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Introduction and Establishment of Meadowfoam as a New Crop in Virginia: History and Lessons Learned*

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INTRODUCTION

Meadowfoam (*Limnanthes alba* Hartw. ex Benth., Limnanthaceae) seeds contain long-chain fatty acids (20- and 22-carbon) which are unique due to very high levels of mono-unsaturation and very low levels of poly-unsaturation. These characteristics make meadowfoam oil very stable, even when heated or exposed to air. The uses of meadowfoam oil include personal care products, such as cosmetics and toiletries, as well as industrial applications including lubricants and inks. Derivatives of meadowfoam oil such as estoloides and silicone esters have potential as coatings and adhesives.

HISTORY OF MEADOWFOAM IN VIRGINIA

The meadowfoam evaluations at Virginia State University in Petersburg started in 1992 upon establishment of a New Crops Program in Agricultural Research Station under the direction of the author. Seed of 'Mermaid' cultivar, received from Oregon State University, were planted in a small observation plot in November. An impressive stand of meadowfoam plants was established. These plants were hand-harvested in May 1993. A similar plot for observations was again planted during 1993 and harvested during 1994. Results of these two plantings indicated that meadowfoam can be grown in Virginia.

During the 1994–1995 season, meadowfoam was evaluated in two replicated experiments at the Randolph Farm of Virginia State University (located at approximately 37.14°N and 77.24°W). The first experiment was conducted to compare performance of 'Mermaid' meadowfoam following five nitrogen rates (0, 56, 112, 168, and 224 kg N/ha). In this experiment, seed yield was affected by N rate. The highest yield of 633 kg/ha was obtained after application of 112 kg N/ha, whereas the lowest yield of 251 kg/ha was obtained from the 0 N treatment. Differences for seed yield among 112, 168, and 224 kg N/ha treatments were not significant. Application of 56 kg N/ha resulted in seed yield of 418 kg/ha, which was significantly greater than the seed yield of control treatment. The oil content (dry weight basis) varied from 21% to 25% with a highly significant negative correlation between N rate and oil content. N rates did not affect contents of fatty acids. In the second experiment, three three-row plots were planted with 'Mermaid' on Feb. 26, 1996 as observation rows to determine if meadowfoam planted at such a late date would mature and produce seed. All plots matured and were harvested manually on June 6, 1996. The average seed yield from the first experiment was 494 kg/ha, whereas the seed yield from the second experiment was 407 kg/ha.

Based on positive results from 1994–1995 research experiments, Fanning Corporation of Chicago, Illinois, supported production of 4 ha of commercial meadowfoam in Dinwiddie County in Virginia during 1996–1997. The meadowfoam was planted in two separate fields, each approximately 2 ha, on Dec. 12, 1996 with a grain drill in a prepared seed bed with about 28 kg seed/ha. Eight beehives were placed in each field. The meadowfoam in both fields was in full bloom by May 9, 1997. The meadowfoam started to mature during the last week of May, 1997. Both fields were combine harvested during June 9–11, 1997. The seed moisture content at harvest was 14% to18%. It is well established that meadowfoam can be swathed at about 42% seed moisture. Samples taken before harvesting revealed that seed moisture content decreased from about 80% on May 28 to about 31% on June 9 indicating that meadowfoam could have been swathed about a week before combine harvesting. This observation is important, since it was estimated that shattering during direct combining caused a seed loss of about 38%. From each field, sample plots were harvested by hand to determine the actual seed yield. This yield level was about 456 kg/ha (408 lb./acre). The average oil content in this crop

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was 26% with long-chain fatty acids comprising 97% indicating that meadowfoam produced in Virginia has desirable oil content and quality.

