イネのリン欠乏と低温不稔が問題となる栽培環境での効率的なリン施肥法

Efficient phosphorus application strategy to improve rice yields under cold stress-prone and P-deficient environments

リンの施肥効率改善は、施用量が不足する地域での作物の生産性向上や枯渇するリン鉱石の持続的利用を実現する上で重要な課題である。熱帯地域に広く分布するリン欠乏土壌では、イネをはじめとする一年生作物の発育（出穂・開花）が遅延し、収穫までの日数が延びることが知られる。しかし、リン欠乏にともなう発育の変化が圃場での作物収量に及ぼす影響については定量的な評価がなされていない。本研究では、リン欠乏と生育後半の低温ストレスが問題となるマダガスカルの中央高地でイネを栽培することで、低温不稔のリスクが高い圃場にリンを施用することで、リン欠乏と低温不稔の双方の改善につながり、増収効果を高められることを明らかにした。

Despite a general perception that phosphorus (P) deficiency delays phenological development in annual crops, the impacts of interaction between this phenological delay and climatic conditions on crop yield remain poorly understood. This study provides field evidence that the effect of P application to rice yields by accelerating phenological development was enhanced by delayed transplanting owing to a combined effect which alleviated both P deficiency and cold-induced spikelet sterility. The result indicates that P use efficiency can be further enhanced by taking climatic conditions into account.

表1 リン施用の有無と移植日の違いがリン欠乏水田でのイネの到穂日数および収量に及ぼす影響
Table1. Effect of P application and transplanting date on days to heading and yield of rice on P deficiency

		Days from transplanting to heading			Yield (t ha^{-1})		
		-P	+P	Difference between +P and -P	-P	+P	Difference between +P and -P
ETP	Field1	111	95	-16	2.2	3.1	0.8
	Field2	110	98	-11	2.4	3.2	0.8
LTP	Field1	109	96	-12	1.9	3.1	1.2
	Field2	105	96	-9	1.8	3.1	1.3

- -P indicates the means of the plots without fertilizer and with N applied as urea at the rate of 80 kg N ha^{-1}.
- +P indicates the means of plots with P applied as triple super phosphate at the rate of 50 kg P_2O_5 ha^{-1} and with N and P combined.
- ETP refers to early transplanting plots (November 28-29). LTP refers to late transplanting plots (December 27-30).
- Underlined values indicate significant differences between -P and +P plots at 5% by Tukey HSD.
- ANOVA detected a significant interaction between P treatment and transplanting dates on yield.

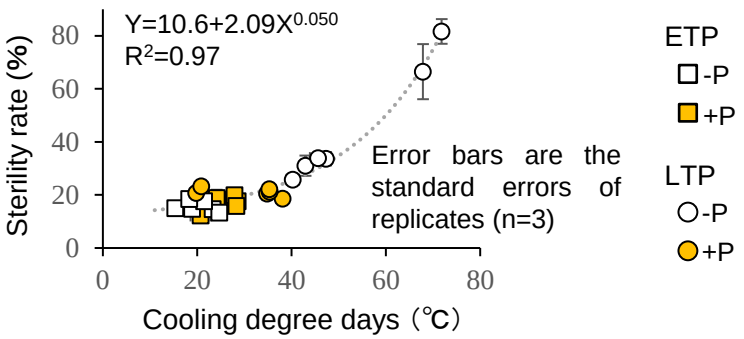

図1. リン施用の有無と移植日の違いがイネの低温指数と不稔率に及ぼす影響
Fig. 1. Effect of transplanting dates and P application on the cooling degree days (CDD) and spikelet sterility

CDD is the sum of daily mean temperatures below 22°C from 15 days before to 7 days after heading.

Reference: Andrianary et al. (2021) *Field Crops Research* 271: 108256, https://doi.org/10.1016/j.fcr.2021.108256, and Rakotoson et al. (2022) *Field Crops Research* 275: 108370, https://doi.org/10.1016/j.fcr.2021.108370

国立研究開発法人 国際農林水産業研究センター
〒305-8686 茨城県つくば市大わし1-1
Japan International Research Center for Agricultural Sciences
1-1 Ohwashi, Tsukuba, Ibaraki, 305-8686 https://www.jircas.go.jp/