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Genetically Engineered Pea Seeds Protect Against Parasites

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Coccidiosis caused by protozoans of genus Eimeria is a chicken parasitic disease of great economical importance. Conventional disease control strategies depend on vaccination and prophylactic use of anticoccidial drugs. Alternative solution to prevent and treat coccidiosis could be provided by passive immunization using orally delivered neutralizing antibodies. We developed a strategy to mitigate the parasitic infection by feeding poultry with antibody expressing transgenic crop seeds. Using the phage display antibody library, a panel of anti-Eimeria single-chain Fv (scFv) antibody fragments with high sporozoite-neutralizing activity was generated. These antibodies were expressed in seeds of transgenic pea plants. Force-feeding experiments demonstrated that oral delivery of flour prepared from the transgenic pea seeds had high parasite neutralizing activity in infected chickens. The pea seed content was found to protect antibodies against degradation by gastrointestinal proteases (>100-fold gain in stability). Ad libitum feeding of chickens demonstrated that the transgenic seeds were well consumed and not shunned. Furthermore, feeding poultry with shred prepared from the antibody expressing pea seeds led to significant mitigation of infection caused both by high and low challenge doses of Eimeria oocysts. The results suggest that our strategy offers a general approach to control parasitic infections in production animals using cost-effective antibody expression in crop seeds affordable for the animal health market.