

## APPENDIX

Table 1: Recommended Cover Crop Mixes

<b>COVER CROP EXAMPLE MIXES:</b>				
<b>Multiple Species Cover Crop Mix (Cool Season planted prior to Soybeans )</b>				
<b>Crop Mixes</b>	<b>Seeding Rate Lb./Ac<sup>1</sup></b>		<b>Seeding Date</b>	<b>C:N ratio in Late Vegetative State<sup>5</sup></b>
	<b>Drilled</b>	<b>Broadcast</b>		
<b>Mix 1</b>				
Cereal Rye	20	26	August 15 to October 15	31
Oats <sup>2</sup>	20	26		
Austrian Winter Peas	11	14		
Crimson Clover	4	5		
Radish	1	1		
Turnip	0.5	0.5		
or				
<b>Mix 2</b>				
Cereal Rye	20	26	August 15 to October 15	32
Wheat	15	20		
Crimson Clover	4	5		
Radish	1.5	1.5		
Hairy Vetch	4	5		
or				
<b>Mix3</b>				
Cereal Rye	28	36		35
Wheat	28	36		
Crimson Clover	4	5		
Radish	1	1		
Turnip	0.5	0.5		
<b>Multiple Species Cover Crop Mix (Cool Season drilled only after double crop soybeans or cotton and up to 20% of land in full season soybeans.)</b>				
<b>Mix 4</b>				
Cereal Rye	20	-	Drilled only up to November 1	33
Triticale	20	-		
Turnip	0.5	-		
Crimson Clover or Hairy Vetch	5	-		
Austrian Winter Peas <sup>3</sup>	13	-		
or				
<b>Mix 5</b>				
Black oats	20	-	Drilled only up to November 1	26
Barley	20	-		
Annual ryegrass <sup>4</sup>	10	-		
Crimson Clover or Hairy Vetch	5	-		
Turnip	0.5	-		
<b>Basic Cover Crop Mix (Cool Season prior to Corn or Soybeans)</b>				
<b>Mix 6</b>				
Cereal Rye	20	26	August 15 to October 15	30
Wheat	20	26		
Crimson Clover	5	7		
Austrian Winter Peas	14	18		
Radish	1	1		

<b>Basic Cover Crop Mix (Cool Season prior to Corn)</b>				
<b>Mix 7</b>				
Wheat	25	32	August 15 to October 15	25
Crimson Clover	5	7		
Austrian Winter Peas	14	18		
Hairy Vetch	5	7		
Radish	1	1		
<b>Multiple Species Cover Crop Mix (Warm Season) Double crop soybean producers could plan a warm season cover crop to achieve 3 consecutive years of cover crops. This option is available to all producers.</b>				
<b>Mix 8</b>				
Buckwheat (optional)	1	1	April 20 to July 1	21
Sunflowers (optional)	1	1		
Sudangrass	10	13		
Millet (any)	4	5		
Cowpeas	11	14		
Soybeans (optional)	11	14		
Turnips	1.5	1.5		
Sunhemp	5	7		
<b>Multiple Species Cover Crop Mix (Self-Terminating) Must be approved by local District Conservationist.</b>				
<b>Mix 9</b>				
Spring Oats	90	117	August 1 – Sept. 10	27
German Millet	20	26		
Spring Pea	15	20		
Radish	1.5	1.5		
Buckwheat	4	5		
Sunflower	2	3		

<sup>1</sup> If grazing is planned increase small grain seeding rate up to 100lb./ac.

<sup>2</sup> Black oats may be substituted for Winter Oats, although in the northern and high elevation areas black oats may freeze out in colder winters. Spring oats provide quick cover but may smother other species so rate should not be increased above 20 lb/ac.

<sup>3</sup> Austrian Winter Peas can be an issue to plant cotton into.

<sup>4</sup> Annual ryegrass, especially Italian ryegrass can be difficult to kill and if it goes to seed it could volunteer later. Best to use a variety with annual ryegrass to improve control of termination. Use a cold tolerant variety if planting late. Annual ryegrass is easier to control when it is terminated at 10". Only recommended for producers with experience controlling it. Not recommended if you plan to grow wheat in the future.

<sup>5</sup> The Carbon: Nitrogen (C:N) ratio is recommended to be 30:1 or higher prior to low residue crops and below 30:1 prior to high residue crops.

