets de la présence d'une ou plusieurs espèces de proies	Général	Pucerons	Snyder et *al.*, 2008
Champignon entomopathogène - Essais sur une sélection de souches (*Lecanicillium lecanii*, *Paecilomyces farinosus*, *Beauveria bassiana*…)	Général	Pucerons	Vu et *al.*, 2007
Explorations de stratégies de gestion des arthropodes	Général	Général	Zehnder et *al.*, 2007
Influence de bandes de cultures (coriandre et chrysanthème) sur la prédation par les larves de Syrphidés (*Syrphidae*)	Laitue	Pucerons (*Nasonovia ribisnigri*)	Pascual-Villalobos et *al.*, 2006

3- PIÈGES, ACTIVATION DES DÉFENSES ET PHYTOPROTECTION			
Approche	**Culture**	**Ravageurs**	**Auteurs**
Filet (clôture)	Carotte, crucifères	Cécidomyie du chou-fleur (*Contarinia nasturtii*) Mouche du chou (*Delia radicum*) Mouche de la carotte (*Psila rosae*)	Andermatt BIOCONTROL AG
Filet (clôture)	Carotte, crucifères	Mouche du chou (*Delia radicum*) Mouche de la carotte (*Psila rosae*)	Siekmann et *al.*, 2005
Filet (clôture), effet sur la dispersion des insectes	Crucifères	Pucerons (*Myzus persicae*)	Bomford et *al.*, 2000
Filet (clôture)	Crucifères	Cécidomyie du chou-fleur (*Contarinia nasturtii*)	Wyss et *al.*, 2004
Bactéries de la rhizosphère favorisant la croissance et diminuant la curcubitacéine, Roténone, Pyrèthre, Sabadilla	Curcubitacées	Chrysomèle rayée du concombre (*Acalymma vittatum*)	Bellows et Diver, 2002 (ATTRA)
Inducteur de résistance par promoteur de croissance rhizobactérien (PGPR)	Curcubitacées	Chrysomèle rayée du concombre (*Acalymma vittatum*) Flétrissement bactérien (*Erwinia tracheiphila*)	Zehnder et *al.*, 2001
Filet (toile) et pyrèthre Acariens prédateurs	Fraise	Anthonome (*Anthonomus rubi*) Tarsonème (*Phytonemus pallidus*)	Berglund et *al.*, 2007
Piège (surveillance et contrôle)	Général	Punaise terne (*Lygus lineolaris*)	Blackmer et *al.*, 2008
Nicotine (oléate de nicotine, stabilisé avec caséinate de sodium)	Général	Général	Casanova et *al.*, 2002
Une revue des biopesticides, de leur mode d'action et de leur efficacité	Général	Général	Copping et Duke, 2007
Une revue des biopesticides, de leur mode d'action et de leur efficacité	Général	Général	Copping et Menn, 2000
Huile essentielle de lavande	Général	Pucerons (*Myzus persicae*)	González-Coloma et *al.*, 2006

3- PIÈGES, ACTIVATION DES DÉFENSES ET PHYTOPROTECTION			
Approche	**Culture**	**Ravageurs**	**Auteurs**
Une revue des huiles essentielles avec un effet insecticide	Général	Pucerons (*Myzus persicae*) utilisés comme insectes témoins	Isman, 2000
Une revue des insecticides « naturels »	Général	Général	Isman, 2006
Ail, Roténone, savon, pyrèthre	Général	Altises	Kuepper, 2003 (ATTRA)
Piperaceae (poivrier long)	Général	Pucerons (*Myzus persicae*)	Park et *al*., 2002
Une revue des biopesticides, de leur mode d'action et de leur efficacité.	Général	Général	Rai, Mahendra et Carpinella M.C. (éditeurs), 2006
Les pesticides « naturels » - un point de vue de l'Industrie	Général	Général	Rice, 1998
Piperaceae (poivrier)	Général	Général	Scott et *al*., 2008
Phéromones	Général	Général	Shani, 2000
Cultures pièges (trap cropping)	Général	Général	Shelton et Badenes - Perez, 2005
Une revue des biopesticides, de leur mode d'action et de leur efficacité	Général	Général	Singh, 2005
Neem/Margousier (Azadiractine)	Laitue	Pucerons (*Nasonovia ribisnigri*)	Palumbo et *al*., 2001
Neem/Margousier Gliciridia (*Gliricidia sepium*)	Maïs	Général	Montes-Molina et *al*., 2008
Spinosad	Pomme	Anthonome (*Anthonomus pomorum*)	Daniel et *al*., 2005

RAVAGEURS–FICHES RÉFÉRENCES

Altieri M.A., 1999. The ecological role of biodiversity in agroecosystems. *Agriculture, Ecosystems and Environment*, Vol. 74 (1): pp. 19-31. [contact: agroeco3@nature.berkeley.edu]

Increasingly research suggests that the level of internal regulation of function in agroecosystems is largely dependent on the level of plant and animal biodiversity present. In agroecosystems, biodiversity performs a variety of ecological services beyond the production of food, including recycling of nutrients, regulation of microclimate and local hydrological processes, suppression of undesirable organisms and detoxification of noxious chemicals. In this paper the role of biodiversity in securing crop protection and soil fertility is explored in detail. It is argued that because biodiversity mediated renewal processes and ecological services are largely biological, their persistence depends upon the maintenance of biological integrity and diversity in agroecosystems. Various options of agroecosystem management and design that enhance functional biodiversity in crop fields are described.

{Recherche appliquée}

Accès au document : limité avec inscription, via le site Science Direct (document pdf)
Coût : 30,00 $

Voir aussi : Agroecology in action.
Site Internet offrant une réflexion et de nombreux documents
sur le sujet. http://www.agroeco.org

Andermatt BIOCONTROL AG (entreprise suisse). Filet vertical pour le contrôle des ravageurs dans les cultures maraîchères, tels que cécidomyies du chou (*Contarinia nasturtii*), mouches du chou (*Delia radicum*) ou mouches de la carotte (*Psila rosae*).

Le FiBL-Insectstop est un filet vertical qui fait l'effet d'une clôture et qui empêche les insectes de migrer dans les cultures maraîchères. Le haut du filet FiBL-Insectstop est replié vers l'extérieur empêchant les insectes de passer par dessus pour atteindre la culture.

Le FiBL-Insectstop doit être installé tout de suite après le semis/plantation ou avant le début du vol des ravageurs. En principe, il faudrait entourer complètement la parcelle à protéger. Il est également envisageable de protéger uniquement le côté de la parcelle avec le même précédent cultural, mais il faut encore déterminer si cette protection est suffisante.

Les résultats des essais conduits de 2002 à 2004 par l'institut de recherche de l'agriculture biologique (FiBL) ont démontré que la migration des cécidomyies du chou-fleur, des mouches du chou et de la carotte a été empêchée par le FiBL-Insectstop. Les migrations des auxiliaires n'ont par contre été que faiblement restreintes. Dans ces essais, on pouvait réduire les dégâts de 60 à 80 %.

{Transfert technologique}

Accès au document : via le site de l'entreprise (document pdf)
http://www.biocontrol.ch/export/index.php?fibl-insectstop

Anon., 2002. Desk study to apply knowledge developed for conventional horticulture to the control of pests in organic vegetables (OF0179). Report, Wellesbourne, Horticulture Research International. [contact: Arable@defra.gsi.gov.uk]

This is the final report for Defra project OF0179.

The demand for organic vegetable and salad crops is likely to increase as a result of the projected requirements of the multiple retailers. The threat of yield and quality reductions due to pest damage is a major constraint to increasing the organic vegetable crop area. The aim of this project is to demonstrate how methods of pest control developed for conventional vegetable production can be adapted for use by organic growers. The project concentrates on the pest insects that cause damage to umbelliferous and cruciferous vegetable crops. Umbelliferous crops are attacked by one major pest insect, the carrot fly (*Psila rosae*), and two minor pests, whereas cruciferous crops are attacked by about eight major, and over 40 less important pests.

A strategy for reducing carrot fly damage in organically grown umbelliferous crops was produced. The strategy is based on the existing carrot fly forecast, on published data and on information collected previously at HRI. This includes the contribution that can be made by partial host plant resistance. Commercial breeding lines of carrots now have levels of partial resistance up to 75% and, if used in combination with late sowing, could reduce infestations by more than 90% when compared with a susceptible variety sown early.

The carrot fly forecast was adapted to predict 1) the proportion of the first generation of flies that will lay eggs on crops sown on different dates and 2) the timing of emergence of the subsequent (second) fly generation within the crop. Field experiments confirmed that late sowing is an effective method of reducing carrot fly damage. The model was modified to identify the times at which crops should be covered to reduce damage by carrot fly larvae. Previous experiments have shown that to avoid damage by carrot fly larvae, crop covers should be applied to susceptible crops before the start of fly emergence. Although third generation carrot flies may be active after the end of September, their progeny do not damage overwintering crops, so late control is unnecessary.

{Recherche appliquée}

Accès au document : via le site orgprints.org (document pdf)

Arancon, N.Q., Edwards, C.A., Yardim, E.N., Oliver, T.J., Byrne, R.J., Keeney, G., 2007. Suppression of two-spotted spider mite (Tetranychus urticae), mealy bug (Pseudococcus sp) and aphid (Myzus persicae) populations and damage by vermicomposts. *Crop Protection*, Vol. 26 (1): pp. 29-39. [contact: arancon.1@osu.edu]

A vermicompost, produced commercially from food wastes, was tested for its capacity to suppress populations and damage to plants, by two-spotted spider mites (*Tetranychus urticae*), mealy bugs (*Pseudococcus* sp.) and aphids (*Myzus persicae*), in the greenhouse. A range of mixtures of food waste vermicompost and a soil-less bedding plant growth medium Metro-Mix 360 (MM360) was tested in cages (40 cm × 40 cm × 40 cm) (0.2 mm mesh aperture) into which known numbers of greenhouse-bred pests were released. The crops tested were cucumbers and tomatoes for mealy bugs, bush beans and eggplants for spider mites, and cabbages for aphids. In all experiments, four 10 cm diameter pots, each containing one seedling, grown in the same MM360/vermicompost mixture were exposed to either 50 mealy bugs, 100 spider mites, or 100 aphids in cages, with each cage treatment replicated 4 times per treatment. The five growth mixtures tested were: (i) 100% MM360; (ii) 90% MM360 with 10% vermicompost; (iii) 80% MM360 with 20% vermicompost; (iv) 60% MM360 with 40% vermicompost; and (v) 20% MM360 with 80% vermicompost. Almost all of the mixtures containing vermicomposts suppressed the arthropod pest populations, and decreased pest damage significantly, compared with the MM360 controls. Not only did the vermicomposts make the plants less attractive to the pests, but they also had considerable effects on pest reproduction over time. The effects of the vermicompost substitutions tended to be least on spider mites, intermediate on mealy bugs, and greatest on aphids; however this may relate to the motility of the pests, as well as to the suppression potential of vermicomposts. Possible mechanisms for the suppression discussed include: the form of nitrogen available in the leaf tissues, the effects of vermicomposts on micronutrient availability, and the possible production of phenols, by the plants after applications of vermicomposts, making the tissues unpalatable.

{Recherche appliquée}

Accès au document : via le site Science Direct (document pdf ou html)
Coût : 30,00 $ US

Bellows, B., Diver, S., 2002. Cucumber Beetles: Organic and Biorational IPM. NCAT/ATTRA Pest Management Series. ATTRA Publication #IP212. National Center for Appropriate Technology, Fayetteville, Arkansas. 16 p.

Cucumber beetles are present throughout the U.S. and are one of the most serious pests on cucurbits in many areas. The overwintering adult insect causes feeding damage on young, emerging plants; larvae maturing in the soil feed on plant roots; and the adults that arise from these larvae feed on plant leaves, blossoms, and fruit. Besides damaging plants by feeding on roots, stems, leaves, and fruits, these insects also transmit bacterial wilt and squash mosaic virus This publication will focus on organic and biorational control methods that fit into an IPM (integrated pest management) approach. Organic control measures include delayed planting and use of trap crops, parasitic organisms, and botanical pesticides. Includes lists of further resources, websites, and suppliers of crop protection materials.

{Transfert technologique}

Accès au document : via le site de l'ATTRA (document html en ligne, ou document pdf)

Berglund, R., Svensson, B., Nilsson C., 2007. Evaluation of methods to control *Phytonemus pallidus* and *Anthonomus rubi* in organic strawberry production *Journal of Applied Entomology*, Vol. 131 (8): pp. 573-578. [contact: Rakel.Berglund@ltj.slu.se]

Use of the predatory mite *Neoseiulus cucumeris* (Oudemans) (Acari, Phytoseiidae) and a fleece cover in combination with pyrethrum application showed potential for control of two important pests in organic production of strawberry (*Fragaria* × *ananassa* Duch.), although there were some unexpected interactions between pyrethrum and the release of *N. cucumeris* that need to be investigated further. Two cultivars, Honeoye and Cavendish, were treated with pyrethrum with or without fleece to control strawberry blossom weevils [*Anthonomus rubi* Herbst. (Col., Curculionidae)] and *N. cucumeris* was released to control strawberry mites [*Phytonemus pallidus* (Banks) (Acari, Tarsonemidae)]. Number of strawberry mites, number of flower buds damaged by the weevil, incidence of grey mould and powdery mildew, and fruit yield were measured in two consecutive fruiting seasons. In Honeoye, the fleece in combination with pyrethrum decreased the proportion of damaged buds by 11–23% and increased yield by 49–91 g per plant. When pyrethrum was used alone it did not influence the number of damaged buds or yield. This indicates that the combined treatment was more effective because of the fleece. In Cavendish, the fleece and pyrethrum treatments were not found to be effective. Almost no *P. pallidus* was found in Honeoye and the results were not analysable. In plots with Cavendish where *N. cucumeris* had been released, there were approximately 50% fewer *P. pallidus* from the end of August onwards in 2003. However, this response did not significantly influence the succeeding year's yield. The number of fruits infected with fungi was very low and no effects were observed for any of the treatments.

{Recherche appliquée}

Accès au document : limité avec inscription, via Wiley Inter Science (document html ou pdf)
Coût : 39,00 $ US pour un accès de 30 jours à l'article

Bianchi, F.J.J.A., Booij, C.J.H., Tscharntke, T., 2006. Sustainable pest regulation in agricultural landscapes: a review on landscape composition, biodiversity and natural pest control. *Proceedings of the Royal Society B. Biological Sciences*, Vol. 273 (1595): pp. 1715-1727

Agricultural intensification has resulted in a simplification of agricultural landscapes by the expansion of agricultural land, enlargement of field size and removal of non-crop habitat. These changes are considered to be an important cause of the rapid decline in farmland biodiversity, with the remaining biodiversity concentrated in field edges and non-crop habitats. The simplification of landscape composition and the decline of biodiversity may affect the functioning of natural pest control because non-crop habitats provide requisites for a broad spectrum of natural enemies, and the exchange of natural enemies between crop and non-crop habitats is likely to be diminished in landscapes dominated by arable cropland. In this review, we test the hypothesis that natural pest control is enhanced in complex patchy landscapes with a high proportion of non-crop habitats as compared to simple large-scale landscapes with little associated non-crop habitat. In 74% and 45% of the studies reviewed, respectively, natural enemy populations were higher and pest pressure lower in complex landscapes versus simple landscapes. Landscape-driven pest suppression may result in lower crop injury, although this has rarely been documented. Enhanced natural enemy activity was associated with herbaceous habitats in 80% of the cases (e.g. fallows, field margins), and somewhat less often with wooded habitats (71%) and landscape patchiness (70%). The similar contributions of these landscape factors suggest that all are equally important in enhancing natural enemy populations. We conclude that diversified landscapes hold most potential for the conservation of biodiversity and sustaining the pest control function.

{Recherche appliquée}

Accès au document : via le site Royal Society Publishing (document pdf ou html)

Bjorkman, M., Hamback, P.A., Ramert, B., 2007. Neighbouring monocultures enhance the effect of intercropping on the turnip root fly (Delia floralis). *Entomologia Experimentalis et Applicata, Blackwell Publishing*, Vol. 124 (3): pp. 319-326.

Knowledge of insect behaviour is essential for accurately interpreting studies of diversification and to develop diversified agroecosystems that have a reliable pest-suppressive effect. In this study, we investigated the egg-laying behaviour of the turnip root fly, *Delia floralis* (Fall.) (Diptera: Anthomyiidae), in an intercrop-monoculture system. We examined both the main effect of intercropping and the effect on oviposition in the border zone between a cabbage monoculture [*Brassica oleracea* L. var. *capitata* (Brassicaceae)] and a cabbage-red clover intercropping system [*Trifolium pratense* L. (Fabaceae)]. To investigate the border-effect, oviposition was measured along a transect from the border between the treatments to the centre of experimental plots. Intercropping reduced the total egg-laying of *D. floralis* with 42% in 2003 and 55% in 2004. In 2004, it was also found that the spatial distribution of eggs within the experimental plots was affected by distance from the adjoining treatment. The difference in egg-laying between monoculture and intercropping was most pronounced close to the border, where egg-laying was 68% lower on intercropped plants. This difference in egg numbers decreased gradually up to a distance of 3.5 m from the border, where intercropped plants had 43% fewer eggs than the corresponding monocultured plants. The reason behind this oviposition pattern is most likely that flies in intercropped plots have a higher probability of entering the monoculture if they are close to the border than if they are in the centre of a plot. When entering the monoculture, flies can pursue their egg-laying behaviour without being disrupted by the clover. As the final decision to land is visually stimulated, flies could also be attracted to fly from the intercropped plots into the monoculture, where host plants are more visually apparent. Visual cues could also hinder flies in a monoculture from entering an intercropped plot. Other possible patterns of insect attack due to differences in insect behaviour are discussed, as well as the practical application of the results of this study.

