WSU personnel who recommend pesticides, such as Extension agents and specialists, must have a public consultant or public operator license. A person with either of those licenses has access to a longer list of products that can be recommended. WSU personnel who do not have a public operator or consultant's license may only recommend home-only products. For this reason, you may get different answers regarding pest management products depending on whom you talk with.

One of the rules that all WSU personnel and volunteers have in common is that everyone is bound by internal policy to only recommend materials that have a state registration or exemption from a registration. If WSU personnel are testing a substance for its pesticidal properties (meaning does it negatively affect some pest), then it must either be registered in the state as a pesticide (for the use being tested) or used under an Experimental Use Permit granted by either USEPA or WSDA. Where this intersects the grower community is our field testing programs.

WSU research and extension personnel test a variety of substances every year for the purpose of gathering data on pest management options. Quite often these test plots are Field Day sites where growers can view the results and hear about existing products or potential products in the registration pipeline. Results are often discussed at winter growers' meetings as well. WSU personnel are obliged to strongly remind growers that, if unregistered compounds were used in test plots, everyone needs to wait until materials are registered before using them in production situations.

Our research and extension personnel serving the organic community have a long set of hurdles to jump before they can deliver an organic pesticide to growers. The pesticide registration process can be fairly daunting and takes resources and manufacturer interest to succeed, then NOP standards must also be met. In some cases a creative approach addresses the problem with better results. Mustard meal illustrates such a creative approach. At present, it would be allowed under NOP standards and in test plots it has good efficacy against certain pests. However, because it is a substance that has pesticidal properties it is legally considered a pesticide. It is not an exempt material and it would need a federal registration, but as yet does not have one so there is no state registration either. That brings us smack up against the issue of illegal pesticide recommendation and use. As things stand, we can not recommend it and growers can not use it. The creative approach taken by our research and extension personnel is to recommend that instead of using mustard meal, organic growers plant green mustards, which are plants and thus not considered pesticides. Data on green mustard cover crops indicates they can be effective, and they are allowable under NOP standards. The issue of pesticides, organic or not, is completely avoided with this creative approach.

I hope when you have gone to Extension and asked for help on a pest problem, you received enough information to solve that problem. For those who may feel we are too conservative and need to speculate more, please remember we are bound by the same rules as everyone else when it comes to pesticides, organic or conventional. First, in order for us to recommend one, we have to have a license. Second, legally, we must stick to the label language unless we have data that shows we can recommend a lower amount than listed on the label or a less frequent use interval. Third, we have an internal policy that does not allow recommendations for home remedies or other unregistered materials. Lastly, if the pest is not on the label we must have data that indicates the product will work on a different pest than those listed.

For More Information

USDA National Organic Program (NOP) publishes a list of NOP approved products.

WSDA Organic Food Program. The WSDA Organic Food Program certifies many producers in Washington State. For more information about allowable organic pesticides under the WSDA program, see their Organic Materials List.

Organic Materials Review Institute (OMRI). OMRI publishes a review of products for organic systems.

Pesticide Licenses. Information on pesticide license types and training courses can be found at the WSU Pesticide Safety

Washington State Pest Management Resource Service
Professional Applicator Training

and Education Program web site. The value of a license is not only being able to purchase and use restricted-use pesticides, but also taking the safety and regulations training and the continuing education classes in state-of-the-art IPM practices.

Washington State Pest Management Resources Service. See the Washington State Pest Management Resources Service web site for more information on pesticides or email Catherine Daniels.

Switchgrass Production in Washington – Biofuel Feedstocks in Washington Part II

Hal Collins & Rick Boydston, USDA-ARS Vegetable and Forage Crops Research Unit, Steve Fransen & An Hang, WSU Irrigated Agricultural Research & Extension Center, Prosser, WA

(Editor's note: This article is the second part of the two-part series on Biofuel Feedstocks in Washington initiated in the September 2006 issue of Sustaining the Pacific Northwest.)

Since 2003, the Integrated Cropping Systems group (ICSG) at Prosser, Washington, consisting of WSU and USDA-ARS personnel, has been evaluating production aspects of a number of irrigated biofuel crops that can be planted in rotation with high value vegetables: oilseeds for biodiesel (safflower, soybeans, mustard, canola/rapeseed) and high biomass producing crops for ethanol production (wheat,

Continued on next page

corn, and switchgrass). These trials are unique in that they are the first comprehensive biofuel trials within Washington State and they provide essential and timely information on biofuel crop production potentials as the nascent bioenergy industry develops. In our previous article (Biofuel Feedstocks in Washington), we discussed oilseed crops for biodiesel production and in this article we will discuss switchgrass, a high biomass producing crop with potential for ethanol production.

