

## IMPLICATIONS OF NEW TECHNOLOGIES FOR SEED POTATO CERTIFICATION PROGRAMS AND SEED GROWERS

Kenneth W. Knutson<sup>1</sup>

The information presented at this symposium clearly documents the extent to which tissue culture technology is being applied to the potato industry on a world-wide basis. Micropropagation appears to provide a practical and effective control strategy for a number of chronic tuber-borne disease problems. Improved field performance has been the major force in persuading growers to utilize these new seed sources. As a result, micropropagation is rapidly becoming adopted as a permanent feature of seed potato programs on a global basis.

Certified seed potato growers and certification agencies are being thrust into the micropropagation revolution whether they want to be or not! However, this group seems to be willingly accepting this new challenge and actually is providing a key element of leadership to facilitate one of the most important advancements in certified seed production. For a moment, however, I would like to compare this relatively new role with a more traditional role for certification agencies. Seed certification programs were developed in the United States on a state by state basis to assist with basic problems of tuber-borne diseases and cultivar purity. The methods of certification and seed improvement were for many years quite static and almost exclusively dependent on field inspection and visual identification of diseases and other problems. While this system made significant contributions to the North American potato industry, certification agencies were not considered or expected to be a conduit for introduction of new technology. Conservative policies and a somewhat parochial attitude characterized the programs. This resulted in regulations and a seed tag color system that were quite difficult to deal with when seed was marketed on a national basis. However, in recent years significant progress has been made to encourage uniformity among programs and promote better communication among buyers and seed producers (1, 7, 9). In this context, micropropagation has provided an additional reason to be concerned about better exchange of ideas among seed programs. Current efforts (2) focus on standardizing terminology to identify the various phases of, or grades of, Limited Generation Seed Lots. It is essential, if not of crucial importance, that a more realistic approach to seed certification and seed marketing evolve. We still have a long way to go, but it appears that we have "turned the corner" and all signs now point

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<sup>1</sup>Manager, Potato Certification Service, Department of Horticulture, Colorado State University, Fort Collins, CO 80523.

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towards a general industry awareness that national and even international seed marketing opportunities will require relatively uniform and high standards of seed performance, largely made possible through use of many new technologies.

What are the various "new technologies" that pose important implications for seed certification programs and growers? Tissue culture and other phases of micropropagation represent the core technology that has received the most attention. However, sensitive disease testing techniques such as ELISA and monoclonal antibodies must also be utilized since tissue culture alone would have little value to certified seed growers and agencies. Other new technologies that are not yet in general use but which will inevitably have an impact on the seed potato industry are laboratory methods for identification of potato clones and genetically engineered potato cultivars. Addressing the implications of the new technologies for seed certification and growers poses an interesting and provoking challenge. Interesting because some changes are rapidly occurring and the results are measurable. Provoking because the current changes are really the forerunner of possibly more dramatic changes in the future. I would first like to discuss some impacts that have already occurred or are currently in progress, and secondly I will deal with some sequels to micropropagation that will impact the seed potato industry within the next decade or two.

### **Legal Implications**

The development of superior products, whether they be seed potatoes, automobiles, TV sets, or even the "O" ring seals on rocket boosters, elevates the expectations of customers. Standards of performance that were not previously thought possible are now expected all of the time. Lack of the expected performance is not only disappointing, but also can have serious consequences. Whenever an imbalance between expectations and performance occurs, the possibility of legal action is created. In the 1970's and continuing into the 1980's, there seems to have been a wave of public interest in using the courts (8) to seek compensation for a wide range of perceived liabilities. Certified seed growers and agencies were caught in the net of this propensity to sue for damages. The ensuing court cases were a blend of legitimate concerns combined with whatever public fad elements that may have been the driving force. I think that it is very important that we do not underestimate or overlook the fact that we are now in the "high tech" phase of the certified seed potato industry. Micropropagation does permit a vastly better quality of seed potatoes to be produced compared to pre-tissue culture methods. It is absolutely essential that seed certification agencies and their participating growers have an accurate and current knowledge of what levels of disease control and other performance factors are possible and expected through the use of micropropagation and sophisticated disease testing methods. In this context, I cannot visualize any certification program surviving throughout

the next decade if it does not have some sort of locally available direct research support. The dynamic nature of micropropagation and disease testing technology will continue and all reasonably achievable levels of performance will become standard!

