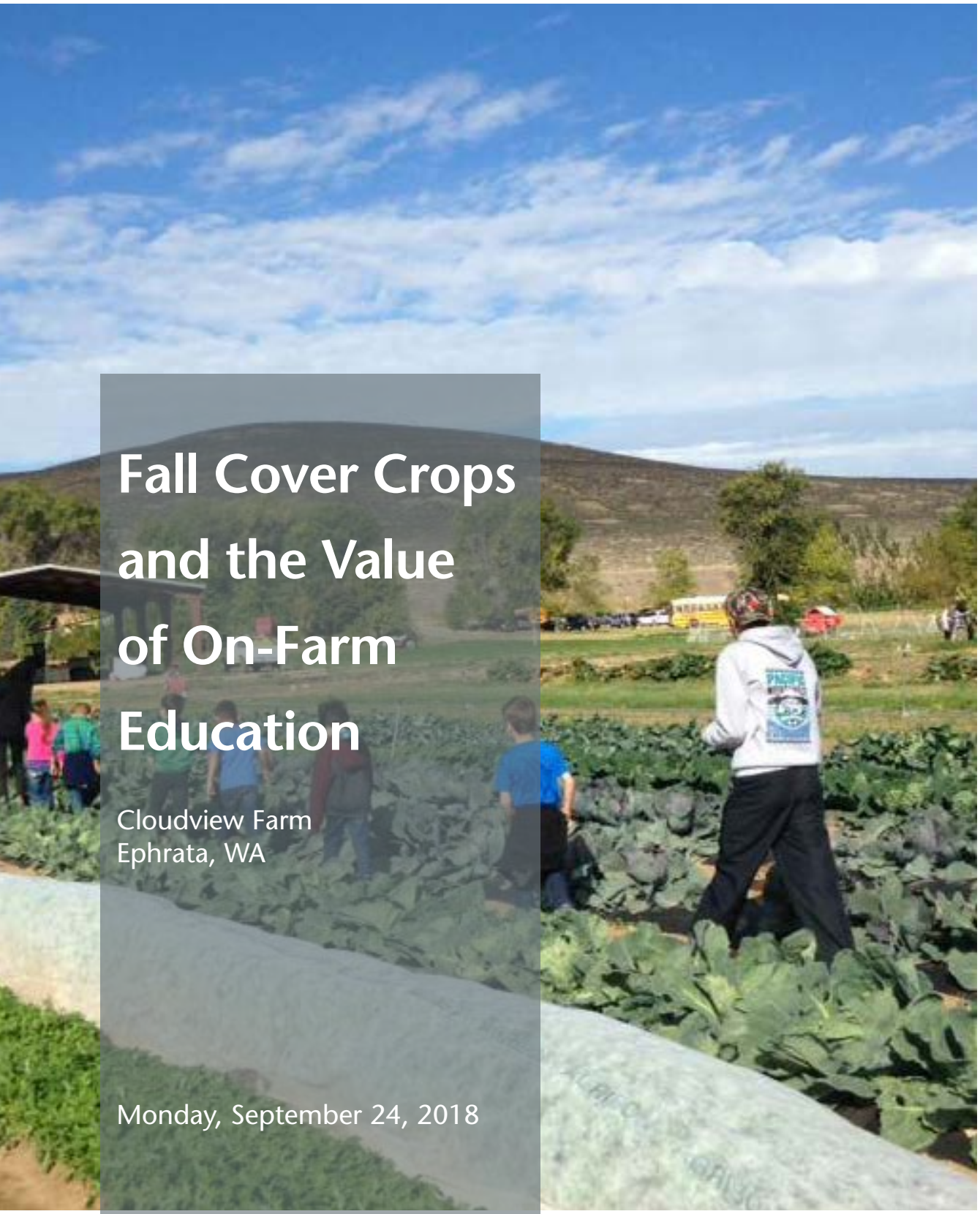
Education for Farmers, by Farmers



Fall Cover Crops and the Value of On-Farm Education

Cloudview Farm
Ephrata, WA

Monday, September 24, 2018

FARMWALK2018

presented collaboratively by:

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Section 1
About Cloudview Farm

Cloudview Farm will demonstrate how, when, and why they sow fall cover crops, while experts will share research from projects being conducted on site. Farmer Jim Baird will also share his expertise on the value of school tours and on-farm education for market diversification.

Section 2
Related Publications

Section 3
Additional Resources

WSU Food Systems Program and Tilth Alliance have been collaboratively presenting Farm Walks for 15 years! Farm Walks are designed to transfer the hard-earned expertise of established farmers to the current and next generations of sustainable producers. Each Farm Walk features farmer-to-farmer education through a tour of farm or business, with guest experts on hand to share the most current research and resources.

USDA
U.S. Department of Agriculture
Risk Management Agency

Funding for this event is provided by USDA Risk Management Grant

About Cloudview Farm

Cloudview Farm is on a mission to improve life in the Ephrata, Soap Lake and Moses Lake communities. You are what you eat, so we grow all of our food without the use of synthetic chemical fertilizers or pesticides.

Born and raised in the Columbia Basin of Central Washington, Jim has been farming for over 40 years. Jim has been involved and served with the Washington apple community, Growers Clearing House board, Washington State Hay Association, Center for Sustaining Agriculture and Natural Resources, and is presently a Tilth Alliance Board member. He is a graduate of the Washington Agricultural Forestry Leadership program and has consulted in Central and Eastern Europe in agricultural systems and orchard development. Jim has operated apple orchards, mixed vegetables, row crops (potatoes, onions, squash, beans, and corn), wheat, and alfalfa. Jim's current passion is for soil building (cover crops, crop rotation, compost and other amendments) along with developing and supporting education and demonstration farms that increase the public's awareness of agriculture.

Cloudview Farm was founded in 2006 in Royal City, and the farm in Ephrata was added in the spring of 2012. These educational farms are designed to provide a space for young people to learn and embrace agriculture. Cloudview Farm has forged relationships with schools, farmers markets, restaurants, and community members in the Basin. Cloudview Farm promotes community wellness through their children's educational programming and community events. Cloudview participates in community projects with similar missions like the Ephrata Farmers Market and Healthy Community Ephrata project.

GROWING HEALTHY FOOD
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GROWING HEALTHY COMMUNITIES

www.cloudviewfarm.org

Cover Crop Type Affects Biomass and Maturation: Implications for Management

Nate Stacey and Doug Collins, WSU CSANR, Puyallup, WA.

Cover crops are utilized in agro-ecosystems to protect against soil erosion, reduce nitrate losses and improve soil and water quality. Functionally, cover crops can be grouped into different classes such as cereals, legumes, and, brassicas. Cereals generally provide the largest biomass and are good for smothering weeds, legumes add nitrogen to the system, and brassicas may suppress soilborne diseases and nematodes.

