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Studio di sistemi a rilascio controllato di fitofarmaci e fitofortificanti nella coltura del ciliegio

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Abstract

Per soddisfare la forte richiesta di mercato delle ciliegie, la loro coltivazione prevede l'ampio utilizzo di fitofarmaci e fitofortificanti, con lo scopo di garantire raccolti migliori sotto il profilo sia quantitativo che qualitativo.
L'obiettivo di questo lavoro di tesi è quello di analizzare la possibilità di ricorrere all'utilizzo di sistemi a rilascio controllato per la veicolazione di sostanze utili alla crescita della coltura, evitando la perdita di ingredienti attivi per scarsa assimilazione o degradazione, riducendo il conseguente danno ambientale e realizzando un'azione specifica e mirata, necessaria per evitare il ricorso a dosaggi multipli.
Dall'analisi effettuata, infatti, emerge il sempre più frequente utilizzo di sistemi a rilascio controllato nel settore agricolo e appare quindi auspicabile l'utilizzo degli stessi nella coltivazione del ciliegio. Sistemi come gli idrogeli e, nello specifico, sistemi su nanoscala risultano efficaci come agenti battericidi contro numerosi funghi patogeni che danneggiano anche i ciliegi e incidono sulle relative rese di raccolta. Definite, quindi, le molecole di interesse da utilizzare, sono possibili approcci sperimentali per determinare metodi e sistemi di somministrazione dedicati, come, ad esempio, nanovettori costituiti da lipidi estratti da microalghe marine, e testare la loro idoneità sul campo. Diversi lavori di letteratura riportano la descrizione di ricerche già avviate che evidenziano quindi il forte slancio verso la ricerca di innovazione anche in campo agricolo, innovazione che, in particolare, si prefigge gli scopi di promuovere la sostenibilità ambientale, di rendere sicuro il lavoro degli operatori, di migliorare l'economia del settore cerasicolo.

To meet the strong market demand for cherries, their cultivation involves the extensive use of pesticides and phyto-fortifying agents, with the aim of ensuring better harvests in terms of both quantity and quality.
The objective of this thesis work is to analyze the possibility of resorting to the use of controlled release systems for the conveyance of substances useful for the growth of the crop, avoiding the loss of active ingredients due to poor assimilation or degradation, reducing the consequent environmental damage and carrying out a specific and targeted action, necessary to avoid the use of multiple dosages.
In fact, from the analysis carried out, the increasingly frequent use of controlled release systems in the agricultural sector emerges and it is therefore desirable to use them in the cultivation of cherry trees. Systems such as hydrogels and, specifically, nanoscale systems are effective as bactericidal agents against numerous pathogenic fungi that also damage the cherry trees and affect the relative harvest yields. Therefore, once the molecules of interest to be used have been defined, experimental approaches are possible to determine dedicated delivery methods and systems, such as, for example, nano-carriers consisting of lipids extracted from marine microalgae, and to test their suitability in the field. Several works in the literature report the description of research already started which therefore highlight the strong impetus towards the search for innovation also in the agricultural field, innovation which, in particular, aims to promote environmental sustainability, to make the work of operators safe, to improve the economy of the cherry sector.

