Nursery Management

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Tropical nursery management includes all aspects of growing plants through all their growth phases as described in Chapter 4, Crop Planning: Propagation Protocols, Schedules, and Records. Management involves an understanding of practical, scientific, technical, interpersonal, and economic aspects of the nursery. Nursery management includes ordering materials and supplies, maintaining facilities, scheduling activities, keeping horticultural and financial records, and much more (figure 19.1). This chapter outlines some essential elements of the day-to-day and year-to-year aspects of managing the nursery.

Figure 19.1*—Nursery management includes not only growing plants, but keeping horticultural and financial records, managing supplies, planning activities (as shown here in American Samoa), and much more. Keeping good records is essential to keeping production on track. Photo by Ronald Overton.*

Facing Page: *Planning space and facilities is an important part of nursery management. Pictured here, staff at the main nursery on Palau hook up new irrigation lines. Photo by George Hernández.*

***Figure 19.2**—Organized management oversees the growth of the plants and the growth of the nursery itself. A nursery manager discusses constructing seedling benches in an area with morning sunlight in the U.S. Virgin Islands. Photo by Brian F. Daley.*

***Figure 19.3**—Periodic educational activities help the nursery staff to expand their knowledge and skills towards achieving the nursery's mission. Here, nursery professionals meet for a workshop in American Samoa. Photo courtesy of Diane L. Haase.*

Identifying Nursery Tasks

A checklist can help provide an overview of the interrelated tasks involved in managing a nursery. The example checklist in the textbox on the following page can be modified and customized to describe your nursery's daily, weekly, monthly, and seasonal tasks.

Only a few required tasks must happen each day; these tasks are the essential activities that keep the crops alive and healthy and the nursery functioning on a daily basis. These tasks include watering, keeping daily records, and monitoring crops as they go through the establishment, rapid growth, and hardening phases. Other tasks need to be done less frequently but are as important. Good planning and oversight will ensure that all nursery tasks are prioritized and scheduled accordingly.

Planning and Scheduling

Schedule an overview and planning session on a weekly basis to assess immediate needs, periodic tasks, and long-term goals. This assessment provides an opportunity to prioritize tasks for the coming week and month (figure 19.2). The needs of the plants, environmental conditions, and many other factors require flexibility and responsiveness in management style. Crops usually do not respond well to a rigid schedule and may perform differently in different years, which is why weekly assessment and planning is so important. Attempts to make rigid schedules (such as "weed every Tuesday") are often far less effective than regular planning to tailor tasks to the observed needs and conditions of the crop.

The observation skills of the nursery manager and staff are the greatest assets to effective planning. Taking time on a weekly basis to review the daily log, plant development record, and other observations will help with prioritizing the work to be done. Observations in the nursery can answer many questions: What growth phase is the crop in: establishment, rapid growth, or hardening? Is it on schedule? What needs to be done next: transplanting, moving to a new structure, altering fertilization rates? Are we observing anything that might indicate a potential problem, such as the presence of a potential pest? When do we next update clients on the crop's progress? Is it time to sow a new crop? These observations aid the nursery manager to plan and schedule important activities and to assign roles, tasks, and deadlines to the appropriate staff members.

Some proactive planning should also occur, focusing beyond what is most urgent. Keeping the nursery's vision and objectives as a focus during meetings can help maintain a broader view for nursery activities. Planning should include activities that are important to the nursery's larger mission beyond the day-to-day details such as public relations or educational activities (figure 19.3). Updating plant protocols and working to improve plant quality with some simple experiments are also valuable activities that should be included in the nursery's schedule.

Nursey Management Checklist

Planning and Scheduling (weekly, monthly, yearly)

- Make a list of what needs to be done based on daily observations, daily logs, and crop development records.
- Establish propagation protocols.
- Create and update crop-growing schedules and facilities schedules.
- Prioritize and delegate tasks.
- Follow up to ensure tasks were done.
- Refine nursery vision and objectives annually; anticipate new crops to grow, changes in production, infrastructure improvements or expansion, and other planning for the future.

Routine Tasks (daily)

- Irrigate
- Crop culturing (for example, weed or pest control, fertilizing).
- Monitor and observe the crops.

Recordkeeping

- Record observations and actions in daily journal or log (daily).
- Make notes in the plant development records for each crop (daily or weekly).
- Update and revise plant protocols (at end of each crop).
- Conduct crop inventory assessment (ongoing).

