Supplemental Table 1. Dates of cover crop planting and termination, dry bean planting, and the timing and number of weed management operations during the dry bean season at the main KBS and MSU sites.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Year | Locationa | Cover crop |  | Dry bean planting date | Weed management |
| Speciesb | Planting date | Termination date |  | First operation timing(DAPc) | Number of operations |
|  | Early season(<V2) | Mid-season(V2-R1) |
| 2011 | KBS | Clover | 3/19/10 | 6/3/11 |  | 6/17/11 | 3 | 3 | 1 |  |
|  |  | Radish | 8/16/10 | WKilld |  |  |
|  |  | Rye | 9/14/10 | 5/13/11 |  |  |
|  |  | No cover | - | 5/13/11 |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
|  | MSU | Clover | 8/17/10 | 6/3/11 |  | 6/20/11 | 2 | 2 | 1 |  |
|  |  | Radish | 8/17/10 | WKill |  |  |
|  |  | Rye | 9/10/10 | 5/12/11 |  |  |
|  |  | No cover | - | 5/12/11 |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
| 2012 | KBS | Clover | 4/1/11 | 5/30/12 |  | 6/18/12 | 17 | 2 | 1 |  |
|  |  | Radish | 8/23/11 | WKill |  |  |
|  |  | Rye | 9/21/11 | 5/10/12 |  |  |
|  |  | No cover | - | 5/30/12 |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
|  | MSU | Clover | 6/9/11 | 5/24/12 |  | 6/12/12 | 27 | 1 | 1e |  |
|  |  | Radish | 9/6/11 | WKill |  |  |
|  |  | Rye | 10/11/11 | 4/27/12 |  |  |
|  |  | No cover | - | 5/24/12 |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
| 2013 | KBS | Clover | 3/14/12 | 6/4/13 |  | 6/24/13 | 7 | 3 | 2 |  |
|  |  | Radish | 9/12/12 | WKill |  |  |
|  |  | Rye | 9/12/12 | 5/13/14 |  |  |
|  |  | No cover | - | 5/13/14 |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
|  | MSU | Clover | 3/19/12 | 5/20/13 |  | 6/20/13 | 11 | 2 | 3 |  |
|  |  | Radish | 8/20/12 | WKill |  |  |
|  |  | Rye | 9/17/12 | 5/9/13 |  |  |
|  |  | No cover | - | 5/9/13 |  |  |

a KBS- Kellogg Biological Station, Hickory Corners, MI. MSU- Michigan State University Horticulture Teaching and Research Center (2011 and 2012) and Agronomy Farm (2013), Lansing, MI.

b Clover= medium red clover, radish= oilseed radish, rye= cereal rye, no cover= weedy control.

c DAP= days after dry bean planting

d WKill= winter-killed

e This field was hand weeded once following R1.

Supplemental Table 2. Cover crop, dry bean, and weed management timings and weed density and biomass during the dry bean season at the on-farm satellite sites.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Cover cropa | Year | Location | Cover crop |  | Dry bean planting date | Weed management  |  | Weed dynamicsb |
| Planting date | Termination date |  | First operation timing(DAP) | Number of operations |  | V2 |  | R1 |
|  | < V2 | V2-R1 | >R1 |  | Density(#) | Biomass(g) |  | Density(#) | Biomass(g) |
|  |  |  |  |  |  |  |  |  |  |  |  | **──────** (10 m row-1)c **─────** |
| Clover | 2011 | Alma | 9/5/10 | 5/18/11 |  | 6/14/11 | 7 | 2 | 0 | 1 |  | 38 |  | 1.2 |  |  | 28 |  | 209.1 |  |
|  |  | Caro | 3/17/10 | 5/18/11 |  | 6/29/11 | 2 | 2 | 0 | 0 |  | 1 |  | 0.1 |  |  | 0 |  | 4.2 |  |
|  |  | Sandusky | 9/3/10 | 6/9/11 |  | 6/18/11 | 10 | 6 | 1 | 1 |  | 74 |  | 10.8 |  |  | - |  | - |  |
|  | 2012 | Sandusky | 6/18/11 | 5/24/12 |  | 6/20/12 | 3 | 4 | 1 | 1 |  | 15 |  | 2.7 |  |  | 6 |  | 55.2 |  |
|  | 2013 | Alma | 3/11/11 | 5/13/13 |  | 6/25/13 | 8 | 3 | 3 | 1 |  | 22 |  | 1.6 |  |  | 19 |  | 11.6 |  |
|  |  | Columbiaville | 3/30/13 | - |  | 6/20/13 | - | - | - | - |  | 14 |  | 1.4 |  |  | 12 |  | 11.1 |  |
|  |  | Sandusky | 9/5/12 | 6/6/13 |  | 6/19/13 | 5 | 3 | 1 | 0 |  | 6 |  | 4.4 |  |  | 10 |  | 56.8 |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Radish | 2011 | Alma | 8/24/10 | - |  | 6/30/11 | 3 | 5 | 1 | 1 |  | 7 |  | 0.1 |  |  | 5 |  | 11.6 |  |
|  |  | Caro | 9/3/10 | - |  | 6/4/11 | 10 | 2 | 2 | 0 |  | 0 |  | 0.0 |  |  | 0 |  | 0.0 |  |
|  |  | Millington | 9/10/10 | - |  | 7/1/11 | 11 | 2 | 2 | 1 |  | 14 |  | 1.3 |  |  | - |  | - |  |
|  | 2012 | Alma | 9/2/11 | - |  | 6/14/12 | 7 | 3 | 3 | 0 |  | 31 |  | 1.3 |  |  | 6 |  | 16.7 |  |
|  |  | Millington | 9/21/11 | - |  | 6/15/12 | 20 | 1 | 2 | 0 |  | 206 |  | 27.2 |  |  | 139 |  | 384.5 |  |
|  | 2013 | Alma | 8/24/12 | - |  | 6/25/13 | 8 | 3 | 3 | 1 |  | 18 |  | 0.6 |  |  | 13 |  | 6.9 |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Rye | 2011 | Caro-A | 11/3/10 | 5/10/11 |  | 6/13/11 | 2 | 3 | 0 | 2 |  | 42 |  | 2.4 |  |  | - |  | - |  |
|  |  | Caro-B | 11/3/10 | 5/18/11 |  | 6/29/11 | 2 | 2 | 0 | 0 |  | 9 |  | 1.1 |  |  | 10 |  | 61.9 |  |
|  |  | Columbiaville | 11/11/10 | 5/9/11 |  | 6/7/11 | 1 | 4 | 0 | 2 |  | 195 |  | 4.5 |  |  | 34 |  | 336.9 |  |
|  | 2012 | Caro | 11/4/11 | 5/19/12 |  | 6/14/12 | 2 | 3 | 3 | 1 |  | 15 |  | 4.4 |  |  | 0 |  | 0.0 |  |
|  | 2013 | Caro | 11/6/12 | 6/13/13 |  | 6/14/13 | 3 | 4 | 3 | 1 |  | 61 |  | 4.6 |  |  | 19 |  | 13.5 |  |

