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Integration of Vinegar for In-Row Weed Control in Transplanted Bell Pepper and Broccoli

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Vinegar can supplement the existing intrarow weed control options of organic farmers. However, there are two primary limitations to its use in vegetable crops. First, it is costly. Second, vinegar applications that contact the crop can cause injury and yield loss. The aim of this research was to use vinegar to control intrarow weeds in bell pepper and broccoli in a way that product costs would be reduced and crop injury would be minimized. Banded applications were shielded and directed below the crop canopy to reduce weed control costs and minimize contact with crop foliage. Organic paints applied to crop stems were evaluated as potential physical barriers to crop stem injury. Four field trials were conducted in 2009, two in transplanted bell pepper and two in transplanted broccoli. A single application of 200-grain vinegar (20% acetic acid) at 700 L ha^{-1} was applied when weeds were in the cotyledon to six-leaf stage. Applications were made to crops with the lower stems coated in one of two stem protectants, or left uncoated. Hand-weeded and weedy treatments were included for comparison. One day after vinegar application, in-row weed control was 100% in both pepper trials and greater than 96% in the broccoli trials. Two weeks after application, 75% fewer weeds germinated in the vinegar-treated areas compared with the areas that were hand weeded. Neither stem protectant prevented crop injury. Despite pepper foliar injury of less than 5%, stem injury 2 wk after application contributed to a measurable yield reduction. Broccoli injury was limited to instances where overspray contacted the crop canopy. With vinegar, high levels of weed control and the extended duration of that control relative to hand weeding could facilitate improved organic intrarow weed control. However, crop injury must be reliably reduced. Alternative stem protectants may merit evaluation.
Nomenclature: Acetic acid; vinegar; broccoli, *Brassica oleracea* L.; pepper, *Capsicum annuum* L.
Key words: Banded application, directed application, intrarow weed control, in-row weed control, natural products, organic, vegetable crops, weed management.

El vinagre puede complementar las opciones existentes de control de malezas entre los surcos utilizadas por los agricultores de productos orgánicos. Sin embargo, existen dos limitantes principales para su uso en cultivos de hortalizas: primeramente es costoso, segundo; las aplicaciones de vinagre que tengan contacto con el cultivo pueden causar daño y pérdida en el rendimiento. El propósito de esta investigación fue utilizar el vinagre en el control de malezas entre los surcos en el cultivo de pimiento morrón (*Capsicum annuum*) y brócoli (*Brassica oleracea*), de manera que los costos del producto se redujeran y el daño en el cultivo fuera minimizado. Aplicaciones en banda se hicieron con pantalla y se dirigieron debajo del follaje del cultivo para reducir el costo del control de malezas y minimizar el contacto con el follaje. Pinturas orgánicas aplicadas al tallo del cultivo se evaluaron como barreras físicas potenciales contra el daño al tallo. Cuatro estudios de campo se realizaron en 2009, dos en pimiento morrón y dos en brócoli, ambos transplantados. Una sola aplicación de vinagre (20% ácido acético) a 700 L ha-1 se hizo cuando las malezas estaban en la etapa de cotiledón a 6 hojas. Las aplicaciones se hicieron a los cultivos con los tallos inferiores cubiertos con uno de los dos protectores, o se dejaron descubiertos. Para comparación se usó un tratamiento con control manual y uno sin control de malezas. Un día después de la aplicación del vinagre, el control de malezas entre surcos fue 100% en ambos campos de pimiento morrón, y mayor de 96% en los campos de brócoli. Dos semanas después de la aplicación, 75% menos malezas germinaron en las áreas tratadas con vinagre, en comparación con aquellas donde se eliminaron manualmente. Ninguno de los dos protectores del tallo evitó el daño al cultivo. A pesar del daño foliar del pimiento morrón de menos de 5%, el daño a los tallos dos semanas después de la aplicación contribuyó a una reducción cuantificable en el rendimiento. El daño al brócoli se limitó a instancias donde el aspersor tuvo contacto con el follaje del cultivo. Con el vinagre, altos niveles de control de maleza y la duración residual de ese control en relación al control manual, se podría mejorar el control orgánico de malezas entre los surcos. Sin embargo, el daño al cultivo debe ser reducido con cierta precisión. Otros protectores del tallo ameritan una evaluación posterior.

Organic farmers need new methods to improve weed management within crop rows. The potential use of natural products has received substantial interest (Boyd and Brennan 2006; Daniels 2004; Ferguson 2004). Products that are made through natural processes and have herbicidal properties are permissible for use in organic agriculture. Materials including vinegar, citric acid, and essential oils can supplement in-row hand weeding, cultivation, plastics, and flame weeding. However, successful integration of natural products for in-row weed control will require development of application technologies that can minimize crop injury and lower usage volumes. The focus of this research was to develop application strategies that could facilitate the use of vinegar for in-row weed control. Vinegar would then be evaluated as a direct substitute for intrarow hand weeding.

There are practical limitations to the use of vinegar in vegetable crops. Vinegar can be costly when broadcast at the

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