- All mixes are only examples of mixes that can be used. Other mixes can be approved for use.
- Buckwheat and sunflower at a 1 lb/ac rate can be added to any mix as long as it is 30 or more days till the date of the average killing frost. These would add to diversity but at this rate they would not count as one of the five species in a mix
- Seed needs to meet the state seed law. It can be variety not stated (VNS), a Variety, certified seed or seed harvested from the producer's farm. Ideal is to be a Variety due to uniformity, Branded seed can be VNS seed.
- Seeding rate can be increased on all species but be aware that early production species can shade and reduce the stand of slower growing species. E.g. radish and or turnip could reduce the stand of other species.
- Some producers have reported a corn yield drag after cereal rye. If it is a concern other small grains can be substituted. Most likely the issue is too much carbon in mixture causing a higher C:N ratio.
- Recommend not using brassicas preceding cotton and caution using Austrian winter peas prior to cotton.
- Brassicas are heavy feeders and caution needs to be taken when using them. Maintain good fertility for the following crop.
- Mixes can be developed using the "smart mix 5\_20\_17 KB slim version.xlsx" calculator. No more than 1.5 lb. of brassicas is typically recommended in a mixture. Turnip and more so rape (canola) can be difficult to kill.
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- Cover crop species that have worked well in suppressing herbicide resistant weeds such as palmer amaranth and horseweed (maretail) are cereal rye, annual ryegrass, rape and black oats. Sorghums, warm season annuals are also reported to have some allelopathic nature.
- Legumes are typically coated and pre-inoculated if not order fresh inoculant and inoculate seed at seeding.

Full Rates of Single Species (not a complete list)					
Plant Species	Peak Bloom Period	Seeding Rate lb./Ac		Seeding Date	Note
		Drilled	Broadcast		
Barley (CSA)	May	90	112	Aug. 15 to Nov. 1	Can be planted later than most cereals
Buckwheat (WSA)	21 days after planting	35	42	June 1 to Aug. 15	Quick warm season cover, can be added as 1 lb/ac to any mix between the last frost and 30 days prior to the first frost
Clover, Crimson (CSA) (ss)	Late April or May	17	21	Aug. 15 to Oct. 15 Feb. 20 to Ap. 1	Tap root, late spring growth
Clover, Berseem (CSA) (ss)	June	11	14	Feb. 20 to Ap. 1	
Clover, Red (CSP) (ss)	July	8	10	Aug. 15 to Oct. 15 Feb. 20 to Ap. 1	
Cowpea	July	56	70	May 20 to June 20	High N producer
Millet, Browntop (WSA)	August	17	21	May 1 to July 1	Quick cover
Oats (CSA)	May	100	140	Sept. 1 to Oct. 1 Feb. 20 to Ap. 1	Spring oats can give quick cover in the fall but will winter kill and may smother other species. Black oats, not as cold tolerant as winter oats but may help weed control.
Phacelia	6 wks. after germ.	15	20	May 1 to June 20	Good for beneficial organisms
Radish, forage (CSA)	-	8	10	Aug. 15 to Oct. 15 Feb. 20 to Ap. 1	May freeze out. 1.5 lb/ac is enough in a mix
Rye, cereal (CSA)	May	90	112	Aug. 15 to Nov. 1	Highest biomass, most cold tolerant, may increase weed control. Tolerant of somewhat poorly drained soils
Ryegrass, annual	June	20	30	Aug. 15 to Oct. 15 Feb. 20 to Ap. 1	Can be invasive particularly in wheat. Deep rooted and tolerant of poorly drained soils
Sudangrass (WSA)	July	28	35	May 1 to June 20	Deep strong roots, can help in weed control
Sunflower (WSA)	July-Aug.	9	11	April 15 to May 15	Can be added as 1 lb/ac in a mix as late as 40 days prior to first frost
Sunhemp (WSA)	-	20	25	May 1 to July 20	Need 60 days minimum growth, N producer
Sweet clover (CSB)	July	13	17	Aug. 15 to Oct. 15 Feb. 20 to Ap. 1	Could be added as 1 lb/ac in a mix
Turnips (CSA)	-	3	4	Aug. 15 to Oct. 15 Feb. 20 to Ap. 1	No more than 1.5 lb/ac in a mix
Vetch, hairy (CSA)	May	22	28	Aug. 15 to Oct. 15 Feb. 20 to Ap. 1	Can be invasive particularly in wheat, tolerant of low fertility and somewhat poorly drained soils
Wheat (CSA)	June	90	112	Aug. 15 to Oct. 15 Feb. 20 to Ap. 1	Low cost, reduced vigor following sorghums
Winter Peas, Austrian	May	40	50	Aug. 15 to Oct. 15 Feb. 20 to Ap. 1	Somewhat slow to establish, produce a lot of biomass in spring

Note: CSA = Cool Season Annual, CSP= Cool Season Perennial, WSA= Warm Season Annual, ss = subsoiler crop or tap rooted, Ideal seeding depth is 8x the width of the seed. Typically in mixed species seeding depth should be 0.50" to 0.75".