

Pest Control in Field-Grown Ranunculus without Methyl Bromide

Susanne Klose^{1*}, J. Gerik², H.A. Ajwa¹, Cheryl Wilen³, and Mike A. Mellano⁴

¹ Department of Plant Sciences, University of California-Davis, Salinas, CA 93905; ² USDA-ARS, Parlier, CA 93648; UC Statewide IPM Program/UCCE, San Diego, CA 92123, ⁴ Mellano & Co., Carlsbad, CA 92008

Cut flower and ornamental bulb industries rely heavily on a methyl bromide/chloropicrin (MB/Pic) mixture as a key pest management tool. The loss of MB will seriously affect the cut flower and bulb industry, and, in the future, will require growers to use alternative fumigants. Therefore, efficacy of shank and drip-applied alternative fumigants (normal and reduced label rates) under high barrier film (virtually impermeable film, VIF) to control weeds, soil-borne pathogens and to produce a marketable ranunculus crop was tested in flower fields in Carlsbad relative to the standard MB/Pic shank fumigation at 350 lb/acre and an untreated soil. The primary goals of this project are to (1) demonstrate alternative fumigation systems at on-farm trials to facilitate the implementation of alternative pest management strategies by the California cut flower and ornamental bulb industry, and to (2) establish an outreach and educational program on alternative pest management practices that decreases the MB dependency of the cut flower industry, minimizes fumigant rates and emissions, while maintaining or increasing floricultural productivity and/or economical viability.

Materials and Methods

Studies were initiated in November 2007 at commercial flower fields in Carlsbad, southern coastal California to grow ranunculus following commercial standard production practices. For the drip trial, beds were shaped prior to fumigant application, and for the shank trial, following broadcast fumigation. Per bed 2 drip tapes (flow rate, 0.4 gpm/100 ft) were laid, and beds were covered with virtually impermeable film (VIF), with exception of methyl bromide shank standard treatments, which were covered with standard polyethylene tarp (PE). The experimental design was a randomized complete block design with each treatment unit replicated 4 or 3 times for the drip and the shank trial, respectively. The total plot area consisted of 52 beds (42" center-to-center) each 150 ft long. The shank trial included the following treatments: Untreated, MB/Pic (67/33) (350 lbs/acre, standard PE mulch), and Paladin/Pic (83% dimethyl disulfate, 17% Pic; 600 lbs/acre, VIF). The drip trial included the following treatments: Untreated, untreated followed by (fb) metam potassium (Kpam, 50 GPA), InLine (62% 1, 3-D, 35% Pic; 270 lbs/acre), InLine fb Kpam (270 lbs/acre fb 50 GPA), Kpam fb InLine (50 GPA fb 270 lbs/acre), chloropicrin (Pic; 200 lbs/acre), and Pic fb Acrolein (200 fb 270 lbs/acre). Primary drip fumigants were applied on November 19, 2007, and sequential pesticide applications were conducted 7 days past the first fumigant application on November 26, 2007. Shank fumigants were applied on December 6, 2007. Ranunculus was seeded 3 weeks after fumigation on December 27 and 28, 2007, and conventional production practices and pest management were followed. Crop response (ranunculus numbers 6 weeks after seeding), and weed control (number of native weeds, weed biomass) were evaluated on February 22 and April 2, 2008. Control of soil-borne pathogens (*Fusarium*, *Pythium spp.*) was evaluated on soil samples collected prior to seeding (December 2007), at peak cut flower harvest (April 2008), and at bulb harvest (July 2008). Ranunculus crop yield comprises of cut flowers (75% of crop revenue) and flower bulbs (25% of crop revenue). Cut flower harvest was conducted by a commercial crew from April 11 to May 8, 2008. Flower bulbs were harvested on July 17, 2008, and are currently graded and counted according to size (lengths and circumference, respectively) for quality evaluation.