However, I do not want to infer that micropropagation will lead us to a state of perfection in seed production. It is well to keep in mind that the very use of certified seed potatoes is still, and probably will continue to be, a shared risk venture. The risk must be shared between the buyer and seller. There are too many uncontrollable variables in seed production to mistakenly assume that we can deliver a guaranteed product. We must keep our customers informed about the limitations of any system that we use so that unrealistic expectations will be minimized. Also complete disclosure to seed buyers of vital information collected through field inspection and laboratory testing can greatly minimize liability threats.

### **Challenges for the Seed Producer**

Some seed producers are “in and out of the seed business,” seemingly on the basis of temporary convenience and opportunistic market strategies. Others are dedicated to pursuing seed production as the central objective of their potato operation. One of the more significant impacts that micropropagation has had is to force growers to decide whether or not they want to be serious certified seed producers. One of the prerequisites to participate in a micropropagation program is to be able to make an intelligent commitment to a new system of basic seed stock development. A modest understanding of tissue culture principles combined with at least some familiarity with the new disease testing methods is fundamental to successfully managing a certified seed operation that utilizes micropropagation. The transition from “the old” to the new programs is creating considerable anxiety and frustration among some seed growers. Certification agencies are rapidly becoming aware of the need to more carefully evaluate the role of grower skill and commitment. In recent years, many agencies have added new regulations which not only specify in considerable detail the rigid disease tolerances and laboratory procedures required to produce basic seed stocks; but, in addition, have included new field and storage isolation factors that must be met. Also, it is highly desirable that all growers understand rather sophisticated sanitation and disinfectant procedures. In the future, certification agencies may even decide to formally evaluate grower capability through administering a qualifying test prior to accepting an application for production of certified seed. If the traditional cooperative efforts of seed growers and certification agencies fail to effectively utilize new technology and deliver seed of commensurate quality, it is not unrealistic to speculate that the leadership for production and marketing of certified seed potatoes could eventually shift to corporate entities that have the resources and commitment to do the job.

### **Challenges to Certification Agencies**

Agencies need to carefully review at least two major phases of their traditional operations. First, we need to take a close look at all of the factors related to seed performance and realize that many things in addition to disease content are of crucial importance. During the last 100 years we have seen human medicine and health management evolve in a very interesting and encouraging way. Diseases such as small pox, malaria, and polio, to name a few, are virtually under complete control. Success in these areas of human medicine has permitted much more attention in recent decades to be directed to non-pathogenic factors of human health such as diet, exercise and stress management. It is entirely possible that the introduction of micropropagation to seed potato production will provide substantial improvement in disease control and create an equivalent opportunity for redirecting attention to other aspects of seed productivity. We in seed certification need to take a look at seed physiology for example. Research results (4, 5, 6) are rapidly pointing out that field and storage conditions can and do influence the productivity of seed tubers—and furthermore many of these conditions, particularly storage, can be controlled and managed by the seed grower. It seems logical, if not inevitable, that certification agencies will be expected to define these production and storage factors that optimize seed physiology and make sure that certified growers produce seed according to the designated guidelines.

A second traditional phase of seed certification that needs to be reviewed is that of disease tolerances. New technology has created the reality of total disease freedom in laboratory produced basic seed stocks which are used for planting the first generation of field grown seed acreages. The practical significance of relatively small to trace amounts of certain diseases which may be present in large acreages of field produced seed will have to be balanced against the cost of testing and the economic jeopardy posed to seed growers by rejection of an otherwise satisfactory seed lot.

### **Economics of Seed Certification Programs that Utilize High Technology Methods**

Everything has a price—as the saying goes—and it is certainly true for micropropagation as it applies to certified seed potatoes. The current stage of micropropagation might be compared to the electronics industry of 10 to 20 years ago. The technology of transistors, lasers, and microprocessor chips were in the early stages of use, and the cost of consumer products was relatively high. As more and better methods of production were achieved, the cost came down. Pocket calculators and desk top computers are classic examples.

Current prices of mini tubers and micro plants place the cost of planting one acre of basic micropropagated seed stock anywhere from

\$6,000 to \$15,000 per acre. Added to this are the costs of specialized field production methods and an intensive lab testing routine; all paid for by the seed grower. It is truly remarkable that micropropagation has progressed as far as it has considering the magnitude of these up-front costs. Fortunately, the economics change rapidly as the succeeding field generations of seed are multiplied. By the third or fourth generation, the rapidly increasing volume of seed (usually at an annual rate of 10 to 15:1) permits a reasonably competitive break-even balance between cost of production and market price. It is too early to tell whether more efficient methods of producing mini tubers will permit price reductions comparable to that which occurred for pocket calculators. It is entirely possible, however, that costs of basic planting stock will be at least cut in half without compromising quality within the next five years. The expenses of laboratory testing and specialized field production may not offer similar opportunities for savings to be realized.

