

13.4.6. Strategies for Water Level Manipulations in Moist-soil Systems



Leigh H. Fredrickson
Gaylord Memorial Laboratory
The School of Natural Resources
University of Missouri-Columbia
Puxico, MO 63960

Water level manipulations are one of the most effective tools in wetland management, provided fluctuations are well-timed and controlled. Manipulations are most effective on sites with (1) a dependable water supply, (2) an elevation gradient that permits complete water coverage at desired depths over a majority of the site, and (3) the proper type of water control structures that enable water to be supplied, distributed, and discharged effectively at desired rates. The size and location of structures are important, but timing, speed, and duration of drawdowns and flooding also have important effects on plant composition, plant production, and avian use. When optimum conditions are not present, effective moist-soil management is still possible, but limitations must be recognized. Such situations present special problems and require particularly astute and timely water level manipulations. For example, sometimes complete drainage is not possible, yet water is usually available for fall flooding. In such situations, management can capitalize on evapotranspiration during most growing seasons to promote the germination of valuable moist-soil plants.

Timing of Drawdowns

Drawdowns often are described in general terms such as early, midseason, or late. Obviously, calendar dates for a drawdown classed as early differ with both latitude and altitude. Thus the terms early, midseason, and late should be considered within the context of the length of the local growing season. Information on frost-free days or the average length of the growing season usually is available from agricultural extension specialists. Horticulturists often use maps depicting different zones of growing conditions (Fig. 1). Although not specifically developed for wetland management, these maps provide general guidelines for estimating an average growing season at a particular site.

In portions of the United States that have a growing season longer than 160 days, drawdowns normally are described as early, midseason, or late. In contrast, when the growing season is shorter than 140 days, drawdown dates are better described as either early or late. Early drawdowns are those that occur during the first 45 days of the growing season, whereas late drawdowns occur in the latter 90 days of the growing season. For example, the growing season extends from mid-April to late October (200 days) in southeastern Missouri. In this area, early drawdowns occur until 15 May, midseason drawdowns occur between 15 May and 1 July, and late drawdowns occur after 1 July (Table 1). The

Table 2. *Important considerations in evaluating wetland management potential.*

| Factors | Optimum condition |
|-------------------------|--|
| Water supply | Independent supply into each unit Water supply enters at highest elevation |
| Water discharge | Independent discharge from each unit Discharge at lowest elevation for complete drainage Floor of control structure set at correct elevation for complete drainage |
| Water control | Stoplog structure allowing 2-inch changes in water levels Adequate capacity to handle storm events |
| Optimum unit size | 5 to 100 acres |
| Optimum number of units | At least 5 within a 10-mile radius of units |

Wetland systems with high salinities can easily accumulate soil salts that affect plant vigor and species composition. Wetland unit configurations that allow flushing of salts by flowing sheet water across the gradient of a unit are essential in such areas. A fully functional discharge system is a necessity in arid environments to move water with high levels of dissolved salts away from intensively managed basins. Thus, successful management in arid environments requires units with an independent water supply and independent discharge as well as precise water-level control.

Scheduling Drawdowns

During most years, early and midseason drawdowns result in the greatest quantity of seeds produced (Table 3). However, there are exceptions, and in some cases, late drawdowns are very successful in stimulating seed production.

Table 3. *Response of common moist-soil plants to drawdown date.*

| Family | Common name | Species Scientific name | Drawdown date | | |
|---------------|------------------------|--|--------------------|------------------------|-------------------|
| | | | Early ^a | Midseason ^b | Late ^c |
| Grass | Swamp timothy | <i>Heleocholea schoenoides</i> | + ^d | +++ | + |
| | Rice cutgrass | <i>Leersia oryzoides</i> | +++ | + | |
| | Sprangletop | <i>Leptochloa</i> sp. | | + | +++ |
| | Crabgrass | <i>Digitaria</i> sp. | | +++ | +++ |
| | Panic grass | <i>Panicum</i> sp. | | +++ | ++ |
| | Wild millet | <i>Echinochloa crusgalli</i> var. <i>frumentacea</i> | +++ | + | + |
| | Wild millet | <i>Echinochloa walteri</i> | + | +++ | ++ |
| | Wild millet | <i>Echinochloa muricata</i> | + | +++ | + |
| Sedge | Red-rooted sedge | <i>Cyperus erythrorhizos</i> | | ++ | |
| | Chufa | <i>Cyperus esculentus</i> | +++ | + | |
| | Spikerush | <i>Eleocharis</i> spp. | +++ | + | + |
| Buckwheat | Pennsylvania smartweed | <i>Polygonum pennsylvanicum</i> | +++ | | |
| | Curlytop ladythumb | <i>Polygonum lapathifolium</i> | +++ | | |
| | Dock | <i>Rumex</i> spp. | | +++ | + |
| Pea | Sweetclover | <i>Melilotus</i> sp. | +++ | | |
| | Sesbania | <i>Sesbania exalta</i> | + | ++ | |
| Composite | Cocklebur | <i>Xanthium strumarium</i> | ++ | +++ | ++ |
| | Beggarticks | <i>Bidens</i> spp. | + | +++ | +++ |
| | Aster | <i>Aster</i> spp. | +++ | ++ | + |
| Loosestrife | Purple loosestrife | <i>Lythrum salicaria</i> | ++ | ++ | + |
| | Toothcup | <i>Ammannia coccinea</i> | + | ++ | ++ |
| Morning glory | Morning glory | <i>Ipomoea</i> spp. | ++ | ++ | |
| Goosefoot | Fat hen | <i>Atriplex</i> spp. | +++ | ++ | |