Results

Stand density: At 6 weeks after seeding, shank applied MB/Pic at 350 lb/acre and Paladin/Pic at

600 lbs/acre resulted in similar ranunculus densities and both fumigants had higher crop densities than the untreated soil (data not shown). All tested drip-applied fumigants resulted in significantly lower ranunculus densities than shank-applied fumigants (data not shown). Among drip-applied alternatives, Kpam fb InLine and Pic fb Acrolein showed highest crop densities, although differences were not significant. **Weed control:** Major weed species at this location are clover spp., which are hard to control by fumigation. Shank-applied Paladin/Pic provided lower weed control than the MB/Pic shank standard (Fig. 1). Selected drip applied alternative pesticides showed better weed control than shank-applied MB/Pic, although differences were not significant. Treatments with improved weed control included Kpam fb InLine, Pic, InLine fb Kpam, and Pic fb Acrolein (Fig. 2). Weed densities showed large spatial variations across all treatments, which was reflected by weeding costs. Average cost for the first hand weeding varied between \$ 530 (untreated), \$ 500 (MB/Pic) to \$ 580 per acre (Paladin/Pic). Weeding costs for drip applied treatments averaged at \$556, 245, 165, 154, 145, 143, and \$105 per acre for untreated, untreated fb Kpam, InLine fb Kpam, Pic fb Acrolein, Pic, InLine, and Kpam fb InLine, respectively. **Pathogen control:** At peak cut flower harvest (April 2008), *Fusarium* control was improved by 35 and 100% in MB/Pic and Paladin/Pic shank fumigated soils, respectively, compared to untreated soils (Fig. 3), but differences were only significant for the untreated and Paladin/Pic treatment. There were no significant differences in *Pythium* control between untreated soils and shank fumigated soils, although, the Paladin/Pic treatment reduced *Pythium* population densities by 32% relative to the untreated soil. Pathogen control was significantly improved in soils fumigated with drip alternative fumigants relative to the MB/Pic shank standard by 80 to 100% for *Fusarium* and 40 to 85% for *Pythium*, except for the untreated fb Kpam treatment (Fig. 4). Population densities of soil-borne pathogens were reduced by 70 to 100% for *Fusarium* and by 70 to 92% for *Pythium* in drip-fumigated soils relative to untreated soils. Among the tested drip fumigant treatments, there were no significant differences in *Fusarium* and *Pythium* control. **Cut Flower Yield:** There were no significant differences in total flower yields between the MB/Pic shank standard and the Paladin/Pic shank treatment, and both fumigants had higher cut flower yields than untreated soils (Fig. 5). Total flower yields were significantly higher in all drip fumigant treatments than in the MB/Pic shank standard, except for the untreated fb Kpam treatment (Fig. 6). Generally, drip-applied alternatives resulted in 43% (Pic) to 86% (Pic fb Acrolein) higher cut flower yields than the MB/Pic shank standard. Untreated soils resulted in 60% lower cut flower yields than the MB/Pic shank standard. Final pathogen control (at bulb harvest), bulb yield and bulb quality data will be presented after completion of evaluation.

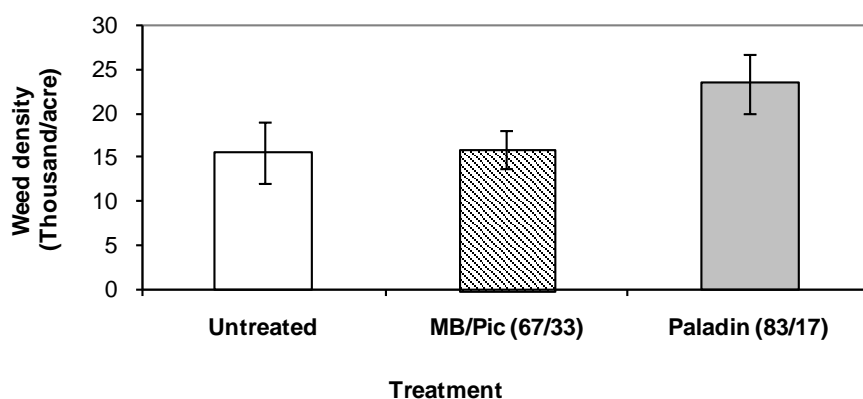


Fig. 1. Weed density February-April in shank-applied MB/Pic and Paladin/Pic in the 2007/2008 field trial in Carlsbad, California.