Switchgrass

Ethanol Feedstocks: Switchgrass

About 90% of the domestic ethanol feedstock supply is derived from corn grain (Zea mays L.). Corn was selected as an ethanol feedstock crop due to: 1) its high starch content which can be rapidly distilled to alcohol; 2) its high distillation efficiencies compared to other feedstocks; 3) the predominance of corn-based ethanol production in the mid-West where corn is widely grown; and 4) the location of most refineries in the Gulf Coastal States which are closer to current ethanol distillation centers. The total dependence of the ethanol market on corn poses inherent problems regarding sustainability. Firstly, corn requires high inputs of fertilizers, herbicides, and insecticides to ensure high yields. Secondly, as an annual crop grown under rain-fed conditions, corn has yield potentials varying significantly from "bin busters to empty bins", making it risky to grow due to the uncertainty of shifts in rainfall as a result of global climate change. Lastly, annual cropping causes soil erosion, a major problem in the arid west.

Switchgrass (Panicum virgatum) is a long-lived perennial, warm-season grass species with deep penetrating roots. The ISCG are investigating its adaptability for use in the Pacific Northwest (PNW) as pasture and hay grass and as a biomass crop for ethanol production. During the past five years we have established eight field research studies at Prosser and Paterson, WA to evaluate varieties and production management under irrigation. While not native to the region, switchgrass has been successfully produced as a seed crop in the Pacific Northwest for more than 20 years.

Long-term adaptability and economic potential of switchgrass as an ethanol feedstock grown in the PNW are largely unknown. We now know switchgrass is well adapted to the warmer and irrigated regions or if it is a viable alternative to corn. Benefits of switchgrass production include: a perennial growth habit eliminates the need for annual tillage and thereby reduces soil loss from erosion; lower fertilizer requirements and fewer pest issues result in decreased fertilizer and pesticide use; the potential to produce a harvestable biomass under low moisture conditions since plants become dormant under moisture stress, unlike corn which would senesce and produce little harvestable yield; and a demonstrated production and adaptation potential demonstrated in research trials in the lower Columbia Basin region since 2001.

Switchgrass varieties are designated as either upland or lowland types. Upland types are more naturally adapted to upland growing areas which tend to have drier soil conditions. Lowland types are more often found in floodplain areas. Lowland types are normally taller and coarser than upland types, they have a more bunchgrass growth habit, and they tend to grow more rapidly. Although the ISCG are evaluating a number of switchgrass varieties in our studies, this article principally reports on three: Kanlow (2n=36) is a lowland type while Cave-in-Rock (2n=72) and Shawnee (2n=72) are upland types.

Switchgrass Growth Characteristics

Switchgrass seed is small with about 325,000 seeds per pound. Seed is "naked", making it easy to drill. In the irrigated regions of the PNW, switchgrass should be planted by late May to mid-June. Seed should be planted into a clean and firm seedbed with a drill using covering chains or packing wheels to ensure good soil-seed contact for rapid germination. We have successfully established stands with seeding rates from seven to 12 pounds pure live seed per acre with a drill on six-inch centers. Reference the seed tag for the percentage of seed germination as it can vary widely for each variety and seed source. A new planting starts as a bunchgrass, but with proper management, its short rhizome growth will develop into a sod over time. It has a panicle seedhead with spikelets forming at the ends of long branches. The basic chromosome number is nine and most varieties are either tetraploids (4n) or octoploids (8n). Varieties are cross pollinated and largely self-incompatible.

Controlling weeds in switchgrass is critical in the year of establishment, as switchgrass is slow to germinate and competes poorly with weeds. Few herbicides are labeled for switchgrass establishment and then only in certain states and special situations, such as on Conservation Reserve Program (CRP) ground. No herbicides are currently labeled in the state of Washington for switchgrass planted for biofuel production. Repeated mowing at 6-8 inch height can be used to help reduce the impact of weeds on switchgrass in the year of establishment. Planting in late May or early June when soil temperatures are warmer promotes faster germination and growth of switchgrass seedlings and may increase switchgrass competition with some weeds.

