

Title: Evaluating Meadowfoam Seed-Meal as a Potential Natural Herbicide for Organic Wheat.

Objectives

The objectives of this project are to

1. To evaluate the efficacy of meadowfoam seed-meal as herbicides of common weeds affecting wheat growth under both laboratory and field conditions
2. To evaluate the effect of meadowfoam seed-meal extracts on wheat germination and growth under both laboratory and field conditions

Progress Report

Laboratory studies: Meadowfoam seed meal was screened for allelopathy, the ability of plants to inhibit or enhance the germination or growth of other plants. Deionized water (100 ml) was added to 5 g of each sample and filtered after 2 hrs to obtain 5% extracts. Petri dishes were filled with 45 g of sand, and 10 downy brome seeds were placed on filter paper on top of the sand. The sand was wetted with 10 ml of extract and 3 filter papers, wetted with the same extract, were placed over the seeds. Petri dishes were incubated at 25°C for 72 hrs. The experiment was replicated 4 times with a deionized water control. Shoot and root length were measured to determine allelopathic effects of meadowfoam seed-meal on downy brome (*Bromus tectorum*). Extracts were also evaluated on Stephens wheat seed germination.

Meadowfoam seed-meal completely inhibited the germination of downy brome. Water extracts of meadowfoam seed-meal also inhibited wheat germination by 96%.

Field experiments

Experiment 1. Preliminary experiments were carried out to determine meadowfoam seed-meal effects on cheat grass under field conditions. Seed meal rates of 0, 433, and 650 lb/a were applied on the soil surface before wheat emerged. The experiment was replicated 3 times.

Table 1. Meadowfoam seed-meal effects on the emergence of wheat and cheat grass

Meadowfoam seed meal rates (lb acre ⁻¹)	†All plants ft ⁻²	†Cheat grass plants ft ⁻²	†Wheat plants ft ⁻²
0	18.9a	1.5a	17.4a
433	14.6ac	1.0ac	13.6ac
650	11.4bc	0.4bc	11.0bc
se	1.5	0.2	1.6

† means with the same letter are not significantly different at the 0.05 probability level

Increasing meadowfoam seed-meal rates significantly decreased both wheat and cheat grass stands (Table 1). Based on seeding rate experiments, the reduction in wheat stand wouldn't necessarily reduce grain yield.

Experiment 2. This experiment was carried out on well established plots of the Tillage and Fertility/Fallow long-term experiment. The experiments consists of three tillage tillage (plow, disk, and sweep) and five (0, 40, 80, 120, and 160 lb N acre⁻¹) treatments.

Meadowfoam treatments (0, 433, and 650 lb N acre⁻¹) were applied to randomly selected three-foot quadrats in each tillage treatment during the spring of the fallow phase of the experiment. By this time some weeds and volunteer wheat were emerging. Plant counts were determined in late April before rod weeding began.

Increasing the seed-meal rates substantially decreased plant stands in all the tillage treatments although this was not significant (Table 2.). The primary reason for lack of significance in this experiment was probably different initial plant stands in each quadrat. This is confirmed by the large standard error of the experiment (Table 2). Starting out with uniform weed stands might improve the accuracy of the experiments. From this experiment, it is also difficult to separate the herbicidal from the smothering effects of meadowfoam seed-meal particularly at the highest rate. The seed-meal was applied after some of the volunteers had already emerged.

Table 2. Meadowfoam seed-meal effects on the control of volunteer wheat and cheat grass

Meadowfoam rates (lb acre ⁻¹)	Plant stand ft ⁻² (wheat volunteer and cheat grass)		
	†Plow	†Disk	†Sweep
0	34.5a	38.9a	67.9a
433	29.6a	45.6a	44.3ac
650	16.7a	20.1a	23.7bc
se	12	12	12

† means with the same letter are not significantly different at the 0.05 probability level

Conclusions: These results demonstrate that meadowfoam seed-meal was allelopathic to downy brome and wheat. Allelochemicals in these plants can be enhanced through breeding, stabilized and used as herbicides. Allelopathy in meadowfoam is attributed to a group of biomolecules called glucosinolates. Allelochemicals may be used to formulate natural herbicides, which may lead to the expansion of organic farming and, furthermore, pave the way for the development of a truly sustainable direct seed organic farming system. More experiments, where the seed-meal will either be mixed with the soil or extract sprayed on the ground or on plants will be conducted to prove meadowfoam seed-meal herbicidal effects and separate out smothering effects.