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A Horticultural Scientist's View of Growth Regulator Research

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The concept (and occasionally the practice) of manipulating plant growth and development using plant growth regulators has fired the imagination of plant scientists for several decades. The optimistic mood of the early 1970s of increasing economic biomass production using plant growth substances (PGSs) (Weaver, 1972) had given way to deep skepticism by the mid-1980s (Daie, 1988). The lack of tangible field success and the personal inclination of the individuals led to plant physiologists tackling topics that had a greater success rate and, as a result, a greater publication rate. More and more, growth regulator research moved away from the horticulturalist to the plant physiologist. Progress as to the chemical structure and the biosynthesis and metabolism of PGSs was rapid. The ability to isolate and quantitate PGSs improved consistently, and a bewildering battery of sophisticated technologies resulted from bioassay, to GC-MS and immunoassay (Brenner, 1981). Having these tools at their disposal meant that the literature expanded considerably with articles about PGS levels in a multitude of plant species. Little attempt was made to explain what the PGS concentrations actually meant, particularly in the whole-plant situation.

However, a group of horticultural scientists has continued with field evaluation of a multitude of chemicals with growth regulator potential (see Miller, 1988). This group, whom I have so often heard referred to as "spray and pray" researchers, slowly made significant contributions to the point that today, asexual propagation practices, including in vitro, are firmly dependent on the use of PGSs, particularly synthetic auxins and cytokinins. Routine control of flowering and fruit size using PGSs is standard practice for

some crops such as pineapple and grape. More recently, gibberellin synthesis inhibitors have received much attention (Davis et al., 1988), and this has resulted in some practical applications. By and large, not much basic knowledge, such as the physiological role of PGSs, resulted from these investigations and, as a consequence, the practice is not readily transferred from one crop to another; i.e., progress is slow. In addition, contact between plant physiologists and horticultural scientists involved with growth regulator research appears to be declining—this trend is evidenced in the decline in the number of publications in the *Journal of the American Society for Horticultural Science* of a growth regulator nature, from 29 in 1979 to 10 in 1989. Added to this, several journals have emerged with a central growth regulator theme, but of little practical value to the production, and often the research, horticultural scientist.

What is to be done to redress this problem? Growth regulator research must still be one of the most important avenues of research with a reasonable chance of increasing economic biomass production in addition to being crucial to the success of any biotechnology program—what is the point of gene transfer if we are unable to regenerate plants from single cells? I believe that an approach only now beginning to bear fruits and having been implemented for many years by the Dept. of Horticultural Science of the Univ. of Stellenbosch under the leadership of Dan Strydom is one viable option and is, by and large, based on field contrasts. First, field horticulturists establish strong and repeatable contrasting responses in the orchard using any horticultural tool at their disposal, from selective pruning cuts and girdling to growth regulator sprays. Once these contrasting responses have become predictable, the experimentation is transferred to the laboratory, where the relevant endogenous PGS complement is determined and quantified. By having a strong field contrast, and usually,

but not always, an untreated control, the differences in the PGS complement often begin to assume rational meaning. Once the responsible PGS(s) have been targeted, a hypothesis for control of the respective response is developed and tested. Every effort is made to explain the results in terms of the whole-plant situation. After all, horticulturists are involved with orchards of functioning whole plants. It seems pointless to measure PGS levels in isolation, as the level of a PGS then becomes almost impossibly difficult to explain. The approach outlined here works, is enthusiastically received by post-graduate students, and can easily be built into a horticultural post-graduate program. Obviously, this approach will not work for every application, but should be seen as a useful addition to the many approaches currently in use. However, it is important to realize that, in order for this approach to be successful, a thorough working knowledge of the target crop is required (to obtain the contrast) as well as a functioning analytical laboratory with a strong emphasis on quality control. This invariably means that at least two people with their respective skills are required, i.e., a team effort. This approach is therefore an excellent opportunity to bring basic plant physiologists back into the realm of horticultural science.

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