

Growing Meadowfoam in the Willamette Valley

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Meadowfoam, *Limnanthes alba*, is a low-growing winter annual native to northern California and southern Oregon. Oil from meadowfoam seed was first tested in the late 1950s as part of a USDA search for plants to provide new industrial raw materials. Tests found that meadowfoam seed oil has a unique chemical composition. Unlike common seed oils, meadowfoam oil consists almost entirely of long-chain fatty acids (more than 18 carbons). These have commercial potential as raw material for many products including lubricants, waxes, and polymers. There currently is strong market demand for meadowfoam oil in the cosmetics industry.

Meadowfoam is well adapted to the relatively mild winters and warm, dry summers of the Pacific Northwest. It will grow in many types of soil, including poorly drained areas of the Willamette Valley that currently are used to produce annual ryegrass. Since few other broadleaf crops will grow in these soils, meadowfoam has potential as a valuable rotation crop in these areas.

Recent registration of herbicides on meadowfoam allows growers to control many grass weed species that have become problems in grass seed production under reduced field burning. With fall plowing and good weed control, a meadowfoam rotation can be used in the Modification of Field History program to meet seed certification requirements without a fallow season. In addition, the

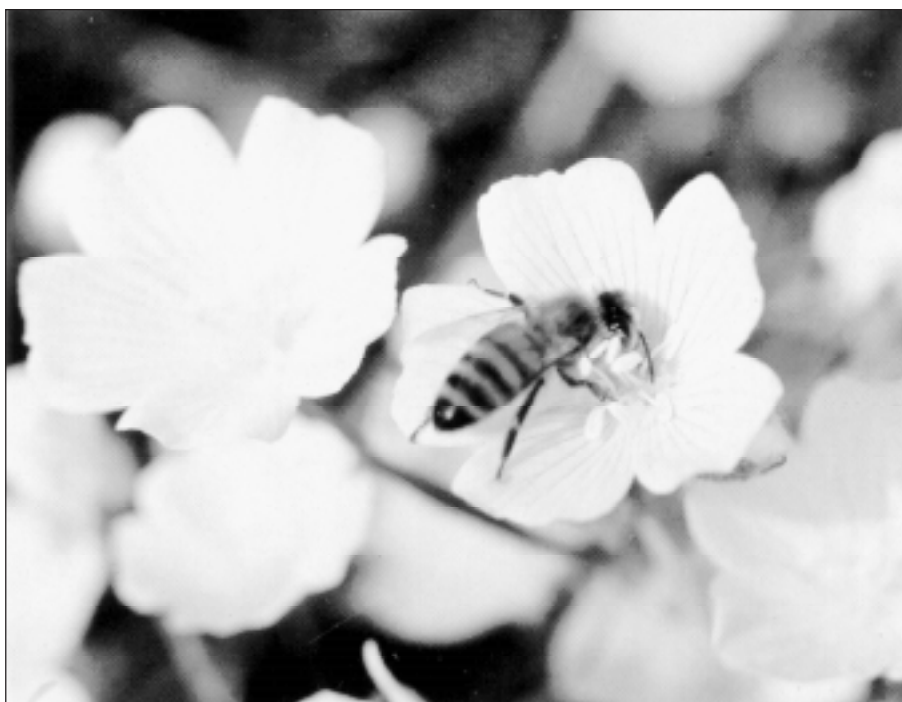


Figure 1.—Meadowfoam blooms in May, and current varieties are pollinated by honey bees.

small amount of straw produced by meadowfoam is pulverized finely during threshing, leaving little residue on the field after harvest. Minimal residue management is required to prepare for the subsequent crop.

Meadowfoam can be grown and harvested with equipment used in grass seed production. Cultural practices are similar to those for grass and grain crops. Planting and harvest times differ from other crops, spreading equipment use and work load over a longer period of time.

