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DEGLI STUDI
DI PADOVA



Proceedings of the 51st National conference of the Italian Society for Agronomy



Botanical garden – University of Padova

19 - 21 September 2022

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Società Italiana di Agronomia (SIA)
www.siagr.it

ISBN: 978-88-908499-5-4

The correct citation of article in this book is:

Authors, 2022. Title. Proceedings of the 51st Conference of the Italian Society of Agronomy (Dalla Marta A., Maucieri C., Ventrella D., Eds.), Padova, Italy, 19th-21st September 2022, pag. x-y

ORAL PRESENTATIONS

A Survey Of Weed Distribution In Italian Rice Fields Related To Agronomic Techniques

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Introduction

The Italian rice area is characterized by the presence of a specialized weed community, consisting of species able to grow in fields often flooded for a variable time period. Although rice is often cultivated in monocropping, the agronomic practices may be quite variable depending on farmer's choice and on the local soil and climatic conditions; these characteristics may affect the floristic composition of the weed community. The agronomic techniques adopted in the Italian rice farms has evolved rapidly over the past decade, a period in which, for example, the dry seeding of rice has become prevalent (Ferrero et al., 2020). Such changes have likely favored an increase in the presence of species more capable of growing under non-flooded conditions. Weed management techniques have also changed in the last years with an increasing area devoted to the cultivation of herbicide-resistant rice varieties further contributing to the changes of the species distribution in the rice fields (Gómez de Barreda et al., 2021).

The objective of the study was to map the distribution and abundance of different rice weeds through farmer's interviews and weed density surveys conducted in 2017-2020 in several rice farms distributed in the main Italian rice-growing area. The weed presence was then related to the main agronomic practices applied in the area and to the soil characteristics.

Materials and Methods

A series of farmer's interviews were conducted in 2018-2020, involving about 1000 rice farms. The questions were related to the rice area cultivated in each farm, the most spread weeds, the extension of the flooded and dry rice seeding area, the farmer's perception of increasing and decreasing weeds, the area devoted to crop rotation, the techniques adopted to prepare the soil (plowing or minimum tillage) and the presence of probable herbicide-resistant weeds.

Weed density was estimated in 295 rice plots in different sites of the main Italian rice area by counting and determining all the weed species. The assessment was carried out in non-weeded plot in each site in three different time during the crop cycle. All the surveyed plots were geographically localized and the type of rice seeding (flooded or dry) was also recorded.

Data from interviews and field assessments were both analyzed through descriptive statistics, such as frequency of different weed species detected by the farmers in their fields and frequency of the application of different management practices. ANOVA was applied on weed density assesment to find significant differences in weed presence between type of seeding. Weed density, the area infested by the different weeds species over the total rice area of each farm, the rice area of each farm, the type of seeding, the soil texture and soil pH of the surveyed areas were analyzed through a PCA and a two-steps cluster analysis to detect which variables accounted most for the data variability.

Results

The farmer's interviews highlighted that in 2018 flooded seeding was performed on 53% of the rice fields, while in 2020 this percentage decreased to 44%. Before seeding, fields were mainly prepared with soil plowing (80% of the area) and rice was cultivated as monocropping in about 70% of the fields.

The most spread weeds in the rice area were *Echinochloa* spp. present on about 87% of the farms. On almost half of the area of the considered farms, *Cyperus difformis* and *Heteranthera reniformis* were present, while weedy rice (*Oryza sativa*) infested about 40% of the rice area. According to the farmers, higher infestations of *Persicaria maculosa*, *Cyperus esculentus*, *Digitaria sanguinalis* and *Panicum dichotomiflorum* were observed in dry seeded rice fields. High presence of weeds typical of flooded environments were present, as expected, in the flooded seeded rice fields, such as *C. difformis*, *H.*

reniformis, *Alisma plantago-aquatica*, *Butomus umbellatum*, *Schoenoplectus mucronatus* and *Ammania coccinea*. Farmers noticed an increase in the infestations in the last five years of *Echinochloa* spp., weedy rice, and *C. esculentus*, while they observed a reduction in the presence of *A. plantago-aquatica* likely due to the introduction of florpyruaxyfen-benzyl, a herbicide highly effective against this weed.

The weed density assessments highlighted a higher weed presence (about 66 plants m⁻²) in flooded fields compared to the dry seeded ones (about 44 plants m⁻²). The PCA showed that weed density was negatively correlated with soil sand content, especially for species found in flooded conditions; in these areas, in fact, seeding in flooded fields was the most applied practice. Moreover, weeds typical of dry environments were found in sandy or loamy sand soils where dry seeding was the most prevalent technique.

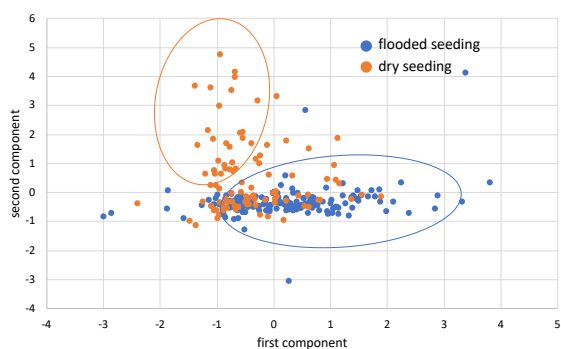


Figure 1. PCA showed that the first component was mainly correlated with weeds typical of flooded seeding, while the second component with weeds found in dry seeding.

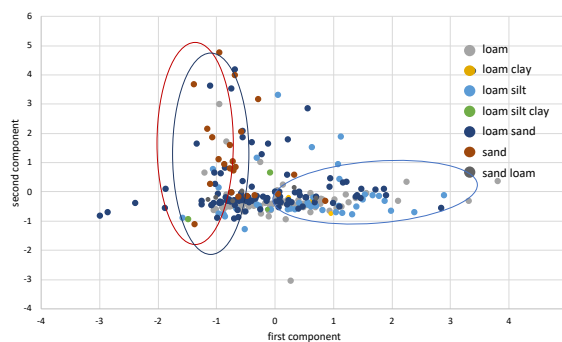


Figure 2. PCA highlighted a positive correlation with silt and clay soil content. Second component mainly correlated with sand content.

The cluster analysis showed that the seeding method was the most important predictor for the cluster formation. Three clusters were built, one constituted by 93% of the sites with seeding in flooded fields and with high density of weeds typical of flooded conditions, such as *H. reniformis*, *Echinochloa* spp., and *C. difformis*. Cluster 2 comprised 74% of the sites with dry seeding and with weeds typical of both flooded and dry seeding, while cluster 3 included 92% of the sites with dry seeding having weeds typical of this conditions.

Conclusions

The study permitted to have an updated picture of the infestations of rice fields and highlighted that some agronomic practices, i.e. type of seeding, can strongly influence the presence of certain weed species. The results highlighted that the choice of the agronomic practices to be adopted for rice cultivation is strategic not only to achieve high productions but also to correctly manage rice weeds by taking into account the spread of the different weed species, which are in turn affected by the agrotechniques.

Literature

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