Within each class, different species or cultivars are available for use as a cover crop. Variability among varieties can be tapped for different management objectives. For example, no-till termination of cover crops without herbicides (with a roller crimper or mower) requires that the crop be in flower, so an early flowering species may be desirable. If the crop is to be incorporated into the soil through tillage then a later maturing crop may be better, especially with cereals. As cereals mature the carbon to nitrogen ratio (C:N) will increase meaning that large amounts of carbon are incorporated without sufficient nitrogen to support decomposition and nitrogen will be temporarily tied up by microbes (immobilized).

We conducted a cover crop trial at 6 farm sites in western Washington and 1 farm site in central Washington to record dates of key plant developmental stages and to assess cover crop biomass at an 'early' and 'late' termination date.

Cover crop planting and termination

Cover crops were planted in late September or early October 2017 with either a drill or by broadcasting (Table 1). Each participating farmer used their own equipment for preparing the soil and planting. For broadcast plantings, seeding rates were increased.

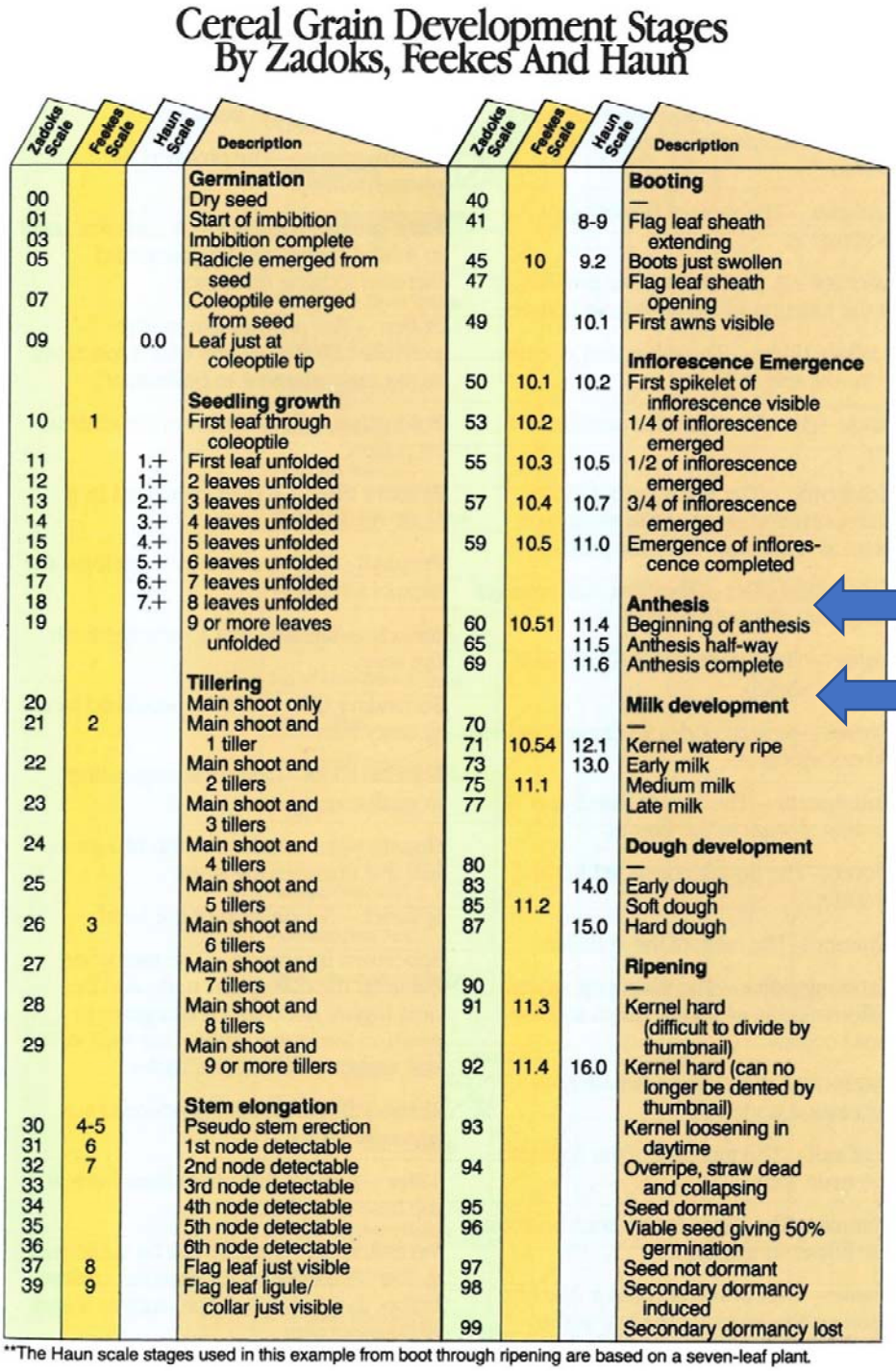
Table 1. Location, planting date, and planting strategy.

Location	Planting Date	Drill or Broadcast*
Cloud Mountain Farm	29 Sept 2017	Broadcast
Cloudview EcoFarm Ephrata	29 Sept 2017	Drill
Kirsop Farm	5 Oct 2017	Drill
Organic Farm School	28 Sept 2017	Broadcast
Organic Seed Alliance	13 Oct 2017	Broadcast
Oxbow Farm	26 Sept 2017	Drill
WSU Puyallup	28 Sept 2017	Drill

*Grains were planted at 100 pounds/acre with a drill or broadcast at 180 pounds/acre. Vetches were planted at 60 pounds/acre with a drill or broadcast at 90 pounds/acre.

Cover crops were harvested at an 'early' and 'late' date based on their growth developmental stages (phenological stage). The target early harvest for cereals was stem elongation and the target for late termination was mid-pollination. The phenological stage of cereals can be assessed numerically with the Zadok's scale (Figure 1.) On the Zadok's scale, the target was 35 for early and 65 for late. The target early harvest for vetches was bud break and the target late harvest was late flowering. The Mischler scale (Mischler et al., 2010) can be used to quantify vetch development. On the Mischler scale, our target for early was 1.1 and the target for late was 5 or 6.