^a Drawdown completed within the first 45 days of the growing season.

^b Drawdown after first 45 days of growing season and before 1 July.

^c Drawdown after 1 July.

^d + = fair response; ++ = moderate response; +++ = excellent response.

shallower water (Fig. 2). The most effective use of invertebrate foods by wetland birds occurs when drawdowns to promote plant growth are scheduled to match key periods of migratory movement in spring. By varying drawdown dates among units, the productivity of each unit can be maintained and resources can be provided for longer periods. Slow drawdowns also prolong use by a greater number and diversity of wetland wildlife.

Effects of Drawdown Rate

Moist-soil Plant Production

Fast Drawdowns

Sometimes fast drawdowns (1–3 days) are warranted, especially in systems with brackish or saline waters where the slow removal of water may increase the level of soil salts. However, in most locations fast drawdowns should only be scheduled early in the season or when flood irrigation is possible. Rapid drawdowns that coincide with conditions of high temperature and little rainfall during the growing season create soil moisture conditions that often result in poor moist-soil responses (Table 4). Some germination may occur, but generally development of root systems is inadequate to assure that these newly established plants survive during summer drought. Thus, at latitudes south of St. Louis, fast drawdowns are never recommended after 15 June if irrigation is not possible.

Slow Drawdowns

Slow drawdowns (2–3 weeks) usually are more desirable for plant establishment and wildlife use. The prolonged period of soil saturation associated with slow drawdowns creates conditions favorable for moist-soil plant germination and establishment (Table 4). For example, slow drawdowns late in the growing season can result in seed yields of 700 pounds per acre. Rapid drawdowns on adjacent units subject to identical weather conditions have resulted in 50 pounds per acre. Furthermore, slow drawdowns provide shallow water over a longer period, ensuring optimum foraging conditions for wildlife. If salinities tend to be high, slow drawdowns should only be scheduled during winter or early in the season when ambient temperatures and evapotranspiration are low.

Table 4. Comparison of plant, invertebrate, bird, and abiotic responses to rate and date of drawdown among wet and dry years.

| | Drawdown rate | |
|---------------------------------|-------------------|-------------------|
| | Fast ^a | Slow ^b |
| Plants | | |
| Germination | | |
| Period of ideal conditions | short | long |
| Root development | | |
| Wet year | good | excellent |
| Dry year | poor | excellent |
| Seed production | | |
| Early season | good | excellent |
| Mid-late season | not recommended | excellent |
| Wet year | good | good |
| Drought year | poor | good |
| Cocklebur production | great potential | reduced potential |
| Invertebrates | | |
| Availability | | |
| Early season | good | excellent |
| Mid-late season | poor | good |
| Period of availability | short | long |
| Bird use | | |
| Early season | good | excellent |
| Mid-late season | poor | good |
| Nutrient export | high | low |
| Reducing soil salinities | good | poor |

^aLess than 4 days.

^bGreater than 2 weeks.

Invertebrate Availability in Relation to Drawdowns

When water is discharged slowly from a unit, invertebrates are trapped and become readily available to foraging birds along the soil–water interface or in shallow water zones (Table 4). These invertebrates provide the critical protein-rich food resources required by pre-breeding and breeding female ducks, newly hatched waterfowl, molting ducks, and shorebirds. Shallow water for foraging is required by the vast majority of species; e.g., only 5 of 54 species that commonly use moist-soil impoundments in Missouri can forage effectively in water greater than 10 inches. Slow drawdowns lengthen the period for optimum foraging and put a large portion of the invertebrates within the foraging ranges of many species. See *Fish and Wildlife Leaflet 13.3.3* for a description of common invertebrates in wetlands.

moderate. When flooding is possible from sources other than rainfall, fall flooding should commence with shallow inundation on impoundments suited for blue-winged teals and pintails. Impoundments with mature but smaller seeds, such as panic grass and crabgrasses, that can be flooded inexpensively are ideal for these early migrating species. Flooding always should be gradual and

should maximize the area with water depths no greater than 4 inches (Fig. 3). As fall progresses, additional units should be flooded to accommodate increasing waterfowl populations or other bird groups such as rails. A reasonable rule of thumb is to have 85% of the surface area of a management complex flooded to an optimum foraging depth at the peak of fall waterfowl migration.