It is understandable that certified seed producers need to recover the high up-front costs of micropropagation as soon as possible. This has resulted in prices for early generation certified stocks that are often relatively high; but more important, it has prevented a stable pricing system from being developed. Nor is it likely to become better defined until laboratory and greenhouse development costs are more predictable and the performance advantages of different classes of seed are better understood. An important three-way seed pricing dialogue among seed producers, seed customers, and certification agencies is occurring in the marketplace right now. The "up side" of this situation is that the seed producers know they have a product that the potato industry needs and wants. The "down side" consists of a tradition of seed pricing in North America that is usually tied to a perception by seed buyers that the relative table stock price should dictate the seed prices. While this concept has some merit, it often ignores or underestimates the superior performance available in micropropagated seed.

### **Impacts of Future Technologies**

The current thrust of micropropagation technology seems to have enough momentum to carry it to a fairly complete stage of development in the near future. Further improvements as they occur will undoubtedly be quickly adopted and lead to a relatively sophisticated system of certified seed production. However, it is my opinion that once the system is in place, it will set the stage for the next generation of biotechnology that is currently on the drawing boards. One of the most hotly debated issues in the research community today focuses on ethics and direction of biotechnology research. One facet of this debate involves the potential control by private companies of plant germplasm created either by conventional methods or new genetic engineering techniques. It is not difficult to understand the profit motive aspects of corporate management as it contemplates possible control of

major blocks of germplasm of a basic food crop such as potatoes. Why do I broach this topic in the context of this symposium? Let me submit several reasons: (A) Legal methods to patent potato cultivars are currently available (8) in the United States; (B) Plant biotechnology research indicates that the potato is relatively well adapted to genetic engineering techniques (3). It is just a matter of time before new cultivars will become available; (C) When (not if) laboratory methods to accurately identify potato cultivars are developed, a fundamental tool will be available to better protect patent rights; (D) Micropropagation offers a unique and easily monitored method for quickly multiplying large volumes of any given potato clone prior to release on a mass production basis; (E) Seed potato certification programs in North America are the only currently accepted and available programs to provide certified seed potatoes. They are statutorily designated to provide this service and, furthermore, most state laws restrict other agencies or private firms from using the certified seed label. This virtually places seed certification agencies in a franchise role of being a key player in the propagation of patented potato cultivars.

At first glance, this may not appear to be an unconventional challenge and a "so-what" response could be given. However, as one digs into the issue a bit more a number of key questions arise: What are the implications of certification agencies being forced to restrict disclosure of certain facts or characteristics related to patented cultivars? Is it possible that certification agencies would be required to assist with protecting patent holders' rights and providing assistance in legal action? Would the new role of certification agencies enhance or detract from their long-standing cooperative relationship with certified seed growers?

These questions certainly do not pose insurmountable challenges. In fact many certification agencies could perhaps deal with them under their current rules. It is likely that the public policy debate over the pros and cons of patented versus publicly available cultivars will continue and eventual legislation enacted to settle the issue. Whatever the outcome, seed certification agencies and participating seed growers have already clearly demonstrated a willingness and capability to be involved. Quite frankly they could not do otherwise. It is somewhat paradoxical that programs that have had all of the earmarks of being very conventional and bureaucratic are suddenly thrust into the midst of the most fast moving and dynamic technology changes of 20th Century agriculture.

### **Summary Comments**

The implications of new technologies for seed potato certification agencies and growers are many and varied. I have attempted to deal with a few of them. I am sure most of you could think of others and perhaps list important ones that I have overlooked. We are already launched into the

biotechnology revolution for potatoes. The next decade will more than likely see changes that are equally significant compared to the past decade. Some legal questions will undoubtedly continue to rear their ugly heads, since it is unlikely that certification agencies and growers will be able to satisfy some unavoidable and unrealistic expectations on the part of seed buyers.

New technologies are creating new opportunities for private and corporate firms to participate in the certified seed industry. It does not appear likely in the near term that a major shift away from the private grower-dominated production system will occur. However, if further biotechnology advancements result in potato cultivars being patented and the truly superior germplasm privately controlled, the traditional system of certified seed production could be further challenged. This is an interesting and exciting time to be involved in the seed potato industry. The “quiet times” and “down home” ways which characterized seed growing as recently as 10 years ago are gone forever!

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