{Recherche appliquée}

Accès au document : via le site Ingenta Connect (document pdf ou html)
Coût de l'article : 55,09 $ US

Blackmer, J.L., Byers, J.A., Saona C.R., 2008. Evaluation of color traps for monitoring Lygus spp.: Design, placement, height, time of day, and non-target effects. *Crop Protection*, Vol. 27: pp. 171-181. [contact: jblackmer@wcrl.ars.usda.gov]

Lygus hesperus and *Lygus lineolaris* are two of the most economically important plant bugs in North America. Here we present results from field trials that evaluated effective trap characteristics for maximizing *Lygus* spp. and other herbivorous insect capture, while minimizing beneficial insect capture. The response of *Lygus* bugs, several other key herbivore species and predators to hue (white, clear, black, yellow, orange, blue, purple, green and red) and value (black, white and two neutral grays) was examined in alfalfa over three seasons using traps coated with Pestick adhesive. *Lygus* spp. exhibited a broad response to trap hue, but showed no response to trap value. Additionally, we showed that time of day, trap height and trap placement influenced the number of *Lygus* spp. captured. More *Lygus* spp. were trapped from late afternoon to dusk compared to all other times of the day, and more males than females were captured on sticky traps even though the sexes were at parity in field sweep net samples. In the alfalfa setting, male *Lygus* were more likely to be captured on traps placed 20 cm above the ground; traps placed 50 and 100 cm above the ground caught similar numbers of males and females. The highest number of plant bugs was captured when traps were placed in a cleared area between two alfalfa fields; lower numbers were captured on traps at the edge and in the center of the field. All other herbivores exhibited distinct preferences to trap hue and, in some cases, trap value. Predators were rarely trapped, but did exhibit preferences to trap color (i.e., hue and value) characteristics. The potential of using sticky traps with specific hue and value characteristics to monitor *Lygus* spp. effectively is discussed.

{Recherche appliquée}

Accès au document : via le site Science Direct (document pdf ou html)
Coût : 30,00 $ US

Bomford, M.K.; Vernon, R.S., Pats, P., 2000. Aphid (Homoptera: *Aphididae*) accumulation and distribution near fences designed for cabbage fly (Diptera: *Anthomyiidae*) exclusion. *Journal of the Entomological Society of British Columbia*, Vol. 97: pp. 79-87.
[contact: michael.bomford@kysu.edu]

Aphids accumulate near exclusion fences designed to intercept *Delia radicum* (L.) movement into fields. Aphid accumulations increase with fence height, but are not affected by fence overhang length. Overall aphid levels are higher in small (4.3 x 4.3 m) enclosed plots than in unenclosed plots. Enclosing large (38 x 38 m) plots does not alter overall aphid catches, but does alter aphid distribution within enclosures. In large enclosures aphid accumulations are higher at enclosure perimeters than interiors, with the highest accumulations near enclosure corners. This concentric distribution is not observed in unfenced areas, and is not altered by the addition of a trap crop inside an enclosure.

{Recherche appliquée}

Accès au document : via le site orgprints.org (document pdf)

Caldwell, J.S., Clarke, P., 1998. Aluminum-coated plastic for repulsion of cucumber beetles. *Commercial Horticulture Newsletter*, January–February 1998. Virginina Cooperative Extension, Virginia Tech.

Striped, *Acalymma vittata* (Fabricius), and spotted, *Diabrotica undecimpunctata howardi* Barber, cucumber beetles (Coleoptera: Chrysomelidae) are major pests of cucurbits in Virginia, especially for biological farmers who do not use insecticides (Caldwell et al., 1995). Feeding damage on young cucurbit seedlings can be serious in May and June. Bacterial wilt is transmitted by these beetles and can cause serious problems when insecticides are not used. Incidence of virus in squash is especially high in August in Virginia. In the Northern Neck of Virginia, average losses due to viruses were 70-80% of marketable yield of sample farms in 1997, and up to 100% in the worst case (Sam Johnson, Extension Agent, personal communication, 1998). Virus diseases on cucurbits include Cucumber mosaic virus (CMV), Squash mosaic virus (SqMV), Zucchini yellow mosaic virus (ZYMV), and Watermelon mosaic virus 2 (WMV2). CMV, WMV2, and ZYMV are transmitted by aphids, but SqMV is transmitted by cucumber beetles (Matthews, 1991).

Aluminum-coated plastic has been known for many years to repel aphids, reduce and delay the incidence of aphid-transmitted virus diseases, and increase total and marketable yield (Brown et al., 1993; Brown et al., 1996; Chalfant et al., 1977; Conway et al., 1989; Lancaster et al., 1987). It has also been shown in one study to reduce the incidence of striped and spotted cucumber beetles (Schalk et al., 1979), but it has not been widely been used for cucumber beetle control. In 1996, there appeared to be few cucumber beetles in an observational plot of squash planted into aluminum-coated plastic (P. Clarke, personal observation). In 1997, we therefore established an experiment to determine the extent to which aluminum-coated plastic repelled cucumber beetles.

{Recherche appliquée}

Accès au document : via le site de Virginia Tech (document html)

Campbell R., 2005. Pneumatic Insect Control for Organic Production. Organic Agriculture Centre of Canada. {En ligne}

Pneumatic equipment uses moving airstreams to dislodge insects from crop plants and then collects them from the dislodging airstream. The dislodging airstream may be either negative pressure (vacuum) or positive pressure (blowing). Dislodged insects are either collected in the vacuum stream and destroyed in turbines, or blown onto a collection device opposite the airstream. The two most common applications of this technology have been the control of the Colorado potato beetle (CPB) in potato fields and of the tarnished plant bug (TPB) in strawberry crops.

{Transfert technologique}

Accès au document : via le site du Centre d'agriculture biologique du Canada

Casanova H, Ortiz C, Peláez C, Vallejo A, Moreno ME, Acevedo M., 2002. Insecticide Formulations Based on Nicotine Oleate Stabilized by Sodium Caseinate. *J. Agric. Food Chem*., Vol. 50 (22): pp. 6389-6394. [contact: casanova@matematicas.udea.edu.co]

Organic farming and new trends toward the use of safer insecticides for crop protection have created new opportunities for botanical insecticides in the pesticide market. In this study, the botanical insecticide nicotine was formulated as a dispersion (20 vol %) stabilized by sodium caseinate, with nicotine oleate solutions used as the dispersed phase. The formulation showed a phase transition on increasing the nicotine oleate concentration, being an emulsion at 7.5-8.2 wt %, a suspo-emulsion at 8.2-9.7 wt %, and a suspension at 9.7-10.8 wt %. Biological activity, apparent viscosity, dispersion time, and protein surface coverage were dependent on nicotine oleate concentration. The emulsion with 8.2 wt % nicotine oleate and the suspo-emulsion with 8.7 wt % nicotine oleate were found to be the most appropriate formulations for insecticide purposes due to their high bioactivity, low viscosity, and low dispersion time. Nicotine oleate formulations showed good creaming and microbiological stability for at least 4 months without losing their biological activity.

{Recherche appliquée}

Accès au document : via le site ACS Publications (document pdf ou html)
Coût de l'article : 25,00 $ US pour un accès de 48 h.

Cook, S.M., Khan, Z.R., Pickett, J.A., 2007. The Use of Push-Pull Strategies in Integrated Pest Management. *Annual Review of Entomology*, Vol. 52: pp. 375-400.
[contact: sam.cook@bbsrc.ac.uk]

Push-pull strategies involve the behavioral manipulation of insect pests and their natural enemies via the integration of stimuli that act to make the protected resource unattractive or unsuitable to the pests (push) while luring them toward an attractive source (pull) from where the pests are subsequently removed. The push and pull components are generally nontoxic. Therefore, the strategies are usually integrated with methods for population reduction, preferably biological control. Push-pull strategies maximize efficacy of behavior-manipulating stimuli through the additive and synergistic effects of integrating their use. By orchestrating a predictable distribution of pests, efficiency of population-reducing components can also be increased. The strategy is a useful tool for integrated pest management programs reducing pesticide input. We describe the principles of the strategy, list the potential components, and present case studies reviewing work on the development and use of push-pull strategies in each of the major areas of pest control.

{Recherche appliquée}

Accès au document : via le site Annual Review (document pdf ou html)
Coût de l'article : 20,00 $ US

Copping, L.G., Duke, S.O., 2007. Natural products that have been used commercially as crop protection agents. *Pest Management Science*, Vol. 63 (6): pp. 524-554.
[contact : lcopping@globainet.co.uk]

Many compounds derived from living organisms have found a use in crop protection. These compounds have formed the basis of chemical synthesis programmes to derive new chemical products; they have been used to identify new biochemical modes of action that can be exploited by industry-led discovery programmes; some have been used as starting materials for semi-synthetic derivatives; and many have been used or continue to be used directly as crop protection agents. This review examines only those compounds derived from living organisms that are currently used as pesticides. Plant growth regulators and semiochemicals have been excluded from the review, as have living organisms that exert their effects by the production of biologically active secondary metabolites.

{Recherche appliquée}

Accès au document : via le site Wiley InterScience (document pdf ou html)
Coût de l'article : 29,95 $ US

Voir aussi : Copping, L.G., 2004.The Manual of biocontrol agents, (3rd Ed. of Biopesticide manual). British Crop Protection Council; 760 p. (environ 275,00 $ can).

Copping, L.G., Menn, J.J., 2000. Biopesticides: a review of their action, applications and efficacy, *Pest Management Science*, Vol. 56 (8): pp. 651-676. [contact : lcopping@globainet.co.uk]

A survey is given of the wide range of different materials and organisms that can be classified as biopesticides. Details are given of those currently of commercial importance, and future developments in this area are discussed. It is considered that, while in the immediate future biopesticides may continue to be limited mainly to niche and speciality markets, there is great potential for long-term development and growth, both in their own right and in providing leads in other areas of pest management science.

Biopesticides is a term that encompasses many aspects of pest control such as:

- Microbial (viral, bacterial and fungal) organisms
- Entomophagous nematodes
- Plant-derived pesticides (botanicals)
- Secondary metabolites from micro-organisms (antibiotics)
- Insect pheromones applied for mating disruption, monitoring or lure-and-kill strategies
- Genes used to transform crops to express resistance to insect, fungal and viral attacks or to render them tolerant of herbicide application.

Indeed, some might suggest the inclusion of insect predators and parasites, although these are not covered in this review.

{Recherche appliquée}

Accès : limité avec inscription, via Wiley Inter Science (document html ou pdf)
Coût : 29,95 $ pour un accès de 24 h à la base données du site Internet.

Voir aussi : Copping, L.G., 2004.The Manual of biocontrol agents, (3rd Ed. of Biopesticide manual). British Crop Protection Council; 760 p. (environ 275,00 $ can).

Corlay, F., Boivin G., Bélair G., 2007. Efficiency of natural enemies against the swede midge Contarinia nasturtii (Diptera: Cecidomyiidae), a new invasive species in North America. *Biological Control*, Vol. 43 (2): pp. 195-201. [contact: boiving@agr.gc.ca]

The swede midge, *Contarinia nasturtii* Kieffer (Diptera: Cecidomyiidae), a widespread pest of cruciferous crops in Europe, has been recently found in Canada. A 2-year survey in Quebec yielded no specialized natural enemies. Two polyphagous coccinellid predators (*Harmonia axyridis* (Pallas) and *Coccinella septempunctata* L) were field collected for further evaluation. In laboratory experiments, these two coccinellid species fed on swede midge larvae, and *H. axyridis* showed a higher voracity than *C. septempunctata*. Late larvae and adults of *H. axyridis* were shown to consume more swede midge larvae than young larvae, while the adults of *H. axyridis* showed no preference between swede midge larvae and the green peach aphid *Myzus persicae*. However, *H. axyridis* adults were not able to prey on swede midge larvae on potted infested broccoli plants. The susceptibility of swede midge larvae to three species of entomopathogenic nematodes (*Steinernema feltiae*, *Steinernema carpocapsae*, and *Heterorhabditis bacteriophora*) was also evaluated. *H. bacteriophora* was the only species that caused significant mortality to swede midge larvae. At a concentration of 1000 IJs/larva, *H. bacteriophora* caused 90-100% mortality to swede midge larvae in loam, sandy loam, clay and muck soils.

{Recherche appliquée}

Accès au document : via le site Science Direct (document pdf ou html)
Coût : 30,00 $ US

Daniel, C.; Tschabol, J.-L., Wyss, E. 2005. Bekämpfung des Apfelblütenstechers mit Spinosad im biologischen Anbau [Lutte contre l'anthonome du pommier dans la culture biologique au moyen de Spinosad]. *Schweizerische Zeitschrift für Obst- und Weinbau,* 141 (4/05): pp. 9-12. (allemand)

Daniel, C.; Wyss, E., Tschabold, J.-L. 2005. Anthonome du pommier: On a enfin trouvé une solution. *Bio actualités,* 1/105: pp. 8-9. (français) [contact: info.suisse@fibl.org]

L'anthonome du pommier est un ravageur très répandu en Europe. Dans la culture biologique, aucun produit de lutte contre l'anthonome du pommier n'était admis à ce jour. Spinosad « Audienz » est désormais autorisé dans la nouvelle liste des produits auxiliaires publiée par l'IRAB pour 2005, pour l'application préflorale contre l'anthonome du pommier.

Lors de traitements effectués en 2003, les applications avec un turbo-diffuseur dans de grandes parcelles étaient nettement plus efficaces que les traitements effectués avec un pulvérisateur dorsal dans des parcelles plus petites; 2 applications ont eu plus d'impact qu'une seule. Les concentrations suggérées vont de 0,02 % à 0,04 % (1 500 litres de bouillis à l'hectare), 1 à 2 applications (en préfloraison) par saison.

{Transfert technologique}

Accès au document : via le site orgprints.org (document pdf)

Dufour, Rex. 2000. Farmscaping to Enhance Biological Control. NCAT/ATTRA Pest Management Series. ATTRA Publication #CT065. National Center for Appropriate Technology, Fayetteville, Arkansas. 40 p. [contact: rexd@ncat.org]

"Farmscaping" is a whole-farm, ecological approach to pest management. It can be defined as the use of hedgerows, insectary plants, cover crops, and water reservoirs to attract and support populations of beneficial organisms such as insects, bats, and birds of prey.

This publication contains information about increasing and managing biodiversity on a farm to favor beneficial organisms, with emphasis on beneficial insects. The types of information farmscapers need to consider is outlined and emphasized. Appendices have information about various types and examples of successful "farmscaping" (manipulations of the agricultural ecosystem), plants that attract beneficials, pests and their predators, seed blends to attract beneficial insects, examples of farmscaping, hedgerow establishment and maintenance budgets, and a sample flowering period table.

{Transfert technologique}

Accès au document : via le site de l'ATTRA (document html en ligne, ou document pdf)

Finch, S., Billiald, H., Collier, R.H., 2003. Companion planting do aromatic plants disrupt host-plant finding by the cabbage root fly and the onion fly more effectively than non-aromatic plants? *Entomologia Experimentalis et Applicata, Blackwell Publishing*, Vol. 109 (3): pp. 183-195.

Brassica and *Allium* host-plants were each surrounded by four non-host plants to determine how background plants affected host-plant finding by the cabbage root fly (*Delia radicum* L.) and the onion fly [*Delia antiqua* (Meig.)] (Diptera: Anthomyiidae), respectively. The 24 non-host plants tested in field-cage experiments included garden `bedding' plants, weeds, aromatic plants, companion plants, and one vegetable plant. Of the 20 non-host plants that disrupted host-plant finding by the cabbage root fly, fewest eggs (18% of check total) were laid on host plants surrounded by the weed *Chenopodium album* L., and most (64% of check total) on those surrounded by the weed *Fumaria officinalis* L. Of the 15 plants that disrupted host-plant finding in the preliminary tests involving the onion fly, the most disruptive (8% of check total) was a green-leaved variant of the bedding plant *Pelargonium* × *hortorum* L.H. Bail and the least disruptive (57% of check total) was the aromatic plant *Mentha piperita* × *citrata* (Ehrh.) Briq. Plant cultivars of *Dahlia variabilis* (Willd.) Desf. and *Pelargonium* × *hortorum*, selected for their reddish foliage, were less disruptive than comparable cultivars with green foliage. The only surrounding plants that did not disrupt oviposition by the cabbage root fly were the low-growing scrambling plant *Sallopia convolvulus* L., the grey-foliage plant *Cineraria maritima* L., and two plants, *Lobularia maritima* (L.) Desv. and *Lobelia erinus* L. which, from their profuse covering of small flowers, appeared to be white and blue, respectively. The leaf on which the fly landed had a considerable effect on subsequent behaviour. Flies that landed on a host plant searched the leaf surface in an excited manner, whereas those that landed on a non-host plant remained more or less motionless. Before taking off again, the flies stayed 2-5 times as long on the leaf of a non-host plant as on the leaf of a host plant. Host-plant finding was affected by the size (weight, leaf area, height) of the surrounding non-host plants. `Companion plants' and aromatic plants were no more disruptive to either species of fly than the other plants tested. Disruption by all plants resulted from their green leaves, and not from their odours and/or tastes.

