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A METHODOLOGY TO INDUCE LODGING AT PLOT SCALE IN THE FIELD

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Purpose:
Mechanical stability of stems is limited in today's highest-yielding, top-heavy cultivars. Further increase in genetic yield potential will be ineffective without improved lodging resistance. Despite ample studies on genetic control, particularly in Japan, lodging is still a weakness of most high-yielding tropical cultivars in high-input systems and dense plant populations. To identify parent materials and evaluate breeding products, a large number of genotypes need to be characterized based on a standard methodology capable of differentiating them.

Approach and methods used:
Studying natural lodging is difficult because of unpredictable and untimely storms in the tropical wet season. We have developed a plot-scale mobile system called the rice blaster, which generates cyclone-like conditions within 1 m wide and 6 m long wind channel blowing at a shallow angle into the rice canopy with a maximum wind speed of 60 km hr^{-1}. It consists of an electric turbine generating wind stream; a jet injecting water into the wind stream; a submersible pump drawing water into the jet; a generator for electricity; an imagery system to monitor the lodging process; and ultrasonic sensors to continuously measure canopy height while blasting. The method allows narrow plot designs because plants near the wind path are unaffected. The blaster was applied at the dough grain stage of contrasting rice genotypes in the 2013 wet season and 2014 dry season at IRRI, using different wind speeds (30, 45, and 60 km hr^{-1}) and constant simulated rainfall (1.5 mm min^{-1}). Canopy height was measured before, immediately after, and at different times until 7 days after blasting. Percentage lodging was calculated as the reduction in canopy height before and after blasting, and recovery as the percentage increase in canopy height from its lodged height.

Key results:
Tall genotypes lodged more and recovered less. Genotypes that lodged less recovered more. Among high-yielding semidwarf rice varieties of equal height, large and reproducible genotypic differences in lodging were observed. These usually could not be predicted with proxy traits such as stem thickness or bending momentum.

Synthesis and Applications:
Lodging study through the blaster proved highly repeatable while integrating many traits and near-natural factors that would be difficult to capture with other methods.