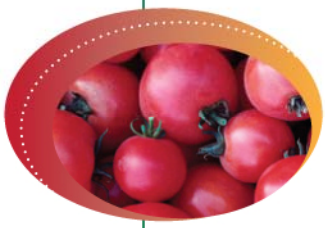
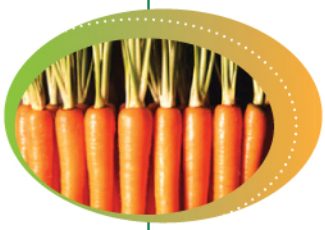
Recueil Bionovation

Édition 2008





Un inventaire des innovations
et de la recherche internationales
dans des secteurs ciblés de la production
végétale biologique

VOLET SEMENCES

Un document complet comprenant tous les volets existe sur le site Agriculture biologique d'Agri-Réseau, sous la rubrique **Recherche et innovation**

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.

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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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

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,* 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)

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

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