SCHOOL OF AGRICULTURE, POLICY AND DEVELOPMENT

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Opportunities for more precise weed management in fields of lowland rice in South-Eastern Nigeria

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Background

In Nigeria hunger is widespread but rice is the most important staple food. Weed infestation is a major constraint to raising rice yield. The farmers struggle to rescue their harvest from some of the worst weeds using handweeding and the uniform application of herbicides across whole fields. These interventions are costly for resource-poor small-scale farmers and constitute health and environmental hazards. If the weeds accumulate in patches, then Precision Agriculture (PA) might help. In the absence of technology, this study aims to introduce PA by refining and adapting traditional knowledge and practices to enable the farmers target interventions more precisely to weed patches.

Objectives

- To investigate the farmers' perspective about the weed distribution in their fields.
- To verify the farmers' reports and suggest low-tech approaches to PA.

Methodology

The study area was Ayamelum Local Government Area of Anambra State, SE Nigeria. The major crop in the area is rain-fed rice, technology is low, most fields are <1ha and are cropped once in a season.

Survey: Questionnaires were administered to 281 respondents.

- Respondents were lowland rice farmer whose fields were within the study area.

Field sampling: Two lowland rice fields were sampled as an independent verification of respondents' claims. The flooding depth and populations of *Nymphaea maculata* Schumach & Thonn and *Echinochloa* spp., were assessed (Fig. 1).

- Flooding depth was mapped by ordinary Kriging, but the inverse distance weighting method was used for weed mapping.

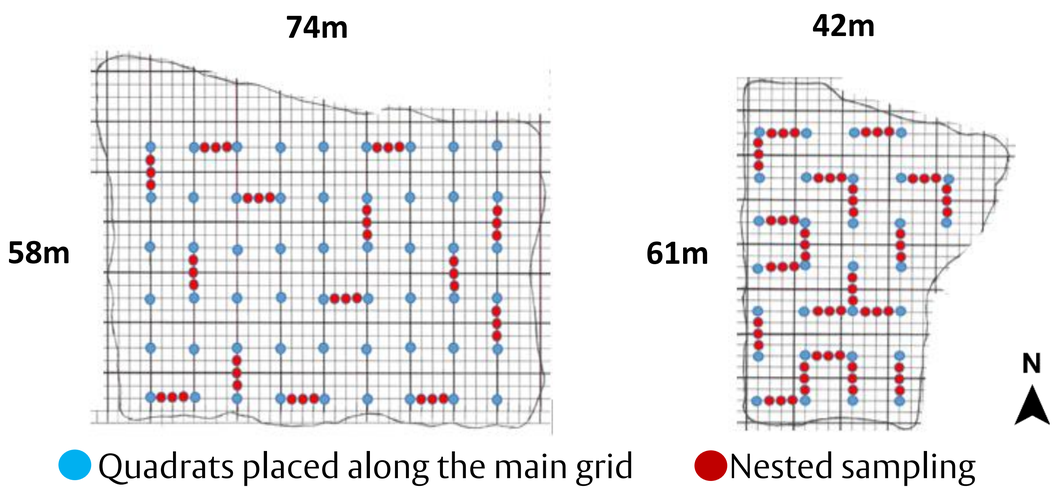

Fig. 1: Eight-metre grid sampling scheme with nested samples at 2m spacing, used to sample two lowland rice fields in SE Nigeria.

Results

- Among 281 respondents, 71% indicated that the weeds in their fields were spatially-variably distributed and 29% did not. Sixty-nine percent of these farmers associated the weed patchiness with variable flooding depth (Fig. 3). Interestingly, farmers associated *N. maculata* with zones of their fields which flooded more deeply and conversely for *Echinochloa* spp. (Fig.4).
- In the two fields used to validate the farmers' claims, variograms confirmed considerable spatially-correlated variation in both fields although they were both <1ha (Fig.5).
- Mapping the variation in flooding depth and weed distributions in the two fields corroborated the respondents' claims regarding the association of the weeds with flooding depth (Fig. 6). Thus in both fields, *N. maculata* was positively correlated with increased flooding depth, while *Echinochloa* spp. was negatively correlated (Fig. 6).