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Production practices

Choosing land

Meadowfoam will grow in most soil types found in the Willamette Valley. It is adapted to poorly drained “white land” soils, but produces higher yields on better soils. Sandy and shallow soils with low water-holding capacity are less favorable, because drought conditions in early spring can cause meadowfoam to mature early and yield less. Meadowfoam overwinters as a low-growing rosette that can tolerate wet soils, but will not survive prolonged flooding.

Meadowfoam is more sensitive to residual herbicides than grass or cereal crops. Herbicide carryover generally has not been a problem following grass seed production; however, high levels of residual diuron, atrazine, or other herbicides may affect meadowfoam stand establishment and yield. Prior field history should be discussed with experienced field representatives before planting meadowfoam.

Meadowfoam should not be grown repeatedly on the same field. Meadowfoam fields that volunteer from seed lost in the previous crop normally have very high stand density, especially in the combine trails, and are subject to lodging, increased insect damage, and lower yield.

Selecting a variety

Meadowfoam is a new crop. Few varieties have been developed. Floral currently is the only variety available in commercial quantities. Floral was developed by Oregon State University and is licensed to the Oregon Meadowfoam Growers Association. Call the Association (503-585-1157) for information on seed and production contracts.

Seeding date

Studies at Oregon State University indicate that seed-zone soil temperatures below 60°F are needed for good germination. Seed planted in warmer soil can develop secondary seed dormancy, which leads to low germination and poor crop stand establishment. Seeding in the first 2 weeks of October has consistently given the best results.

By this time of year, temperatures generally are low enough to avoid inducing high-temperature seed dormancy after the seeds have imbibed. Seeding this time of year has resulted in good stands even with dry fall weather conditions.

Preparing the seedbed

Work the seedbed for meadowfoam as you would to establish a grass seed crop by plowing, harrowing, and rolling. You will minimize possible carryover effects on meadowfoam from persistent, immobile herbicides by blending the surface layer of soil before planting. The seedbed should be moderately fine (no large soil clods) and firm. Meadowfoam seed is small, and good seed-soil contact is required for uniform germination. Good seedbed preparation before meadowfoam planting will allow the following crop to be planted with minimal soil disturbance.

Seeding rate and row spacing

Meadowfoam seedlings are not competitive, and narrow row spacings and high plant populations allow for greatest competition with weeds. High populations of Floral produce more flowers per acre and consequently more seed. High populations also make it more likely that plants will flower at the same time (synchronously). Synchronous flowering is desirable because there is greater potential to attract bees and to mature the crop uniformly.

Floral has a seed count ranging from 44,000 to 68,000 seeds per pound, with an average near 50,000. Seeding rates of 30–35 pounds per acre are required to obtain an adequate population (1.5–1.8 million seeds per acre).

Plant with a standard grain drill (6–8 inch row spacing) into a firm seedbed. Planting depth should be one-quarter to three-quarters of an inch.

Although growers have been successful using a seeding rate of 25 lb/a, avoid the temptation to stretch seed supplies with lower planting rates. Thin stands



Figure 2.—Meadowfoam seeds contain 20–30 percent oil with a unique fatty acid composition.

provide little competition for weeds, which cause yield loss and harvest difficulties.

Some plot studies have shown that meadowfoam yields increase as row spacing is narrowed, and as plant population is increased. You're encouraged to experiment with row spacing and plant populations to fine tune these practices for your production environment.

Many growers are attempting to intercrop meadowfoam with grass species either by mixing grass seed with meadowfoam before planting, or drilling grass into the meadowfoam stand in early spring. Expect yield reductions in meadowfoam when using this practice due to competition with the grass crop, especially under drought stress. Intercropping also severely limits weed control options, and no herbicides currently are registered for this use.

Fertilization

Meadowfoam seems to have low fertilizer requirements compared to other field crops. Research and field experience have shown that the highest yields are obtained when limited amounts of nitrogen fertilizer are used.