Crop-Phase Production Tasks

- Establishment tasks (for example, making growing media, sowing seeds, inoculating with microsymbionts).
- Rapid growth phase tasks (for example, fertilizing, monitoring).
- Hardening phase tasks (for example, changing fertilization and light regimes).
- Update clients about crop development.
- Harvesting, packing and shipping tasks.

Seasonal Cleanup

- Purge or transplant holdover stock.
- Clean floors, tables, tools, equipment, and so on.
- Clean and sterilize containers.
- Check and repair equipment, tools, and infrastructure such as irrigation lines.

Financial Management

- Determine expenses, including labor, time and supplies needed to produce crops, and overhead costs (for example, utilities).
- Determine estimated income.
- Create and manage an annual budget based on anticipated income and expenses.
- Administer contracts.
- Inventory supplies for production and maintenance (for example, growing media, fertilizers, containers and trays, irrigation parts) and order as needed.
- Estimate future costs and income and adjust budget accordingly.

Problem Solving and Troubleshooting

- Identify and analyze problems as they arise.
- Know who to call for help (for example, another grower, a soil scientist, a pest expert, an irrigation specialist) and contact them as needed.
- Develop and test hypotheses to solve the problem.
- Implement a solution.

Cultivating Good Relationships with Staff, Clients, and the Community

- Provide staff education and training.
- Connect staff with nursery vision and objectives.
- Give and receive feedback and input (observations and improvement suggestions).
- Plan meetings, safety awareness, and so on.
- Develop target plant specifications with clients.
- Educate clients about key issues for handling, outplanting, and care.
- Visit outplanting sites and clients to check up on survival and growth; follow up with clients to discuss field performance of plants, revisions of target plant criteria, and future needs.
- Offer public education and outreach.

Learning and Sharing

- Attend training events and conferences.
- Learn from other nurseries; host and attend field days and visits.
- Read published literature (for example, *Native Plants Journal*).
- Explore ways to improve crop production and plant quality.

***Figure 19.4**—Daily activities include the essentials of keeping the plants alive and healthy, including watering (A), weeding (B), and timely transplanting (C). Photo A in Yap by Tara Luna, photo B in Tanzania by Ronald Overton, and photo C in U.S. Virgin Islands by Brian F. Daley.*

Daily Tasks and Observations

Daily activities include the essentials of keeping the plants alive and healthy such as irrigating, weeding, monitoring, fertilizing, and pest management (figure 19.4). Daily observation of the crop is essential for good nursery management and an important way to determine their needs.

The manager or a designated "crop monitor" needs to observe the crop every day (figure 19.5). This task can be done once daily as a formal practice separate from other tasks. Measurements occasionally will be taken to evaluate the crops progress or to quantify environmental conditions. The person monitoring the crop needs to understand what "normal" is for that crop and for the nursery environment and be highly sensitive to any deviations from that norm (figure 19.6).

Experience and daily observations can identify potential problems long before they become emergencies.

Observations may include the following (Landis 1984)—

- **Appearance**—Inspect the crop visually to see if plant size and shoot-to-root ratio are proper for the stage of growth. Look for signs of nutrition or disease problems on the roots and foliage. Inspect closely for insect pests. Examine roots to see if beneficial microsymbionts are visible.
- **Smells**—Some problems, such as gray mold, may be discernible to the experienced grower by its odor. Overheating motors, broken fans, composting troubles, and other potential problems can also be detected by the sense of smell.
- **Noises**—Listen for unusual sounds in the nursery such as an engine running unsteadily or water running when it should not be.
- **Feel**—Pay attention to the temperature and humidity in the nursery. Feel the growing medium to determine if it is at the proper moisture level.

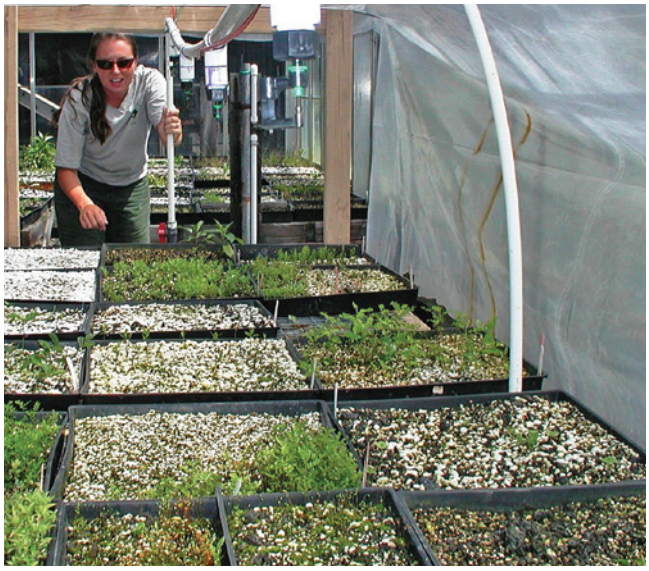

***Figure 19.5**—A manager or a designated "crop monitor" should observe the crop every day. Photo at Volcanoes National Park, on the Big Island of Hawai'i, by Brian F. Daley.*

