Comparison of causality of temperature and precipitation on Italian ryegrass (*Lolium Multiflorum* Lam.) yield between cultivation fields via multi-group structural equation model analysis in Korea

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The composition of climatic factors was similar, but the causality by the paths was different between upland fields and paddy fields. In particular, yield in the paddy fields was sensitive to autumn precipitation due to short growing days in the rice-rotation system. In the paddy fields, the precipitation effect in both autumn and the next spring indirectly affected yield through temperature. The autumn temperature effect on yield in the paddy fields was 2.82 times greater than in the upland fields, between the two field types, the spring temperature effect was somewhat similar after wintering; thus, IRG cultivation in paddy fields should be limited to the south. However, there is greater suitability for IRG in the upland fields in the autumn, where the benefits of higher temperatures accumulate to offset effectively the short growing days.

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