INTEGRATED MANAGEMENT OF MAYWEED CHAMOMILE IN WHEAT AND PULSE CROP PRODUCTION SYSTEMS

By

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Abstract

Mayweed chamomile (*Anthemis cotula*) is a troublesome weed in small grain and pulse crops throughout the high rainfall zones of the Inland Pacific Northwest (PNW). It is an annual that can germinate in the fall or spring and that reproduces only by seed. Individual plants can produce as many as 17,000 seeds, and seed remain viable in the soil for many years. Preventing seed production is the key to managing mayweed chamomile! While herbicides are an effective tool for mayweed chamomile control, herbicide-resistant biotypes are an increasing concern. An integrated management approach is required for the sustainable, long-term control of this species.

Introduction

Mayweed chamomile, also known as dog fennel, mayweed, stinkweed, or stinking chamomile, is a native of the Mediterranean region. It is commonly found in disturbed areas, roadsides, along ditches, and in fields of wheat, barley, and pulse crops throughout the high rainfall zones (greater than 16 inches of average annual precipitation) of the Inland PNW, where it is well adapted to the warm, dry summer weather. The bushy annual, sometimes winter annual, has attractive daisy-like flowers and a strong, unpleasant odor. Mayweed chamomile is a member of the sunflower family (*Asteraceae*). The species name, cotula, is from a Greek word for "small cup," which describes the shape of the flower. Contact with mayweed chamomile can result in skin rashes in some people and irritation to the mucous membranes of livestock. It can also impart a strong flavor to the milk of dairy livestock. Mayweed chamomile reduces crop yields through competition for water, nutrients, and light. Yield losses in winter wheat are usually less than 5%, but in spring wheat, mayweed chamomile can reduce grain yields by up to 25%. In pulse crops, particularly lentils, mayweed chamomile infestations can result in total crop loss.

Identification

Although mayweed chamomile seed germinates throughout the year, most seeds germinate in the autumn and spring when soil moisture is plentiful. The cotyledons, also known as the seed leaves, are small, stemless, smooth-edged, and oval in shape (Figure 1). The cotyledons often dry up quickly and are frequently not present on plants with more than a few true leaves (Figure 1). The first pair of true leaves are opposite to one another on the stem, while subsequent leaves are alternate to one another. The leaves are bright green, fleshy, and divided into many small, narrow, sharp-pointed parts (Gaines and Swan 1972). Leaves are 1 to 2.5 inches long and about 3/4-inch wide, with the lower leaves having stems (petioles) and the upper leaves lacking petioles. The leaves can be nearly hairless to hairy.

Mayweed chamomile has a short, thick taproot. Mature plants grow to be 4 to 24 inches tall, are branched, and contain single flower heads, about 3/4-

Figure 1. Mayweed chamomile seedling with cotyledons (plant on right) that quickly wither and are seldom seen by the time several true leaves emerge (plant in center). Photo courtesy of Henry Wetzel, Washington State University.

Figure 2. Mayweed chamomile flowers are 3/4- to 1-inch in diameter and usually have 10 to 16 white ray flowers surrounding a center of yellow cone flowers. Photo courtesy of Henry Wetzel, Washington State University.

to 1-inch in diameter, on the ends of branches and unbranched stalks in the leaf axils (the junction of the leaf and stem). The flower heads consist of white ray flowers circling a center of yellow disc flowers (Figure 2). Plants flower from May to October, with the main flowering period occurring June to July (Van Vleet 2006). Stems and remnants of flowers often persist into the winter months.

Similar Weeds Confused with Mayweed Chamomile

Pineapple-weed (*Matricaria discoidea*) and scentless chamomile (*Tripleurospermum maritimum*) are two species that can be easily confused with mayweed chamomile (Table 1). Pineapple-weed can be differentiated from mayweed chamomile by the lack of ray flowers in the flower head and by the lack of foul odor when the leaves are crushed. Pineapple-weed leaves give off a sweet pineapple scent when crushed. As the name implies, scentless chamomile gives off no distinctive odor when the leaves are crushed. It tends to grow taller and have more ray flowers than mayweed chamomile.

Seed Production and Dispersal

Mayweed chamomile reproduces by seed. The small brown seeds, about 1/16 of an inch (1.6 mm) long, are peg-shaped and have several lengthwise, warty ridges (Gaines and Swan 1972; Figure 3). Average-sized mayweed chamomile plants can produce 5,000 to 17,000 seeds (Van Vleet 2006). Seeds have a hard seed coat and have been reported to survive up to 25 years in the soil under field conditions (DiTomaso and Healy 2007, p. 192).

