The Importance of Crop Records and Sowing Rates in the Propagation of Woody Plants from Seed©

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INTRODUCTION

Raising plants from seed involves many variables which need constant monitoring and appropriate and timely action. Success depends on attention to detail in every operation from seed collection to the point the seedling is despatched. Failure to achieve this often results in poor stands of unusable and unsaleable plants. As the subject is so diverse and many aspects have already been covered and recorded in past papers in *Combined Proceedings International Plant Propagators'Society* this paper will only attempt to cover two important aspects which have a significant impact in decision making to determine the final germination. These are the keeping of crop records and the use of data on plant density, seed viability, and field factors in determining sowing rates.

CROP RECORDS

Accurate records are a must, too many nurseries lose too much vital information as a result of lack of recording. Before any seed is handled there is a need to establish a crop recording system which can be implemented from the very beginning. It is vital that each batch of seed is traceable throughout its life. Table 1 lists some suggested headings that can be used either for own-collected or for purchased seed — but all recording needs to be tailor-made to suit your own requirements.

The more information that can be recorded, the more complete the picture will be at any given time. You should be aiming for records that will provide a history of what has happened and what is happening to the seed so far, as a tool to be used in both short- and long-term decision making

The accumulation of information over many seasons provides a wealth of information, showing the successes and failures and when analysed will provide answers that should lead to more efficient planning and treatments

DETERMING SOWING RATE

Sowing rate means sowing the correct number of seeds to achieve the desired plant population. This does not have to be the hit-and-miss exercise that it still is on some nurseries. Using data on plant density, germination potential, and field factors, coupled with past experience and accurate records, eliminates a lot of the guesswork.

Plant Density. This is the total number of plants a given area can support. Too high a density causes retarded, leggy growth; too low and plants can become too large and bushy. Specific production objectives need to be set from the start. What are we trying to achieve in terms of crop size and grade — single or multistem, feathered, or unfeathered? There is a need to arrive at a figure that will produce the maximum number of plants of the required quality from a given area and volume of seed. By considering certain criteria which have a bearing on these objectives, it should be possible to arrive at a realistic figure on which to base one's sowing rate.

Table 1. Suggested heading for seed crop recording system.

Name of species	Quantity brought in or collected
Seed count	Sowing date
Batch number or identification number	Condition of seed on arrival or at collection
Viable seed (%)	Sowing location
Provenance	Suppliers information
Germinable seeds (%)	Area sown
Supplier or location of collection	Production target
Seed treatment/or treatments	Quantity sown
Date of arrival/or date collected	Quantity treated
Sowing calculations	Quantity harvested

Plant Leaf Size. As a general rule this has the greatest impact on the numbers of plants a given area can support. Large-leaved plants can only grow at fairly low densities compared to smaller-leafed and needled plants which can tolerate substantially higher densities and still produce acceptable plants. Density, coupled with leaf size, will therefore have an influence on height, girth, stem straightness, and bushiness. All are affected by light and space. The lower the density the more light and space available. Girth, height, and bushiness will increase, but as the density increases the available light and space decreases, causing an increase in stem elongation influencing stem straightness and a decrease in proportion of stem girth, basal development, and feathering.

Site Exposure. This can be a major factor. Plant size is drastically reduced with increased exposure, generally allowing plant densities to be increased because more light and space is available.

Soil Type. Light soils retain less available water compared to heavier soils which have higher water reserves and will therefore support plant growth much longer under dry conditions. Sites of a light soil type with no artificial irrigation tend to produce much smaller plants.

Germination Percentage. The next step is to ascertain the percentage of germinable seeds from a given quantity of seed. This will vary from batch to batch and year to year but is far more accurate for calculating the final sowing rate than use of supplied values for percentage of viable seeds—at best this is a guide but factors such as deterioration during storage means viability and germinability are often different.

Some seed suppliers will provide up to date germination figures (germinable seeds kg^{-1}) relevant only if you carry out specific treatment to duplicate their tests. These tend only to refer to species which are not dormant, or only exhibit very simple cold period dormancies such as *Betula, Alnus, Pinus, Abies,* etc. Most will only supply the figure for percentage of viable seeds. There are several practical methods to carry out germination tests in advance of sowing.