a Clover= medium red clover, radish= oilseed radish, rye= cereal rye, no cover= weedy control.

b Weed densities and biomass are averaged across the cover crop and no cover crop treatments at each site.

c The plants (10 m row)-1 measurement is 15 cm in width. Weed densities and biomass were only recorded within the row as most inter-row weeds were effectively removed via cultivation.

Supplemental Table 3*.* Monthly precipitationa and the 30-yr averages for the main sites, 2011 – spring 2014.

|  |  |  |  |
| --- | --- | --- | --- |
|  | KBSb |  | MSU |
| Month | 2011 | 2012 | 2013 | 2014 | 30 year average |  | 2011 | 2012 | 2013 | 2014 | 30 year average |
|  | **──────────────────────────────**mm**───────────────────────────────** |
| Jan. | 27 |  | 68 |  | 51 |  | 75 | 55 |  |  | 8 |  | 38 |  | 69 |  | 14 | 42 |  |
| Feb. | 69 |  | 36 |  | 189 |  | 61 | 50 |  |  | 19 |  | 26 |  | 23 |  | 13 | 37 |  |
| Mar. | 73 |  | 95 |  | 29 |  | 52 | 65 |  |  | 66 |  | 63 |  | 17 |  | 19 | 43 |  |
| Apr. | 133 |  | 91 |  | 160 |  | 59 | 91 |  |  | 135 |  | 53 |  | 165 |  | 21 | 73 |  |
| May | 74 |  | 34 |  | 128 |  | 81 | 99 |  |  | 152 |  | 73 |  | 84 |  | 74 | 84 |  |
| June | 26 |  | 37 |  | 108 |  | - | 101 |  |  | 44 |  | 28 |  | 115 |  | - | 83 |  |
| July | 131 |  | 40 |  | 76 |  | - | 98 |  |  | 178 |  | 64 |  | 56 |  | - | 82 |  |
| Aug. | 95 |  | 75 |  | 127 |  | - | 107 |  |  | 64 |  | 49 |  | 110 |  | - | 83 |  |
| Sept. | 79 |  | 40 |  | 19 |  | - | 119 |  |  | 67 |  | 59 |  | 18 |  | - | 93 |  |
| Oct. | 94 |  | 142 |  | 55 |  | - | 88 |  |  | 74 |  | 96 |  | 118 |  | - | 69 |  |
| Nov. | 109 |  | 14 |  | 113 |  | - | 86 |  |  | 76 |  | 8 |  | 55 |  | - | 69 |  |
| Dec. | 63 |  | 52 |  | 64 |  | - | 69 |  |  | 54 |  | 32 |  | 26 |  | - | 43 |  |

a Monthly precipitation data were collected from the Michigan State University Enviro-weather database (MSU Enviroweather 2014). Thirty year average data were collected from the Michigan State Climatologist’s office (MI Climatologist 2014).

b KBS- Kellogg Biological Station, Hickory Corners, MI. MSU- Michigan State University Horticulture Teaching and Research Center and Agronomy Farm, Lansing, MI.