Figure 1. Zadoks scale and preferred timing for cover crop termination for incorporation or reduced tillage mulch



Cereal Grain Development Stages By Zadoks, Feekes And Haun

Zadoks Scale	Feekes Scale	Haun Scale	Description
			Germination
00			Dry seed
01			Start of imbibition
03			Imbibition complete
05			Radicle emerged from seed
07			Coleoptile emerged from seed
09		0.0	Leaf just at coleoptile tip
			Seedling growth
10	1		First leaf through coleoptile
11		1.+	First leaf unfolded
12		1.+	2 leaves unfolded
13		2.+	3 leaves unfolded
14		3.+	4 leaves unfolded
15		4.+	5 leaves unfolded
16		5.+	6 leaves unfolded
17		6.+	7 leaves unfolded
18		7.+	8 leaves unfolded
19			9 or more leaves unfolded
			Tillering
20			Main shoot only
21	2		Main shoot and 1 tiller
22			Main shoot and 2 tillers
23			Main shoot and 3 tillers
24			Main shoot and 4 tillers
25			Main shoot and 5 tillers
26	3		Main shoot and 6 tillers
27			Main shoot and 7 tillers
28			Main shoot and 8 tillers
29			Main shoot and 9 or more tillers
			Stem elongation
30	4-5		Pseudo stem erection
31	6		1st node detectable
32	7		2nd node detectable
33			3rd node detectable
34			4th node detectable
35			5th node detectable
36			6th node detectable
37	8		Flag leaf just visible
39	9		Flag leaf ligule/ collar just visible
40			**Booting** —
41		8-9	Flag leaf sheath extending
45	10	9.2	Boots just swollen
47			Flag leaf sheath opening
49		10.1	First awns visible
			Inflorescence Emergence
50	10.1	10.2	First spikelet of inflorescence visible
53	10.2		1/4 of inflorescence emerged
55	10.3	10.5	1/2 of inflorescence emerged
57	10.4	10.7	3/4 of inflorescence emerged
59	10.5	11.0	Emergence of inflorescence completed
			Anthesis
60	10.51	11.4	Beginning of anthesis
65		11.5	Anthesis half-way
69		11.6	Anthesis complete
			Milk development
70			—
71	10.54	12.1	Kernel watery ripe
73		13.0	Early milk
75	11.1		Medium milk
77			Late milk
			Dough development
80			—
83		14.0	Early dough
85	11.2		Soft dough
87		15.0	Hard dough
			Ripening
90			—
91	11.3		Kernel hard (difficult to divide by thumbnail)
92	11.4	16.0	Kernel hard (can no longer be dented by thumbnail)
93			Kernel loosening in daytime
94			Overripe, straw dead and collapsing
95			Seed dormant
96			Viable seed giving 50% germination
97			Seed not dormant
98			Secondary dormancy induced
99			Secondary dormancy lost

**The Haun scale stages used in this example from boot through ripening are based on a seven-leaf plant.

Reduced Tillage Termination of Grain Cover Crops

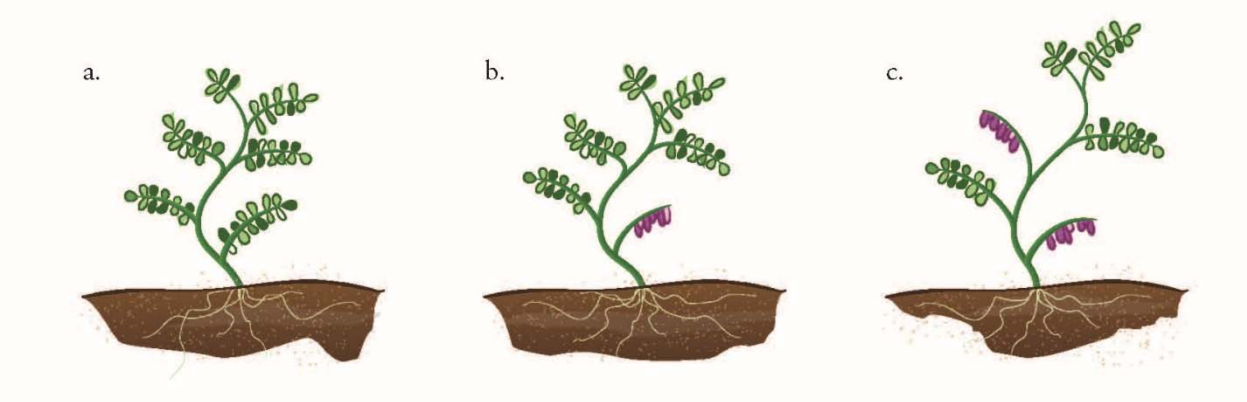
Early anthesis: Mowing will consistently terminate crop at this point. Crop may stand up if rolled

Late anthesis: Rye will consistently stay down if rolled, but seeds likely formed (in western WA).

Incorporating Grain Cover Crops

Stem elongation: incorporate grain cover crops during elongation for the best balance of

Figure 2. Vetch growth stages based on the upper 5 nodes of the vine

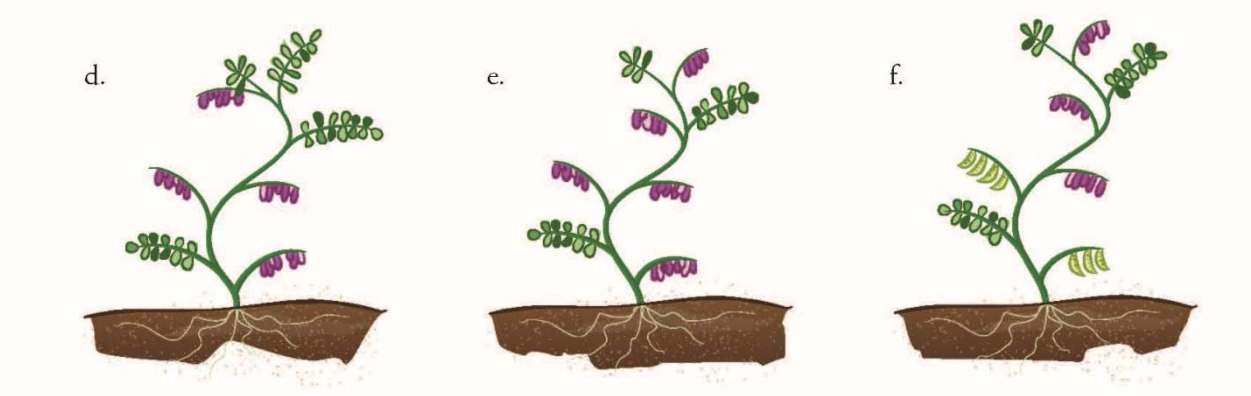


Vegetative
1

20% Flower
2

40% Flower
3

Consistent control with
mowing in W. Washington



80% Flower
5

100% Flower
6

Early Pod Set
7

Reported control with
rolling/crimping in other climates

To evaluate vetch flowering, at least three stems per subplot are chosen at random and evaluated. Following the method of Mishler et al. (2010), the first five nodes below the apical meristem are counted. Nodes have to be at least 5 cm apart or the next sequential node is counted. Each node is recorded as a bud, flower, or pod to classify the growing stage. Flowers include "any purple color on the raceme."