{Recherche appliquée}

Accès au document : via le site Ingenta Connect (document pdf ou html)
Coût de l'article : 55,09 $ US

González-Coloma, A., Martín-Benito, D., Mohamed, N., García-Vallejo, M.C., Soria, A.C., 2006. Antifeedant effects and chemical composition of essential oils from different populations of Lavandula luisieri L. *Biochemical Systematics and Ecology*, Vol. 34 (8): pp. 609-616.
[contact: azu@ccma.csic.es]

Forty-seven individual *Lavandula luisieri* (Rozeira) Riv.-Mart. plants were grouped into six categories according to their volatile composition using Principal Component Analysis. The essential oils from flowers and leaves from these six groups were analyzed by GC–MS and their antifeedant effects tested against the insect species *Spodoptera littoralis*, *Leptinotarsa decemlineata* and *Myzus persicae*; *L. decemlineata* and *M. persicae* being the most sensitive species. The antifeedant effects of these oils could not be justified by the activity of their major components considered individually thus pointing to synergistic effects among the oil components as suggested by a stepwise linear regression of compound concentrations on antifeedant effects for these groups.

{Recherche appliquée}

Accès au document : via le site Science Direct (document pdf ou html)
Coût : 30,00 $ US

Grundy, A. 2006. Using weeds to reduce pest insect numbers in organic vegetable crops - a desk study (OF0329). Report, Warwick HRI. [contact: Arable@defra.gsi.gov.uk]

Vegetable brassicas were chosen as the experimental crop, because their pest and weed models have been well validated, and because Brassica crops account for approximately 20% of the total organic vegetables grown in the UK. However, the research also demonstrates how the system could be adapted for other crop/pest combinations.

Three non-host weed plants were used in the study; Chenopodium album (fat hen), Stellaria media (common chickweed) and Tripleurospermum inodorum (scentless mayweed). These species were selected because they are common weeds in field vegetable crops, reduce colonisation by the cabbage root fly (Delia radicum) and have contrasting architecture (spread and height). The treatments combined weed species, planting times, plant sizes and plant densities to examine the impact on pest colonisation of cabbage.

To combine weed and pest insect models to quantify the interactions between crop growth, weed growth and pest insect numbers, further statistical analyses were done to consider relationships between the numbers of pests per plant and various crop and weed parameters.

The strategies were timed to coincide with periods of either low or high pest incidence in the field, predicted using the D. radicum forecast, and the weeds were removed 4 weeks after transplanting, when the cabbage plants should have been sufficiently well established to withstand a certain amount of root damage. Although the weeds were removed after the first 4 weeks of cabbage growth, the high density of weeds required over this period caused a significant reduction in crop yield.

Practical conclusions

1. The trade-off between crop yield and pest control is clearly illustrated by the study. Yield loss (up to 30%) due to competition may be tolerable as an alternative to severe pest damage, in situations where infestation levels are high.
2. The strategy of allowing weed presence for a limited period whilst maintaining a «weed: crop» ratio above a threshold can provide some protection against pest damage.
3. Planting into a background of natural flora is probably the most practical way of achieving this protection. However, the weeds would need to be well established before the cabbage was transplanted to achieve the required weed: crop ratio.
4. Weeds in close proximity to the crop do reduce pest colonisation, as seen in other studies. Hence a lower total number of weeds could potentially achieve the same protective effect, providing they are close to the crop plant.
   Further information is needed on the spatial characteristics of plant competition to enable more realistic and practical strategies to be evaluated.

{Recherche appliquée}

Accès au document : via le site orgprints.org (document pdf)

Holopainen, J.K. 2005. Improvement of biological control by volatile plant compounds. *Forskningsnytt om økologisk landbruk i Norden*, (1): pp. 18-19 [contact: riitta.koistinen@mtt.fi]

Compared to conventional farming the pest management strategies in organic farming is based on better plant resistance and sustainable cultivation technique that does not destroy the natural enemies of pest insects. Methods that reduce feeding efforts of pests and maintain strong population of predators and parasitoid on crop plant, are the way forward for sustainable plant protection strategies. Volatile compounds extracted from plants and sprayed on crop plants are one of the key factors for the development of these techniques.

{Transfert technologique}

Accès au document : via le site orgprints.org (document pdf)

Isman M.B., 2006. Botanical Insecticides, deterrents, and repellents in modern agriculture and an increasingly regulated world. *Annual Review of Entomology*, Vol. 51: pp. 45-66.
[contact: murray.isman@ubc.ca]

Botanical insecticides have long been touted as attractive alternatives to synthetic chemical insecticides for pest management because botanicals reputedly pose little threat to the environment or to human health. The body of scientific literature documenting bioactivity of plant derivatives to arthropod pests continues to expand, yet only a handful of botanicals are currently used in agriculture in the industrialized world, and there are few prospects for commercial development of new botanical products. Pyrethrum and neem are well established commercially, pesticides based on plant essential oils have recently entered the marketplace, and the use of rotenone appears to be waning. A number of plant substances have been considered for use as insect antifeedants or repellents, but apart from some natural mosquito repellents, little commercial success has ensued for plant substances that modify arthropod behavior. Several factors appear to limit the success of botanicals, most notably regulatory barriers and the availability of competing products (newer synthetics, fermentation products, microbials) that are cost-effective and relatively safe compared with their predecessors. In the context of agricultural pest management, botanical insecticides are best suited for use in organic food production in industrialized countries but can play a much greater role in the production and postharvest protection of food in developing countries.

{Recherche appliquée}

Accès au document : via le site Annual Review (document pdf ou html)

Coût de l'article : 20,00 $ US

Isman, M.B., 2000. Plant essential oils for pest and disease management. *Crop Protection*, Vol. 19 (8-10): pp. 603-608. [contact: murray.isman@ubc.ca]

Certain essential plant oils, widely used as fragrances and flavors in the perfume and food industries, have long been reputed to repel insects. Recent investigations in several countries confirm that some plant essential oils not only repel insects, but have contact and fumigant insecticidal actions against specific pests, and fungicidal actions against some important plant pathogens. As part of an effort aimed at the development of reduced-risk pesticides based on plant essential oils, toxic and sublethal effects of some essential oil terpenes and phenols have been investigated using the tobacco cutworm (*Spodoptera litura*) and the green peach aphid (*Myzus persicae*) as model pest species. In this paper I review (i) the range of biological activities of essential oils and their constituents; (ii) their toxicity and proposed mode-of-action in insects; (iii) their potential health and environmental impacts as crop protectants; and (iv) commercialization of pesticides based on plant essential oils.

{Recherche appliquée}

Accès au document : via le site Science Direct (document pdf ou html)
Coût : 30,00 $ US

Kuepper, G. 2003. Flea Beetle: Organic Control Options. NCAT/ATTRA Pest Management Series. ATTRA Publication #CT114. National Center for Appropriate Technology, Fayetteville, Arkansas. 6 p. [contact: georgek@ncat.org]

This publication focuses on organic control of flea beetles, one of the more serious vegetable crop pests. Cultural and biological options are discussed along with alternative pesticidal materials.

In organic systems, the preferred approaches to pest management are those that enhance the diversity of the farm system, such as cover cropping, rotation, and interplanting; those that use special knowledge of pest biology, such as delayed planting; and those that take advantage of existing on-farm resources. These approaches are typified by cultural and biological controls, which will be discussed first. Alternative pesticides, while frequently necessary for some crop pests and conditions, can be treated as "rescue chemistry"—to be used when and if other strategies fall short.

{Transfert technologique}

Accès au document : via le site de l'ATTRA (document html en ligne, ou document pdf)

Landis, D.A., Wratten, S.D., Gurr G.M., 2000. Habitat management to conserve natural enemies of arthropod pests in agriculture. *Annual Review of Entomology*, Vol. 45: pp. 175-201.
[contact: landisd@pilot.msu.edu]

Many agroecosystems are unfavorable environments for natural enemies due to high levels of disturbance. Habitat management, a form of conservation biological control, is an ecologically based approach aimed at favoring natural enemies and enhancing biological control in agricultural systems. The goal of habitat management is to create a suitable ecological infrastructure within the agricultural landscape to provide resources such as food for adult natural enemies, alternative prey or hosts, and shelter from adverse conditions. These resources must be integrated into the landscape in a way that is spatially and temporally favorable to natural enemies and practical for producers to implement. The rapidly expanding literature on habitat management is reviewed with attention to practices for favoring predators and parasitoids, implementation of habitat management, and the contributions of modeling and ecological theory to this developing area of conservation biological control**.** The potential to integrate the goals of habitat management for natural enemies and nature conservation is discussed.

{Recherche appliquée}

Accès au document : via le site Annual Review (document pdf ou html)
Coût de l'article : 20,00 $ US

Leland, J.E., McGuire, M.R., 2006. Effects of different Beauveria bassiana isolates on field populations of Lygus lineolaris in pigweed (Amaranthus spp) *Biological Control*, Vol. (3): pp. 272-281. [contact: jleland@ars.usda.gov]

The tarnished plant bug, *Lygus lineolaris* (Palisot de Beauvois), is a pest of various fruit, vegetable, fiber, and seed crops; including cotton. *Lygus* spp. populations often build on alternate host plants before moving to cotton, and in the midsouthern U.S. wild host plants, such as pigweed (*Amaranthus* spp.), play a major role in *L. lineolaris* population development. Three isolates of the entomopathogenic fungus *Beauveria bassiana* (Balsamo) were evaluated for *L. lineolaris* control in redroot pigweed (*Amaranthus retroflexus* L.): one from *L. lineolaris* in Mississippi (TPB3); one from *Lygus hesperus* (Knight) in California (WTPB2); and one commercial isolate from Mycotrol® (GHA). Fungal applications resulted in moderate to high mycosis in adults (33 to 80%) and moderate mycosis in nymphs (36 to 53%) that were collected from field plots at 2 days post-treatment and incubated under laboratory conditions. Although TPB3 was previously found to be more pathogenic in laboratory bioassays, there was not a consistent separation of this isolate from the other two isolates in field trials. Where differences in adult mycosis or mortality were observed, TPB3 was the most pathogenic. However, in one field trial 7 day mortality for nymphs treated with GHA was higher than those treated with TPB3 or WTPB2. Infection rates at 2, 7, and 14 days post-treatment from caged and non-caged adults suggested that movement of adults among plots occurred, which could have masked some treatment effects. Fungal treatments did not significantly reduce populations relative to controls. This may have been caused by delayed mortality rates under field conditions and/or difficulties with estimating population change under field conditions characteristic of wild host plant populations (e.g., heterogeneous populations, adult movement, and small plot size). Further work evaluating time–dose–mortality over dynamic temperatures, spring and fall field trials on this and other wild hosts, and improved methods for estimating populations on wild hosts are needed.

{Recherche appliquée}

Accès au document : via le site Science Direct (document pdf ou html)
Coût : 30,00 $ US

Letourneau, D., Bruggen, A. van, 2006. Crop protection in organic agriculture. In :. Kristiansen, P., Taji, A., Reganold, J., Eds. 2006. Organic agriculture: a global perspective. CSIRO Publishing, Collingwood / CABI, Wallingford / Cornell University Press, Ithaca / Manaaki Whenua Press, Lincoln. pp. 93-121. [contact: dletour@ucsc.edu]

This subject is reviewed under the following headings: pests and diseases in organic versus conventional agriculture; pest and disease management in organic versus conventional agriculture, including prevention of colonization or establishment of pests and pathogens in organic agriculture, regulation of established pests and pathogens in organic agriculture, host plant resistance, community resistance - vegetation, community resistance - pathogens and herbivores, community resistance - biological control, curative control; and pest and disease management case studies in organic versus conventional agriculture. Future research directions are also discussed.

{Recueil}

Accès au document : via le site orgprints.org (document pdf)

Montes-Molina, J..A., Luna-Guido, M.L., Espinoza-Paz, N., Govaerts, B., Gutierrez-Miceli, F.A., Dendooven, L., 2008. Are extracts of neem (Azadirachta indica A. Juss. (L.)) and Gliricidia sepium (Jacquin) an alternative to control pests on maize (Zea mays L.). *Crop Protection*, Vol. 27 (3-5): pp. 763-774. [contact: dendoove@cinvestav.mx]

Extracts of plants have been used to control pests, but little information exists about how effective they are to limit crop damage, or how they affect plant growth, crop yield and insects. Extracts from Azadirachta indica A. Juss. (L.) leaves (NEEM treatment), a plant originating from India known for its bio-insecticide characteristics, and Gliricidia sepium (Jacquin kunth ex Walp.) (GLIRICIDIA treatment), a plant originating from Mexico and Central America known to repel insects, were compared to a standard insecticide, lambda-cyalothrin or Karate® (CHEMICAL treatment) for insect pest efficacy in cultivated maize in Chiapas, Mexico. Untreated maize plants served as control (CONTROL treatment). Plant damage, crop growth, yield and fauna were monitored during four growing seasons from 2003 to 2006. Mean maize yield was significantly higher in the NEEM and CHEMICAL treatments, i.e. 9784 and 9916 kg ha^{-1}, respectively, compared to the CONTROL treatment (7206 kg ha^{-1}). The GLIRICIDIA treatment yielded 8747 kg ha^{-1}. Of the 26 insect species found during the growing season, only the number of Spodoptera frugiperda (Lepidoptera: Noctuidae), Macrodactylus spp. (Coleoptera: Melolonthidae) and Frankliniella spp. (Thysanoptera: Thripidae) was significantly different between the treatments, with the lowest values found in the chemical treated plots. The amount of beneficial insects was not affected by treatment, while the amount of insects that cause damage was significantly lower (ca. 2-fold) in the CHEMICAL treatment than in the other treatments. Mean damage to the newly formed leaves was 18% in the NEEM treatment and 23% in the GLIRICIDIA treatment and significantly lower than that of the CONTROL treatment (37%), but significantly higher than that of the CHEMICAL treatment (11%). It was found that leaf extracts of G. sepium and A. indica reduced damage to the newly formed leaves and increased yields compared to untreated maize plants, with neem being more effective. However, neem was not as effective as chemical control with lambda-cyalothrin, for overall maize protection.

{Recherche appliquée}

Accès au document : via le site Science Direct (document pdf ou html)
Coût : 30,00 $ US

Palumbo, J.C., Reyes, F.J., Mullis Jr., C.H., Amaya, A., Ledesma, L., Carey, L., 2001. Neonicotinoids and Azadirachtin in Lettuce: Comparison of Application Methods for Control of Lettuce Aphids. In D. N. Byrne and Baciewicz, Patti [ed.], Vegetable Report Series P-127. Publ. No. AZ1252. University of Arizona, College of Agriculture and Life Sciences, Cooperative Extension, Tucson, Arizona. pp. 35-42.

Several small-plot field studies were conducted at the University of Arizona, Yuma Agricultural Center in the spring 2001 growing season to evaluate various neonicotinoids and azadirachtin products against lettuce aphid, *Nasonovia ribisnigri*, in lettuce. Further, these products were compared as soil-applied treatments, foliar sprays and application through sub-surface irrigation.

The results of these trials provide useful information for understanding how to effectively use the new chemistries available for aphid management in lettuce. First, Platinum performed best as a post-planting application through a side-dress application or through the drip. The foliar neonicotinoids, Assail and Actara were active against lettuce aphids, but were most effective when populations densities were lower. Comparatively, the conventional chemistries (MSR, Orthene/Provado, Provado/Endosulfan) provided consistent control when used aggressively. The azadirachtin products were significantly less effective against LA in head lettuce due largely to their inability to contact the insects, but on formulation (AzaDirect) showed better efficacy when applied through drip irrigation or sprayed repeatedly in romaine lettuce.

{Recherche appliquée}

Accès au document : via le site de l'Université d'Arizona (document pdf)

Park, B.-S., Lee, S.-E., Choi, W.-S., Jeong, C.-Y., Song C., Cho, K.-Y., 2002. Insecticidal and acaricidal activity of pipernonaline and piperoctadecalidine derived from dried fruits of Piper longum L. *Crop Protection*, Vol. 21 (3): pp. 249-251. [contact: sel@pw.usda.gov]

Toxicities of two piperidine alkaloids, pipernonaline and piperoctadecalidine, isolated from *Piper longum* L. were determined against five species of arthropod pests. The most potent insecticidal activities of both alkaloids, pipernonaline (LD_{50}=125 mg/l) and piperoctadecalidine (LD_{50}=95.5 mg/l), were against *Spodoptera litura* F. (Lepidoptera: Noctuidae). Both alkaloids also showed insecticidal activities towards *Myzus persicae* Sulzer (Hemiptera: Sternorrhynche: Aphididae). Piperoctadecalidine (LD_{50}=246 mg/l) but not pipernonaline showed acaricidal activity against *Tetranychus urticae* Koch (Acari: Tetranychidae). Neither compound showed insecticidal effects on *Nilaparvata lugens* Stål (Hemiptera: Fulgoromorpha: Delphacidae) or *Plutella xylostella* L. (Lepidopetera: Yponomeutoidae).

{Recherche appliquée}

Accès au document : via le site Science Direct (document pdf ou html)
Coût : 30,00 $ US

Parker, W.E., Collier, R.H., Ellis, P.R., Mead, A., Chandler, D., Blood Smyth, J.A., Tatchell, G.M., 2002. Matching control options to a pest complex: the integrated pest management of aphids in sequentially-planted crops of outdoor lettuce. *Crop Protection*, Vol. 21 (3): pp. 235-248. [contact: bill.parker@adas.co.uk]

Sequentially planted short-season vegetable crops grown in temperate climates offer the opportunity to use known variations in pest phenology through the season to develop a strategic way of matching control options on different plantings to predicted levels of pest risk. To test this approach in the UK, five field experiments were done over two years to test integrated pest management (IPM) programmes for four aphid pest species (*Nasonovia ribisnigri, Macrosiphum euphorbiae, Pemphigus bursarius* and *Myzus persicae*) on outdoor lettuce crops. Crops were planted to coincide with different periods of forecast aphid risk. The results suggested that acceptable levels of aphid control could be achieved, provided a full range of treatment options (resistant cultivars, selective insecticides, biocontrol agents and validated pest forecasts) could be utilised. Commercial and technical constraints to the commercial adoption of this approach are discussed.

