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A physiological study of adventitious bud formation in potato

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Summary

The purpose of this study was to investigate physiological factors regulating the initiation of adventitious buds in potato (*Solanum tuberosum*).

Adventitious bud formation was studied on de-eyed tuber pieces kept in moist sand. In most varieties the ability of this material to form buds was small or even absent. Attempts to initiate buds by growth regulators were unsuccessful. Tuber-slices treated with auxin formed adventitious roots in most varieties.

Rooted tuber-slices easily formed buds when they were planted in soil. I tried to account for the bud-promotive influence of the roots. Water-culture experiments showed that rooted slices did not produce buds when the roots were deprived of mineral nutrients; especially potassium and nitrogen seemed to be required. No supply of these minerals, however, was necessary to initiate buds in non-rooted tuber pieces in sterile culture. This result suggested that the roots do not promote bud formation by their uptake of minerals. Attempts were made to relate bud formation on rooted tuber-slices to cytokinin synthesis in the roots. Cytokinin activity was demonstrated in root extracts but a causal relationship with bud formation could not be proved. Experiments with tuber explants in sterile culture demonstrated that the bud-promotive influence of the root system could not be substituted by application of root extract or cytokinin. Further research will be necessary to trace the cause of bud formation on rooted tuber-slices. Since nearly all buds originate on or near the roots, specific characteristics of the living root tissue may be involved.

A different approach of the bud formation problem was made possible by the genotypic variation in regeneration behaviour of non-rooted tuber pieces in sterile culture. Tuber tissue of the variety Multa formed buds very easily, whereas in the variety Bintje no bud formation occurred. Trials to initiate bud formation in Bintje by application of Multa tuber extract were unsuccessful. A comparative investigation of tuber tissue of the two varieties showed a considerably higher sensitivity to auxin in Bintje than in Multa. It was hypothesized that differences in bud regenerative ability are caused by differences in hormone sensitivity of the tissue.