Maintaining Flower Seed Quality for Plug Production

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Many factors contribute to seed deterioration. Some of these -- such as the type of crop, the structure and chemistry of the seed, the physiological quality of the seed at harvest -- are difficult for the seed company and plug grower to control. As an example, Table 1 presents the relative storage life of various flower crops. The genetic propensity for short-lived seeds such as begonia, impatiens, pansy, salvia, vinca, and viola will continue to present seed companies and plug growers seed quality problems regardless of the production practices used. There are, however, some fundamental approaches that can be employed by both seed companies and plug growers that assure optimum seed performance.

What Can Seed Companies Do?

Flower seed companies are concerned about maintaining seed quality. They recognize that high seed quality provides the plug grower important benefits. Included among these are the increased percentage useable seedlings, rate of germination, uniformity of seedlings, quality of the finished product, and early time to bloom. Previously, seed companies conducted and reported results of germination tests using the recommended temperatures and test times specified by the Association of Official Seed Analysts (AOSA). But, these AOSA germination results often overestimated the emergence results obtaining in plug trays creating concern by growers that the germination results were sometimes of little value. Flower crops where this commonly was a problem included begonia, geranium, impatiens, marigold, petunia, and many pelleted seed crops. To address these inconsistencies, seed companies began soil testing in plug trays using standard plug production conditions in highly controlled greenhouses and/or germinators. Since these conditions more closely mimicked those under normal plug production situations, the results expressed as percentage useable seedlings were more closely correlated with those obtained by the plug grower. Most flower seed companies have adopted this practice and it has helped renew confidence in the validity of the seed germination result.

Still, further modifications in germination test protocols are necessary and are being evaluated by seed companies. For example, the germination temperatures recommended by AOSA for flower seeds are being reassessed to determine whether they are optimum for a new era of contemporary flower varieties. In addition, flower seed companies are currently conducting comparative

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germination tests among companies for the same seed lots to determine whether the companies obtain the same germination results. Early findings indicate that variability does exist and further efforts are required to standardize germination test protocols. Another important standardization activity is the development of normal/abnormal seedling descriptions and the provision of photographs depicting what such seedlings should look like. This information will increase the ability of seed analysts to acquire the same germination results for the same seed lots, providing plug growers even greater confidence in test results. Flower seed companies are also establishing minimum germination percentages that are considered acceptable for marketed seed lots. Seed lots with values lower than those presented in Table 2 are considered unacceptable and should not be marketed to plug growers. Importantly, it should be recognized that these minimum germination standards likely will increase in the future due to the increasing emphasis on seed quality by companies and growers' insistence on higher seed quality.

Flower seed companies can still do more to help plug growers understand the quality of the seed being purchased. For example, when germination results are presented, they should specify when the seedlings were counted, whether the results were from a laboratory or soil test, and the anticipated percentage useable seedlings expected in a plug flat. Other recommendations include:

- Incorporate vigor tests into quality control programs.
- Provide seed storage recommendations on the label for grower use.
- Provide an expiration date on the seed lot when recommended seed storage conditions are followed.
- Emphasize that "enhanced" seeds do not store as well as "raw" seeds.

What Can Plug Growers Do?

Plug growers can assure optimum seed performance by first knowing the crop and providing excellent growing conditions that often are different than for other crops. Providing seeds the best environment for growth assures excellent performance and minimizes disappointments due to poor seedling establishment. Once the optimum growing conditions are known, the next step is to purchase high quality seeds from a reputable seed company. Enhanced (pelleted/coated, primed, pregerminated, etc.) seeds offer real performance advantages to plug growers. But, they also present unique storage and handling situations that must be understood and properly addressed by plug growers. For example, pelleted seed should be stored in crush-proof containers and the vibration of the seed hopper lowered at planting to maintain the integrity of the pellet. Primed and pregerminated seeds have a shorter shelf-life and they require less moisture than "raw" seed for germination. Plug growers should insist on high seed quality from the supplier and if the performance is not obtained, the seed should be returned to the company for a refund or new seed.

Other practical activities that plug growers can implement to maintain seed quality include:

- Determine seed needs one year in advance. While this is often difficult in a changing environment for specialized ornamental varieties, it can result in real benefits to the plug grower. By letting the seed company know needs ahead of time, the seed company is able to acquire the desired seed at the proper time so that it is fresh and of the highest quality. They are also provided sufficient time to thoroughly test the seed prior to shipment and, if problems are discovered, take corrective action so that the best seed product is provided in a timely manner.

- Order seed quantities that fit each planting. Too often, plug growers order more seed than necessary. After the seed is planted, they are tempted to store and reuse the seed at a later date. Instead, plug growers should order smaller seed packet sizes and, if necessary, receive periodic shipments. This allows the plug grower improved inventory control since there are fewer stored seed samples, reduced chance of mixing varieties during handling and planting, and the smaller seed packets may result in some packets remaining unopened for longer durations ensuring a fresher seed source. In some cases, unopened packets may be returned to the seed supplier.
- Plug growers must always follow the "Rules of Thumb" by maintaining as low a relative humidity and temperature as possible during seed storage and planting. The seeds should be refrigerated as long as the packet is unopened. Prior to opening the packet, seeds should be allowed to reach room temperature so that condensation around cold seeds is minimized. Seeds should always be planted as promptly as possible in the greenhouse. Following planting, if seeds are stored, they should be placed into an air-tight container such as a jar with a screw lid containing a desiccant such as Drierite^{TM} (30 to 40% relative humidity) and introduced into a refrigerator at 40^{o}F.
- Use opened seed within 6 months and unopened seeds within 12 months. Enhanced seeds should not be stored. If seed is stored, it is advisable to retest the seed for germination and vigor prior to planting.

Both seed companies and plug growers are making significant strides in maintaining optimum seed quality. Because the cost of seed typically represents only 5% of total plug production costs, it makes economic sense to purchase the best quality seed. Flower seed companies have established successful seed quality control programs that emphasize every aspect of maintaining seed quality and they are doing even more. Plug growers need to understand that seeds are living entities prone to rapid deterioration if handled inappropriately. Because the factors that govern seed deterioration are complex, plug growers might consider leaving seed storage concerns to the seed company professionals. The question should always be asked by plug growers as to "What is the risk of planting stored seed vs. the benefits acquired from the purchase of new seed?" Buying new seed every year is a sound investment in a successful plug operation.

Table 1. Relative storage life of flower seeds.

Short	Medium	Long
Anemone	Ageratum	Centaurea
Aster	Alyssum	Chrysanthemum
Begonia	Cyclamen	Shasta Daisy
Coneflower	Dusty miller	Morningglory
Coreopsis	Gaillardia	Sweet pea
Impatiens	Lisanthus	Zinnia
Pansy	Marigold	
Phlox	Nicotiana	
Salvia	Petunia	
Vinca	Snapdragon	
Viola	Verbena	

Table 2. Minimum germination standard for ornamental crops after a specified period.

Crop	% Germination	Day
Ageratum	88	7
Alyssum	75	7
Aster	80	10
Begonia	80	21
Celosia	80	7
Dahlia	80	10
Dianthus	88	7
Dracaena	65	28
Dusty miller	75	14
Geranium	88	10
Gerbera	80	21
Impatiens	88	10
Lisanthus	80	21
Lobelia	85	14
Marigold	88	7
Pansy	88	10
Petunia	88	10
Salvia	88	10
Snapdragon	75	14
Verbena	75	14
Vinca	80	10
Viola	88	10
Zinnia	80	7