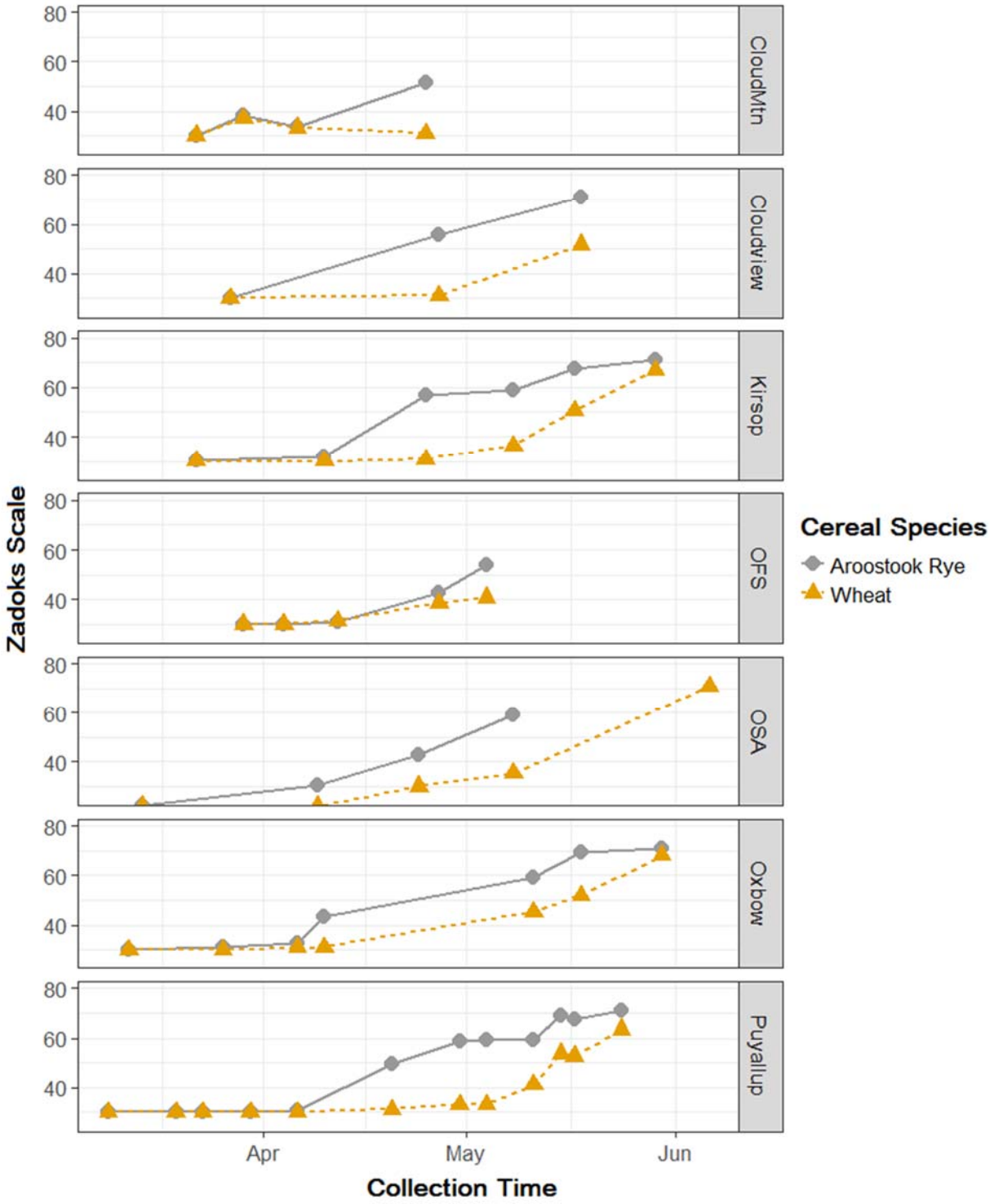
Mischler, R., S. Duiker, W. Curran, and D. Wilson. 2010. Hairy Vetch Management for No-Till Organic Corn Production. Agronomy Journal 102: 355–362.

The best time to terminate a cover crop is dependent on specific needs for the following crop. For incorporating cereals into the soil, termination is recommended during the elongation stage (Zadoks 30-39), to maximize a balance between biomass and C:N. Vetches provide more flexibility in terms of nitrogen management. Waiting until flowering (between Mischler 1 and 2) will increase biomass and maximize the nitrogen contribution from the crop. For reduced tillage termination, a flail mower provides more flexibility than a roller crimper. Flail mowing is effective for terminating vetches at Mischler 2 to 7 and for terminating grains at Zadoks 60-80. Rolling crimping one time has not been successful in western Washington with either vetches or cereals, but may be more successful in dryer climates. In western Washington, rolling crimping at mid anthesis is does knock the crop down, but seed development continues. Dates of 'early' and 'late' harvests for cover crops are shown in Table 2. Plant development through time was characterized in both cereal (Aroostook rye and wheat, Fig. 3) and vetch (hairy and common, Fig. 4) cover crops using the Zadoks and Mischler scales, respectively.