***Figure 19.6**—Making regular observations of the crop and staying alert and aware are key to avoiding problems. Photo by Tara Luna.*

Although one designated crop monitor is responsible for this task, all staff need to understand that observation and being alert and aware are key to precluding problems. The manager should welcome and encourage staff to share their observations and contribute to the daily log; this practice builds observation skills and greater crop awareness.

Recordkeeping

As described in Chapter 4, Crop Planning: Propagation Protocols, Schedules, and Records, keeping good records is essential to keeping production on track and precluding serious problems (figure 19.7). Nursery recordkeeping includes the following—

- **A Daily Log**—can be as simple as writing the day's date and jotting down some notes in a notebook about observations and activities at the end of each day. Make a habit of entering something in the log each day, even if the observations seem unimportant at the time.
- **Plant Development Records**—for each crop should be kept in an easily accessible place and a few notes should be jotted down as changes occur with the crop.
- **Propagation Protocols**—show how to produce each kind of crop successfully in your nursery. The protocols provide guidance for each new crop in developing the production plan and listing needed facilities and supplies and should be regularly updated and revised.
- **Inventory Assessment**—should include all plants in the nursery by bench or structure number, current developmental stage of each crop, and details of delivery (target requirements, outplanting site, name of client, seed source, and anticipated delivery date).

As the nursery grows in size and complexity, entering records into a computer will make the information easier to track. Every day creates small amounts of vital information that will contribute immeasurably to improving nursery management and productivity over time (figures 19.8, 19.9).

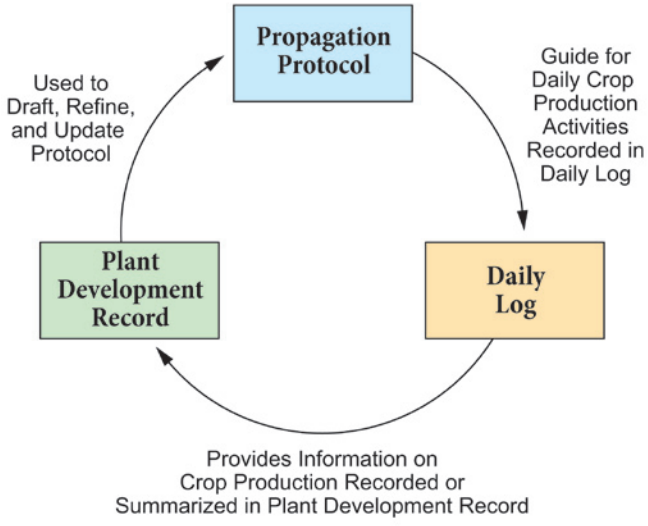

***Figure 19.7**—The daily log, the plant development record, and the propagation protocol are the foundation of nursery recordkeeping and are used to support plant production and inform nursery management. Illustration adapted from Dumroese and others (2008) by Jim Marin.*

***Figure 19.8**—Recordkeeping tools should be easily accessible at the manager's workstation; make a habit of entering something in it each day. Photo by Kim M. Wilkinson.*

***Figure 19.9**—The timing of nursery tasks, such as transplanting, should be recorded in the daily log and the plant development log. These records will help you keep the current crop on track and will help you plan, budget, and schedule for future crops. Photo by Kim M. Wilkinson.*

This information is invaluable for many aspects of nursery management, including the following—

- Budgeting funds.
- Estimating schedules to produce future crops.
- Determining what labor-saving equipment might give the most benefit for the cost.
- Analyzing nursery expenses.
- Improving profits or production.
- Replicating successful crops.

Crop Planning and Production Tasks

The details of planning crops are discussed in Chapter 4, Crop Planning: Propagation Protocols, Schedules, and Records. Management needs during the crop production include—

- Understanding the three growth phases crops go through (establishment, rapid growth, and hardening) and the distinct requirements for each phase.
- Making growing schedules for crop production from seed procurement through outplanting and detailing changes as the growing cycle progresses (figure 19.10).
- Listing space, labor, equipment, and supplies required to support the crop during the three stages of growth.

