Table S1. Article information used in meta-analysis of Canada thistle management in annual cropping systems. Articles that had information on crop yield are indicated by an \* next to the citation.

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| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **Study duration** | |
| **Citation** | **Study location** | **Annual cropping system description** | **Management technique** | **Herbicide groups** | **<1 year** | **≥1 year** |
| Armel et al. 2005 | Delaware, United States | corn | herbicide | 4, 27, mix | X |  |
| Asadi et al. 2013 \* | Mashhad, Iran | winter wheat | biocontrol | na | X |  |
| Bicksler and Masiunas 2009 | Illinois, United States | fallow, cover crop- buckwheat, sudangrass, or sudangrass-cowpea mix | crop diversification | na | X | X |
| Blasko and Nemeth 2006 | Hungary | corn | herbicide | 2, mix | X | X |
| Bondarenko 1957 | Ohio, United States | fallow | herbicide | 11 |  | X |
|  |  |  | herbicide integrated | 11 |  | X |
| Brosten and Sands 1986 | Montana, United States | fallow | biocontrol | na | X | X |
| Carlson and Donald 1988 | North Dakota, United States | spring wheat | herbicide | 9, mix | X | X |
| Carson and Bandeen 1975 | Ontario, Canada | fallow | herbicide | 4, 5 | X |  |
| Causey and Webb 1990 | Delaware, United States | corn | herbicide | mix | X |  |
| Curtis and Haagsma 1986 | Alberta, Canada | wheat, barley | herbicide | 4 | X | X |
| Darwent et al. 1994 | Alberta, Canada | barley, canola-barley-barley, lentil-barley-barley, wheat-barley-barley, field pea-wheat | herbicide | 9 |  | X |
| Davies and Orson 1987 | Norfolk and Essex, England | winter wheat | herbicide | 2, 4 | X |  |
|  | Cambridge and March, England | fallow | herbicide | 2, 4 |  | X |
| Derscheid et al. 1961 | South Dakota, United States | oats | herbicide | 4 | X | X |
|  |  |  | herbicide integrated | 4 | X |  |
| Donald 1993 | North Dakota, United States | fallow | herbicide | 4, 9 | X |  |
| Donald and Prato 1992a | North Dakota, United States | spring wheat | herbicide | 4, mix | X |  |
| Donald and Prato 1992b \* | North Dakota, United States | spring wheat | herbicide | 2, 4 | X |  |
| Faravani and Khlaghani 2004 | Khorasan, Iran | wheat | herbicide | 9, 2 | X |  |
| Glenn and Heimer 1994 \* | Maryland, United States | corn | herbicide | 2, 4, 9, mix | X |  |
| Graglia et al. 2006 | Slagelse, Denmark | grass/clover, spring barley | mowing | na |  | X |
|  |  | red clover, spring barley | soil disturbance | na |  | X |
| Gronwald et al. 2002 | Minnesota, United States | soybean | biocontrol | na | X |  |
| Hodgson 1958 \* | Montana, United States | spring wheat | fertilizer | na |  | X |
|  |  | fallow, spring wheat, peas | herbicide | 4 |  | X |
|  |  | spring wheat, potatoes and corn | herbicide integrated | 4 |  | X |
| Hoeft et al. 2001 | Minnesota, United States | soybean | biocontrol | na | X |  |
|  |  |  | herbicide | 6 | X |  |
| Howatt et al. 2006 | North Dakota, United States | spring wheat | herbicide | 9, mix | X |  |
| Kirkland 1977 \* | Saskatchewan, Canada | fallow | herbicide | 9 | X |  |
|  |  |  | herbicide integrated | 9 | X |  |
| Kluth et al. 2005 | Lower Saxony, Germany | fallow | biocontrol | na | X |  |
| Kwiatkowski 2009 | Lublin, Poland | spring barley | crop diversification | na | X |  |
| Lym and Deibert 2005 | North Dakota, United States | fallow | herbicide | 4, mix | X | X |
| McKay 1959 | Idaho, United States | potatoes | competition | na |  | X |
|  |  | spring wheat | fertilizer | na |  | X |
|  |  | spring wheat | herbicide | 4 |  | X |
|  |  | spring wheat-alfalfa | herbicide integrated | 4 |  | X |
| McKone 1989 | Montana, United States | barley | herbicide | 2, 4 | X |  |
| Miller 1987 \* | Wyoming, United States | barley | herbicide | 2, 4, mix | X |  |