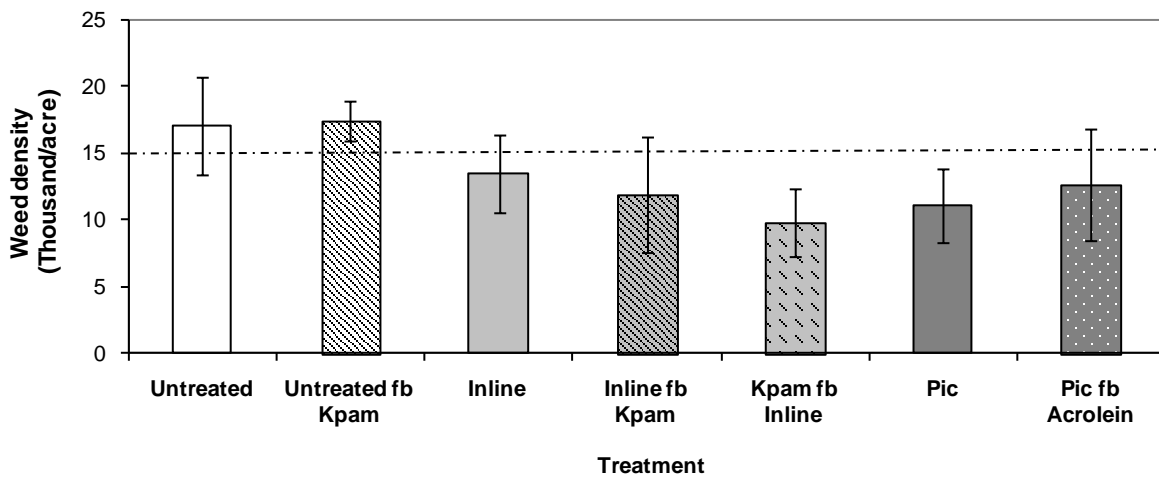


Fig. 2. Weed density February-April 2008 after application of drip-applied MB alternatives in the 2007/2008 field trial in Carlsbad, CA (dotted line represents the MB/Pic shank standard).

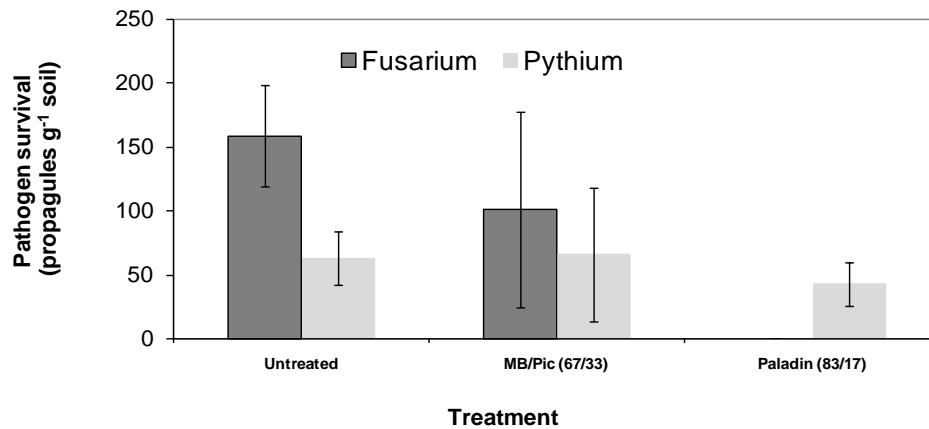


Fig. 3. Pathogen survival in April 2008 in shank-applied MB/Pic and Paladin/Pic in the 2007/2008 field trial in Carlsbad, CA.