Although no direct yield increase has been found from fall fertilizer application on meadowfoam, small amounts of starter fertilizer (10–15 lb N/a) applied through the drill at planting generally improve stand establishment, especially on heavier soils. As with fall-planted cereals, many growers commonly apply 100 lb/a of 16-16-16. This is not necessary in situations with high residual nitrogen carryover from the previous crop.

Spring nitrogen generally is applied in February or early March prior to stem elongation. Spring nitrogen applications should not exceed 40 to 50 pounds N per acre. This can be applied in either dry or liquid form. When using solution 32, dilute 50:50 with water to avoid burning meadowfoam leaves.

Avoid the temptation to produce lush, green foliage. Too much nitrogen leads to excessive foliage, increased incidence of lodging and disease, and seems to attract insects that damage stems, buds, and flowers. Excess nitrogen also encourages weed growth. For highest yield and fewest production problems, the crop should appear slightly yellow.

No response has been observed from meadowfoam to application of phosphorus, potassium, sulfur, or micronutrients unless soils are deficient. Use a winter wheat soil test and recommendations to determine adequacy of these nutrients.

Excessive driving on the crop can heavily damage meadowfoam, especially in wet soil conditions. Try to minimize the number of trips over established fields, and avoid driving on the crop after the stems begin to elongate (approximately mid-March).

Diseases and pests

Meadowfoam has few diseases or insect pests. Pests such as slugs and geese are not known to damage meadowfoam.

The only known insect problem in meadowfoam is a tiny fly in the genus *Scaptomyza*. Adults of this species can

be trapped in meadowfoam or grass fields on warm days from December to May throughout the Willamette Valley. Adults lay eggs in the meadowfoam crowns and buds, and their small larvae feed on crown tissue, leaf petioles, and stem and flower buds. *Scaptomyza* have been only an occasional problem, but populations may build with increased meadowfoam acreage. Insect damage, monitoring, and control assessment work has just begun. Contact your county agent of the OSU Extension Service or field representative for the latest information on this insect.

Grey mold (*Botrytis cinerea*) has been reported as a serious pest in commercial meadowfoam fields in past years. This fungus attacks stems, leaves, and flowers, resulting in flower loss and reduced seed yield. The most serious problems have been seen where nitrogen fertilization has been excessive and the crop canopy is dense and lush. Careful attention to nitrogen management is a good strategy for grey mold control.

Weed control

Meadowfoam seedlings are not highly competitive with weeds. Both fall and spring germinating weeds can compete severely with meadowfoam, resulting in lower yields. A management

strategy that results in dense, uniform, early-maturing stands provides maximum competition with weeds and is an effective part of an integrated weed control program. (See the sections on seeding dates, rates, and row spacing for more information.)

Special Local Need labels under Section 24(c) of FIFRA currently are available for the use of some herbicides. Growers must sign a waiver of liability before applying these compounds on meadowfoam. Current label information can be obtained by contacting your county Extension office, field representative, or the Oregon Meadowfoam Growers Association.

Pollination

Meadowfoam requires insect pollination. Two or more honey bee colonies per acre are essential for good pollination and seed set in the Willamette Valley under favorable weather conditions. Bloom usually begins in early May.

Three factors dramatically limit the effectiveness of insect pollinators and result in reduced seed yield:

- Cool, wet, and windy weather
- The presence of other flowering plants
- The distance of beehives from the meadowfoam field

Use pesticides safely!

- **Wear** protective clothing and safety devices as recommended on the label. **Bathe or shower** after each use.
 - **Read** the pesticide label—even if you've used the pesticide before. **Follow closely** the instructions on the label (and any other directions you have).
 - **Be cautious** when you apply pesticides. **Know** your legal responsibility as a pesticide applicator. You may be liable for injury or damage resulting from pesticide use.
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Figure 3.—Meadowfoam is harvested using conventional grass seed combines. Minimal residue remains in the field after harvest.