The work to produce a crop consists of managing the plants through each phase of development so that plants receive what they need and are as strong and healthy as possible for outplanting. After a schedule has been made showing what plants need to be sown and by when, the tasks of preparing growing media, filling containers, and sowing can be scheduled. In the establishment phase, plants begin to germinate, and thinning, transplanting, and inoculation with beneficial microorganisms will take place. As the plants move from the germinant phase to the rapid growth phase and later the hardening phase, their needs will change.

For some nurseries, plants will be physically moved from a germination or rooting area to a more open environment (figure 19.11). For other nurseries, climate control (such as removing shadecloth) might have the same effect. Fertiliza-

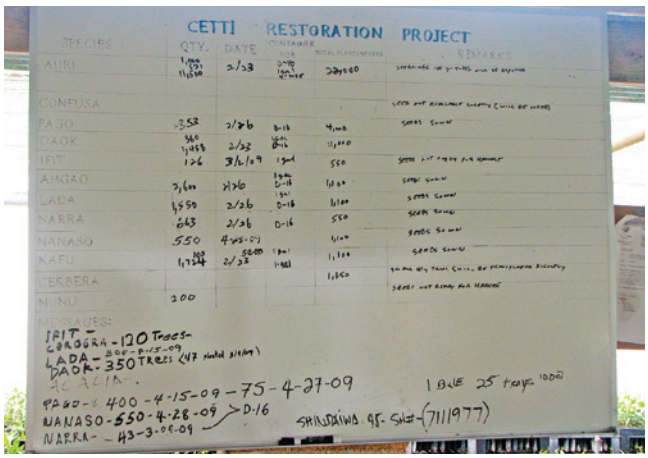

***Figure 19.10**—The work to produce a crop consists of managing activities and resources through each phase of crop development. This whiteboard at the Guam Division of Forestry and Soil Resources nursery lists crops being grown for the Cetti Bay restoration project including how many plants are needed (species and container types) and the current status of the crops. Photo by Ronald Overton.*

Figure 19.11—*Plants are moved from one structure to another as they go through their three phases of growth. Good planning and management maintains open paths and an easy flow of work between structures. Photo by Tara Luna.*

tion and watering regimes are changed for each of the three phases. When the crop is ready, it will be harvested and shipped, as described in Chapter 16, Harvesting and Shipping.

To keep up with production, planning for space and facilities is important. The manager also needs to have the necessary materials on hand when they are needed (figure 19.12). These materials include supplies for production such as seeds, growing media, containers, and so forth. For nurseries in remote areas, obtaining supplies may require ordering months ahead of the time when they are needed. In these cases, extras of essential items need to be kept on hand. If spare parts are used for repairs, they need to be replaced right away.

Seasonal Cleanup and Maintenance

Time is usually available between crops or at the end of each season for some "deep cleaning" and maintenance. Cleanliness is essential to avoid disease problems and to maintain a professional, appealing image for the nursery. A clean environment builds customer confidence and staff morale. Perform the following tasks every 2 to 6 months:

- Dispose of any holdover stock.
- Clean and hose down the floors and tables (applying dilute bleach or other cleanser if no plants are present).
- Clean and sterilize containers (see Chapter 7, Containers).
- Flush out irrigation system and run a cup test (see Chapter 11, Water Quality and Irrigation).
- Conduct equipment checks and make any repairs.
- Replace roof plastic, if necessary.

Financial Management

Good financial management is necessary for the nursery is to thrive in the long term. The daily journal and other records should include the amount of labor spent on various activities, money spent for materials, and overhead costs such as rent and utilities. These costs can be used to estimate the cost of each crop, thereby enabling the manager to accurately budget time and funds. This information also is essential for determining what the nursery must charge for various plant materials sold. Learning more about basic business planning through publications and local learning opportunities can be very helpful for making wise financial choices.

Figure 19.12—*Management involves planning the timing of essential production tasks and ensuring that all the necessary supplies are available. Shown here: checking a seed supply in Hawai'i (A), filling bags with growing medium made from composted coffee cherries in East Timor (B), and assembling a drip irrigation system on Yap (C). Photo A by Kim M. Wilkinson, photo B by J.B. Friday, and photo C by George Hernández.*

In keeping financial records, be sure to note the following factors:

- Size of stock and growing space needed to produce it.
- Time to grow.
- Labor (in person-hours) required through all phases.
- Materials required and their cost (for example, seeds, containers, growing media).
- Need for custom culture (for example, special containers, extra labor).
- Overhead costs (for example, utilities).
- Cost inflation over time.
- Typical losses (percentage of crop discarded).
- Price charged when the crop left the nursery.