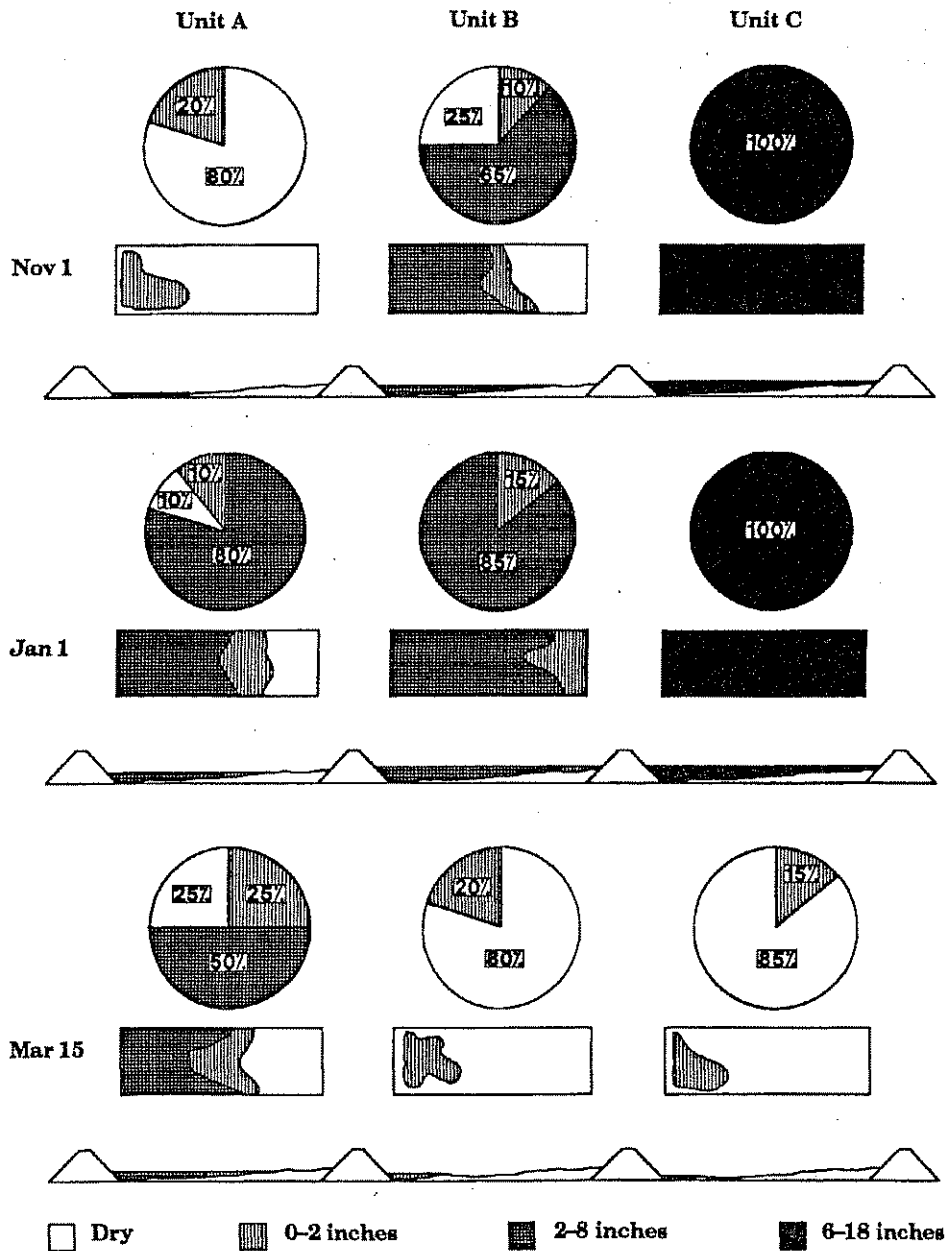


Fig. 3. Planned flooding strategies for three moist-soil units during one winter season. The initiation, depth, and duration of flooding are different for each unit. Note that two of the three units were never intentionally flooded to capacity. This does not mean that natural events would not flood the unit to capacity. Flooding strategies should be varied among years to enhance productivity.