Let $\phi$ be a morphism of $\mathbb{P}^N$ defined over a number field $K$. We prove that there is a bound $B$ depending only on $\phi$ such that every twist of $\phi$ has no more than $B K$-rational preperiodic points. (This result is analogous to a result of Silverman for abelian varieties.) For two specific families of quadratic rational maps over $\mathbb{Q}$, we find the bound $B$ explicitly. (Received July 30, 2012)