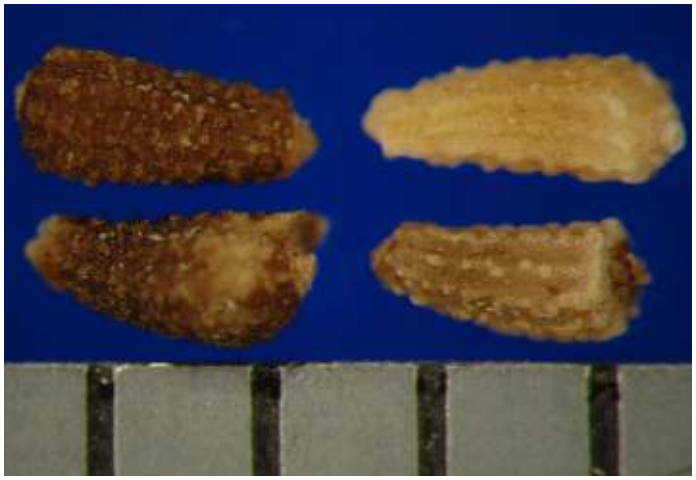

Figure 3. Mayweed chamomile seed is small (1/16 inch or 1.6 mm), brown, and tapered from the apex to the base. The surface is roughened by rows of longitudinal ribs having wart-like projections. Photo courtesy of the Oregon State University Seed Laboratory and used with permission.

Table 1. Mayweed chamomile is sometimes confused with pineapple-weed or scentless chamomile, but these two look-alike species can be differentiated from mayweed chamomile using the differences noted in this table.

		
Mayweed Chamomile (*Anthemis cotula*)	Pineapple-weed (*Matricaria discoidea*)	Scentless Chamomile (*Tripleurospermum maritimum*)
Strong, unpleasant odor when leaves or flowers are crushed.	Pleasant pineapple aroma when leaves or flowers are crushed.	No distinct odor when crushed.
Height varies from 12 to 24 inches.	Height varies from 12 to 16 inches.	Height varies from 15 to 32 inches.
Flower head with 10 to 16 white ray florets (petals), each with a 3-toothed tip.	Flower head lacks white ray florets.	Flower head with 15 to 35 white ray florets.
Chaffy scales only toward the middle of the receptacle (base or underside of flower head).	Lacks chaffy scales on receptacle.	Lacks chaffy scales on receptacle.

Mayweed chamomile and pineapple-weed photos courtesy of Henry Wetzel, Washington State University. Scentless chamomile picture courtesy of Joan Campbell, University of Idaho.

Mayweed chamomile seed is dispersed by flowing water, contaminated crop seed, and the movement of farm equipment and livestock (Graham and Johnson 2004). It is important to try to prevent seed production and spread because once an area is infested, it is difficult to eradicate mayweed chamomile. Developmental prediction tools, based on growing degree day models, may be useful to predict flowering or seed set and allow for timely management to prevent seed production (Hauvermale et al., 2018).

Integrated Management

Prevention

Plant only certified, weed-free crop seed. Clean equipment and vehicles whenever they are moved from infested to non-infested fields. Eliminate small infestations before they spread. **Preventing seed production is the key to managing mayweed chamomile!** Mowing immediately before the plants start to flower can reduce seed production. However, mayweed chamomile that is mowed too early will have a more prostrate growth form and flowers and seed will be produced below the height of the mower blades.

Plant and manage perennial, cool-season grasses in non-crop areas and field borders. Vigorous stands of grasses are highly competitive with mayweed chamomile and other annual weeds. Growing perennial grasses also allows the use of some broadleaf herbicides in these areas for the control of mayweed chamomile.

Tillage

Shallow, light tillage after crop harvest can be used to increase seed-to-soil contact and encourage weed seed germination. Emerged mayweed chamomile seedlings can subsequently be controlled with tillage or nonselective herbicides such as glyphosate or paraquat. Tillage for weed management works best when soils are dry, air temperatures are warm enough, and relative humidity is low enough to cause the disturbed weed seedlings to wilt quickly and desiccate.

As previously mentioned, mayweed chamomile seed remains viable in the soil for many years. This makes deep inversion tillage less effective for managing mayweed chamomile than it is for a species such as downy brome that has little viable seed in the soil after three years. Deep tillage done within ten years of an initial deep tillage operation to bury mayweed chamomile seed simply brings viable buried seed back to the soil surface where it can germinate and grow.

