Involvement of endogenous gibberellins in potato tuber dormancy and early sprout growth: a critical assessment

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Abstract

The role of endogenous gibberellins (GAs) in the regulation of potato (*Solanum tuberosum*) tuber dormancy was examined by determining: 1. changes in endogenous GA levels during natural dormancy progression, 2. the effects of GA biosynthesis inhibitors on tuber dormancy duration and 3. the dormancy status and tuber GA levels in a dwarf mutant of potato. The tubers (cv. Russet Burbank) used in these studies were still completely dormant after 98 days of storage. Between 98 and 134 days of storage, dormancy began to end and tubers exhibited limited (<2 mm) sprout growth. Tuber dormancy weakened with further storage and tubers exhibited greater rates of sprout growth after 187 days of storage. Tubers stored for 212 days or longer were completely non-dormant and exhibited vigorous sprout growth. Immediately after harvest, the endogenous contents of GA_{19}, GA_{20}, and GA_1 were relatively high (0.48–0.62 ng g fresh weight^{-1}). The content of these GAs declined between 33 and 93 days of storage. Internal levels of GA_{19}, GA_{20}, and GA_1 rose slightly between 93 and 135 days of storage reaching levels comparable to those found in highly dormant tubers immediately after harvest. Levels of GA_{19}, GA_{20}, and GA_1 continued to increase as sprout growth became more vigorous. Neither GA_4 nor GA_8 was detected in any tuber sample regardless of dormancy status. Dormant tubers exhibited a time-dependent increase in apparent GA sensitivity. Freshly harvested tubers were completely insensitive to exogenous GAs. As postharvest storage continued, exogenous GAs promoted premature dormancy release with GA_1 and GA_{20} eliciting the greatest response. Injection of up to 5 ⌈g tuber^{-1} of kaurene, GA_{12}, GA_{19} or GA_8 had no effect on dormancy release. Sprout growth from non-dormant tubers was also promoted by exogenous GA in the following sequence of activity: $GA_1 = GA_{20} > GA_{19}$. Kaurene, GA_{12}, and GA_8 were inactive. Continuous exposure of developing tubers to inhibitors of GA biosynthesis (AMO-1618, ancymidol, or tetcyclasis) did not extend tuber dormancy but rather hastened dormancy release. Comparison of tuber dormancy and GA_1 content in tubers of a wild-type and dwarf mutant of *S. tuberosum* ssp. andigena revealed a near-identical pattern of dormancy progression in spite of the absence of detectable levels of GA_1 in tubers of the dwarf sibling at any time during dormancy progression. Collectively, these results do not support a role for endogenous GA in potato tuber dormancy release but are consistent with a role for GAs in the regulation of subsequent sprout growth.