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Bibliografia

1. https://www.ortodacoltivare.it/frutti/ciliegio.html.
2. https://blog.europlantsvivai.com/coltivare-il-ciliegio-la-guida-completa/.
3. https://rivistafrutticoltura.edagricole.it/featured/aspetti-produttivi-e-di-mercato-dellattuale-cerasicoltura/.
4. ; Available from: https://www.dinamica-fp.com/images/dinamica/patentini_fitosanitari 2016/modulo_01/REV2016_MOD1_UD1_prodotti.pdf.
5. VanEtten, H.D., et al., *Two classes of plant antibiotics: phytoalexins versus" phytoanticipins".* The Plant Cell, 1994. **6**(9): p. 1191.
6. Erogul, D., *Effect of preharvest calcium treatments on sweet cherry fruit quality.* Notulae Botanicae Horti Agrobotanici Cluj-Napoca, 2014. **42**(1): p. 150-153.
7. Rupert, M., et al., *Calcium chloride reduces rain cracking in sweet cherries.* California Agriculture, 1997. **51**(5): p. 35-40.
8. Ozkan, Y., et al., *Pre-harvest gibberellic acid (GA3) treatments play an important role on bioactive compounds and fruit quality of sweet cherry cultivars.* Scientia Horticulturae, 2016. **211**: p. 358-362.
9. Ozkaya, O., O. Dundar, and A. Kuden, *Effect of preharvest gibberellic acid treatments on postharvest quality of sweet cherry.* Journal of Food Agriculture and Environment, 2006. **4**(1): p. 189.
10. Kucuker, E. and B. Ozturk, *The effects of aminoethoxyvinylglycine and methyl jasmonate on bioactive compounds and fruit quality of 'North Wonder'sweet cherry.* African Journal of Traditional, Complementary and Alternative Medicines, 2015. **12**(2): p. 114-119.
11. Yao, H. and S. Tian, *Effects of pre-and post-harvest application of salicylic acid or methyl jasmonate on inducing disease resistance of sweet cherry fruit in storage.* Postharvest Biology and Technology, 2005. **35**(3): p. 253-262.
12. Romanazzi, G., *Chitosan treatment for the control of postharvest decay of table grapes, strawberries and sweet cherries.* Fresh Produce, 2010. **4**: p. 111-115.
13. Feliziani, E., et al., *Pre-and postharvest treatment with alternatives to synthetic fungicides to control postharvest decay of sweet cherry.* Postharvest Biology and Technology, 2013. **78**: p. 133-138.
14. Ippolito, A., et al., *Control of postharvest rots of sweet cherries by pre-and postharvest applications of Aureobasidium pullulans in combination with calcium chloride or sodium bicarbonate.* Postharvest Biology and Technology, 2005. **36**(3): p. 245-252.
15. Spotts, R., et al., *Control of brown rot and blue mold of sweet cherry with preharvest iprodione, postharvest Cryptococcus infirmo-miniatus, and modified atmosphere packaging.* Plant disease, 1998. **82**(10): p. 1158-1160.
16. *WO1989007395*. Available from: https://patentscope.wipo.int/search/en/detail.jsf?docId=WO1989007395&tab=PCTDESCRIPTION&_cid=P11-KTLBOO-35518-3.
17. *AU20200088*. Available from: https://patentscope.wipo.int/search/en/detail.jsf?docId=AU282290488&tab=PCTDESCRIPTION&_cid=P11-KTLCM3-48468-1.
18. *US20120077674*. Available from: https://patentscope.wipo.int/search/en/detail.jsf?docId=US73524900&tab=PCTDESCRIPTION.
19. *EP0878129*. Available from: https://patentscope.wipo.int/search/en/detail.jsf?docId=EP13085356&tab=PCTDESCRIPTION&_cid=P21-KTO4JA-67737-1.
20. Singh, A., et al., *Advances in controlled release pesticide formulations: Prospects to safer integrated pest management and sustainable agriculture.* Journal of hazardous materials, 2020. **385**: p. 121525.
21. Kim, H.S., et al. *Antifungal effectiveness of nanosilver colloid against rose powdery mildew in greenhouses*. in *Solid State Phenomena*. 2008. Trans Tech Publ.
22. Caccavo, D., et al., *Hydrogel-based granular Phytostrengtheners for prolonged release: Production and characterization.* Chemical Engineering Transactions, 2015. **44**: p. 235-240.
23. Rudzinski, W.E., et al., *Hydrogels as controlled release devices in agriculture.* Designed monomers and polymers, 2002. **5**(1): p. 39-65.
24. Rehab, A., et al., *Controlled release of herbicides supported on polysaccharide based hydrogels.* Journal of bioactive and compatible polymers, 1991. **6**(1): p. 52-63.
25. Chhipa, H., *Nanofertilizers and nanopesticides for agriculture.* Environmental chemistry letters, 2017. **15**(1): p. 15-22.
26. He, L., et al., *Antifungal activity of zinc oxide nanoparticles against Botrytis cinerea and Penicillium expansum.* Microbiological research, 2011. **166**(3): p. 207-215.
27. Menicucci, F., et al., *Thymol-loaded lipid nanovectors from the marine microalga Nannochloropsis sp. as potential antibacterial agents.* Biocatalysis and Agricultural Biotechnology, 2021. **32**: p. 101962.