| Miller and Lym 1998 | North Dakota, United States | corn, soybean | herbicide | 4, mix | X |  |
|  |  |  | soil disturbance | na | X |  |
| Miller et al. 1989 \* | Wyoming, United States | barley | herbicide | 4, 5, mix | X |  |
| Miller et al. 1994 \* | Wyoming, United States | sugarbeets | herbicide | 4 | X |  |
| Naish 1975 | New Zealand | fallow | herbicide | 4 | X |  |
| O'Donovan et al. 2001 \* | Alberta, Canada | barley-canola | herbicide | 4 | X |  |
| O'Sullivan 1982 | Alberta, Canada | barley and wheat | herbicide | 2 | X |  |
| O'Sullivan and Kossatz 1982 \* | Alberta, Canada | rapeseed | herbicide | 4 | X |  |
| O'Sullivan and Kossatz 1984a \* | Alberta, Canada | rapeseed | herbicide | 4 | X |  |
| O'Sullivan and Kossatz 1984b \* | Alberta, Canada | barley | herbicide | 4 | X |  |
| Parochetti 1974 | Maryland, United States | corn | herbicide | 5, 11 | X |  |
| Rabcewicz 1995 | Alnarp, Sweden | fallow | soil disturbance | na | X |  |
| Renner 1991 | Michigan, United States | sugarbeets | herbicide | 4 | X |  |
| Selleck and Baird 1981 | Pennsylvania, United States | corn and soybeans | herbicide | 9, mix | X |  |
| Singh and Malik 1992 | Hisar, India | fallow | herbicide | 4 | X |  |
| Terry and Wilson 1964 | Essex, England | winter wheat | herbicide | 5 | X |  |
| Thomsen et al. 2015 \* | As, Norway | spring wheat | crop diversification | na |  | X |
|  |  |  | non-herbicide integrated | na |  | X |
| Tolimir et al. 2006 \* | Belgrade, Serbia | corn | soil disturbance | na | X |  |
| Warden 1964 | South Dakota, Minnesota, and Wisconsin United States | fallow | herbicide | 4 | X |  |
|  | Montana, United States | winter wheat | herbicide | 4 |  | X |
|  | Minnesota, United States | oats | herbicide | 4 |  | X |
| Warnes 1974 | Minnesota, United States | fallow-corn | herbicide | 4 | X | X |
|  |  |  | herbicide integrated | 4 | X | X |
|  |  |  | soil disturbance | na | X |  |
| Wedryk and Cardina 2012 | Ohio, United States | fallow | competition | na | X |  |
| Westra and D'Amato 1988 | Colorado, United States | winter wheat | herbicide | 2, 4, 9, mix | X |  |
| Zimdahl and Foster 1974 | Colorado, United States | fallow | herbicide | 4, 5, 9, mix | X | X |
| Zimdahl and Foster 1979 | Colorado, United States | fallow | herbicide | 4, 5, 9, mix | X |  |
| Zimdahl and Foster 1993 | Colorado, United States | fallow | herbicide | 2, 4, 9 | X |  |
| Zuris et al. 1987 | Nebraska, United States | winter wheat-fallow | herbicide | 2 | X | X |

Table S2. Article information used in meta-analysis of Canada thistle management in perennial systems. Articles that had information on desired plant yield are indicated by an \* next to the citation.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **Study duration** | |
| **Citation** | **Study location** | **Perennial system description** | **Management technique** | **Herbicide groups** | **<1 year** | **≥1 year** |
| Almquist and Lym 2010 | Minnesota, United States | range | herbicide | 4 | X | X |
| Amor and Harris 1977 | Victoria, Australia | pasture | herbicide | 4, 9, 11 | X | X |
|  |  |  | mowing | na | X | X |
| Beck 1988 | Colorado, United States | pasture | herbicide | 4, mix | X | X |
| Beck et al. 1989 | Colorado, United States | pasture | herbicide | 4 | X | X |
| Biesboer et al. 1994 | Minnesota, United States | natural area | competition | na | X | X |
| Bixler et al. 1991 | Washington, United States | natural area, pasture | herbicide | 2, 4, mix | X | X |
| Boerboom and Wyse 1988 | Minnesota, United States | pasture | herbicide | 6 |  | X |
| Bourdot et al. 1993 | Canterbury, New Zealand | pasture | biocontrol | na | X | X |
| Bourdot et al. 2004 | Canterbury, New Zealand | pasture | biocontrol | na | X |  |
| Bourdot et al. 2006 | Canterbury, New Zealand | pasture | biocontrol | na |  | X |
| Bultsma et al. 1992 | Wyoming, United States | range | herbicide | 4 |  | X |