Table 2. Early and late harvest dates for different cover crops

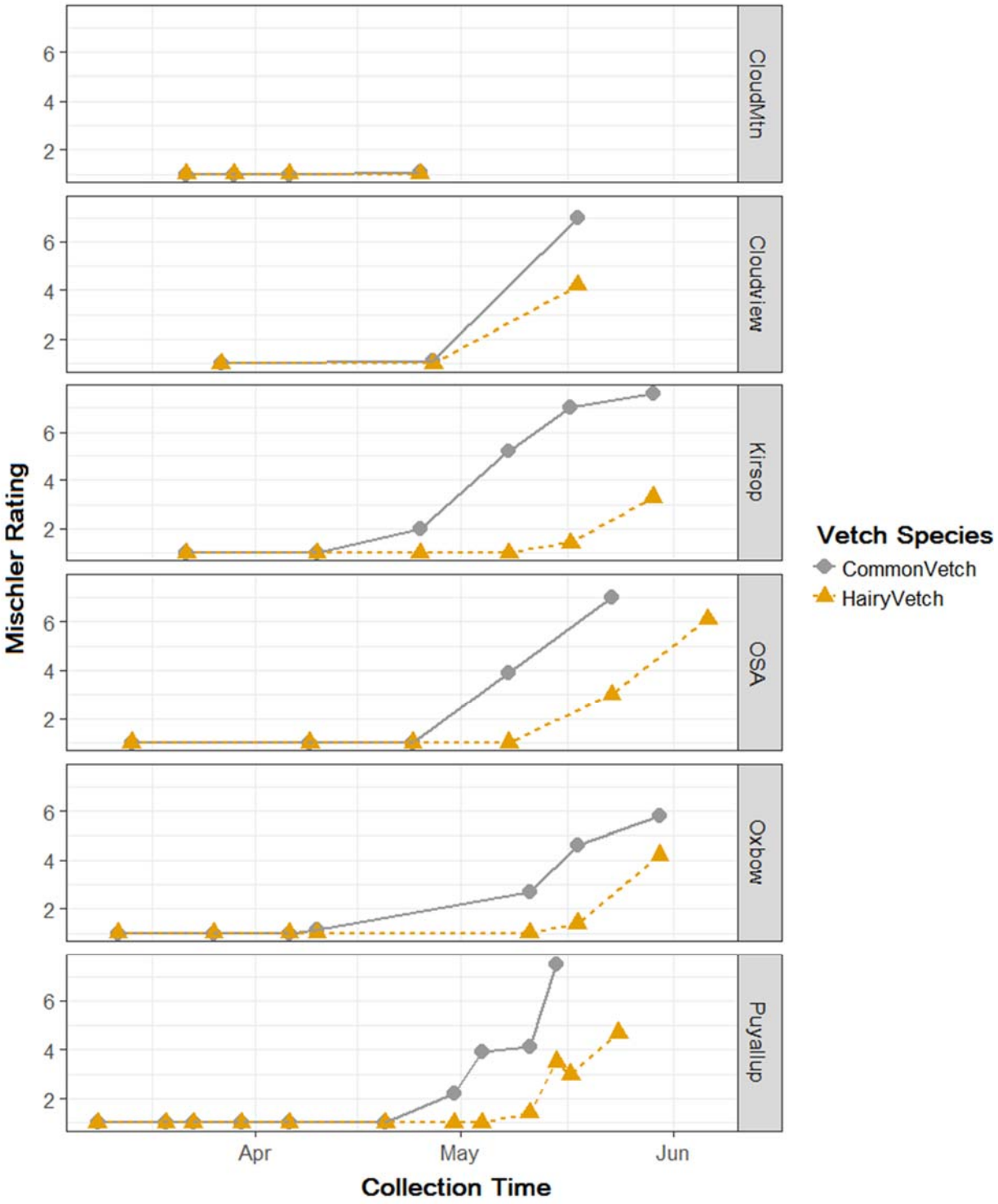
Location	Early Harvest Date	Late Harvest Date
Common Vetch		
Cloud Mountain	25 April	ND
Cloudview	27 April	18 May
Kirsop	25 April	8 May
Organic Farm School	Failed crop	Failed crop
Organic Seed Alliance	8 May	23 May
Oxbow	24 April	31 May
Puyallup	1 May	11 May
Hairy Vetch		
Cloud Mountain	ND	ND
Cloudview	27 April	18 May
Kirsop	16 May	11 June
Organic Farm School	16 May	ND
Organic Seed Alliance	23 May	6 June
Oxbow	18 May	31 May
Puyallup	10 May	11 June
Aroostook Rye		
Cloud Mountain	10 April	ND
Cloudview	27 April	18 May
Kirsop	10 April	17 May
Organic Farm School	16 April	16 May
Organic Seed Alliance	24 April	5 June
Oxbow	10 April	18 May
Puyallup	13 April	18 May
Bobtail or Farnam Wheat		
Cloud Mountain	25 April	ND
Cloudview	27 April	27 June
Kirsop	8 May	29 May
Organic Farm School	16 April	16 May
Organic Seed Alliance	8 May	6 June
Oxbow	24 April	31 May
Puyallup	4 May	29 May

Figure 3. **Development of Cereal Species at Different Farms**



Ratings on each date are the mean of 10 observation). Wheat at Cloudview was planted to 'Farnam', all others planted to 'Bobtail'.

Figure 4. Development of Vetch Species at Different Farms



Ratings on a date are the mean of 10 observations.

Biomass

Dry biomass production of cultivars of cereal ('Aroostook' rye and 'Bobtail' and 'Farnam' wheat) and vetch (common and hairy vetch) cover crops at study sites are shown in Figures 5 and 6.

Figure 5. Cereal Biomass Production Early and Late Season

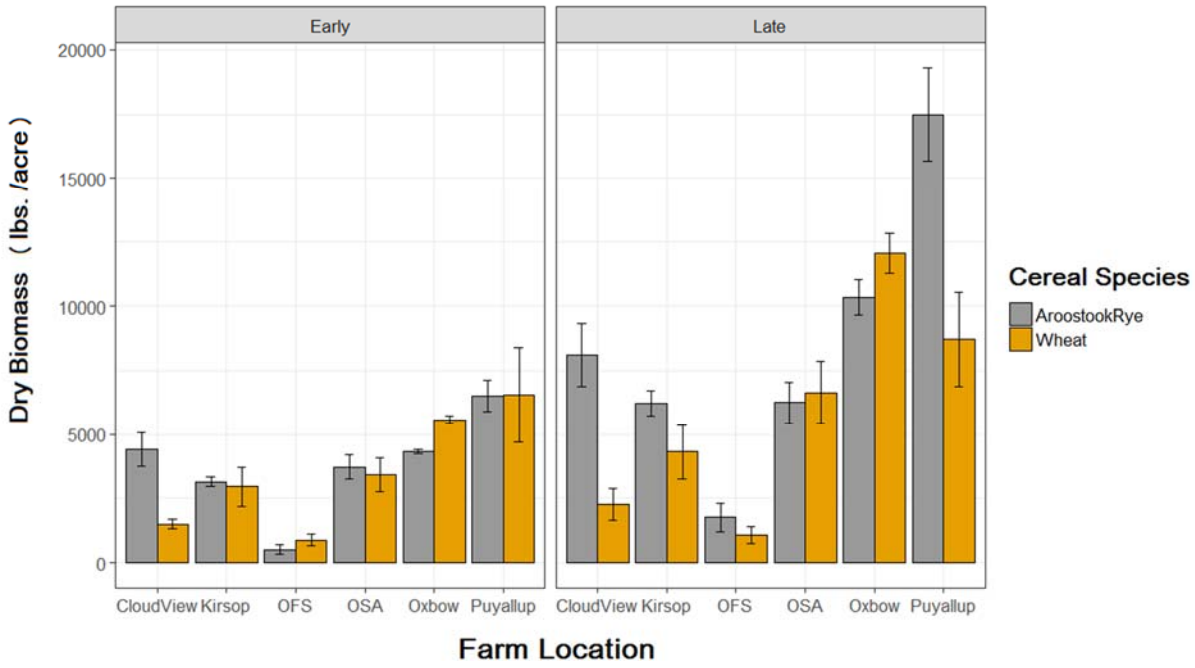
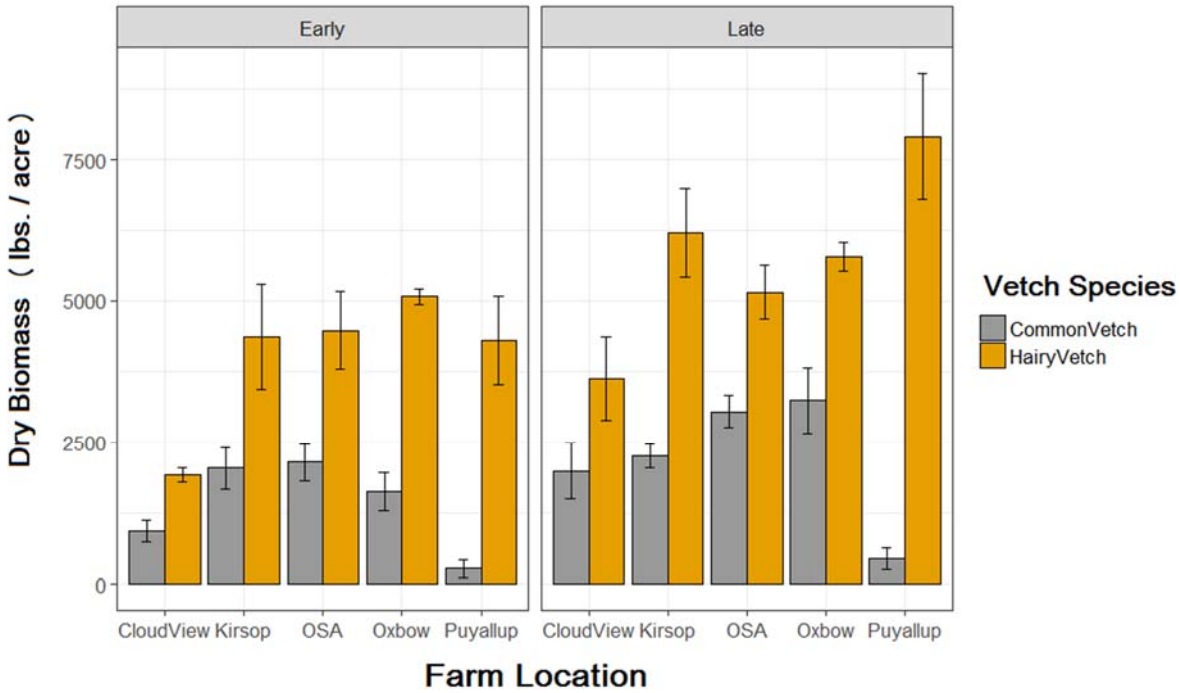