The ISCG have tested and identified pre-emergence applied herbicides that control most annual weeds with very little injury to switchgrass. Annual grass weeds often escape pre-

Continued on next page

emergence herbicide treatments and ISCG tests have identified several post-emergence applied herbicides for annual grass control in switchgrass. Obtaining herbicide registrations for use in switchgrass grown for biofuel is a critical need. *(Editor's Note: For more specifics, Rick Boydston invites you to contact him at 509-786-9267.)*

Switchgrass requires between three and five years to develop mature plants and maximum yields, but a planting can be harvested the year after planting. For biofuel production, harvest twice per growing season. Harvest first in early to mid-July, when crops are 4-6 feet tall, and second at the end of the season in late September or early October. July growth and regrowth is rapid if soil moisture and adequate stubble height are maintained. A 5-6 inch stubble at harvest will cause regrowth within 5-7 days, but may take as long as 10

Switchgrass at 13 months.

days. Growth during August slows compared to July, possibly due to reduced photoperiod.

By September, growth is much slower than in August, as temperatures cool rapidly and days shorten. The second harvest should be made in late September to early October, again leaving suitable stubble for winter survival. Long-term survival is not likely to be an issue as long as adequate stubble is maintained and good agronomic practices are followed. As yet, there has been no winterkill with any switchgrass varieties, probably due to good irrigation management and a cutting regime allowing the plants to enter deep dormancy of the plant in late October to early November. In December 2003, record low temperatures occurred (-19^{0}F) when the first switchgrass planting was in the juvenile stage. All the varieties survived without winterkill problems.

In our studies in the Lower Yakima Valley and Columbia Basin, switchgrass broke dormancy from early to mid-April but had less than six inches of growth by May 1. Early growth depends upon irrigation and temperature. Growth of early maturing varieties will be 20 inches or more by late May. With increasing June summer temperatures, growth increases significantly. The earliest maturing switchgrass variety we have grown is Dacotah, which heads by mid-June and is fully headed by July 1, several weeks before other varieties.

In 2005 the ISCG planted Alamo, a very late maturing lowland cultivar, and to date, stands are still very weak. This variety planting had an open canopy that allowed greater weed invasion than any other variety in our studies. Kanlow, a lowland variety and late cultivar, has performed very well at both locations. Dacotah, an upland cultivar, is the earliest maturing and may be too early for biofuel production in the lower Columbia Basin region. It may be best adapted to a higher elevation and a shorter growing season. If precipitation is adequate, this deeply rooted variety will likely thrive. Other varieties evaluated include Cave-In-Rock, Trailblazer, Blackwell, Nebraska 28, Sunburst, Forestburg and Shawnee.

Switchgrass harvested July, 2006.

Table 1 provides yield results for selected varieties in the second year of production at Paterson. Mean yield of the three varieties after two seasons ranged from seven to 10 tons of dry matter per acre for two cuttings. Of these three varieties, Kanlow is the most promising for production in the South Basin. Conservative estimates of ethanol yield ranged from 568-776 gallons per acre with an estimate of 25,000 - 35,000 acres needed to support a 20 million gallon ethanol facility. Wheat straw and corn stover residues would need to be collected from over 70,000 acres to support a 20 M gallon facility, assuming 60% of the residues where harvested. Determination of ethanol production through laboratory analysis is needed to verify these estimates. A comparison of yields of Kanlow and Cave In Rock in several states show the yield potential of switchgrass production in Washington is on par with states where it is native (Table 2).

Table 1: Biomass Variety Trials Yield Data (Paterson, WA)

		Biomass Yield (tons/acre)	Ethanol Yield** (gallons/acre)	Acres Necessary to Supply 20 M gal Facility	% of Planted Crop Acreage
Crop	Wheat Straw	5.3	219 +	91, 324	61.7
	Corn (grain)	6.3	580	34, 480	46.4
	Corn (stover)	5.8	278 +	71, 940	93
	Corn (G+S)	12.1	858	23, 310	34.5
Switchgrass Variety	Cave'n Rock	5.9	472	42, 375	24.4 ++
	Shawnee	6.8	544	36, 765	21.1 ++
	Kanlow	8.4	672	29, 760	17.1 ++

** Ethanol recovery from wheat straw and corn stover is estimated at 69 gallons/ton, from corn starch is 92 gallons/ton and switchgrass biomass is 80 gallons/ton.

+ Assumes 60% removal of residues.

++ Acreage based on percentage of current forage and hay cropland.