Cultural Practices

A competitive stand of healthy wheat is one of the most effective means of controlling annual weeds. Establishing a competitive wheat stand requires choosing a well-adapted wheat variety and seeding at the appropriate seeding rate and depth (usually 1 1/2 to 2 inches deep) into a firm, moist seedbed at the optimum time for your region. Adequate soil fertility is needed to promote early wheat growth. Placing the fertilizer close to the wheat seed, although not too close as to cause damage, gives wheat seedlings preferential access to the fertilizer compared to the weed seedlings. Using large, fungicide-treated seed can increase seedling vigor and improve early season competition with weeds.

Mayweed chamomile is most easily controlled in cereal and grass crops because broadleaf herbicides may be used for weed control with minimal risk for crop injury. Rotating winter wheat with spring crops or summer fallow provides opportunities to apply non-selective herbicides, including glyphosate or paraquat, for the control of mayweed chamomile. Alternatively, tillage may be used in the spring when mayweed chamomile seedlings are easier to control. Including pulse crops in the rotation with wheat allows the use of herbicides with different mechanisms of action, although postemergence herbicide options for broadleaf weed control are limited in pulse crops.

Herbicides in Wheat

ALS inhibitors (Group 2)

When first introduced, the ALS-inhibiting sulfonylurea herbicides provided excellent control of mayweed chamomile in wheat (Table 2). Unfortunately, some mayweed chamomile populations in the PNW are now resistant to many of the Group 2 herbicides including chlorsulfuron (Glean XP), metsulfuron (Ally XP), thifensulfuron (Harmony SG), and tribenuron (Express). These herbicides may still provide effective control of some mayweed chamomile biotypes, but they should always be tank mixed with one or more herbicides with a different mechanism of action. Although genetic tests for herbicide resistance can determine if a specific Group 2 herbicide will be effective for control, basing the entire mayweed chamomile control program on the use of a Group 2 herbicide is not advised.

Table 2. Postemergence control of mayweed chamomile in winter wheat averaged across at least two of three sites (Pullman, Lind, and Davenport, WA) and four years (2008–2011). Product availability may have changed since this study was conducted.

Treatment	Rate (oz product/acre)	Mayweed visual control (%)[a]
prosulfuron (Peak) + NIS	0.38	95a
chlorsulfuron (Glean XP) + NIS	0.25	94ab
metsulfuron (Ally XP) + NIS	0.1	93ab
clopyralid + fluroxypyr (WideMatch)	16	93ab
pyrasulfotole + bromoxynil (Huskie)	13.5	90abc
thifensulfuron (Harmony SG) + NIS	0.75	89abc
florasulam + MCPA (Orion)	17	89abc
tribenuron (Express) + NIS	0.375	84abcd
linuron (Linex) + bromoxynil	8 + 16	82bcd
bromoxynil	24	82bcd
2,4-D (4 lb)	16	78cde
diuron (Karmex DF)	16	72def
metribuzin	5.3	67efg
triasulfuron (Amber)	0.47	67efg
fluroxypyr (Starane Ultra)	4	67efg
MCPA (4 lb)	16	65fg
dicamba (Banvel)	4	62fg
carfentrazone (Aim) + NIS	1	59g

[a]Visual control ratings followed by the same letter are not significantly different from each other with a confidence level of 95%.

Synthetic auxins (Group 4)

Several synthetic auxin herbicides can work well for the control of mayweed chamomile in wheat. MCPA can provide effective control of mayweed chamomile seedlings, especially when combined with bromoxynil (Group 6, photosystem II inhibitors). Clopyralid, one of the active ingredients in WideMatch, WideARmatch, Curtail, and Curtail M, is a synthetic auxin that provides excellent control of mayweed chamomile in wheat. Although clopyralid is effective, it is relatively slow to kill plants and patience is required when using this product. Fair to good control of mayweed chamomile can be achieved with 2,4-D, but the relatively high risk of crop injury limits its use in the higher rainfall regions of the PNW where mayweed chamomile is most prevalent.

Many synthetic auxin herbicides can injure wheat if applied too early or too late. Make sure to check the herbicide label and stage of wheat to reduce the risk of crop injury with these herbicides. See Managing Wheat by Growth Stage (Wise et al. 2011), published by Purdue Extension, for a good reference for staging wheat plants.