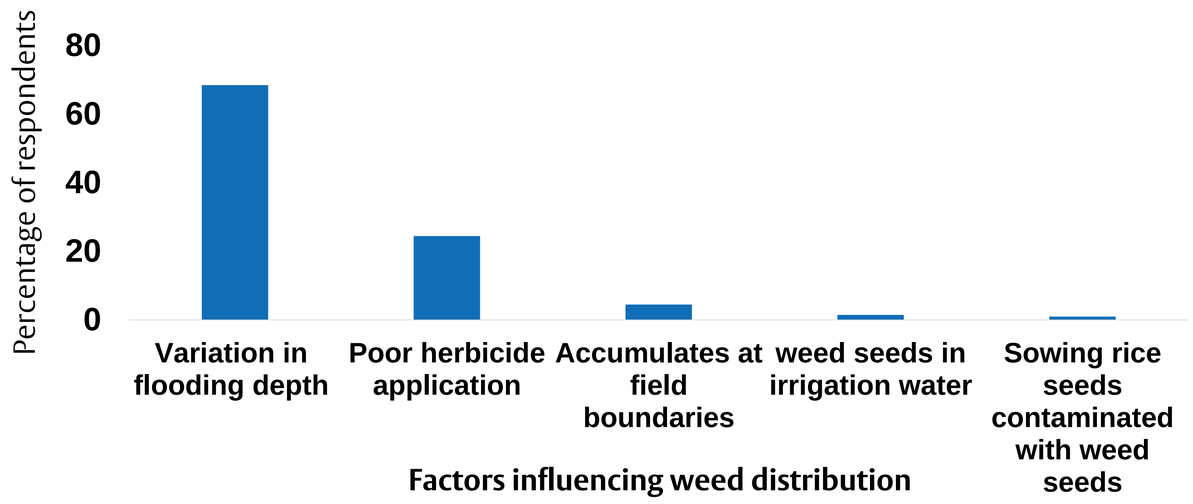

Fig. 2: Respondents describe factors responsible for weed patchiness in their fields.

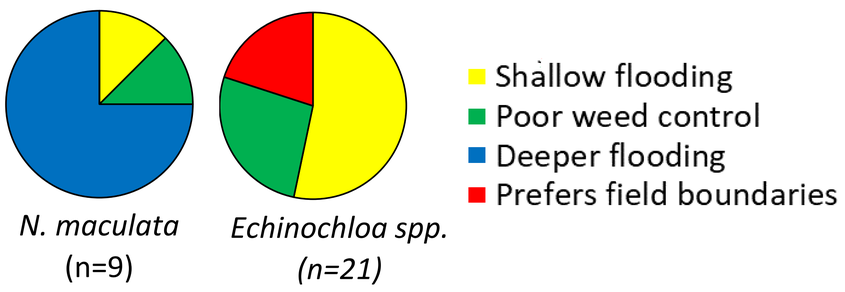

Fig. 3: Factors the respondents associate with higher densities of *N. maculata* and *Echinochloa* spp.

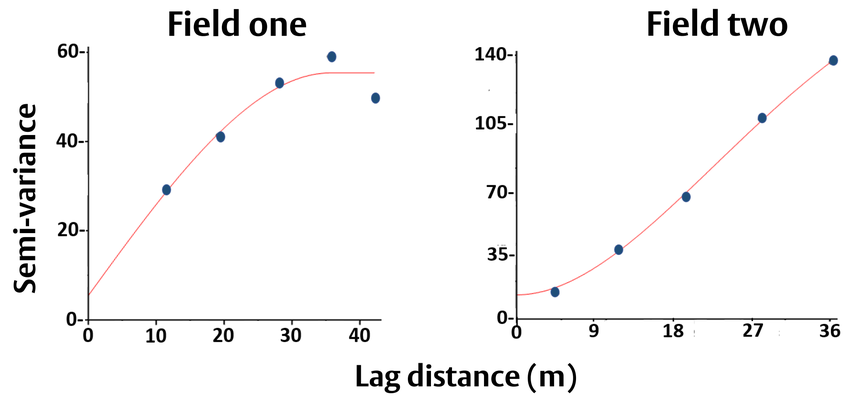

Fig. 4: Variogram models fitted to describe the spatial structure of flooding depth in two lowland rice fields in SE Nigeria.