Continued on next page

Table 2: US Swithgrass Yields

State/ Region	Switchgrass Variety Yields + (tons/ac)	
	Kanlow	Cave In rock
Texas	4.5	2.4
Upper South	5.5	4.2
Alabama	8.3	4.2
Iowa	5.8	--
Nebraska	9.2	7.3
Washington	8.4	5.9

+ Values presented are the sum of two cuttings.

Summary

We lack the production history for switchgrass compared to other areas of the US where this grass is native. However, in our studies we have identified two important results: 1) results from the initial planting in 2002 show that yields continue to increase each year as stands thicken and the crop is managed for biofuel, and 2) second year production yields were similar to those reported in the mid-west with six-year old stands. Switchgrass requires between three and five years to develop mature plants and our oldest plantings are just now reaching that age. The high yields recorded on juvenile stands suggest mature stand yields could be even greater. Continued evaluation of switchgrass will determine the extent to which it may prove to be a viable alternative to the use of corn or crop residues (like wheat straw) for ethanol production. At this time, it appears that switchgrass is a viable crop in the warmer regions of the PNW if natural rainfall is adequate or irrigation water is applied. Likely, switchgrass will not be raised in the Willamette Valley due to 1) cool summer temperatures, and 2) lack of summer irrigation. Therefore, the primary locations for production will be Eastern Washington and Oregon with their longer growing seasons, hot-dry weather, and access to irrigation.

Events

2008 Organic Seed Growers Conference

This event will be held February 14-15, 2008, at the Salem Convention Center in Salem, Oregon. Co-hosted by the Organic Seed Alliance, Washington State University, and Oregon State University, the Organic Seed Growers Conference comprises the largest meeting of seed professionals engaged in organic seed production, research, and plant breeding in the United States. This event brings together producers, university Extension and researchers, seed industry professionals, and food industry participants from across the country.

In preparation for the 2008 Conference, the conference committee seeks input from diverse public and private stakeholders in developing an agenda. The organizers welcome ideas for topics and suggestions for speakers. Please email your input to Micaela Colley and include the following information: name and contact information (for follow-up questions), suggested topics, suggested speakers, and any additional input regarding conference format and agenda.

Call for Proposals. Input and proposals for presentations and posters must be submitted by June 1, 2007. Applicants for presentations and posters will be notified by August 1, 2007. To submit a proposal for a presentation or poster, please contact Micaela Colley with the following information: contact information, name and title of speaker or author, title of presentation or poster, topic of presentation or poster, target audience, and a brief description (300 words or less). All presenters are required to submit papers for publishing in the conference proceedings. Please inquire if you need assistance in developing presentations, posters, or papers.

Workshop - Integrated Plant Protection Center

The Integrated Plant Protection Center of OSU will host a Participatory Research Workshop May 1st, 2007, 9:00 - 5:00 at the Peavy Arboretum Lodge at Oregon State University in Corvallis, Oregon. All PNW researchers, farmers, non-profit and agency personnel who would like to improve the quality of agricultural research by increasing their skills in participatory research are welcome and encouraged to participate in this hands-on workshop. There will be a small fee and lunch will be provided. Contact Gwendolyn Ellen at 541-737-6272 for information.

Announcements

International Exchange for Agricultural Research

Lori Anderson, Exchange Visitor Program Manager

Matthieu Reigne, 22, grew up on his family's 750-acre farm in the southwest of France. He worked in the corn, wheat, and sunflower fields from a young age and was particularly enchanted with the farm's 32 acres of plum and hazelnut orchards. After graduating from high school, he went on to receive technical degrees in both agriculture and horticulture. He spent the following two years applying his knowledge and skills within the family-owned business.

With this background and experience, Matthieu applied to the Experience International (EI) J-1 visa training program. He wanted to learn as much as he could about hazelnut breeding and production in the U.S. Experience International matched him with OSU horticultural researcher Dr. Shawn Mehlenbacher who directs a hazelnut breeding program focused on creating disease-resistant varieties of hazelnut trees, especially those resistant to Eastern Filbert Blight (EFB). Although the disease has not yet spread to Western Europe, Matthieu knew he could enrich his understanding of hazelnut production while assisting Dr. Mehlenbacher with his research.

Experience International, a non-profit agricultural exchange organization specializing in J-1 visa training programs, arranged a six-month work-training internship for Reign as his official J-1 sponsor. Experience

Continued on next page