4-HPPD inhibitors (Group 27)

Huskie herbicide contains pyrasulfotole and bromoxynil and it provides excellent control of mayweed chamomile in spring wheat. However, in winter wheat Huskie is only labeled for the suppression of mayweed chamomile. Talinor herbicide contains bicyclopyrone and bromoxynil and it provides excellent control of mayweed chamomile in winter and spring wheat.

Good coverage is important with Huskie and Talinor herbicides, so use adequate carrier volume (a minimum of 10 gallons/acre) and the correct nozzles and spray pressure to ensure adequate coverage. Treating mayweed chamomile seedlings early with MCPA, with or without bromoxynil, can allow a Huskie or Talinor application to be delayed to manage later emerging plants. Tank mixing MCPA and Huskie is also a good option for the control of mayweed chamomile in wheat and grass seed crops.

Herbicides in Chickpea, Lentil, and Pea

The availability of herbicides, particularly postemergence herbicides, to selectively control mayweed chamomile in the pulse crops grown in the region (i.e., chickpea, lentil, and dry pea) is limited. Every effort should be made to prevent seed production in the wheat and/or barley crops preceding a pulse crop because controlling mayweed chamomile in the pulse crops can be more challenging than in wheat or barley. Having a pulse crop in the rotation with wheat or barley does permit the use of herbicides with different mechanisms of action than those used in the wheat or barley crops. Selecting herbicides with different mechanisms of action for use in the pulse crop is wise herbicide stewardship.

Synthetic auxins (Group 4)

MCPA is a synthetic auxin that can provide fair to good control of small mayweed chamomile when applied postemergence in dry pea. As a synthetic auxin, there is a risk for crop injury with MCPA. MCPA is not labeled for use in chickpea or lentil.

Photosystem II inhibitors (Groups 5, 6, and 7)

Metribuzin is applied preemergence in all three pulse crops and provides fair to good control of mayweed chamomile. It is seldom a standalone treatment. Metribuzin activity is strongly influenced by soil texture and organic matter content. Do not use metribuzin on coarse-textured soils or soils with less than 1.5% organic matter content. Planting depth should be a minimum of 2 inches to prevent crop injury. Rain or mechanical incorporation is needed to activate metribuzin.

Bentazon (Basagran) is similar to bromoxynil (previously discussed for use in wheat). Basagran is labeled for use in dry pea, but not in chickpea or lentil.

Linuron (Lorox DF) is applied preemergence and provides good control of mayweed chamomile. It is seldom a standalone treatment, but can play an important role in mayweed chamomile control. Lorox is only labeled for use in pulse crops in Washington and Idaho. Lorox activity is strongly influenced by soil texture and organic matter content. Do not use Lorox on coarse-textured soils or soils with less than 1.0% organic matter content.

Inhibitors of Protox (Group 14)

There are several Group 14 herbicides that provide effective control of mayweed chamomile chickpea and dry pea. None are labeled for use in lentil. Sulfentrazone (Spartan 4F) may be applied preplant, preemergence, or preplant incorporated (spring only). Spartan provides good to excellent control of mayweed chamomile and it poses little risk for crop injury. Like most soil-applied herbicides, its activity is influenced by soil texture, organic matter content, and precipitation required to activate the product. See the label for the appropriate use rates for various soils. Flumioxazin (Valor EZ) is another Group 14 herbicide with good activity on mayweed chamomile. Valor is in a different chemical family than Spartan and the risk of crop injury from Valor is greater than with Spartan. In university field studies in the region, Valor + Lorox has provided consistently good control of mayweed chamomile. Saflufenacil (Sharpen) provides effective control of small, emerged mayweed chamomile when applied prior to pulse crop emergence. When applied at 1 to 2 ounces/acre, it does not provide residual control of mayweed chamomile, but when Sharpen is applied at 2 ounces/acre preplant and followed by 2 additional ounces per acre preemergence, Sharpen can provide 2 to 3 weeks of residual control of mayweed chamomile.

Herbicide trade names change, new products come to market, some products are removed from the market, and new cases of herbicide resistance develop over time. To stay current with these changes, visit the current edition of the PNW Weed Management Handbook (Peachey 2022), available at pnwhandbooks.org/weed/. As with all crop protection chemicals, read and follow label directions and understand their proper use.

Although herbicides can be an effective tool for managing mayweed chamomile, they should be used as part of an integrated management plan that uses sanitation, cultural practices, and mechanical control. **Limiting seed production is the key to long-term management of mayweed chamomile.**

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