| Celebi et al. 2010 \* | Van, Turkey | alfalfa | competition | na |  | X |
| Clements et al. 2012 | Southampton, England | pasture | fertilizer | na | X |  |
| Derscheid et al. 1961 | South Dakota, United States | pasture | herbicide integrated | 4 | X |  |
|  |  |  | non-herbicide integrated | na | X |  |
| Enloe et al. 2007 | North Dakota, Colorado, and Wyoming, United States | range, pasture | herbicide | 4, mix |  | X |
| Foote et al. 1970 | Minnesota, United States | roadside | herbicide | 4 |  | X |
| Gaisler et al. 2008 | Liberec, Czech Republic | natural area | mowing | na | X |  |
|  |  |  | mulch | na | X |  |
| Gallagher and Vanden Born 1976 \* | Alberta, Canada | grass for seed | herbicide | 4 | X | X |
| Gramig and Ganguli 2015 | North Dakota, United States | range | herbicide integrated | 4 |  | X |
| Grekul and Bork 2007 | Alberta, Canada | pasture | fertilizer | na | X |  |
|  |  |  | herbicide | 4 |  | X |
|  |  |  | herbicide integrated | 4 | X |  |
|  |  |  | mowing | na |  | X |
|  |  |  | non-herbicide integrated | na | X |  |
| Harrington et al. 2014 | Washington, United States | meadow | herbicide | 4 |  | X |
| Hartley and James 1979 | Hamilton, New Zealand | pasture | herbicide integrated | 4 | X |  |
|  |  |  | non-herbicide integrated | na | X |  |
| Hartley and Thomson 1982 | Normany, New Zealand | pasture | herbicide | 4 | X |  |
|  |  |  | mowing | na | X |  |
| Harvey et al. 1993 | Canterbury, New Zealand | pasture | biocontrol | na |  | X |
| Harvey et al. 1998 | Canterbury, New Zealand | pasture | biocontrol | na | X | X |
| Hodgson 1958 | Montana, United States | pasture, alfalfa | herbicide integrated | 4 |  | X |
|  |  |  | mowing | na |  | X |
| Hurrell and Bourdot 1996 | Canterbury, New Zealand | pasture | biocontrol | na |  | X |
|  |  |  | mowing | na | X |  |
|  |  |  | non-herbicide integrated | na | X |  |
| Hurrell and Bourdot 2001 | Canterbury, New Zealand | pasture | biocontrol | na | X |  |
| Krueger-Mangold 2002 et al. \* | Montana, United States | natural area | herbicide | 9 |  | X |
| McKay 1959 | Idaho, United States | alfalfa | competition | na |  | X |
|  |  |  | herbicide integrated | 4 |  | X |
| Meeklah and Mitchell 1984 | Otago, New Zealand | pasture | herbicide | 4 | X | X |
|  |  |  | herbicide integrated | 4 | X |  |
|  |  |  | mowing | na | X |  |
| Melichar and Stafford 1989 | Iowa, Kentucky, and Indiana, United States | roadside | herbicide | 4 | X |  |
| Mesbah and Miller 2005 \* | Wyoming, United States | alfalfa | herbicide | 2, 4, 6, mix | X |  |
| Peterson and Parochetti 1978 | Maryland, United States | range | herbicide | 4 | X |  |
| Samuel and Lym 2008 | North Dakota, United States | range | herbicide | 4 | X | X |
| Sebastian et al. 1992 | Colorado, United States | range | herbicide | 2, mix |  | X |
| Thrasher et al. 1963 | Montana, United States | range | fertilizer | na | X |  |
|  |  |  | water manipulation | na | X |  |
|  |  |  | non-herbicide integrated | na | X |  |
| Tipping 2001 | Maryland, United States | range | herbicide | 5 | X |  |
| Travnicek et al. 2005 | North Dakota, United States | range | burn | na | X |  |
|  |  |  | herbicide | 4 | X |  |
|  |  |  | herbicide integrated | 4 | X |  |
| Vantoor 1994 | Southland, New Zealand | pasture | herbicide | 9 |  | X |
| Wedryk and Cardina 2012 | Ohio, United States | pasture | competition | na | X |  |
| Whitson and Ferrell 1986 | Wyoming, United States | range | herbicide | 4 |  | X |
| Wilson and Kachman 1999 | Nebraska, United States | pasture | competition | na | X |  |
|  |  |  | herbicide integrated | 4, 9 | X |  |
|  |  |  | non-herbicide integrated | na | X |  |
| Wilson and Michiels 2003 | Nebraska, United States | range | herbicide | 4 | X |  |
| Wilson et al. 2006 | Nebraska, United States | pasture | herbicide | 4 | X |  |