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Light-Activated, Sensor-Controlled Sprayer Provides Effective Postemergence Control of Broadleaf Weeds in Fallow

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A study was conducted in summer fallow fields near Davenport, WA, and Pendleton, OR, in 2007 and 2008 to evaluate the POST weed control efficacy of herbicide treatments applied with a light-activated, sensor-controlled (LASC) sprayer compared to the broadcast application of glyphosate. The LASC application of glyphosate alone (at all rates) and in mixture with pyrasulfotole plus bromoxynil or 2,4-D had weed control (≥ 88%) and dry weight (≤ 6% of control) similar to the broadcast application of glyphosate across locations and years. Tumble pigweed and prickly lettuce control with bromoxynil, 2,4-D, or carfentrazone plus dicamba, was 12 to 85% less than glyphosate applied alone with LASC or broadcast sprayer. Overall, none of the tested alternate herbicides was promising enough to replace glyphosate under present conditions.
Nomenclature: 2,4-D; bromoxynil; carfentrazone; dicamba; glyphosate; pyrasulfotole; prickly lettuce, *Lactuca serriola* L. LACSE; tumble mustard, *Sisymbrium altissimum* L. SSYAL; tumble pigweed, *Amaranthus albus* L. AMAAL.
Key words: Chemical fallow, herbicide efficacy, herbicide resistance, synthetic auxins, winter wheat.

En 2007 y 2008 se llevó al cabo un estudio en campos de barbecho en verano, cerca de Davenport, WA y Pendleton, OR, para evaluar la eficacia del control post-emergente de malezas con herbicidas aplicados con un aspersor controlado y activado por un sensor de luz en comparación con la aplicación de glifosato con un aspersor convencional. Las aplicaciones de glifosato solo (a todas las dosis) y mezclado con pyrasulfotole más bromoxynil o 2,4-D con el aspersor controlado y activado por un sensor de luz, obtuvieron un control de malezas (≥ 88%) y peso seco (≤ 6% del control) similar a la aplicación de glifosato con el aspersor convencional en todas las localidades y años. El control de *Amaranthus albus* y *Lactuca serriola* con bromoxynil, carfentrazone más dicamba o 2,4-D, fue 12 a 85% menor que con glifosato aplicado solo con el aspersor controlado y activado por un sensor de luz o el convencional. En general, ninguno de los herbicidas alternos probados fue lo suficientemente prometedor para reemplazar al glifosato bajo las condiciones actuales.

Summer fallow is a common practice to conserve soil moisture in the dryland wheat (*Triticum aestivum* L.) production systems of the low- and intermediate-rainfall zones of the inland Pacific Northwest (PNW) of the United States. Conventional fallow methods utilize a soil dust mulch tillage system that conserves soil moisture within the seed zone by establishing a dry layer of soil over subsurface moisture (Schillinger and Papendick 2008). However, intensive tillage operations for weed control in conventional dust-mulch fallow systems result in decreased soil organic matter (Rasmussen and Parton 1994) and increased wind and water erosion of soil (Papendick 1998). Current alternatives to dust-mulch fallow systems rely heavily on the nonselective herbicide glyphosate due to its low cost, broad spectrum of control, and lack of soil activity (Jemmett et al. 2008). Generally, multiple applications of glyphosate at 840 to 1680 g ha^{-1} are made during the fallow period to keep the field weed-free. Lower rates of glyphosate (840 g ha^{-1}) in spring effectively control volunteer wheat and winter annuals because sufficient soil moisture allows for active plant growth, which is necessary for glyphosate efficacy. However, Tanpipat et al. (1997) found that glyphosate efficacy was severely reduced when applied under hot, dry conditions, which frequently occur during summer in the PNW. Therefore, higher rates of glyphosate are needed for effective weed control during summer. Additionally, overreliance on a single herbicide has resulted in the development of herbicide-resistant weed populations that require alternative weed control options for efficient control (Prather et al. 2000). Alternative control tactics may include mixtures of herbicides, which are more expensive than rod-weeding and other forms of mechanical control.

Herbicides are used on 87 million ha of cropland in the United States (Gianessi and Reigner 2007) and represent 60% of the volume and 65% of the expenditure of pesticides in the United States (Donaldson et al. 2002). The PNW has the greatest dryland wheat yields in the world (Young 2004). Herbicides comprise a major input cost for PNW wheat production and are applied to 92% of the winter wheat crop area annually (NASS 2010).

Bennett and Pannell (1998) reported that the sparse, patchy nature of weed distribution often results in deposition of most of broadcast herbicide applications on bare soil rather than on weed foliage. Thus, effective spot treatments of herbicides in chemical fallow, even using greater per-hectare rates, could result in substantial cost savings, reduced herbicide use, and possibly improved weed control compared to broadcast applications. Efficient spot applications of herbicides to fields have not been practical due to high equipment cost and lack of automated equipment or technical expertise needed by the sprayer operator. However, the introduction of real-time LASC sprayers has resulted in more accurate and precise spot applications of herbicides (Biller 1998) and could be used in chemical fallow systems to reduce the amount and area of herbicide applications.

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