Figure 6. Vetch Biomass Production Early and Late Season



Vertical bars represent the standard deviation of the sample *(n=3)*. Wheat at Cloudview was planted to 'Farnam', all others planted to 'Bobtail'.

WASHINGTON STATE UNIVERSITY EXTENSION

MUSTARD GREEN MANURES

By
Andrew McGuire, Irrigated Cropping Systems Agronomist,
Washington State University Extension.

WSU PEER REVIEWED
FS219E

Mustard Green Manures

Farmers are using several types of mustard for their ability to build soil quality and to suppress soilborne diseases, nematodes, and weeds. Described below are the practices typically used by farmers for mustard green manure crops in the irrigated Columbia Basin.

Types of Mustard

There are two types of mustard being used in the Columbia Basin: white mustard (*Sinapis alba*, also called *Brassica hirta* or yellow mustard) and oriental mustard (*Brassica juncea*, also called Indian or brown mustard). See Figures 1 and 2. Commercial varieties are used to produce table mustard, oil, and spices. Blends of the two types of mustard, most with a high proportion of oriental mustard, are often planted for green manuring.

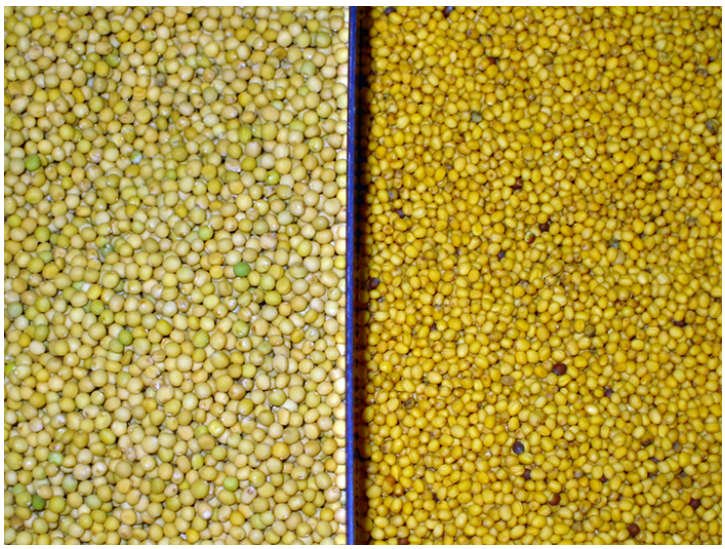


Figure 1. White mustard seed *(Sinapis alba)* on left; Oriental mustard seed *(Brassica juncea)* on right.

Uses

Farmers are using mustard green manures, mainly before potatoes, to:

Suppress soilborne diseases and nematodes. When used as a green manure, researchers (Larkin and Griffin 2007, Ochiai et al. 2008) have found that mustards can suppress some diseases such as Verticillium dahliae and *Aphanomyces euteiches* (common root rot). Mustard green manures have also been found to suppress Columbia root-knot nematodes and may be effective against other types of nematodes (Mojtahedi et al. 1993; Fourie et al. 2016). However, because even low levels of some nematodes puts potato crops at risk of being rejected by processors, mustard cover crops should be used to enhance, not eliminate, chemical control of nematodes. Fall incorporation works best for control of nematodes and soilborne diseases and, oriental mustard may be better for this use than white mustard for disease suppression (Lazzeri and Manici 2001). Research is ongoing.

Suppress weeds. Weed control using mustard green manures has been variable (Haramoto and Gallandt 2004). The level of suppression seems to depend on the combination of mustard type and weed species and on the management of the green manure crop.

Biofumigation. Reductions in the numbers of nematodes, disease problems, and weeds are thought to be due in part to the presence of glucosinolates in mustards (Matthiessen and Kirkegaard 2006).

Figure 2. White mustard *(Sinapis alba)* on left; Oriental mustard *(Brassica juncea)* on right.

When the crop is incorporated into the soil, the breakdown of glucosinolates produces other chemicals that act against pests. These chemicals are similar to the active chemical in the commercial fumigant metam sodium.

Improve soil quality. Regular use of mustard green manure crops, with reduced tillage, has been found to increase soil organic matter levels and water infiltration rates and reduce wind erosion (McGuire 2003).