Problem Solving

Good management, staff training, monitoring, and planning will generally preclude emergency situations in the nursery. Even the best manager, however, cannot avoid problems entirely. Some problems, such as difficulties with the irrigation system, appear suddenly and must be handled instantly. Others require a longer term approach. With experience, troubleshooting problems may become easier. Do not be reluctant to reach out to colleagues, other nursery managers, or other professionals. Everyone has problems once in a while, and we can all help each other learn more about plants as we share our experiences.

The problem should next be classified into some sort of order, separating problems into three types based on the amount of information available (Landis 1984, Van Gundy 1980):

- **Type I problems** are well structured. These are the routine problems that occur daily. Their main characteristic is that all the information needed to solve them is already available. Problems in this category have probably occurred before and can usually be solved by standard procedures. Expertise for solving these problems can normally be found at the nursery, so outside help is not required.
- **Type II problems** are semistructured. This is an intermediate category—some information about the problem is available, but some degree of uncertainty also exists. These problems may have occurred before but something about them makes them different. Existing techniques must be adapted to solve this type of problem, and some expert help may be needed. The final solution is probably a combination of standard and newly developed methods.
- Type III problems are poorly structured. Their distinguishing characteristic is that little or no information is available about them. These are the problems never encountered before; therefore, expert help should be sought and the information needed to solve these problems generated through the problem-solving process. Solutions to poorly structured problems usually have to be custom made and require creative problem-solving techniques.

Type 1 problems are usually solved with standard operating procedures, whereas Types II and III require more creative steps.

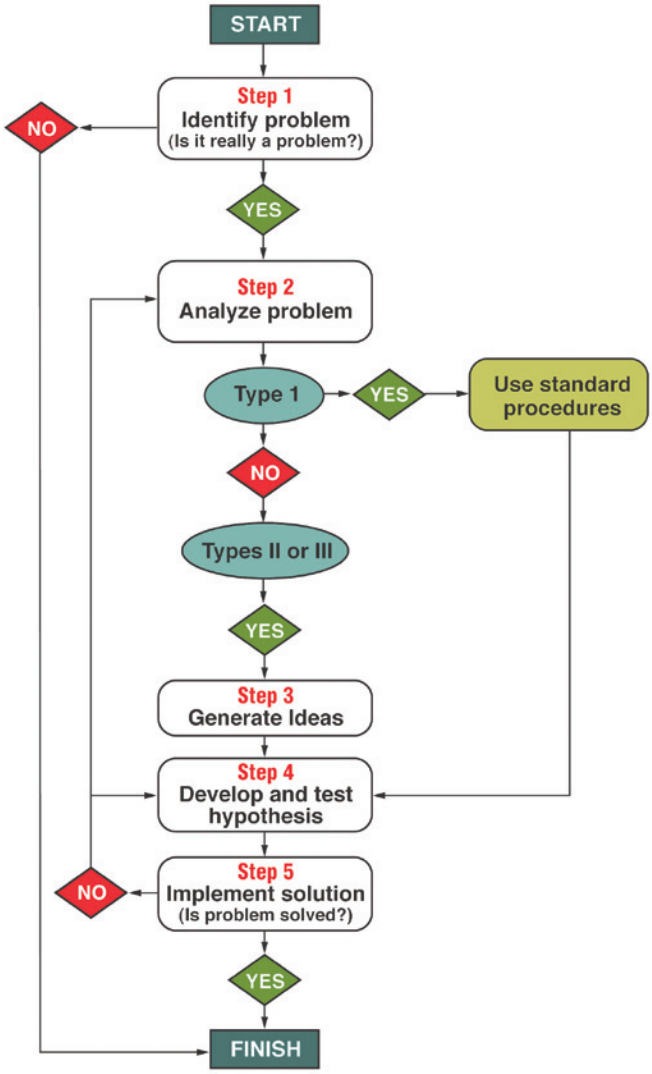

Figure 19.13—*A problem-solving matrix. Illustration adapted from Landis (1984) by Jim Marin.*

This five-step systematic approach can be helpful when approaching long-term challenges (figure 19.13; Landis 1984):

- **Identify the Problem—**Is it really a problem? What seems to be wrong?
- **Analyze the Problem—**What happened exactly? When did it start?
- **Generate Ideas—**Identify potential sources of the problem. Consult literature, other nurseries, staff members, or outside sources of help such as extension agents or specialists.
- **Develop and Test Hypotheses—**At some point, a conclusion about the source of the problem must be decided and acted upon.
- **Implement a Solution—**Decide on a way to solve the problem. Observe the results. If the problem is not solved, start again with step 2.

References

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