{Recherche appliquée}

Accès au document : via le site Science Direct (document pdf ou html)
Coût : 30,00 $ US

Pascual-Villalobos, M.J., Lacasa, A., González, A., Varó, P., García, M.J., 2006. Effect of flowering plant strips on aphid and syrphid populations in lettuce. *European Journal of Agronomy,* Vol. 24 (2): pp. 182-185. [contact: MJesus.Pascual@carm.es]

A two-year field experiment was carried out in Southeast Spain to study the effect of planting strips of *Coriandrum sativum* L. or *Chrysanthemum coronarium* L. with spring Iceberg lettuce on aphid and syrphid predator populations. Without chemical treatments, infestations by *Nasonovia ribisnigri* Mosley spread over the field in March and April. In 2001, the severity of infestations was greater (statistically significant) in lettuces from the plot with coriander margins in comparison with the monoculture. In 2002, predatory syrphid larvae were more abundant (tendency not statistically significant) on lettuces from the plot with flowering plant strips (1.9 larvae/head) than on lettuce monocultures (1.3 larvae/head). Adult syrphids were foraging on flowering strips from early winter to spring. Species identified being: *Episyrphus balteatus* De Geer, *Eupeodes corollae* Fabricius, *Sphaerophoria rueppellii* Wiedemann and *Sphaerophoria scripta* Linnaeus.

{Recherche appliquée}

Accès au document : via le site Science Direct (document pdf ou html)
Coût : 30,00 $ US

Rai, Mahendra et María Cecilia Carpinella (éditeurs), 2006. *Naturally Occurring Bioactive Compounds. Advances in Phytomedicine*, Vol. 3: pp. 1-502. ISBN: 9780444522412
http://www.sciencedirect.com/science/bookseries/1572557X

Chapitres :

1- Natural compounds as antioxidant and molting inhibitors can play a role as a model for search of new botanical pesticides.
2- Pesticides based on plant essential oils: from traditional practice to commercialization.
3- Natural substrates and inhibitors of multidrug resistant pumps (MDRs) redefine the plant antimicrobials.
4- New concept to search for alternate insect control agents from plants.
5- Role of Melia azedarach L. (Meliaceae) for the control of insects and acari: present status and future prospects.
6- Bioactivity of fabaceous plants against food-borne and plant pathogens: potentials and limitations.
7- Screening of plants against fungi affecting crops and stored foods.
8- Opportunities and potentials of botanical extracts and products for management of insect pests in cruciferous vegetables.
9- The potential for using neem (Azadirachta indica A. Juss) extracts for pine weevil management in temperate forestry.
10- Plant allelochemicals in thrips control strategies.
11- Importance of plant secondary metabolites for protection against insects and microbial infections.
12- Naturally occurring house dust mites control agents: development and commercialization.
13- The search for plant-derived compounds with antifeedant activity.
14- An overview of the antimicrobial properties of Mexican medicinal plants.
15- Promissory botanical repellents/deterrents for managing two key tropical insect pests, the whitefly Bemisia tabaci and the mahogany shootborer Hypsipyla grandella.
16- Naturally occurring anti-insect proteins: current status and future aspects.
17- Antifungal natural products: assays and applications.

{Recherche appliquée}

Accès au document : chaque chapitre est disponible via le site Science Direct
(document pdf ou html)
Coût : 30,00 $ US par chapitre

Rice, M.J., Legg, M., Powell, K.A., 1998. Natural products in agriculture - a view from the industry. P*esticide Science*, Vol. 52 (2): pp. 184-188.

The paper discusses the use of natural products and biological control agents in crop protection from an industrial viewpoint. The criteria which must be satisfied are noted. Examples are given from the genetic engineering of baculoviruses and proteins. The final section considers the utility of natural products as a source of leads for conventional agrochemicals, and the screens needed.

{Recherche appliquée}

Accès au document : via le site Wiley InterScience (document pdf ou html)
Coût de l'article : 29,95 $ US

Rosenfeld, A., Collier, R., Jayasinghe, C. 2006 Evaluation of module-sown companion plants as a method of controlling cabbage root fly. Paper presented at Joint Organic Congress, Odense, Denmark, May 30-31, 2006. [contact: arosenfeld@hdra.org.uk]

A novel technique for controlling cabbage root fly was tested. Companion plants of either birdsfoot trefoil (*Lotus corniculatus*), red clover (*Trifolium pratense*) or yellow trefoil (*Medicago lupulina)* were sown into modules together with calabrese (*Brassica oleracea* var Italica). The presence of companion plants subsequently reduced cabbage root fly egg-laying by up to 48% and reduced root damage considerably. Companion plant species did not affect egg-laying in this trial. Although, financially, this technique compares very favourably with an alternative strategy of applying fleece, further refinement is needed to improve the survival of companion plants on a commercial field scale as they were particularly vulnerable to damage by steerage hoes, which are used commonly in organic systems.

{Recherche appliquée}

Accès au document : via le site orgprints.org (document pdf)

Scott, I.M., Jensen, H.R., Philogène, B.J.R., Arnason, J.T., 2008. A review of *Piper* spp. (Piperaceae) phytochemistry, insecticidal activity and mode of action. *Phytochemistry Reviews,* Springer Netherlands, Vol. 7-1: pp.65-75. [contact: ims32@cornell.edu]

The tropical plant family Piperaceae has provided many past and present civilizations with a source of diverse medicines and food grade spice. The secondary plant compounds that produce these desired qualities function also as chemical defenses for many species in the genus *Piper*. The compounds with the greatest insecticidal activity are the piperamides. Many studies have shown the effectiveness of *Piper* spp. extracts for the control of stored products pests and recently studies from our laboratory group have tested the extracts of *Piper. nigrum*, *P. guineense* and *P. tuberculatum* against insect pests of the home and garden. These results and those from investigations that examined the biochemical and molecular modes of action of the piperamides singly or in combination will be the focus of this review. The conclusions of our current work with Piperaceae are that *Piper* extracts offer a unique and useful source of biopesticide material for controlling small-scale insect out-breaks and reducing the likelihood of resistance development when applied as a synergist with other botanical insecticides such as pyrethrum.

{Recherche appliquée}

Accès au document : via le site Springer Link (document pdf ou html)
Coût de l'article : 32,00 $ US

Shani, A., 2000. Chemical communication agents (pheromones) in integrated pest management. *Drug Dev. Res*., Vol. 50 (3-4): pp. 400-405. [contact : ashani@bgumail.bgu.ac.il]

The increasing resistance of pests to pesticides and microbes to drugs constitutes one of the major problems facing farmers and physicians, respectively. In the agricultural arena, there is a steady shift away from mere pesticide application to a more diversified approach and especially to integrated pest management (IPM). The latter strategy focuses, among others, on chemical communication among the species that cause most damage to crops - insect pests - and on disease transfer agents. Pheromones are the principal agent of chemical communication exploited in pest control. The major features of these natural nontoxic chemicals and their modes of application, current as well as potential, are described.

{Recherche appliquée}

Accès au document : via le site Wiley InterScience (document pdf ou html)
Coût de l'article : 29,95 $ US

Shelton, A.M., Badenes-Perez F.R., 2005. Concepts and applications of trap cropping in pest management. *Annual Review of Entomology*, Vol. 51: pp. 285-308. [contact: ams5@cornell.edu]

Interest in trap cropping, a traditional tool of pest management, has increased considerably in recent years. In this review we propose a broader definition of trap cropping that encompasses the inherent characteristics of the trap crop plants themselves as well as the strategies associated with their deployment. Inherent characteristics of a trap crop may include not only natural differential attractiveness for oviposition and feeding, but also other attributes that enable the trap crop plants to serve as a sink for insects or the pathogens they vector. Successful deployment of trap crops within a landscape depends on the inherent characteristics of the trap crop and the higher value crop, the spatial and temporal characteristics of each, the behavior and movement patterns of insect pests, and the agronomic and economic requirements of the production system. Thus, trap cropping is more knowledge-intensive than many other forms of pest management. We review recent references on trap cropping, classify them according to their modalities and level of implementation, and provide a synthesis of the factors that influence the success of trap cropping. Last, we provide a list of recommendations and guidelines that should prove helpful in moving trap cropping forward to its full potential.

{Recherche appliquée}

Accès au document : via le site Annual Review (document pdf ou html)
Coût de l'article : 20,00 $ US

Siekmann, G., Hommes, M., 2005. Controlling root flies with exclusion fences?. Report, Institut für Pflanzenschutz im Gartenbau, Biologische Bundesanstalt für Land- und Forstwirtschaft. [contact: g.siekmann@bba.de]

Protecting crops with insect fences is currently being considered as an alternative to row cover netting and synthetic insecticides. Previous studies reported efficacies of such fences with 50-90% reduction in crop damage by root flies. We conducted trials with a 1.70 m fence over two years to monitor carrot rust fly (*Psila rosae*) in carrots and cabbage root fly (*Delia radicum*) in radish. There was a significant reduction in cabbage root fly damage in fenced plots whereas no such effect could be found with carrot rust fly. The structure of the overhang at the top of the fence and the mobility of this particular species may be important elements to consider in fence design. The length of the overhang also seemed to be important for cabbage root fly (*Delia radicum*) control, as a statistically significant treatment effect was observed only when the overhang was 35 cm long. Using radish as a test crop, the fences reduced damage by 55% in the second year of the trial. The population size of overwintering cabbage root flies was also an important factor, as the number of flies in the year that the fence was effective was lower than in the previous year.

{Recherche appliquée}

Accès au document : via le site orgprints.org (document pdf)

Singh, A., 2005. Pests in Organic Systems and Promising Solutions. Organic Agriculture Centre of Canada. {En ligne}

Organic farming emphasizes creating healthy soils using compost and green manures, crop rotations (including underseeding and intercropping), and having crop production integrated with a livestock enterprise. These management practices also act as a first-line of defence against pests. Pests, simply defined, are insects, weeds, or diseases that may affect the yield or quality of a crop.

This article will provide a brief introduction to many generic substances used by organic farmers and will list some potential products that are seeking regulation.

{Transfert technologique}

Accès au document : via le site du Centre d'agriculture biologique du Canada

Snyder, G.B., Finke, D.L., Snyder, W.E., 2008. Predator biodiversity strengthens aphid suppression across single- and multiple-species prey communities. *Biological Control*, Vol. 44 (1): pp. 52-60. [contact: gbsnyder@wsu.edu]

A positive relationship between predator biodiversity and improved pest suppression might be most clearly realized when several prey species are present, if a diversified prey base allows complementarity among predators to be realized. In two field experiments we manipulated diversity both within a guild of predatory insects (one versus four predator species) and among their herbivore prey (one versus two aphid species present). The strength of aphid suppression always increased with greater predator biodiversity, but this effect was independent of prey species diversity or identity, and no niche differentiation by aphid species was apparent among the predator species. This suggests that either niche partitioning among predators occurred but was not based on prey species identity or that the benefits of predator diversity for biological control were mediated by interactions within the predator community, such that a diverse resource base was not necessary to yield a positive relationship between predator biodiversity and effective herbivore suppression.

{Recherche appliquée}

Accès au document : via le site Science Direct (document pdf ou html)
Coût : 30,00 $ US

Tilmon K.J., Hoffmann, M.P., 2003. Biological control of Lygus lineolaris by Peristenus spp. in strawberry. *Biological Control*, Vol. 26 (3): pp. 287-292.
[contact: kjtilmon@facstaff.wisc.edu]

Peristenus digoneutis Loan (Hymenoptera: *Braconidae*) was introduced to the US for biological control of the tarnished plant bug, *Lygus lineolaris* (Palisot de Beauvois) (Hemiptera: *Miridae*), and has since spread through much of the northeast. The purpose of this study was to determine if P. digoneutis and a native congener, *Peristenus pallipes* (Curtis), parasitize *L. lineolaris* in strawberry (where it is a key pest), and what factors relate to parasitism levels. During 1997–1999 we monitored parasitism on 17 strawberry farms in 14 counties in eastern and western New York State. We found that in eastern NY (where *P. digoneutis* has been established since the early 1990s), overall mean parasitism was 19.7% (ranging from 0 to 70%), mostly by *P. digoneutis*. Mean parasitism was significantly lower (12.3%, ranging from 0 to 58%) in western NY (where *P. digoneutis* was first recorded in 1999), and was mostly by *P. pallipes*. *P. pallipes* parasitism was significantly lower in eastern than western NY, suggesting the potential for competitive interaction with *P. digoneutis*. The insecticide regime of a farm was an important factor influencing parasitism rate, which was 5- to 6.5-fold higher on organic or casually sprayed farms than on intensely treated farms, though pest density under these three regimes was not significantly different. *L. lineolaris* density, and parasitism rate in nearby alfalfa and abandoned fields were also significant factors for parasitism in strawberry.

{Recherche appliquée}

Accès au document : via le site Science Direct (document pdf ou html)
Coût : 30,00 $ US

Vu, Van H., Hong, Suk I., Kim, K., 2007. Selection of Entomopathogenic Fungi for Aphid Control. *Journal of Bioscience and Bioengineering*, Vol. 104 (6): pp. 498-505.
[contact: kkim@suwon.ac.kr]

Twelve strains of entomopathogenic fungi such as *Lecanicillium lecanii*, *Paecilomyces farinosus*, *Beauveria bassiana*, *Metarhizium anisopliae*, *Cordyceps scarabaeicola*, and *Nomuraea rileyi* were screened for aphid control. At 25°C and 75% relative humidity (RH), among tested entomopathogenic fungi, *L. lecanii* 41185 showed the highest virulent pathogenicity for both *Myzus persicae* and *Aphis gossypii*, and their control values were both nearly 100% 5 and 2 d after treatment, respectively. Moreover, at an RH of 45% and in a wide temperature range (20–30°C), *L. lecanii* 41185 also exhibited the highest virulence to *M. persicae*. The control value of *M. persicae* and the 50% lethal time (LT_{50}) decreased significantly as the applied conidial concentration increased. The 50% lethal concentration (LC_{50}) of the conidial suspension of this fungus was determined to be 6.55×10^5 conidia/ml. The control values of *M. persicae* resulting from the application of 1×10^7 and 1×10^8 conidia/ml were nearly the same and were significantly higher than that of 1×10^6 conidia/ml. The tested entomopathogenic fungi grew in a broad temperature range (15–30°C). *Lecanicillium* strains showed optimum growth at 25°C. The aerial conidia of *Lecanicillium* strains also could germinate in a broad temperature range (15–30°C) and *L. lecanii* 41185 was the only strain with conidial germination at 35°C.

{Recherche appliquée}

Accès au document : via le site de Journal of Bioscience and Bioengineering (document pdf)

Wyss, E., Daniel, C., 2004. Die Wirksamkeit von Einflugbarrieren gegen die Besiedlung von Broccoli und Kohlrabi durch die Kohldrehherzgallmücke *Contarinia nasturtii* (Diptera: *Cecidomyiidae*). [The effect of exclusion fences on the colonization of broccoli and kohlrabi by the Swede midge, *Contarinia nasturtii* (Diptera: *Cecidomyiidae*).] *Mitteilungen der Deutschen Gesellschaft für allgemeine und angewandte Entomologie*, Vol. 14 (1-6): pp. 387-390. [contact: info.suisse@fibl.org]

The Swede midge Contarinia nasturtii (Diptera: Cecidomyiidae) is an important and wide spread pest in Europe. In Swiss organic vegetable production only the expensive product “Audienz” (active matter: Spinosad) is permitted. In addition, netting the entire crop surface can exclude the Swede midges from crops, but it has a negative influence on the microclimatic conditions and the labour and capital cost are often too high. Since it is known, that several vegetable key pest species spread within the crop or only a few centimetres above it, the use of vertical exclusion fences has been developed in Canada. The objective of our study was to exclude C. nasturtii from the crops by using a similar, but cheaper prototype of exclusion fence.

The studies were undertaken on two fields (broccoli and kohlrabi) and the effect of the fences (fenced in area: 15x20m for broccoli, 7.5x20m for kohlrabi; height of fences: 1.4m with a 0.25m overhang; 4 replications each field) was compared with an untreated control and with a treatment of “Audienz” (3 applications, 0.5l/ha). At harvest the damages were assessed by classifying the symptoms of 100 plants per treatment and replication in three (kohlrabi) or four (broccoli) categories. Inside the fences 100 plants near the fence and 100 plants in the centre were visually controlled.

The exclusion fences significantly reduced the damages caused by the Swede midge. The treatment of “Audienz“ reduced the damages, too, but in the broccoli trial, “Audienz“ had a significantly lower effect than the fences. The effectiveness of “Audienz” with 36.4% (broccoli) and 58.3% (kohlrabi), respectively, was lower than the effectiveness of the fences: 69.1% and 60.0% near the fence and 77.8% and 78.9% in the centre. The results are discussed.

{Recherche appliquée}

Accès au document : limité avec inscription, via le site orgprints.org (document pdf)

Zehnder, G., Gurr, G.M., Kühne, S., Wade, M.R., Wratten, SS.D., Wyss, E., 2007. Arthropod Pest Management in Organic Crops. *Annual Review of Entomology*, Vol. 52: pp. 57-80.
[contact: zehnder@clemson.edu]

Burgeoning consumer interest in organically produced foods has made organic farming one of the fastest growing segments of agriculture. This growth has not been supported adequately by rigorous research to address challenges such as arthropod pest management. The research that has been conducted, however, is complemented by research in aspects of conventional agriculture that may have applicability in organic systems, as well as by research in underpinning fields such as applied ecology. This article synthesizes the available literature in relation to a conceptual model of arthropod pest management strategies suitable for organic systems. The present work uses the four phases of the model to review the strategies in an agroecological context and provides a synthesis of the factors that influence the success of each phase. Rather than constituting a fringe science, pest management research for organic systems draws on cutting edge science in fields such as landscape and chemical ecology and has a bright future.