Crop Characteristics and Requirements

Soils

Mustards tolerate saline soils as well as barley and grow in soils with pH 5.5–8.3.

Temperature

Healthy, unstressed mustard plants can withstand temperatures into the low 20s (°F).

Herbicide Sensitivity

Mustards are sensitive to glyphosate as well as to 2,4-D and various other broadleaf herbicides. They may also be affected by carryover from herbicides used on previous crops.

Growth and Biomass

A mustard cover crop, planted in early to mid-August, will generally be in full bloom by the end of September in the Moses Lake area. Cool temperatures in September and October usually prevent it from producing viable seed before it is incorporated or freezes in late October or November. With approximately 100–120 lb available nitrogen and irrigation, mustards will produce up to 9,000 lb of dry matter per acre, depending on management and temperatures during the growing season (McGuire 2012).

Management

Seeding Dates

The optimal seeding time is during the second week of August; otherwise, up to the end of August is appropriate. With current varieties, planting in July is not recommended, as the mustard will mature quickly and require early incorporation to prevent production of viable seed.

Varieties and Sources

Several varieties and blends of both types of mustard are currently available. Plant seed that has been tested and certified not to be infected with the black leg (*Phoma lingam*) and black rot (*Xanthomonas campestris* pv. *campestris*) pathogens to avoid spreading these diseases. Most of Washington State is now protected by a Crucifer Quarantine to avoid introducing these pathogens on seed. If planting seed in an area where these diseases are established, plant only seed treated with fungicides that are effective against black leg or seed treated with hot water.

The mustards that are currently being used do not have hard or dormant seed. Cover crop varieties may not be acceptable for commercial purposes.

Wheat Straw

If possible when following wheat, leave the standing stubble to be incorporated with the mustard. This reduces the volunteer wheat emergence, avoids nitrogen immobilization by the straw and the resulting need for additional nitrogen, and may reduce winter leaching by immobilizing nitrogen released by mustard residues. See Figure 3.

Seeding Rates and Methods

The following seeding rates are the minimum recommended rates for white mustard green manures. Seeding rates for oriental mustard, which has smaller seed, may be reduced by one third. Some producers are experimenting with higher seeding rates which will produce smaller stems and roots that decompose more quickly when incorporated.

Figure 3. Mustard green manure growing in standing wheat straw.

Drilled. Drill 8–10 lb seed per acre through wheat straw using a minimum or no-till drill, or a drill with offset, double-disk openers.

Aerial seeding. Fly on the day before wheat harvest at 10–15 lb per acre Keep surface wet until crop has emerged after 5–10 days. Rolling or packing the field before irrigation will result in better stands.

Broadcast. Same rate as aerial seeding. This can be done in combination with fertilizer application, followed by a pass of a noninversion undercutter V-sweep implement which also kills existing weeds (Figure 4). Alternatively, use a packer to press seed into soil or, if wheat straw is absent, a light cultivation.

Seeding Depth

For quick emergence, which improves weed control, a depth of 1/8–1/4 inches is recommended for center-pivot irrigated fields, or down to one inch where overhead irrigation is not available.

Figure 4. An undercutter like this can be used to incorporate broadcast mustard seed while also killing weeds.

Seed Cost

Cost of seed is $2.00–2.40 per lb as of 2015. Commercial condiment varieties may be less expensive but may also be less suited for use as green manures. Ask your seed dealer.

Fertilization

Test soil to determine residual soil nitrate available to crop. For optimum growth, 120 lb available nitrogen per acre total (100–140 range) is needed over the season, with sulfur at 6:1 nitrogen-to-sulfur ratio. Early applied nitrogen will help the mustard compete with weeds and volunteer wheat.

Irrigation

To attain maximum benefits, maintain adequate soil moisture throughout growing season. This is critical to keep the mustard plants vegetative as long as possible for maximum biomass production. Stress will initiate flowering and limit biomass production.

Weed Control

Because mustard does not compete well early on, weed control may be needed. For best mustard growth, control the volunteer wheat and other grassy weeds with selective herbicides. Broadleaf weeds, such as pigweed, that emerge at the same time as the mustard are difficult to control, although the mustard often outgrows the weeds. In addition, large weeds that may be left after wheat harvest should be controlled before mustard emergence (see the broadcast seeding method in the Seeding Rates and Methods section). Check to see which herbicides are currently labeled for use with mustard.

Incorporation

Irrigation water shut-off, or fall practices such as fumigation, can dictate the timing of incorporation. For maximum biomass production, wait until late October to early November in the upper Columbia Basin, or three to six weeks before spring planting. Flail chopping followed immediately by disking to incorporate into top six inches of soil is recommended for maximum biofumigation effects (Figure 5).

One of the effects of a green manure is to bind soil particles together, enhancing resistance to erosion. However, this is a short-term effect. Therefore, leave sufficient residue—mustard, straw, or both—where wind erosion may be a problem. Do not let soil dry out in the fall because this will inhibit breakdown of the incorporated cover crop.

Figure 5. Chopping and disking of a mustard green manure crop.

Growers of mustards have a responsibility to either incorporate or otherwise kill plants which survive in fields or field borders to prevent potential cross-pollination with seed crops. Compared with spring-incorporated cover crops, fall-incorporated mustards will scavenge less soil nitrogen and therefore may result in nitrate leaching in some conditions. Incorporating the green manure with wheat straw may reduce this risk.

Possible Problems

Insects. There is the potential for increased soil insect populations after incorporation. Incorporate in fall or four to six weeks before planting spring crops to avoid these problems. In very mild winters, when the mustard does not winterkill, green peach aphids may overwinter on mustards. To avoid this, kill cover crop before spring warm-up. Various aphids and loopers can attack mustard, but damage is generally limited in late summer- or fall-planted mustard.

Effects. The effects of mustard green manures may vary due to differences in soil texture, organic matter levels, and quality; crop rotation; mustard variety and growth; initial pest levels; and other biological factors.

Other Resources

Mustard Green Manures, WSU Center for Sustaining Agriculture and Natural Resources

Using Green Manures in Potato Cropping Systems

This is a revision of EB1952E, written by Andrew McGuire and published by WSU Extension in 2003.

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Use pesticides with care. Apply them only to plants, animals, or sites as listed on the label. When mixing and applying pesticides, follow all label precautions to protect yourself and others around you. It is a violation of the law to disregard label directions. If pesticides are spilled on skin or clothing, remove clothing and wash skin thoroughly. Store pesticides in their original containers and keep them out of the reach of children, pets, and livestock.

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U.S. Department of Agriculture
Risk Management Agency

Agricultural Risk Management

June 2018

Risk Management Planning

Due to the inherently risky nature of agriculture, it is important for producers to manage risks from five primary sources.

