Maturation Dates of Warm Season Cover Crop Species – 2017

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Objective: To conduct a preliminary evaluation of several species and varieties of warm season cover crops to determine adaptation and time to maturation in California's Central Valley.
County: San Joaquin
Average Annual Precipitation: 17.24 inches
MLRA: 17
Practice: 340-Cover crop
Dominant Soil Type: Vina fine sandy loam
Slope: 0-2%
Aspect: N/A
Elevation: 66 feet

Common Buckwheat 33 DAP	White Proso Millet 46 DAP

Figure 1. Quick maturing warm season cover crops at 50% bloom/anthesis at the Lockeford Plant Materials Center.

Site/Seedbed Preparation: The area was disked and cultipacked prior to planting.
Seeding Dates: 07/10/17
Seeding Rate: Recommended seeding rate.
Seed Cost: N/A
Seeding Method: Great Plains No-Till Drill Cone Seeder
Acres Seeded or Plot Design: Non-replicated demonstration with 5 x 25 foot plots.
Previous Site History: Not seeded or worked the previous year.
Fertilizer: None
Irrigation: ¾ inch (using linear precision irrigation system)
Monitoring Dates: July-Nov 2017

Introduction:

Warm season cover crops (WSCC) are rarely used in California because they require some irrigation for establishment in the hot, dry summers of the Mediterranean climate. WSCC can provide benefits of improved soil quality, enhanced nutrients, increased water holding capacity, and competitive suppression of weeds. Planted in late summer or early fall, WSCC protect the soil from erosion prior to the first fall rainstorms. Depending on selected species, WSCC may also contribute or retain nitrogen, while suppressing fall weeds and breaking pest cycles. Barriers to implementation of cool season cover crops into annual cropping systems include termination and residue concerns prior to planting the cash crop. WSCC avoid this problem since they winterkill with cold temperatures, leaving residue to prevent erosion in the fall. This residue will break down over the winter and enable early planting in the spring. When selecting a suitable cover crop, understanding the time to maturation (here defined as 50% bloom), is critical as the plants selected must mature quickly enough to provide suitable biomass, while not producing seed that could lead to future weed problems. The purpose of this demonstration was to determine the time of maturation for selected WSCC in California's Central Valley with minimal irrigation.

Methods:

The 2017/18 demonstration was drilled into Field 7 at the Lockeford PMC with a Great Plains Cone Seeder on July 10, 2017. During the previous year, this field was not seeded. Mechanical and chemical methods were used over the spring to control weeds. The field was disked and cultipacked prior to planting. Seeding rates vary depending on species (Table 1). Plots were approximately 25 feet long by 5 feet wide with 9 rows at 7 inch spacing. Legumes were inoculated prior to planting. After seeding, irrigation was applied 3 times during the growing season in ¼ inch amounts, by a linear irrigation sprinkler.

Results:

Plots were monitored, and photos were collected every week from time of planting to one month after the winterkill date on the morning of October 12, when the temperature dropped below 35 °F. Evaluations included germination/field emergence, bloom period, plant height, and percent canopy cover (shown in Table 1). Bloom period provides flowering data for pollinators and indicates maximum nitrogen content in the aboveground biomass at 50% bloom. Maturity was defined as the number of days after planting to reach 50% bloom or 50% anthesis within a plot. Plant height was the average height of lush canopy growth collected from three random locations within each plot at 50% bloom. Canopy cover was a visual estimate of the percentage of ground covered by the seeded species.

Table 1. Warm Season Cover Crop Evaluations at the Lockeford PMC in 2017.