Based on these results, Oregon Meadowfoam Growers Association (OMGA) expressed an interest in supporting commercial meadowfoam production in Virginia. After extensive discussions and meetings by representatives of OMGA with Virginia farmers, approximately 49 ha were planted with meadowfoam under contract with OMGA during 1997–1998. This production effort was unsuccessful. Possible reasons for this lack of success could be unfavorable environment for bee foraging at pollination time, late application of herbicides, improper harvesting techniques (mostly a swather was used to cut the crop followed by the use of a belt pick up attached to a combine), etc. Meadowfoam was produced on approximately 40 ha during the 1998–1999, and 1999–2000 growing seasons, and on approximately 12 ha during the 2000–2001 season. The results from these efforts were mixed. Some farmers were able to harvest up to 896 kg/ha (800 lb./acre) whereas other farmers abandoned their fields.

CURRENT STATUS OF MEADOWFOAM IN VIRGINIA

The commercial production of meadowfoam in Virginia is currently in limbo due to many factors, especially lack of site-specific production technology and unavailability of locally-adapted cultivars and uncertain marketing. Lack of locally-adapted weed management systems has also played a major negative role. Currently, there are no approved herbicides for weed control in meadowfoam in Virginia. Administrative decisions during 1998–1999 and later resulted in curtailment of farmer interaction with researchers, and the responsibility of supporting meadowfoam production in Virginia was assigned to local extension personnel. A group of Virginia farmers and extension personnel visited Oregon to learn first-hand the intricacies of meadowfoam production. All these efforts were unproductive and by 2000–2001 season, meadowfoam area in Virginia had fallen to approximately 12 ha.

However, there is continuing interest among farmers to grow meadowfoam. Upon being approached by a group of farmers and extension personnel requesting research support for commercial meadowfoam production in Virginia, Virginia State University undertook to support efforts to: (1) determine bee hive usage guidelines; (2) develop weed control strategies; (3) develop a production system (fertilizer rates, row spacing, planting time, harvesting strategies); (4) identify/develop meadowfoam varieties adapted to Virginia; and (5) determine potential insect pests and develop control/management strategies.

These efforts were started during 2000–2001 season both in farmers' fields and at the research farm of Virginia State University. Preliminary results have indicated that Dual herbicide incorporated before planting at 1.2 or 1.5 L/ha was safe to use on meadowfoam and was effective against annual and broadleaf weeds. One year's results indicated that mid November is the optimal time for planting meadowfoam and that optimal fertilizer rates for meadowfoam were 56 kg N/ha (50 lb./acre), 28 kg P/ha (25 lb./acre), and 28 kg K/ha (25 b./acre). These results also indicated that application of sulfur may be desirable for meadowfoam production in Virginia. Efforts were also undertaken to develop self-fertilizing and open-pollinated cultivars adapted to Virginia's agro-climatic conditions. One year's observation indicated no serious insect-pests but indicated that rye mixed with meadowfoam may result in effective pollination by honey bees. These efforts are being coordinated by a group consisting of a plant breeder/agronomist, a weed scientist, an entomologist, three extension personnel, and two meadowfoam farmers.

LESSONS LEARNED

The history of meadowfoam introduction and establishment in Virginia, over the last several years, has been educational. Theses experiences have suggested the following:

1. A knowledgeable and experienced person, such as a plant breeder/agronomist, should be heavily involved in commercial production, especially during earlier periods of adoption.
2. A production system adapted to the local production region must be developed and should be in place before the start of commercial production.
3. A close cooperation and on-going interaction should exist between early producers, researchers, and extension personnel.

4. A dependable marketing system should be in place.
5. Significant support of extension personnel in establishment of new crops is crucial. However, “turf” battles need to be avoided.

PROSPECTS OF COMMERCIAL MEADOWFOAM PRODUCTION IN VIRGINIA

Successful and genuine cooperation among researchers, farmers, and extension personnel to identify needs and goals and object-oriented research, as is underway in Virginia, is expected to facilitate commercial meadowfoam production in Virginia. Preliminary results have indicated that efforts to establish meadowfoam as a new and alternative crop in Virginia have an above-average probability of success given that most of the difficulties encountered during production can be overcome. However, availability of a marketing/utilization plan would greatly enhance the probability of this success. Alternatives such as local crushing followed by marketing of oil and utilization of meal for other local uses exist and are being considered.