{Recherche appliquée}

Accès au document : via le site Annual Review (document pdf ou html)
Coût de l'article : 20,00 $ US

Zehnder, G.W., Murphy, J.F., Sikora, E.J., Kloepper, J.W., 2001. Application to rhizobacteria for induced resistance. *European Journal of Plant Pathology*, Vol. 107 (1): pp. 39-50.
[contact: zehnder@clemson.edu]

This article provides a review of experiments conducted over a six-year period to develop a biological control system for insect-transmitted diseases in vegetables based on induced systemic resistance (ISR) mediated by plant growth-promoting rhizobacteria (PGPR). Initial experiments investigated the factors involved in treatment with PGPR led to ISR to bacterial wilt disease in cucumber caused by *Erwinia tracheiphila*. Results demonstrated that PGPR-ISR against bacterial wilt and feeding by the cucumber beetle vectors of *E. trachiphiela* were associated with reduced concentrations of cucurbitacin, a secondary plant metabolite and powerful beetle feeding stimulant. In other experiments, PGPR induced resistance against bacterial wilt in the absence of the beetle vectors, suggesting that PGPR-ISR protects cucumber against bacterial wilt not only by reducing beetle feeding and transmission of the pathogen, but also through the induction of other plant defense mechanisms after the pathogen has been introduced into the plant. Additional greenhouse and field experiments are described in which PGPR strains were selected for ISR against cucumber mosaic virus (CMV) and tomato mottle virus (ToMoV). Although results varied from year to year, field-grown tomatoes treated with PGPR demonstrated a reduction in the development of disease symptoms, and often a reduction in the incidence of viral infection and an increase in tomato yield. Recent efforts on commercial development of PGPR are described in which biological preparations containing industrial formulated spores of PGPR plus chitosan were formulated and evaluated for use in a transplant soil mix system for developing plants that can withstand disease attack after transplanting in the field.

{Recherche appliquée}

Accès au document : limité avec inscription, via le site Springer Link (document pdf)
Coût : 32,00 $

MALADIES PARASITAIRES–TABLEAUX RÉCAPITULATIFS

1-PRATIQUES CULTURALES			
1.1- Approches diverses			
Approche	**Culture**	**Pathogènes**	**Auteurs**
Assainissement du feuillage, culture sur 1 rang	Fraise	Moisissure grise (*Botrytis cinerea*) Tache commune (*Mycosphaerella fragariae*)	Schmid et *al.*, 2005
Biofumigation (glucosinolate)	Général	Champignons telluriques (*Aphanomyces euteiches* var. *pisi*, *Gaeumannomyces graminis* var. *tritici*, *Verticillium dahliae*)	Bellostas et *al.*, 2006
Général	Général	Général	Letourneau et *al.*, 2006
Solarisation Mycostop (*Streptomyces griseoviridis*)	Tomate	Flétrissure fusarienne (*F. oxysporum*) Verticilliose (*Verticillium dahliae*)	Minuto et *al.*, 2006
1.2- Réduction du cuivre			
Extraits de PEN (*Penicillium chrysogenum*)	Diverses	Blanc de la vigne (*Uncinula necator*) Mildiou de l'oignon (*Peronospora destructor*) Mildiou de la vigne (*Plasmopara viticola*) Mildiou des solanacées (*Phytophthora infestans*) Tavelure du pommier (*Venturia inaequalis*)	Thürig et *al.*, 2006
Assainissement du feuillage, culture sur 1 rang	Fraise	Moisissure grise (*Botrytis cinerea*) Tache commune (*Mycosphaerella fragariae*)	Schmid et *al.*, 2005
Chitosan + dose réduite de cuivre (sulfate de pentahydrate)	Pommes de terre	Mildiou des solanacées (*Phytophthora infestans*)	Hadwiger et McBride, 2006

2- CONTRÔLE BIOLOGIQUE : PRÉDATEUR, PARASITOÏDE OU ANTAGONISTE			
Approche	**Culture**	**Pathogènes**	**Auteurs**
Bactérie (*Bacillus mycoides*), levure (*Pichia guilermondii*)	Fraise	Moisissure grise (*Botrytis cinerea*)	Guetsky et *al*., 2002
Cryptococcus albidus (levure)	Fraise	Moisissure grise (*Botrytis cinerea*)	Helbig, 2002
Gliocladium catenulatum	Fraise	Moisissure grise (*Botrytis cinerea*)	Lahdenperä, 2006
Trichoderma harzianum (*Bombus terrestris* comme agent disséminant de)	Fraise	Moisissure grise (*Botrytis cinerea*)	Pinna et *al.*, 2005
Trichoderma harzianum (abeille comme agent disséminant de)	Fraise	Moisissure grise (*Botrytis cinerea*)	Shafir et *al*., 2006
Bactériophages	Général	Maladie bactérienne	Jones et *al*., 2007
Ampelomyces quisqualis	Rose	Blanc de la rose (*Sphaerotheca pannosa* var. *rosae*)	Pasini et *al*., 1997
Crinipellis perniciosa (champignon)	Tomate	Tache bactérienne (*Xanthomonas vesicatoria*)	Cavalcanti et *al*., 2007
Extraits de composts, *Trichoderma asperellum, F. oxysporum* Fo47	Tomate	Flétrissure fusarienne (*F. oxysporum*)	Cotxarrera et *al*., 2002
Souches de bactéries	Tomate	Flétrissure bactérienne (*Ralstonia solanacearum*)	Jetiyanon et Kloepper, 2002
Souches de bactéries	Tomate	Flétrissure bactérienne (*Ralstonia solanacearum*)	Lwin et Ranamukhaarachchi, 2006
Mycostop (*Streptomyces griseovirides*) Solarisation	Tomate	Flétrissure fusarienne (*F. oxysporum*) Verticilliose (*Verticillium dahliae*)	Minuto et *al*., 2006
Bactéries endophytiques	Tomates	Général	Nejad et Johnson, 2000
Acariens mycophages (*Orthotydeus lambi*)	Vigne	Blanc de la vigne (*Uncinula necator*)	English-Loeb et *al*., 2007
Ampelomyces quisqualis	Vigne	Blanc de la vigne (*Uncinula necator*)	Falk et *al*., 1995.

3- ACTIVATION DES DÉFENSES NATURELLES ET PHYTOPROTECTION

Approche	Culture	Pathogènes	Auteurs
Lait de vache	Curcubitacées	Blanc des curcubitacées (*Sphaerotheca fuliginea*)	Bettiol, 1999
Extraits de PEN (*Penicillium chrysogenum*)	Diverses	Blanc de la vigne (*Uncinula necator*) Mildiou de l'oignon (*Peronospora destructor*) Mildiou de la vigne (*Plasmopara viticola*) Mildiou des solanacées (*Phytophthora infestans*) Tavelure du pommier (*Venturia inaequalis*)	Thürig et *al*., 2006
Extraits de composts	Fraise	Moisissure grise (*Botrytis cinerea*)	Welke, 2004
Extraits de composts	Fruitière	Mildiou de la vigne (*Plasmopara viticola*) Tavelure du pommier (*Venturia inaequalis*)	Larbi, 2006
Une revue des biofongicides	Fruits et légumes en post-récolte	Général (pour prolonger la vie, utile post-récolte)	Tripathi et Dubey, 2004
Propolis et pollen	Général	Propriétés antibactériennes utilisables en agriculture (testées in vitro)	Basim et *al*., 2006
Glucosinolate	Général	Champignons telluriques (*Aphanomyces euteiches* var. *pisi*, *Gaeumannomyces graminis* var. *tritici*, *Verticillium dahliae*)	Bellostas et *al*., 2006
Une revue des biopesticides, de leur mode d'action et de leur efficacité	Général	Général	Copping et Duke, 2007
Une revue des biopesticides, de leur mode d'action et de leur efficacité	Général	Général	Copping et Menn, 2000
Ptérocarpans (phytoallexines - composés de défense naturels des plantes)	Général	Général	Jiménez et *al*., 2008
Bicarbonate de sodium et de potassium	Général	Moisissure grise (*Botrytis cinerea*) Général	Kuepper et *al*., 2001 (ATTRA)
Une revue des biopesticides, de leur mode d'action et de leur efficacité	Général	Général	Rai, Mahendra et Carpinella M.C. (éditeurs), 2006

3- ACTIVATION DES DÉFENSES NATURELLES ET PHYTOPROTECTION			
Approche	**Culture**	**Pathogènes**	**Auteurs**
Les pesticides « naturels » - un point de vue de l'Industrie	Général	Général	Rice, 1998
Glucosinolate	Général	Champignons telluriques	Rosa et Rodrigez., 1999
Huiles, sels, Neem/margousier, Milsana (*Reynoutria sachalinensis*)	Rose	Blanc de la rose (*Sphaerotheca pannosa* var. *rosae*)	Pasini et *al*., 1997
Extraits de composts	Tomate	Tache bactérienne (*Xanthomonas vesicatoria*)	Al-Dahmani, et *al*., 2003
Silice	Tomate	Flétrissure bactérienne (*Ralstonia solanacearum*)	Dannon et Wydra, 2004
Huiles d'ail et de margousier, extrait d'algues, Serenade (*Bacillus subtilis*), Sonata (*Bacillus pumilis*)	Tomate	Brûlure alternarienne (*Alternaria solani*) Tache septorienne (*Septoria lycopersici*)	Wszelaki et Miller, 2005
Extraits de vermicomposts	Tomate	Mildiou des solanacées (*Phytophthora infestans*)	Zaller, 2006
Extraits de bryophytes	Tomate, Général	Brûlure alternarienne (*Alternaria solani*) Mildiou des solanacées (*Phytophthora infestans*) Moisissure grise (*Botrytis cinerea*)	Mekuria et *al*., 2005

MALADIES PARASITAIRES–FICHES RÉFÉRENCES

Al-Dahmani, J.H., Abbasi, P.A., Miller, S.A., Hoitink, H.A.J., 2003. Suppression of Bacterial Spot of Tomato with Foliar Sprays of Compost Extracts Under Greenhouse and Field Conditions. *Plant disease*, Vol. 87 (8): pp. 913-919.

The efficacy of foliar sprays with compost water extracts (compost extracts) in reducing the severity of bacterial spot of tomato caused by *Xanthomonas vesicatoria* was investigated. Extracts prepared from composted cow manure, composted pine bark, an organic farm compost, or composted yard waste, applied as foliar sprays on tomato transplants, resulted in a moderate but statistically significant reduction in the severity of bacterial spot. The population of *X. vesicatoria* in infected leaves was reduced significantly by extracts prepared from composted cow manure. Efficacy of the water extracts was not affected by oxygen concentrations in the suspension during extraction, compost maturity, or sterilization by filtration or autoclaving. The degree of control provided by foliar sprays with the most effective compost extracts did not differ from that obtained with the plant activator acibenzolar-*S*-methyl. In the field in two growing seasons, foliar sprays with compost water extracts did not reduce the severity of foliar diseases, including bacterial spot. During the 1997 season, when the severity of bacterial spot in the field was high, foliar sprays with compost water extracts significantly reduced the incidence of bacterial spot on tomato fruit. Amending plot soil with several rates of composted yard waste did not lead to additional control of fruit disease over those only sprayed with extracts. Foliar sprays with a mixture of chlorothalonil and copper hydroxide or with acibenzolar-*S*-methyl reduced the severity of bacterial spot as well as incidence of spot on fruit.

{Recherche appliquée}

Accès au document : via le site APS Journals (document pdf ou html)

Basim, E., Basim, H., Özcan, M., 2006. Antibacterial activities of Turkish pollen and propolis extracts against plant bacterial pathogens. *Journal of Food Engineering*, Vol. 77 (4): pp. 992-996. [contact: ebasim@yahoo.com]

The "in vitro" antibacterial activities of Turkish pollen and propolis extracts were investigated against 13 different species of agricultural bacterial pathogens including *Agrobacterium tumefaciens*, *A. vitis*, *Clavibacter michiganensis* subsp. *michiganensis*, *Erwinia amylovora*, *E. carotovora* pv. *carotovora*, *Pseudomonas corrugata*, *P. savastanoi* pv. *savastanoi*, *P. syringae* pv. *phaseolicola*, *P. syringae* pv. *syringae*, *P. syringae* pv. *tomato*, *Ralstonia solanacearum*, *Xanthomonas campestris* pv. *campestris* and *X. axonopodis* pv. *vesicatoria*. Among the tested bacteria, *A. tumefaciens* was the most sensitive one to 1/5 concentration of pollen extract, and the sensitivity of the bacteria followed the sequence *A. tumefaciens* > *P. syringae* pv. *tomato*, *X. axonopodis* pv. *vesicatoria* > *E. amylovora*, *P. corrugata*, *R. solanacearum*, *X. campestris* pv. *campestris* > *A. vitis*, *C. michiganensis* subsp. *michiganensis* > *E. carotovora* pv. *carotovora*, *P. savastanoi* pv. *savastanoi*, *P. syringae* pv. *phaseolicola* > *P. syringae* pv. *syringae*. *P. syringae* pv. *phaseolicola* was the most sensitive one to 1/10 concentration of propolis extract, and the sensitivity of the bacteria followed the sequence *P. syringae* pv. *phaseolicola* > *P. savastanoi* pv. *savastanoi*, *P. corrugata*, *R. solanacearum* > *E. carotovora* pv. *carotovora*, *P. syringae* pv. *syringae*, *E. amylovora*, *A. tumefaciens*, *A. vitis*, *C. michiganensis* subsp. *michiganensis*, *P. syringae* pv. *tomato*, *X. campestris* pv. *campestris*, *X. axonopodis* pv. *vesicatoria*. The least active concentrations towards the tested bacteria were 1/100 of the pollen extract and 1/1000 of the propolis extract. This study is the first report on the antibacterial activities of pollen and propolis against the plant pathogenic bacteria.

{Recherche appliquée}

Accès au document : via le site Science Direct (document pdf ou html)
Coût : 30,00 $ US

Bellostas, N., Casanova, E., Garcia-Mina, J.M., Sorensen, J.C., Sorensen, H., 2006. In vitro screening of the effect of three glucosinolate derived nitriles on soil-borne fungi. Poster presented at Second International Biofumigation Symposium, Moscow, Idaho, USA, 26-29 June 2006. [contact: nabm@kvl.dk]

Glucosinolates are allelochemicals present in all plants of the order Capparales that are hydrolysed by endogenous enzymes (myrosinases) forming a variety of compounds with biological activity. 'Biofumigation' is the term used to describe the effect of these compounds on soil-borne pathogens and it has normally been attributed to isothiocyanates. At acidic pH and in the presence of redox co-factors such as glutathione, glucosinolate hydrolysis yields also nitriles, which are more hydrophilic and stable than isothiocyanates.

Three nitriles (allyl-, benzyl- and phenethyl cyanide) were tested against soil borne fungi of economic importance: *Aphanomyces euteiches* var. *pisi*, *Gaeumannomyces graminis* var. *tritici* and *Verticillium dahliae*. The nitriles were initially tested at 1 mM and four additional concentrations were further tested in order to determine LD50.

At 1 mM, allyl cyanide showed in all cases less than 10% inhibition and it did not inhibit fungi growth at higher concentrations. LD50 of benzyl cyanide was 2.5 mM for *Verticillium* and *Aphanomyces*, whereas it was as low as 0.5 mM for *Gaeumannomyces*. LD50 of phenyl ethyl cyanide was 2.5 mM for *Verticillium*, 1.4 mM *Gaeumannomyces* and 1.25 mM *Aphanomyces*.

Although nitriles are generally less toxic than ITCs, their role in biofumigation should not be disregarded.

{Recherche appliquée}

Accès au document : via le site orgprints.org (document pdf)

Bettiol, Wagner, 1999. Effectiveness of cow's milk against zucchini squash powdery mildew (Sphaerotheca fuliginea) in greenhouse conditions. *Crop Protection*, 18: pp. 489-492.
[contact: bettiol@cnpma.embrapa.br]

Efficacy of fresh cow milk was tested in five greenhouse experiments against powdery mildew (*Sphaerotheca fuliginea*) on zucchini squash (*Cucurbita pepo*). Plants were sprayed with milk at 5, 10, 20, 30, 40, and 50%, either once or twice a week. Additional treatments were fungicides (fenarimol 0.1 ml/l or benomyl 0.1 g/l) applied once a week and water as a control treatment. Severity of the powdery mildew was visually evaluated on individual leaves at weekly intervals and scored as percentage of leaf area infected for infected leaves. A negative correlation was found between the infected leaf area per infected leaf and milk concentration sprayed on plants for the five experiments. High concentrations of milk were more effective than the conventional fungicides tested. This study demonstrated that milk is an effective alternative for the control of powdery mildew in organic agriculture.