1. **Production**: weather, pests, diseases, and other factors affecting quantity and quality
2. **Financial**: debt repayment, restricted credit availability, and rising interest rates
3. **Marketing**: price variability, cost of inputs, and limited market outlets
4. **Human Resources**: business disruptions by health, accident, death or other personal problems
5. **Legal**: government changing laws, regulations, and support payment policies

A checklist to assess risk exposure in these areas is available here:
https://www.rma.usda.gov/pubs/2011/risk_management_checklist.pdf

USDA Tools for Farmers

Risk management involves choosing among alternatives that reduce financial effects that can result from uncertainties. The USDA has tools to help farmers in these risk planning endeavors, such as:

- **Crop Insurance:** through the Federal Crop Insurance Corporation, USDA and participating Approved Insurance Providers offer crop insurance to American farmers and ranchers to help them manage risks on their farms and ranches
- **Marketing Assistance:** USDA's FSA can provide assistance managing the market risks, including price loss and disparities faced by geographically-disadvantaged producers
- **Disaster Assistance**: USDA's FSA and Natural Resources Conservation Service (NRCS) can provide assistance for losses resulting from natural disasters such as drought, flood, fire, freeze, tornadoes, pest infestation, and other calamities
- **Risk-Management Education:** USDA provides funds to provide risk education and tools tailored for different regions of the country and types of farming operations

More information is available here: https://newfarmers.usda.gov/risk-management

Examples of Government Risk Management Programs

- **Federal Crop Insurance:** pays when weather or other natural causes adversely affect yield or crop value below a specified level
- **Supplemental Coverage Option:** additional insurance coverage for a portion of your underlying crop insurance policy deductible
- **Noninsured Crop Disaster Assistance Program:** provides financial assistance to producers of non-insurable crops when low yields, loss of inventory, or prevented planting occur due to natural disasters
- **Agricultural Risk Coverage Plan:** pays when county crop, or individual farm, revenue for covered commodities falls below 86% of benchmark revenue

- **Emergency Loans and Feed Assistance Programs:** disaster assistance packages, such as supply of pasture or hay for livestock producers when feed is limited due to drought or other adverse conditions

More information about these programs, and more, is available here:
https://www.rma.usda.gov/
https://www.fsa.usda.gov/

Whole-Farm Revenue Protection

Whole-Farm Revenue Protection (WFRP) provides a risk management safety net for all commodities on the farm under one insurance policy. This insurance plan is tailored for any farm with up to $8.5 million in insured revenue, including farms with specialty or organic commodities (both crops and livestock), or those marketing to local, regional, farm-identity preserved, specialty, or direct markets.

Why is WFRP important?
WFRP provides protection against the loss of insured revenue due to an unavoidable natural cause of loss which occurs during the insurance period and will also provide carryover loss coverage if you are insured the following year.

More information is available here: https://www.rma.usda.gov/policies/wfrp.html

Evaluation of Risk Management

Examining the effectiveness of a risk management plan is important to improve the success of your farm and mitigate more risks. A mechanism such as a checklist can be very useful in this evaluation:

- ☑ *Have the primary sources of risk been identified and classified?*
- ☑ *Have the risk outcomes and their likelihood or probability of occurring been estimated?*
- ☑ *Has the financial capacity of the business or ability to bear risk been evaluated?*
- ☑ *Have the risk tolerances of the business operators been considered?*
- ☑ *Are risk goals written and are they specific, measurable, attainable, relevant, and timed?*
- ☑ *Have the goals been shared with everyone involved in the business?*
- ☑ *Have risk tools and strategies been identified to help manage risks which could prevent achieving established goals?*
- ☑ *Has a confident relationship been established with a team of risk management advisors, so they can help assess and manage business and personal risk exposure?*

Additional Resources

Online Resources:

- **"An Evaluation of Soil Improvement Practices Being Used on Irrigated Soils in the Columbia Basin"**
  Andrew McGuire, Irrigated Cropping Systems Agronomist, WSU Extension & CSANR, Moses Lake, WA, David Granatstein, Sustainable Agriculture Specialist, WSU Extension & CSANR, Wenatchee, WA, Mark Amara, Moses Lake, WA
  http://extension.wsu.edu/publications/pubs/tb41/

- **"Improving Soil Quality on Irrigated Soils in the Columbia Basin"**
  David Granatstein, Sustainable Agriculture Specialist, WSU Extension & CSANR, Wenatchee, WA, Andrew McGuire, Irrigated Cropping Systems Agronomist, WSU Extension & CSANR, Moses Lake, WA, Mark Amara, Moses Lake, WA
  http://extension.wsu.edu/publications/pubs/fs252e/

- **"Soil Fertility in Organic Systems: A Guide for Gardeners and Small Acreage Farmers"**
  Doug Collins, Small Farms Extension Specialist, Center for Sustaining Agriculture and Natural Resources, WSU Puyallup; Carol Miles, Vegetable Extension Specialist, Department of Horticulture, WSU Mount Vernon; Craig Cogger, Soil Scientist and Extension Specialist, Department of Crop and Soil Sciences, WSU Puyallup; and Rich Koenig, Soil Scientist and Director of Extension, WSU Pullman.
  http://cru.cahe.wsu.edu/CEPublications/PNW646/PNW646.pdf

- **"Cover Crops for Home Gardens East of the Cascades"**
  Craig Cogger, Chris Benedict, Nick Andrews, Steve Fransen, Andy McGuire
  http://cru.cahe.wsu.edu/CEPublications/FS117E/FS117E.pdf
  Use this link if the top one doesn't work: http://pubs.wsu.edu/ItemDetail.aspx?ProductID=15659

- **"Methods for Successful Cover Crop Management in Your Home Garden"**
  Chris Benedict, Regional Extension Specialist, WSU Whatcom County Extension; Craig Cogger, Extension Soil Specialist, WSU Puyallup Research and Extension Center; Nick Andrews, Metro-Area Small Farms Extension Agent, OSU North Willamette Research and Extension Center
  http://cru.cahe.wsu.edu/CEPublications/FS119E/FS119E.pdf

Want to search for more?

WSU Publications: https://pubs.wsu.edu
WSU Extension: https://extension.wsu.edu

Notes

Notes

The Cascadia Grains Conference is presented by WSU Food Systems

Working to bring together farmers, bakers, brewers, distillers, brokers, investors, researchers and others in an effort to enhance the local food economy by sharing the latest science, techniques, and developments for niche-grains in the Cascadia region. Holding a space for new business, policy, and research relationships to form and existing ones to be strengthened.

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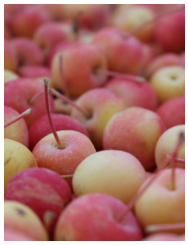


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