Seed that arrives early or is already being stored can be divided into three groups:

Dry Seed That Is Not Dormant. Sow given weights where the seed is too small to count or sow a given number of seeds, e.g., 100 seeds, onto a medium; provide suitable conditions for germination and simply count and record.

Dry Seed That Only Exhibits a Physical Barrier or Impervious Seed Coat Preventing Water Absorption. This includes species, such as, *Caragana, Gleditsia, Laburnum, Robinia,* and *Wisteria*. This can easily be overcome by treating with acid, hot, warm, or cold water; then allow to become fully imbibed and simply germinate and count.

Seed with a Cold Period Dormancy. Treat samples by subjecting them to a period of cold to remove the dormancy. With good historical records one should have an idea of the average length of cold required before germination will take place, thus giving an indication when to start to remove samples for testing on a weekly basis. Over a period of time this will show the optimum period of cold required to achieve the maximum germination. It is important to sow, or treat for sowing, several batches to obtain a more realistic figure.

If seed has been treated over a long period, due to its complexity of dormancy, or has simply arrived late, it is possible to face the situation in which the whole batch has to receive artificial cold to complete its treatment. Here it is more practical to germinate each sample mixed into its medium in a small container or bag. Recording is fairly easy, simply remove the medium with a sieve, count the germinating and nongerminating seed separately, and record. By carrying out a simple cut-test (see below) on the nongerminated seed, one can ascertain the percentage of live seed remaining that could germinate.

By plotting the percentage of germination this will provide an up to date picture of the stage/condition of the seed, enabling you to decide when to sow. It will also show the speed that germination (chitting) occurs once removed from cold, giving advance notice of the need to sow. Many species, once dormancy has been broken, will start to chit if not sown immediately, resulting in a bent root system developing.

Cut Test. It is not always possible or practical to obtain germination results, for example if the seed is to be sown fresh or to be sown dry or partly treated to allow nature to complete the process, or it simply arrives too late. The cut-test is a simple viability test prior to sowing. This can be achieved by taking a random sample of 100 seeds or more and cutting through the seed, observing whether or not the embryo has developed, counting only those which have developed. Interpretation comes down to experience. If there is sufficient seed, carry out several tests and average them out.

Field Factor. The survival rate depends on those factors which have an effect on germination and early establishment, which are influenced by the soil and climatic conditions. These are very difficult to estimate accurately but personal knowledge of site conditions enables growers to take measures to improve the conditions for germination and establishment. The field factor is the number of extra seed which must be sown to account for field conditions.

Improvement of soil for better drainage and aeration will help to eliminate the occurrence and spread of root, stem and collar rots. Soil sterilisation will control many fungal diseases associated with seedling failure and control soil pests such as nematodes and a wide range of weed seeds. Consider irrigation, if necessary, at that crucial period when seed is germinating, often vital for late spring and early summer sowing during hot and/or windy conditions especially with fine seed which is barely covered or sown on the surface e.g., *Betula, Salix,* and *Buddleja*. Shading can often help if water is not available by reducing the loss of moisture from the surface. Artificial windbreaks are also useful for reducing wind speed and evaporation. Frost protection is vital for those species such as *Fagus* and *Fraxinus* which are susceptible to damage in the early stages once germination has taken place. Control vermin such as mice and birds which can have a devastating effect, nullifying the bed density calculations and resulting in lost yield and quality.

Even taking into account all the variables of site and climatic conditions, the greatest unknown factor is what percentage of seed will actually germinate. It must be remembered that even with the best treatment there will always be a percentage of viable seed that will not germinate. This is where the skill of the propagator and their personal experience of the seed's performance in particular field conditions is vital when deciding what the "field factor" should be.

Use accurate germination figures in the calculations rather than a figure for percentage viable seeds (see above) to eliminate guesswork. Accurate records of the number of germinable seeds sown and the actual quantity and grade achieved will enable you to adjust from season to season both the density figure and the field factor to more closely achieve your production objectives.