{Recherche appliquée}

Accès au document : via le site Science Direct (document pdf ou html)
Coût : 30,00 $ US

Cavalcanti, F.R., Resende, M.L.V., Carvalho, C.P.S., Silveira J.A.G., Oliveira, J.T.A., 2007. An aqueous suspension of Crinipellis perniciosa mycelium activates tomato defence responses against Xanthomonas vesicatoria. *Crop Protection*, Vol. 26 (5): pp. 729-738.
[contact: rossi@ufc.br]

The efficacy of controlling bacterial spot in susceptible tomato plants by using a natural product was compared to a commercial resistance inducer. Plants were sprayed with (a) acibenzolar-*S*-methyl, ASM [Bion® 50 WG (0.2 g l^{-1})] and (b) a heterogeneous chitosan suspension (MCp) from *Crinipellis perniciosa* mycelium. Plants were challenged 4 d later with a virulent strain of *Xanthomonas vesicatoria*, under greenhouse conditions. In assessing disease, MCp-treated plants showed significant responses, reaching 87% of ASM protection performance against *X. vesicatoria* leaf spot. Tomato leaves exposed to MCp and ASM were assayed for pathogenesis-related enzymes, lignin deposition and soluble phenolic compounds. Induced resistance (IR) was evidenced by the enhancement of peroxidase (POX), polyphenol oxidase (PPO), and chitinase (CHI) activities at 1–72 h after spraying. These enzymes and phenylalanine ammonia-lyase (PAL) were also observed at 6, 9 and 12 d after spraying (DAS) interval. Treated and inoculated plants showed an increase in lignin deposition. The content of total soluble phenolic compounds decreased significantly by 9 and 12 DAS. The results suggest that (IR) was characterized by increased POX and PPO activities, improving lignification and, to a less extent, by CHI activity.

{Recherche appliquée}

Accès au document : via le site Science Direct (document pdf ou html)
Coût : 30,00 $ US

Copping, L.G., Duke, S.O., 2007. Natural products that have been used commercially as crop protection agents. *Pest Management Science*, Vol. 63 (6): pp. 524-554.
[contact: lcopping@globainet.co.uk]

Many compounds derived from living organisms have found a use in crop protection. These compounds have formed the basis of chemical synthesis programmes to derive new chemical products; they have been used to identify new biochemical modes of action that can be exploited by industry-led discovery programmes; some have been used as starting materials for semi-synthetic derivatives; and many have been used or continue to be used directly as crop protection agents. This review examines only those compounds derived from living organisms that are currently used as pesticides. Plant growth regulators and semiochemicals have been excluded from the review, as have living organisms that exert their effects by the production of biologically active secondary metabolites.

{Recherche appliquée}

Accès au document : via le site Wiley InterScience (document pdf ou html)
Coût de l'article : 29,95 $ US

Copping, L.G., Menn, J.J., 2000. Biopesticides: a review of their action, applications and efficacy, *Pest Management Science*, Vol. 56: pp. 651-676. [contact: lcopping@globainet.co.uk]

A survey is given of the wide range of different materials and organisms that can be classified as biopesticides. Details are given of those currently of commercial importance, and future developments in this area are discussed. It is considered that, while in the immediate future biopesticides may continue to be limited mainly to niche and speciality markets, there is great potential for long-term development and growth, both in their own right and in providing leads in other areas of pest management science.

- Biopesticides is a term that encompasses many aspects of pest control such as:
- Microbial (viral, bacterial and fungal) organisms
- Entomophagous nematodes
- Plant-derived pesticides (botanicals)
- Secondary metabolites from micro-organisms (antibiotics)
- Insect pheromones applied for mating disruption, monitoring or lure-and-kill strategies
- Genes used to transform crops to express resistance to insect, fungal and viral attacks or to render them tolerant of herbicide application.

Indeed, some might suggest the inclusion of insect predators and parasites, although these are not covered in this review.

{Recherche appliquée}

Accès au document : limité avec inscription, via Wiley Inter Science (document html ou pdf)
Coût : 29,95 $ pour un accès de 24 h à la base données du site Internet.

Voir aussi : Copping, L.G., 2004.The Manual of biocontrol agents, (3rd Ed. of Biopesticide manual). *British Crop Protection Council*; 760 p. (environ 275,00 $ can).

Cotxarrera, L., Trillas-Gay, M. I., Steinberg, C., Alabouvette, C., 2002. Use of sewage sludge compost and Trichoderma asperellum isolates to suppress Fusarium wilt of tomato. *Soil Biology and Biochemistry*, Vol. 34 (4): pp. 467-476. [contact: lurdesc@porthos.bio.ub.es]

It has been reported that plant growth media amended with composted bark suppress Fusarium wilts whereas media amended with composted municipal sludge aggravate this disease. However, in this study, a compost prepared from vegetable and animal market wastes, sewage sludge and yard wastes showed a high ability to suppress Fusarium wilt of tomato caused by F*usarium oxysporum* f. sp. *lycopersici* race 1. The ability of this compost to suppress Fusarium wilt of tomato was compared with that of a peat mix (peat:vermiculite, 1:1 v/v) and a naturally suppressive soil from Chateaurenard, France. The compost and the soil from Chateaurenard were highly suppressive, whereas the peat mix was highly conducive. Amendment with this compost significantly ($P<0.05$) increased the suppressiveness of the peat mix. Biotic and abiotic properties were compared among these substrates. The peat mix was acidic, and had a low EC, whereas the compost was basic and a high EC. The compost–peat mix had a similar pH to the compost, however EC was approximately half that of the compost. The bacterial populations and microbial activity were highest in the compost and the compost–peat mix. Compost (10%; v/v), *Trichoderma asperellum* isolates isolated from natural compost–peat mix, and the nonpathogenic biocontrol agent *F. oxysporum* Fo47 isolated from Chateaurenard soil were inoculated into sterilized compost–peat mix and Chateaurenard soil to assess their ability to restore suppressiveness in the sterilized substrates. Both the natural compost and the *T. asperellum* isolates significantly ($P<0.05$) increased the suppressive ability of sterilized compost–peat mix and Chateaurenard soil. Fo47 was relatively the most effective biocontrol agent. The incidence of Fusarium wilt was lowest in tomato plants grown in either sterilized compost–peat mix or Chateaurenard soil inoculated with this strain. Our results show that the use of some composted sewage sludge in the plant growth medium is effective for suppression of Fusarium wilt at the early stage of plant growth. In addition, the *T. asperellum* isolates isolated from the suppressive compost–peat mix appear to have the potential to be a new alternative of biocontrol of Fusarium wilt.

{Recherche appliquée}

Accès au document : via le site Science Direct (document pdf ou html)
Coût de l'article : 30,00 $ US

Dannon, E.A., Wydra, K., 2004. Interaction between silicon amendment, bacterial wilt development and phenotype of Ralstonia solanacearum in tomato genotypes . *Physiological and Molecular Plant Pathology*, Vol. 64 (5): pp. 233-243. [contact: wydra@ipp.uni-hannover.de]

Silicon amendment significantly reduced bacterial wilt incidence expressed as area under disease progress curve for tomato genotypes L390 (susceptible) by 26.8% and King Kong2 (moderately resistant) by 56.1% compared to non-treated plants grown in hydroponic culture. However, wilt incidence in silicon-treated plants of genotype L390 reached 100% at 13 days post-inoculation (dpi), while in genotype King Kong2, plant death was retarded by 6 days, with 20% reduction of final wilt incidence. Bacterial numbers were significantly lower in silicon-treated compared to non-treated plants in King Kong2 at 2 dpi in midstems and in all organs at 5 dpi, and in Hawaii 7998 (resistant) in all organs at 2 dpi. Differences between genotypes were obvious on midstem level (5 dpi), where bacterial populations were generally significantly lower compared to roots. Increased tolerance was observed in genotypes L390 and King Kong2 with silicon treatment. Silicon accumulated in roots and was low in stems and leaves. Inoculation with *Ralstonia solanacearum* did not significantly affect silicon uptake and distribution. Negative correlations between root silicon content and bacterial numbers of midstems in genotypes Hawaii 7998 and King Kong2 suggested an induced resistance. Indications for an influence of host genotype and silicon treatment on the phenotypic conversion of *R. solanacearum* strain To-udk2-sb from fluidal to non-fluidal colonies in planta were observed.

This is the first report on the effect of silicon on a bacterial disease and in a silicon-non-accumulator plant.

{Recherche appliquée}

Accès au document : via le site Science Direct (document pdf ou html)
Coût de l'article : 30,00 $ US

English-Loeb, G., Norton, A.P., Gadoury, D., Seem, R., Wilcox, W., 2007. Biological Control of Grape Powdery Mildew Using Mycophagous Mites. *Plant Disease*, Vol. 91 (4): pp. 421-429.

We evaluated the efficacy of a mycophagous tydeid mite, *Orthotydeus lambi,* in controlling grape powdery mildew on mature vines of nine different grape cultivars and one unnamed hybrid grown in an experimental vineyard over a 3-year period. *O. lambi* became well established on all vines where they were released. However, some cultivars supported higher densities than others, depending on, among other factors, the presence and abundance of leaf trichomes in vein axils (domatia). The establishment of *O. lambi* substantially reduced powdery mildew on foliage and fruit, although the magnitude of disease suppression was greater on some grape genotypes than others, depending on mite density and innate susceptibility to grape powdery mildew. Treatments where *O. lambi* was used alone were as effective as fungicide. Significantly better disease control was found in treatments with both mites and fungicides. The mass of pruning material and leaf photosynthetic rates were significantly greater for vines with *O. lambi*, fungicide, or a combination of mites and fungicide compared with untreated vines. The combination of mites and fungicide resulted in significantly greater yield than mites or fungicide alone. Our results illustrate the potential of *O. lambi* for biological control of grape powdery mildew but also highlight limitations related to differences among grape genotypes in innate susceptibility to mildew and suitability for mites.

{Recherche appliquée}

Accès au document : via APS journal (document pdf)
Coût de l'article 14,00 $

Falk, S.P., Gadoury, D.M., Cortesi, P., Pearson, R.C., Seem, R.C., 1995. Parasitism of *Uncinula necator* cleistothecia by the mycoparasite *Ampelomyces quisqualis*. *Phytopathology*, 85: pp. 794-800.

Parasitism of *Uncinula necator* cleistothecia by the mycoparasite *Ampelomyces quisqualis* was widespread in the Vitaceae around New York State. Although *A. quisqualis* did not survive in naturally parasitized *U. necator* cleistothecia on grape leaves, it did overwinter in parasitized cleistothecia on the bark of grapevines. Although only 1% of the total population of cleistothecia on bark was parasitized, the bark may still be an important site for overwintering of *A. quisqualis* since the mycoparasite is located adjacent to developing powdery mildew colonies on leaves, analogous to that of healthy cleistothecia, which also overwinter on bark and release primary inoculum to infect emerging grape leaves. In vitro studies of parasitism of *U. necator* cleistothecia showed that infection occurs only during early stages of development prior to or at the earliest stages of the formation of appendages but before darkening of the cleistothecial wall. When *A. quisqualis* was applied to grapevines from colonized cotton-wick cultures suspended above vines, parasitism of cleistothecia on leaves increased compared to naturally occurring parasitism, although during a season with high rainfall the level of parasitism was similar by the end of the season. The impact of increased parasitism was a reduction in the number of cleistothecia dispersed from leaves to bark and a reduction (50 to 60%) in the number of cleistothecia overwintering on bark of grapevines. Thus, biological control of grape powdery mildew with *A. quisqualis* may be further enhanced by a reduction in the level of overwintering inoculum for the next season.

{Recherche appliquée}

Accès au document : via APS net – free Access (document pdf)

Guetsky, R., Shtienberg, D., Elad, Y., Fisher, E., Dinoor, A., 2002. Combining biocontrol agents to reduce the variability of biological control. *Phytopathology*, Vol. 92 (9): pp. 976-985.

Two biocontrol agents, a yeast (*Pichia guilermondii*) and a bacterium (*Bacillus mycoides*), were tested separately and together for suppression of *Botrytis cinerea* on strawberry leaves and plants. Scanning electron microscopy revealed significant inhibition of *Botrytis cinerea* conidial germination in the presence of *Pichia guilermondii*, whereas *Bacillus mycoides* caused breakage and destruction of conidia. When both biocontrol agents were applied in a mixture, conidial destruction was more severe. The modes of action of each of the biocontrol agents were elucidated and the relative quantitative contribution of each mechanism to suppression of *Botrytis cinerea* was estimated using multiple regression with dummy variables. The improvement in control efficacy achieved by introducing one or more mechanisms at a time was calculated. *Pichia guilermondii* competed with *Botrytis cinerea* for glucose, sucrose, adenine, histidine, and folic acid. Viability of the yeast cells played a crucial role in suppression of *Botrytis cinerea* and they secreted an inhibitory compound that had an acropetal effect and was not volatile. *Bacillus mycoides* did not compete for any of the sugars, amino acids, or vitamins examined at a level that would affect *Botrytis cinerea* development. Viable cells and the compounds secreted by them contributed similarly to *Botrytis cinerea* suppression. The bacteria secreted volatile and non-volatile inhibitory compounds and activated the defense systems of the host. The nonvolatile compounds had both acropetal and basipetal effects. Mixture of *Pichia guilermondii* and *Bacillus mycoides* resulted in additive activity compared with their separate application. The combined activity was due to the summation of biocontrol mechanisms of both agents. This work provides a theoretical explanation for our previous findings of reduced disease control variability with a mixture of *Pichia guilermondii* and *Bacillus mycoides*.

{Recherche appliquée}

Accès au document : via APS journal (document pdf)
gratuit

Hadwiger, L. A., and McBride, P.O., 2006. Low-level copper plus chitosan applications provide protection against late blight of potato. Online. Plant Health Progress
[contact: chitosan@wsu.edu]

The organic grower can manage potato late blight, caused by *Phytophthora infestans* (Mont.) de Bary, with natural copper compounds such as copper sulfate pentahydrate, copper oxide, or copper hydroxide. However, recent environmental concerns about copper residues by the USDA's National Organic Program indicate a need to control late blight with reduced copper levels. This report describes a strategy for disease control using lower levels of copper sulfate pentahydrate in combination with a chitosan sticker and complexing agent. In excised leaf assays, this combination provided moderate control of late blight and protection against copper-related leaf yellowing at copper levels approximately 40 fold lower than those recommended for a commercial fungicide with copper hydroxide as the active ingredient.

{Recherche appliquée}

Accès au document : via le site Plant Health Progress (document pdf ou html)

Helbig J., 2002. Ability of the antagonistic yeast Cryptococcus albidus to control Botrytis cinerea in strawberry. *Biocontrol*, Vol. 47 (1): pp. 85-99. [contact: juergen.helbig@agrar.hu-berlin.de]

The yeast *Cryptococcus albidus*, originally isolated from mature strawberry fruits, was tested for antagonistic activity against *Botrytis cinerea*, the causal agent of grey mould in strawberries. Conidial germination and germ tube growth of conidia of *B. cinerea* were inhibited by a cell suspension of the antagonist in aqueous strawberry fruit pulp suspension (1%) after 6 and 24 hours of incubation. Application of a cell suspension (1×10^6 cells/ml) on detached strawberry leaf disks incubated at 10°C reduced incidence and conidiophore density of *B. cinerea* by 86 and 99%, respectively, but effectiveness was reduced at higher temperatures. Treatments with *C. albidus* during bloom of strawberries reduced incidence of grey mould on ripe strawberry fruits after harvest by 33, 28 and 21% in three years of field trials. The effectiveness of the yeast was increased when formulation substances (alginate, xanthan and cellulose) were added to the cell suspension.

{Recherche appliquée}

Accès au document : via le site SpringerLink (document pdf ou html)
Coût : 32,00 $ US

Jetiyanon, K., Kloepper, J.W., 2002. Mixtures of plant growth-promoting rhizobacteria for induction of systemic resistance against multiple plant diseases . *Biological Control*, Vol. 24 (3): pp. 285-291. [contact: kanchaleej@nu.ac.th]

Studies of induced systemic resistance using strains of plant growth-promoting rhizobacteria (PGPR) have concentrated on the use of individual PGPR as inducers against multiple diseases of a single crop. To date, few reports have examined the potential of PGPR strain mixtures to induce systemic resistance against diseases of several different plant hosts. The objective of this study was to select mixtures of compatible PGPR strains with the capacity to elicit induced systemic resistance in four hosts. The specific diseases and hosts tested in this study included: bacterial wilt of tomato (*Lycopersicon esculentum*) caused by *Ralstonia solanacearum*, anthracnose of long cayenne pepper (*Capsicum annuum* var. *acuminatum*) caused by *Colletotrichum gloeosporioides*, damping off of green kuang futsoi (*Brassica chinensis* var. *parachinensis*) caused by *Rhizoctonia solani*, and cucumber mosaic virus (CMV) on cucumber (*Cucumis sativus*). To examine compatibility, seven selected PGPR strains were individually tested for in vitro antibiosis against all other PGPR strains and against three of the tested pathogens (*R. solanacearum*, *C. gloeosporioides*, and *R. solani*). No in vitro antibiosis was observed among PGPR strains or against pathogens. Twenty-one combinations of PGPR and seven individual PGPR were tested in the greenhouse for induced resistance activity. Results indicated that four mixtures of PGPR and one individual strain treatment significantly reduced the severity of all four diseases compared to the nonbacterized control: 11 mixtures reduced CMV of cucumber, 16 mixtures reduced bacterial wilt of tomato, 18 mixtures reduced anthracnose of long cayenne pepper, and 7 mixtures reduced damping off of green kuang futsoi. Most mixtures of PGPR provided a greater disease suppression than individual PGPR strains. These results suggest that mixtures of PGPR can elicit induced systemic resistance to fungal, bacterial, and viral diseases in the four hosts tested.