Common Name	Scientific Name	Target Seeding Rate (lb/ac) [1]	Germination/ Emergence @ 28 DAP	Maturity[2] (DAP)	Height[2] (inches)	Canopy Cover[2]
Forbs						
Black Oil Sunflower	*Helianthus annuus*[3]	8	0 - 25%	72	48	45%
Common Buckwheat	*Fagopyrum esculentum*	55	70 - 85%	33	30	65%
Legumes						
California Blackeye Cowpea	*Vigna unguiculata*	75	50 - 65%	64	21	65%
Iron & Clay Cowpea	*Vigna unguiculata*	75	60 - 75%	92	29	85%
Red Ripper Cowpea	*Vigna unguiculata*	75	70 - 85%	64	21	90%
Victor Red Cowpea	*Vigna unguiculata*	75	70 - 85%	86	24	90%
Sesbania	*Sesbania exaltata*[3]	18	70 - 85%	79	58	80%
Tropic Sun Sunn Hemp	*Crotolaria juncea*	40	20 - 35%	92	55	40%
Tepary Bean	*Phaseolus acutifolius*[3]	30	30 - 45%	72	16	70%
Grasses						
Japanese Millet	*Echinochloa esculenta*	35	80 - 95%	72	38	90%
White Proso Millet	*Panicum miliaceum*	35	80 - 95%	46	28	80%
Piper Sudangrass	*Sorghum bicolor ssp. drummondii*	35	80 - 95%	72	>72	90%
Sorghum-Sudangrass	*Sorghum bicolor x Sorghum bicolor var. sudanense*	35	50 - 65%	72	>72	90%
Excalibur Teff	*Eragrostis tef*	12	40 - 55%	77	21	75%

[1]Actual seeding rates adjusted due to seed lot Pure Live Seed. [2]Data taken at 50% bloom/anthesis. [3]Native to the US.
DAP = Days After Planting.

Summary and Discussion:

The WSCC evaluated in this demonstration are drought tolerant and provide benefits of erosion prevention, organic matter, and pollinator and beneficial insect habitat. The fastest maturing WSCC (proso millet and buckwheat), provide quick cover for <60 day planting window (Figure 1). However, due to their early maturity, these cover crops can reseed and quickly turn into a weed problem if not managed properly. Slower maturing legumes, like cowpeas (depending on the variety), provide nitrogen, ground cover, and weed suppression (Figure 2). Reseeding of cowpea can also occur if pods form mature seed. Fast growing, vigorous, warm season grasses like Japanese millet, sudangrass, and sorghum-sudangrass are valuable for scavenging nitrogen, suppressing weeds, and breaking up compaction with their fibrous roots. However, if sudangrass, and sorghum-sudangrass grow tall, they produce large amounts of tough residue that are challenging to manage. Teff is a low growing grass that provides good forage, decomposes quickly, but only provides some weed suppression. Sunflower and tepary bean are slower growing and slower maturing warm season cover crops that would be best used in a mix with other more weed competitive species. Sunn hemp and sesbania are legumes and fix nitrogen. Sesbania may provide weed suppression, but becomes woody beyond 60 days, so early termination is recommended. Sunn hemp did not provide much weed suppression, or cover in this demonstration, as it may require more water than the 1 inch provided. This demonstration indicates several WSCC species are well adapted to California's Central Valley. Further investigations need to be conducted on disease and insect resistance, biomass production, and nitrogen contributions of these species. Their drought tolerance, ability to winterkill in the fall, and range in maturity dates suggest potential for WSCC incorporation into many California cropping systems.

References:

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California Blackeye Cowpea 64 DAP

Red Ripper Cowpea 64 DAP

Black Oil Sunflower 72 DAP

Tepary Bean 72 DAP

Japanese Millet 72 DAP

Piper Sudangrass 72 DAP

Sorghum-Sudangrass 72 DAP

Excalibur Teff 77 DAP

Sesbania 79 DAP

Victor Red Cowpea 86 DAP

Iron & Clay Cowpea 92 DAP

Tropic Sun Sunn Hemp 92 DAP

Figure 2. Warm season cover crop species at 50% bloom/anthesis at the Lockeford Plant Materials Center. Images placed by time to maturity.