Bees may go to other crops if they have a choice. Avoid growing meadowfoam immediately adjacent to fall-planted Brassicas, clovers, or vetches that will bloom at the same time as meadowfoam. Place hives immediately adjacent to fields, and, if possible, spread them out around the field. For more information on meadowfoam flowering and pollination, see EM 8666, *Pollination and Seed Set in Meadowfoam*. If you have not grown a crop that requires use of bees, we highly recommend that you read PNW 245, *Evaluating Honey Bee Colonies for Pollination: A Guide for Growers and Beekeepers*.

Harvest

Swathing

Meadowfoam is swathed like grass seed crops. Swathing typically begins during the last week in June but can be later depending on weather conditions. Meadowfoam cuts very easily compared to grass seed crops due to the small amount of biomass produced.

You can predict the swathing date accurately using moisture curves, as is commonly done with grass seed crops. Meadowfoam seeds are mature at 42 percent seed moisture and should be swathed close to that moisture level for highest yield. At this point, the seeds are turning brown but stems are still greenish-yellow and pliable. From about 65 to 40 percent moisture, seed moisture content drops 2 percent per day (except rainy days). Below this level, seed moisture can drop at 10 percent per day during hot weather. Check with your field representative for help with moisture testing.

Most meadowfoam seed losses occur when dry stems break just below the flowers. Seed loss from swathing can be minimized by cutting after the seeds are fully mature but before the stems become dry and brittle. Windrow in the

early morning when enough dew is present to prevent stem breakage.

Combining

You generally can thresh windrows 7 to 10 days after swathing. At this time, seed moisture content usually is below 12 percent. Windrows should be dry with brittle, brown stems for most efficient combining.

You will need a combine with a windrow pickup attachment. Rasp bar, spike tooth, and rotary combines all have been used on meadowfoam. Most growers use clover concaves or extra teeth when harvesting meadowfoam. High cylinder speed and close tolerances are needed to thresh meadowfoam seed out of the flowers. With these combine settings, virtually the entire crop is finely pulverized and passes over the sieves. To minimize seed loss over the sieve, take care in adjusting the screen opening and fan speed. Grower experience has shown that a combine ground speed near 1.5 miles per hour is best.

Seed cleaning

After harvest, meadowfoam seed is usually scalped to remove stems and dirt prior to shipment for oil extraction. Seed often is passed through a debearder to break up unthreshed seed clusters before cleaning. For the past several years, central receiving elevators have offered meadowfoam cleaning service, but many growers use their own cleaning plants.

Seed yield

Commercial clean seed yields range from 400 to over 1,200 pounds per acre. Yields vary dramatically from field to field and year to year. Poor weather during pollination probably has the greatest effect on yield. Fields intercropped with grass seed generally have had lower yield than pure stands of meadowfoam. An enterprise budget for

meadowfoam and other crops is available through your county office of the OSU Extension Service.

With continued interest in rotation crops for the Willamette Valley, meadowfoam is an economically viable alternative to grass seed production on poorly drained soils. As research provides more information, results will be available through the Oregon State University Department of Crop and Soil Science, Agricultural Experiment Station, and Extension Service.

For more information

1. Burgett, D.M., Glenn C. Fisher, Daniel F. Mayer, and Carl A. Johansen, *Evaluating Honey Bee Colonies for Pollination: A Guide for Growers and Beekeepers*, PNW 245 (Oregon State University, Corvallis, reprinted 1993). \$1.00

To order copies of the above publication, send the complete title and series number (PNW 245), along with a check or money order for the amount listed, to:

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2. Johns, T.R., D.M. Burgett, and G.D. Jolliff, *Pollination and Seed Set in Meadowfoam*, EM 8666 (Oregon State University, Corvallis, 1997). No charge.

To obtain copies of the above publication (EM 8666), contact your county office of the OSU Extension Service or visit the Extension and Experiment Station Communications Web site at <http://www.agcomm.ads.orst.edu/>

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