{Recherche appliquée}

Accès au document : via le site Science Direct (document pdf ou html)
Coût de l'article : 30,00 $ US

Jiménez-González, L., Álvarez-Corral, M., Muñoz-Dorado, M., Rodríguez-García I., 2008. Pterocarpans: interesting natural products with antifungal activity and other biological properties. *Phytochemistry Reviews*, Springer Netherlands, Vol. 7-1: pp. 125-154. [contact: irodrigu@ual.es]

Among the phytoalexins with the highest antifungal activity is the isoflavonoid based group of pterocarpans. Here, we present a comprehensive inventory of the structures and sources of pterocarpans, and summarize some of their most interesting biological activities.

{Recherche appliquée}

Accès au document : via le site Springer Link (document pdf ou html)
Coût de l'article : 32,00 $ US

Jones, J.B., Jackson, L.E., Balogh, B., Obradovic, A., Iriarte F.B., Momol M.T., 2007. Bacteriophages for Plant Disease Control. *Annual Review of Phytopathology*, Vol. 45: pp. 245-262. [contact: jbjones@ufl.edu]

The use of phages for disease control is a fast expanding area of plant protection with great potential to replace the chemical control measures now prevalent. Phages can be used effectively as part of integrated disease management strategies. The relative ease of preparing phage treatments and low cost of production of these agents make them good candidates for widespread use in developing countries as well. However, the efficacy of phages, as is true of many biological control agents, depends greatly on prevailing environmental factors as well as on susceptibility of the target organism. Great care is necessary during development, production and application of phage treatments. In addition, constant monitoring for the emergence of resistant bacterial strains is essential. Phage-based disease control management is a dynamic process with a need for continuous adjustment of the phage preparation in order to effectively fight potentially adapting pathogenic bacteria.

{Recherche appliquée}

Accès au document : via le site Annual Review (document pdf ou html)
Coût de l'article : 20,00 $ US

Kuepper, G., Thomas, R., Earles, R., 2001. Use of Baking Soda as a Fungicide. NCAT/ATTRA Pest Management Series. ATTRA Publication #IP130/102. National Center for Appropriate Technology, Fayetteville, Arkansas. 4 p. [contact: georgek@ncat.org]

There has been considerable interest in the use of baking soda (sodium bicarbonate, $NaHCO_3$) and potassium bicarbonate ($KHCO_3$) to control powdery mildew and other fungal diseases of plants. This publication provides a brief survey of observations, research, and recommendations on the use of bicarbonates in horticulture.

While industry was in the process of developing bicarbonate products for commercial and home horticulture, a number of recommendations for using kitchen-grade baking soda also surfaced.

*Various carbonates and bicarbonates have been proven effective against gray mold, the number one post-harvest disease of grapes. Researchers found that carbonates were more effective than bicarbonates at reducing gray mold *(Botrytis cinerea)* spore germination, and that sodium and ammonium bicarbonates were better than potassium bicarbonate.

{Transfert technologique}

Accès au document : via le site de l'ATTRA (document html en ligne, ou document pdf)

Lahdenperä, Marja-L., 2006. *Gliocladium catenulatum* as an antagonist against grey mould on strawberry. Paper presented at Pest, disease and weed management in strawberry - progress and challenges for the Nordic production: NJF seminar 389, Lepaa, Finland, 8-9 November 2006; Published in *NJF Report,* 2 (10), p.15. Nordic Association of Agricultural Scientists.
[contact: riitta.koistinen@mtt.fi]

G. catenulatum gave excellent control of *Botrytis* on strawberry in several field trials in Finland. In biological control the product based on this antagonist increased the amount of total yield from 5 to 21% and increased the marketable yield as well, but in integrated control even better results were obtained. A combined use of one *Gliocladium* treatment and two chemical applications turned out to be an especially effective control program.

G. catenulatum J1446 seems to affect also the shelf-life of strawberries in storage. *Gliocladium* treatments applied at the time of flowering resulted in a better preservation of strawberry fruits than untreated or chemical applications.

The application of *G. catenulatum* J1446 on strawberry is accepted by the EU only in an integrated management of *Botrytis* where the first spraying is made by *Gliocladium* and the two subsequent treatments with chemical fungicides. The national sales permits for different Prestop formulations have to be applied separately. Prestop Mix was finally registered in Finland in 2006, while the submission of Prestop WP is still in progress.

{Recherche appliquée}

Accès au document : via le site orgprints.org (document pdf)
Accès aux extraits complets du séminaire : via http://www.njf.nu/site/redirect.asp?p=1321
Voir également la décision d'homologation de l'ARLA :
http://www.pmra-arla.gc.ca/francais/pdf/prdd/prd2008-03-f.pdf

Larbi, M., 2006. Influence de la qualité des composts et de leurs extraits sur la protection des plantes contre les maladies fongiques. Dissertation (pour obtention d'un Doctorat), Institut de recherche de l'agriculture biologique FiBL, CH-Frick; l'Université de Neuchâtel.

Le potentiel suppressif de certains composts et de leurs extraits sur les maladies telluriques ou foliaires a souvent été démontré. L'efficacité des composts et/ou des extraits varie en fonction du type de compost et du système plante hôte-pathogène. Les raisons de cette variabilité demeurent encore en grande partie méconnues. De plus, les mécanismes d'inhibition des pathogènes par les composts et/ou les extraits de composts restent encore insuffisamment explorés.

La majorité des extraits de composts, in vivo, ont réduit significativement la sévérité de la tavelure du pommier (agent pathogène, *Venturia inaequalis*) et du mildiou de la vigne (agent pathogène, *Plasmopara viticola*).

Le mode de production de l'extrait (durée et rapport d'extraction), l'âge des composts utilisés, ainsi que la stérilisation du compost par autoclavage avant son extraction et de l'extrait lui-même après son extraction (par autoclavage ou par filtration à 0,2 µm) n'ont pas influencé l'efficacité des extraits.

L'application des acides humiques et fulviques des composts a également réduit significativement la sévérité de la maladie causée par *V. inaequalis*. In vitro, les extraits de composts n'ont pas inhibé la germination de conidies de *V. inaequalis*, mais l'ont au contraire stimulée. Par contre, l'activité de zoospores de *P. viticola* a été fortement inhibée par les extraits de composts (70 %), inhibition probablement due à la salinité des extraits.

Contrairement aux mécanismes mis en jeu dans la protection des plantes contre les maladies telluriques, le mécanisme d'inhibition des extraits des composts contre les maladies foliaires n'est pas lié à leur activité microbienne. Le principe actif contre *V. inaequalis* doit être soluble à l'eau, thermostable et déjà présent dans le compost avant son extraction. Étant donné que les extraits des composts ne montrent aucun effet fongicide contre *V. inaequalis*, le mécanisme d'action passe soit par la plante (éventuellement induction de résistance), soit par l'influence de la phyllosphère. En ce qui concerne la protection de la vigne contre *P. viticola*, une action directe des extraits sur le pathogène semble également jouer un rôle déterminant.

Les résultats obtenus mettent en évidence que les composts et les extraits possèdent un potentiel intéressant à protéger les plantes contre divers agents pathogènes. Des essais complémentaires dans les conditions pratiques s'avèrent ainsi nécessaires afin d'optimiser l'utilisation des composts et de leurs extraits et de déterminer les limites d'efficacité de ces techniques. À cet égard, l'application combinée de compost dans le sol et des extraits sur les feuilles pourrait s'avérer intéressante pour offrir une protection globale des plantes.

{Recherche appliquée}

Accès au document : via le site orgprints.org (document pdf)

Letourneau, D., Bruggen, A. van, 2006. Crop protection in organic agriculture. In:. Kristiansen, P., Taji, A., Reganold, J., Eds. 2006. Organic agriculture: a global perspective. CSIRO Publishing, Collingwood / CABI, Wallingford / Cornell University Press, Ithaca / Manaaki Whenua Press, Lincoln. pp. 93-121. [contact: dletour@ucsc.edu]

This subject is reviewed under the following headings: pests and diseases in organic versus conventional agriculture; pest and disease management in organic versus conventional agriculture, including prevention of colonization or establishment of pests and pathogens in organic agriculture, regulation of established pests and pathogens in organic agriculture, host plant resistance, community resistance - vegetation, community resistance - pathogens and herbivores, community resistance - biological control, curative control; and pest and disease management case studies in organic versus conventional agriculture. Future research directions are also discussed.

{Recueil}

Accès au document : via le site orgprints.org (document pdf)

Lwin, M., Ranamukhaarachchi, S.L., 2006. Development of biological control of *Ralstonia solanacearum* through antagonistic microbial populations. International Journal of Agriculture and Biology. Friends Science Publishers, Faisalabad, Pakistan. 8: pp. 5, 657-660.
[contact: lwin399@gmail.com]

Potential antagonists were screened out and evaluated in-vitro and in-vivo as biological control agents (BCAs) against the bacterial wilt pathogen (*R. solanacearum*). Three selected antagonists (LR 3, LR 6 and LT 10) and 5 commercial BCAs (EM instant, EM5 (EM preserved with vinegar and distilled ethyl alcohol), EM-FPE, Bokashi (EM fermented compost) and *Bacillus subtilis*) were evaluated. All the BCAs reduced the bacterial wilt disease to various degrees. Among the BCAs tested, EM instant was the most effective, while the degree of disease suppression by other microbes varied with the time of application. The effects of EM-FPE and Bokashi were not different from EM instant. Among the antagonists isolated from infested soils, LR 10 showed the highest potential of disease suppression. The antagonists isolated from EM sources were effective to suppress against bacterial wilt pathogen. It means that EM contains some microbes, which can suppress the disease. Application method of biological control agent should be suitable for antagonist's action and prior to pathogen attack.

{Recherche appliquée}

Accès au document : via le site de Friends Science Publishers, International Journal of Agriculture & Biology
http://www.fspublishers.org

Mekuria, T., Steiner, U., Hindorf, H,. Frahm, J.P., Dehne, H.W., 2005. Bioactivity of bryophyte extracts against Botrytis cinerea, Alternaria solani and Phytophthora infestans. *Journal of Applied Botany and Food Quality*. Blackwell Publishing, Berlin, Germany, 2005. Vol. 79 (2): pp. 89-93.

Plant extracts can be used as crude extracts, alternative sources of known fungicides, new leads for fungicides and resistance inducers for an integrated pest management strategy. They are the point of interest in discovery of organic pesticides. Though several phytochemical constituents and medicinal uses of bryophytes are known, their potentials in the course of crop protection remained yet little or unexplored. The scope of this work was to study extracts from 17 bryophytes as source of potential antifungal agents under in vitro and it? vivo circumstances. Results showed that bryophyte extracts from *Bazzania trilobata*, *Diplophyllum albicans*, *Sphagnum quinquefarium*, *Dicranodontium denudatum* and *Hylocomium splendens* with high level of inhibition (> 50%) of the mycelial growth of *Botrytis cinerea* and *Alternaria solani*. Extracts of *B. trilobata* and *D. albicans* significantly reduced disease severity of *Phytophthora infestans* on tomatoes. In conclusion, the study indicated that extracts from bryophytes can be used as natural sources for alternative pest managment tools.

{Recherche appliquée}

Accès limité au document (résumé) : via Cab Abstract
Se référer au journal de publication pour l'article.

Minuto, A., Spadaro, D., Garibaldi, A., Gullino, M.L., 2006. Control of soilborne pathogens of tomato using a commercial formulation of *Streptomyces griseoviridis* and solarization. *Crop Protection*, Vol. 25 (5): pp. 468-475. [contact: davide.spadaro@unito.it]

Mycostop® is a commercial formulation of strain K61 of *Streptomyces griseoviridis*. This strain was isolated from Sphagnum peat and can control or suppress some root rot and wilt diseases by colonizing the rhizosphere prior to pathogens. The present work was carried out to test the ability of the commercial formulation, combined or not with soil solarization, to control diseases of greenhouse-grown tomato. Data obtained from four trials carried out over 2 years (2001 and 2002) demonstrated that *S. griseoviridis* could play a role in the integrated control of tomato soilborne diseases. This study is among the first to test *S. griseoviridis*'s effectiveness against corky root rot caused by *Pyrenochaeta lycopersici* when it is applied throughout the irrigation system (10 l of water per m^2). The biofungicide was very effective against *Fusarium oxysporum* f.sp. *lycopersici* and *Verticillium dahliae* in 2002 in artificially infested soils; however, in 2001 there was no statistically significant reduction of the vascular wilts compared to the control. Soil spraying was more effective than soil irrigation to control tomato wilts. The bacterial antagonist was not effective against Fusarium crown and root rot caused by F. oxysporum f.sp. radicis-lycopersici, when applied alone, but was less effective when applied with S. griseoviridis. Soil solarization provided good control of *V. dahliae* and *F. oxysporum* f.sp. *lycopersici*, but was also slightly less effective when combined with *S. griseoviridis*. A significant increase in fruit mass and a higher yield m^{-2} was recorded when solarization and the biofungicide were applied together in 2001. This indicated there may be a potential additive effect of the commercial biofungicide and solarization in increasing tomato yield; however, it was not consistent and generally not significantly different from the inoculated control. Metham sodium provided the most effective control of corky root and greatest yield increase of all the treatments evaluated.

{Recherche appliquée}

Accès au document : via le site Science Direct (document pdf ou html)
Coût de l'article : 30,00 $ US

Nejad, P., Johnson, P.A., 2000. Endophytic Bacteria Induce Growth Promotion and Wilt Disease Suppression in Oilseed Rape and Tomato. *Biological Control*, Vol. 18 (3): pp. 208-215.

To determine whether bacteria isolated from within plant tissue can have plant growth-promotion potential and provide biological control against soilborne diseases, seeds and young plants of oilseed rape (*Brassica napus* L. cv. Casino) and tomato (*Lycopersicon lycopersicum* L. cv. Dansk export) were inoculated with individual bacterial isolates or mixtures of bacteria that originated from symptomless oilseed rape, wild and cultivated. They were isolated after surface sterilization of living roots and stems. The effects of these isolates on plant growth and soilborne diseases for oilseed rape and tomato were evaluated in greenhouse experiments. We found isolates that not only significantly improved seed germination, seedling length, and plant growth of oilseed rape and tomato but also, when used for seed treatment, significantly reduced disease symptoms caused by their vascular wilt pathogens *Verticillium dahliae* Kleb and *Fusarium oxysporum* f. sp. *lycopersici* (Sacc.), respectively.

{Recherche appliquée}

Accès au document : via le site Science Direct (document pdf ou html)
Coût de l'article : 30,00 $ US

Pasini, C., D'Aquila, F., Curir, P., Gullino, M.L., 1997. Effectiveness of antifungal compounds against rose powdery mildew (*Sphaerotheca pannosa* var. *rosae*) in glasshouses.
Crop Protection, Vol. 16 (3): pp. 251-256.

The efficacy of several antifungal compounds, chosen among salts, oils, plant extracts, and of the hyperparasitic fungus *Ampelomyces quisqualis*, were tested in seven glasshouse trials against powdery incidence (55% of untreated leaves infected in six out of seven trials), all the antifungal compounds and the biocontrol agent *A. quisqualis*, applied individually, provided satisfactory control of mildew on roses (*Sphaerotheca pannosa* var. *rosae*) in Sanremo (N. Italy). In the presence of a high disease powdery mildew. Most treatments were as efficient as the fungicide dodemorph, which, sprayed at weekly intervals, provided a 75% average efficacy throughout the trials. Among the test compounds, KH_2PO_2, at 0.5 and 1%, offered good and consistent disease control, $NaHCO_3$, at 0.5%, showed a satisfactory level of activity, while at 1% it was phytotoxic. Wine vinegar, applied at 5 and 10%, gave good control, but acetic acid was phytotoxic. JMS Stylet oil, the canola oil, Synertrol and neem extract provided satisfactory disease control. Fatty acids formulated as potassium salts significantly and consistently reduced powdery mildew severity, but caused some phytotoxicity. Milsana, a concentrated extract from leaves of *Reynoutria sachalinensis*, only partially controlled powdery mildew. Several strategies based on the rotation of different antifungal compounds, with or without the application of dodemorph, provided very good, consistent disease control. The potential of some of the antifungal compounds and of the biocontrol fungus *A. quisqualis* against rose powdery mildew is discussed.

{Recherche appliquée}

Accès au document : via le site Science Direct (document pdf ou html)
Coût : 30,00 $ US

Pinna, M., Gamba, U., Spagnolo, S., 2005. Impiego di *Bombus terrestris* (L.) per la diffusione di antagonisti naturali di *Botrytis cinerea* (Pers.) in ambienti protetti coltivati a fragola [Using *Bombus terrestris* (L.) to disseminate natural antagonists of *Botrytis cinerea* (Pers.) in protected strawberry cultivation.]. Paper presented at "La difesa delle colture in agricoltura biologica" convegno AIPP (Associazione Italiana Protezione Piante - Italian Association for plant protection), Cesena (FO) Italy, 23-24 novembre 2004; Published in TURCHI, ANNALISA and SALVATI, MARCELLO, Eds. *BOLLETTINO DI AGRICOLTURA BIOLOGICA A CURA DEL CRAB (Reference Centre for organic farming)* (2): pp. 59-68. PROVINCIA DI TORINO (Turin province, Italy). (italien) [contact: info@agribiocentro.it]

Three years of investigation (2002-2004) proved the efficacy of using the pollinator insect Bombus terrestris to disseminate natural antagonists of Botrytis cinerea. The trials were conducted in greenhouses on strawberry cultivations and showed the possibility of biological control of Botrytis cinerea.

In 2002, the efficacy of the dissemination of Trichoderma harzianum with Bombus terrestris was comparable with the chemical control obtained by fungicides.