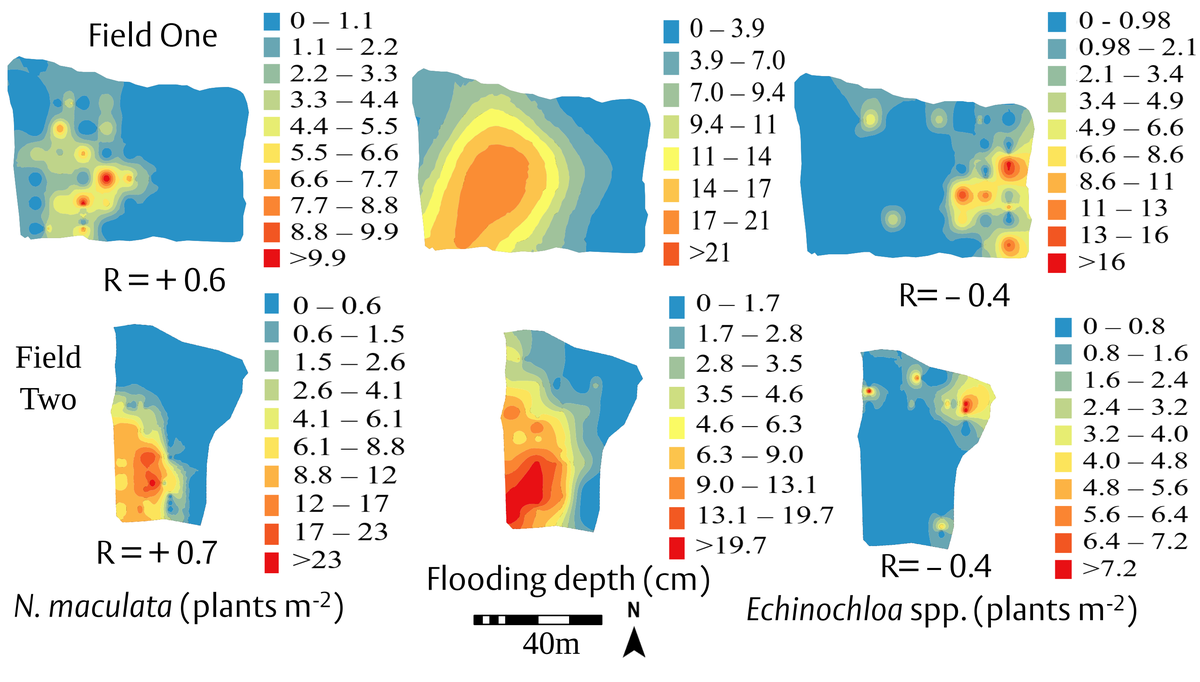

Fig. 5: Maps of the distribution of *N. maculata*, *Echinochloa* spp. and flooding depth across two lowland rice fields in SE Nigeria. (Colour scales differ on each map)
R is Pearson's correlation coefficient between flooding depth and weed populations.

Discussion and conclusion

Interestingly, the respondents began adopting site-specific weed management (SSWM) immediately following the study. Some of them applied herbicides spatially-variably while others replaced traditional uniform handweeding with patch-based handweeding.

In future, farmers could demarcate weed management zones based on flooding depth and expected weed infestations. Zones could also be bunded to flood to desired levels for better weed control. SSWM could therefore be implemented to allow different doses or types of herbicides and varying handweeding schedules.

Acknowledgements

The Commonwealth Scholarships Commission is appreciated for the award of PhD scholarship to Mr Odinkemneme Ukwoma-Eke.

Thanks to AfricaRice for linking the researchers up with lowland rice farmers in the study area.

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