{Recherche appliquée}

Accès au document : via le site orgprints.org (document pdf)

Rai, Mahendra et María Cecilia Carpinella (éditeurs), 2006. *Naturally Occurring Bioactive Compounds. Advances in Phytomedicine*, Vol. 3, pp. 1-502. ISBN: 9780444522412
http://www.sciencedirect.com/science/bookseries/1572557X

Chapters

3- Natural compounds as antioxidant and molting inhibitors can play a role as a model for search of new botanical pesticides.
4- Pesticides based on plant essential oils: from traditional practice to commercialization.
3- Natural substrates and inhibitors of multidrug resistant pumps (MDRs) redefine the plant antimicrobials.
4- New concept to search for alternate insect control agents from plants.
5- Role of Melia azedarach L. (Meliaceae) for the control of insects and acari: present status and future prospects.
6- Bioactivity of fabaceous plants against food-borne and plant pathogens: potentials and limitations.
7- Screening of plants against fungi affecting crops and stored foods.
8- Opportunities and potentials of botanical extracts and products for management of insect pests in cruciferous vegetables.
9- The potential for using neem (Azadirachta indica A. Juss) extracts for pine weevil management in temperate forestry.
10- Plant allelochemicals in thrips control strategies.
11- Importance of plant secondary metabolites for protection against insects and microbial infections.
12- Naturally occurring house dust mites control agents: development and commercialization.
13- The search for plant-derived compounds with antifeedant activity.
14- An overview of the antimicrobial properties of Mexican medicinal plants.
15- Promissory botanical repellents/deterrents for managing two key tropical insect pests, the whitefly Bemisia tabaci and the mahogany shootborer Hypsipyla grandella.
16- Naturally occurring anti-insect proteins: current status and future aspects.
17- Antifungal natural products: assays and applications.

{Recherche appliquée}

Accès au document : chaque chapitre est disponible via le site Science Direct
(document pdf ou html)
Coût : 30,00 $ US par chapitre

Rice, M.J., Legg, M., Powell, K.A., 1998. Natural products in agriculture - a view from the industry. *Pesticide Science*, Vol. 52 (2): pp. 184-188.

The paper discusses the use of natural products and biological control agents in crop protection from an industrial viewpoint. The criteria which must be satisfied are noted. Examples are given from the genetic engineering of baculoviruses and proteins. The final section considers the utility of natural products as a source of leads for conventional agrochemicals, and the screens needed.

{Recherche appliquée}

Accès au document : via le site Wiley InterScience (document pdf ou html)
Coût de l'article : 29,95 $ US

Rosa, E., Rodrigues. P., 1999. Towards a more sustainable agriculture system: the effect of glucosinolates on the control of soil-borne diseases. *J Hortic Sci Biotech*, Vol. 74 (6): pp. 667-674.

The effect of glucosinolates and compounds derived from them, and the effect of amendments with brassicas, on soilborne microorganisms deleterious to crop plants is reviewed. It is concluded that soil amendment with brassicas has a beneficial effect on the control of some soilborne pathogens, probably due to isothiocyanates derived from the breakdown of glucosinolates. Residues from brassica crops could be incorporated directly into the soil or brassicas could be used as intercrops. Further research is recommended on the biological activity of the specific degradation products of glucosinolates and on the identification of species and cultivars yielding higher levels of isothiocyanates.

{Recherche appliquée}

Accès au document : via le site The Journal of Horticultural Science & Biotechnology
(document pdf ou html)
Coût de l'article : 30,50 $

Schmid, A., Daniel, C., Weibel, F., 2005. Effect of cultural methods on leaf spot (Mycosphaerella fragariae) and gray mold (Botrytis cinerea) damage in strawberries. *BioControl,* Vol. 50 (1): pp. 179-194. [contact: info.suisse@fibl.org]

Damage of leaf spot, caused by *Mycosphaerella fragariae* and gray mold also called Botrytis fruit rot, caused by *Botrytis cinerea*, average fruit weight and yield were evaluated with regard to cultural methods over two years. Leaf spot damage decreased significantly by around 90% due to leaf sanitation (removal of dead and leaf spot infected leaves in early spring) and by 50% due to plantation in a one-row-system instead of a two-row-system. When all leaves including the healthy green ones were removed in early spring average fruit weight decreased significantly by 10%. Fruit sanitation - the third treatment – did not influence any of the measured parameters.

Neither leaf sanitation nor fruit sanitation (removal of damaged fruits during harvest) reduced B. cinerea damage significant. Only the combination of a one-row-system, leaf sanitation and fruit sanitation almost halved (not significantly) *B. cinerea* damage in the first crop year compared to a two-row-system without leaf and fruit sanitation. *B. cinerea* damage correlated significant positive with the biomass of plants by R2= 0.47. According this study and the cited literature it is suggest for humid Central European conditions to apply a one-row system combined with leaf sanitation in early spring and fruit sanitation during harvest if fruit density is high to reduce the risk of damages in larger dimension caused by *M. fragariae* and *B. cinerea*.

{Recherche appliquée}

Accès au document : via Ingenta Connect (document pdf)
Coût de l'article 42,00 $

Shafir, S., Dag, A., Bilu, A., Abu-Toamy, M., Elad, Y., 2006. Honey bee dispersal of the biocontrol agent *Trichoderma harzianum* T39: effectiveness in suppressing *Botrytis cinerea* on strawberry under field conditions. *European Journal of Plant Pathology*, Vol. 116 (2): pp. 119-128.
[contact: shafir@agri.huji.ac.il]

Botrytis cinerea, which causes grey mould, is a major pathogen of many crops. On strawberry, isolates of *Trichoderma* spp. can effectively control *B. cinerea*, but frequent application is necessary. Bees can be used to disseminate biological control agents to the target crop. We tested the ability of honey bees to disseminate *Trichoderma harzianum* T39 to control *B. cinerea* in strawberry in the field during the winter in Israel over two consecutive seasons. We used the recently developed 'Triwaks' dispenser for loading the bees with the *T. harzianum* inoculum. During both years, grey mould developed in late January in untreated control plots; at low to medium disease levels it was partially controlled by fungicide treatment, and was best controlled in bee-visited plots. At high disease levels neither chemical nor biological control was effective. To assess the spatial distribution of inoculum by bees, we sampled flowers up to 200 m from the hives and found effective levels of *T. harzianum* even at 200 m. The approach used in this study provides an effective control of grey mould in strawberry in conditions of low to medium grey mould incidence.

{Recherche appliquée}

Accès au document : via le site SpringerLink (document pdf ou html)
Coût : 32,00 $ US

Thürig, B., Binder, A., Boller, T., Guyer, U., Jiménez, S., Rentsch, C., Tamm, L., 2006. An aqueous extract of the dry mycelium of Penicillium chrysogenum induces resistance in several crops under controlled and field conditions. *European Journal of Plant Pathology,* Vol. 114 (2): pp. 185-197. [contact: lucius.tamm@fibl.ch]

We have examined the effect of Pen, an aqueous extract of the dry mycelium of *Penicillium chrysogenum*, on plant–pathogen interactions. Pen controlled a broad range of pathogens on several crop plants under greenhouse and field conditions. Pen protected grapevine from downy and powdery mildew (caused by *Plasmopara viticola* and *Uncinula necator*), tomato from early blight (caused by *Phytophthora infestans*), onion from downy mildew (*Peronospora destructor*) and apple trees from apple scab (caused by *Venturia inaequalis*) to a similar extent as fungicides such as copper and sulphur or well-known inducers such as benzothiadiazole or b-aminobutyric acid. Pen had no major direct fungicidal effect and is thus supposed to protect plants by activating their defense mechanisms. The raw material for extraction of Pen was available in constant quality, a prerequisite for commercial application. Under certain conditions, Pen caused phytotoxic side effects. The symptoms mostly consisted of small necrotic spots or, more rarely, of larger necrotic areas. The development of the symptoms was dependent on several parameters, including concentration of Pen, the number of applications, the persistence on the plant tissue, the plant species and variety and environmental conditions. In grapevine, a partially purified fraction of Pen was much less toxic than the crude Pen extract, but protected the plants to a similar extent against P. viticola. Our data show that Pen has interesting and unique properties as a plant protection agent, but more research is needed to further reduce its phytotoxic side effects.

{Recherche appliquée}

Accès au document : via Springer Link (document pdf)
Coût de l'article 32,00 $

Tripathi P., Dubey, N.K., 2004. Exploitation of natural products as an alternative strategy to control postharvest fungal rotting of fruit and vegetables. *Postharvest Biology and Technology*, Vol. 32 (3): pp. 235-245. [contact: pramilatripathi_bhu@rediffmail.com]

Chemical fungicides provide the primary means for controlling postharvest fungal decay of fruit and vegetables. Continuous use of fungicides has faced two major obstacles—increasing public concern regarding contamination of perishables with fungicidal residues, and proliferation of resistance in the pathogen populations. The ultimate aim of recent research in this area has been the development and evaluation of various alternative control strategies to reduce dependency on synthetic fungicides. Several non-chemical treatments have been proposed for fungal decay control. Although these approaches have been shown to reduce postharvest rots of fruit and vegetables, each has limitations that can affect their commercial applicability. When used as stand-alone treatments, none of the non-chemical control methods has been clearly shown to offer a consistently economic level of disease control that warrants acceptance as an alternative to synthetic fungicides. Recently, the exploitation of natural products to control decay and prolong storage life of perishables has received more and more attention. Biologically active natural products have the potential to replace synthetic fungicides. This review deals with exploitation of some natural products such as flavour compounds, acetic acid, jasmonates, glucosinolates, propolis, fusapyrone and deoxyfusapyrone, chitosan, essential oils and plant extracts for the management of fungal rotting of fruit and vegetables, thereby prolonging shelf life.

{Recherche appliquée}

Accès au document : via le site Science Direct (document pdf ou html)
Coût : 30,00 $ US

Welke, S.E. 2004. The effect of compost extract on yields of strawberries and the severity of Botrytis cenerea. *Journal of Sustainable Agriculture*, Vol. 25 (1): pp. 57-68.
[contact: Myriad64@sympatico.ca]

The effect of compost extracts on strawberry yields and in the suppression of grey mould, *Botrytis cinerea*, in strawberries was studied over a period of two growing seasons on an organic, market garden farm in the southern interior of British Columbia. Composts were prepared both anaerobically and aerobically as well as at a 8:1 and 4:1 water to compost dilution in order to determine if preparation method and concentration changed any suppressive effect. Anaerobically prepared compost extract had little effect on strawberry yields yet reduced the severity (0.38 0.16) of *Botrytis cinerea* compared to water sprays (1.02 0.36). Aerobically prepared extracts improved yields (1.70 0.08 t/ha) over the control (1.36 0.11 t/ha) and water spray (1.37 0.09) treatments and also reduced disease severity. Dilute extract reduced the incidence of the disease to a greater extent than all other treatments.

{Recherche appliquée}

Accès au document : via Ingenta Connect (document pdf)
Coût de l'article 35,00 $

Wszelaki, A. L., and Miller, S. A. 2005. Determining the efficacy of disease management products in organically-produced tomatoes. Online. Plant Health Progress [contact: miller.769@osu.edu]

Seize produits thérapeutiques ou combinaisons de produits utilisés en régie biologique ont fait l'objet de tests visant à en évaluer l'efficacité relativement aux maladies de la tomate. En 2002, l'incidence des maladies a été plutôt faible, et aucun traitement n'a permis de réduire considérablement l'incidence de la maladie comparativement au groupe témoin. En 2003, la brûlure alternarienne et la tache septorienne sont survenues assez tard dans la saison. La bouillie bordelaise, l'hydroxyde de cuivre, les huiles d'ail et de margousier, l'extrait d'algues et le Serenade ont tous contribué à endiguer la propagation de la maladie comparativement au groupe témoin. Les parcelles traitées au Sonata ont donné les plus beaux fruits.

Sixteen disease control products or product combinations used in organic production systems were tested for efficacy against tomato diseases. Disease pressure was low in 2002, and no treatment significantly reduced disease relative to the control. In 2003, early blight and Septoria leaf spot developed late in the season, and Bordeaux mixture, copper hydroxide, garlic and neem oils, seaweed extract, and Serenade reduced disease development compared to the control. Plots treated with Sonata yielded the most marketable fruit.

{Recherche appliquée}

Accès au document : via le site Plant Health Progress (document pdf ou html)

Zaller, J.G., 2006. Foliar spraying of vermicompost extracts: effects on fruit quality and indications of late-blight suppression of field-grown tomatoes. *Biological Agriculture & Horticulture,* 24: pp. 165-180. [contact: johann.zaller@boku.ac.at or http://www.dib.boku.ac.at/zaller.html]

The effect of foliar sprays with aqueous vermicompost extracts on growth, yields, morphological and chemical fruit quality and natural infection with late blight disease *Phytophthora infestans* on three tomato varieties (*Lycopersicon esculentum* Mill., cv. Diplom F1, cv. Matina, cv. Rheinlands Ruhm) was investigated in a field experiment. Extracts were prepared of vermicompost produced from fruit, vegetable and cotton waste by redworms (*Eisenia fetida* Sav., *Lumbricidae*); tap water served as control treatment. Foliar application (spraying) of vermicompost extracts did not affect plant growth, biomass or nutrient allocation, or yields and number of fruits of the three tomato varieties; however, for several dates it significantly reduced the number of flowers produced. Foliar vermicompost spraying either increased or decreased peel firmness dependent on tomato variety and increased fruit circumference consistently as well as contents of nitrogen but decreased L-ascorbic acid compared with water sprayed fruits. All other measured parameters of fruit quality (dry matter, C, N, P, K, Ca, Mg, glucose and fructose content) were similar for vermicompost and water sprayed plants.

Natural infection of leaves, stems and fruits by *P. infestans* was generally very low under the experimental conditions; however, across varieties, only half as many vermicompost sprayed plants showed clear signs of *P. infestans* infection as water sprayed plants; the severity of the infection was unaffected by the two spraying treatments. In conclusion, these results suggest that the use of vermicompost might be considered more in organic farming not only as a substitute for peat in potting media but also as foliar sprays for fertilization and biological control.

{Recherche appliquée}

Accès au document : via le site de «University of Natural Resources and Applied Life Sciences, Vienna»
http://www.boku.ac.at/zoology/download/zaller/Zaller_2006BAH.pdf

ANNEXE : LIENS UTILES

Canada

Centre d'agriculture biologique du Canada
www.oacc.info

Réseau Biocontrôle (magazines de vulgarisation)
www.biocontrol.ca/bcf/main_f.html

États-Unis

Cornell University College of Agriculture and Life Sciences
Biological Control
Organic Insect and Disease Management Resource Guide

National Agricultural Library, Alternative Agriculture Information Center
www.nal.usda.gov/

National Sustainable Agriculture Information Service (ATTRA)
www.attra.org

Sustainable Agriculture Research and Education (SARE)
www.sare.org/index.htm

Europe

Danish Research Centre for Organic Farming (DARCOF)
Danemark (anglais)
www.darcof.dk

Forschungsinstitut für biologischen Landbau (FiBL) - Research Institute of Organic Agriculture
Suisse-Allemagne-Autriche (certaines informations disponibles en français)
www.fibl.org/francais/index.php

Institut National de la Recherche Agronomique (INRA), France
www.inra.fr/la_science_et_vous/dossiers_scientifiques/agriculture_biologique

Institut Technique de l'Agriculture Biologique (ITAB), France
Publications de la revue Alter Agri, d'actes de journées techniques, de dossiers spéciaux, etc.
www.itab.asso.fr

Nordic Association of Agricultural Sciences
Pays Scandinaves et Baltiques (anglais)
www.njf.nu/site/redirect.asp?p=1000

The Organic Research Centre, Elm Farm
Grande-Bretagne (United Kingdom) (anglais)
www.efrc.com
Organic Inform-Elm farm (bulletin d'information) : www.organicinform.org

Québec

Ecological Agricultural Projects
Université McGill
www.eap.mcgill.ca

- Plusieurs publications et liens

CRAAQ
Les sites d'Agri-Réseau

Quelques exemples :

- L'importance des éléments mineurs : des carences à la toxicité. Une préoccupation en agriculture biologique?
- Lutter contre les insectes nuisibles en agriculture biologique : intervenir en harmonie face à la complexité
- Manuel des Intrants Bio, partie 1 production végétale et partie 2 production animale
- Moyens de lutte contre des mauvaises herbes spécifiques (8 documents)
- Engrais verts et faux semis : influence sur la levée des mauvaises herbes en production maraîchère
- Cultures pièges et kaolin contre la chrysomèle rayée du concombre
- Étude d'efficacité de l'argile kaoline (Surround WP) pour lutter contre la pyrale des atocas (*Acrobasis vaccini* Rilay) et détermination d'un protocole d'application judicieux de matières fertilisantes dans la production de canneberges biologiques.
- Glumobile : mise au point d'un appareil mobile pour le piégeage massif de certains insectes ravageurs en maraîchage biologique
- Les couvertures flottantes pour la hâtivité et le contrôle des insectes dans la carotte, la laitue et le radis

MAPAQ –section Protection des cultures
Lutte antiparasitaire

MAPAQ :
Homologation des pesticides pour usages limités, détermination des priorités pour 2008 en entomologie, malherbologie et pathologie. Voir les tableaux Horticulture biologique.

MDDEP
Recherche et développement de biopesticides et pesticides naturels à faible toxicité pour les organismes non ciblés et respectueux de l'environnement Phytopathologie-Entomologie (2006)
Sous la direction de Richard Bélanger et Jacques Brodeur, revue littérature et résultats de recherche.

Archives- Base de données

CABI : produits tels que CAB Abstracts, la collection des Compendia, et ressources Internet.
www.cabi.org
www.organic-research.com

Organic Agriculture Information website (Organic AgInfo)
www.organicaginfo.org/

The Organic Eprints archive. Réseau européen de recherche en Agriculture biologique
www.orgprints.org