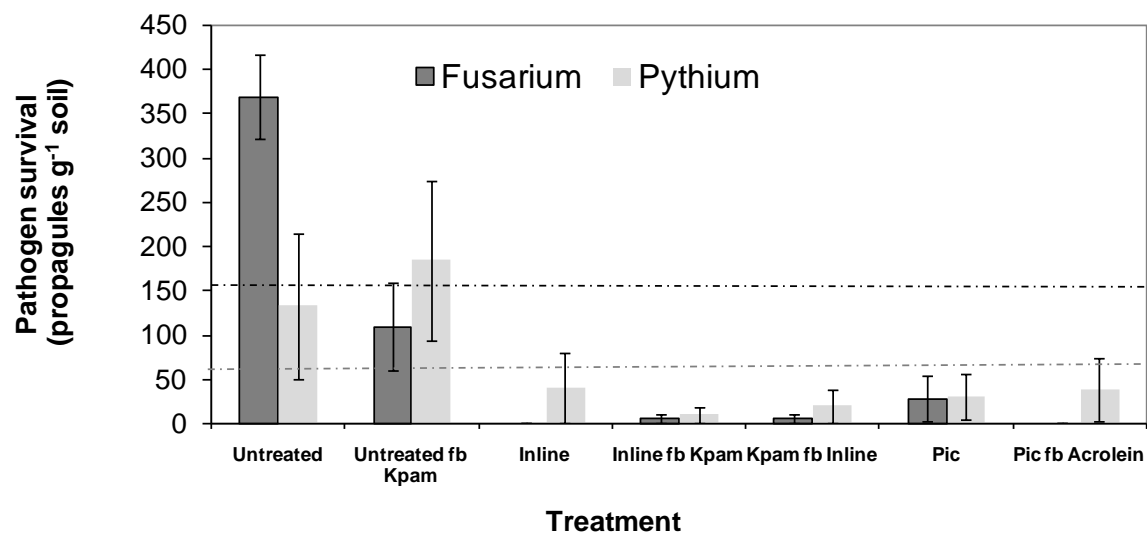


Fig. 4. Pathogen survival in April 2008 in drip-applied MB alternatives in the 2007/2008 field trial in Carlsbad, CA (dotted lines represent the MB/Pic shank standard for each pathogen).

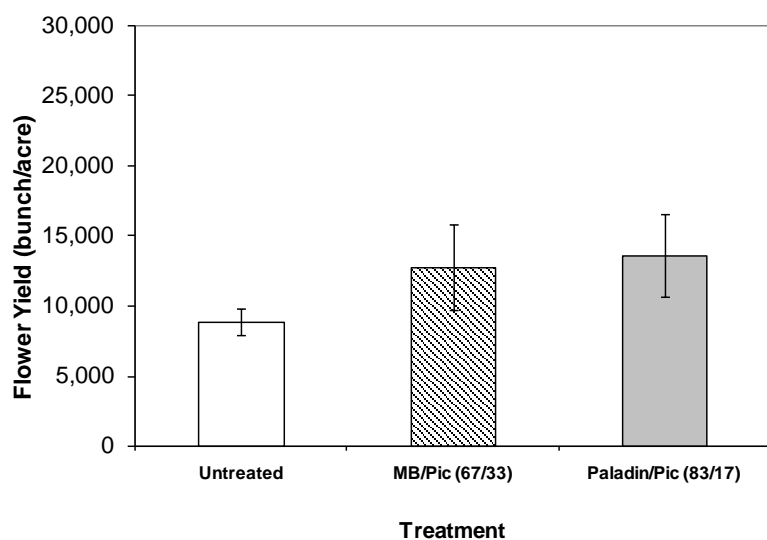


Fig 5. Flower yield from soils shank-fumigated with MB/Pic and Paladin/Pic in the 2007/2008 field trial in Carlsbad, CA.

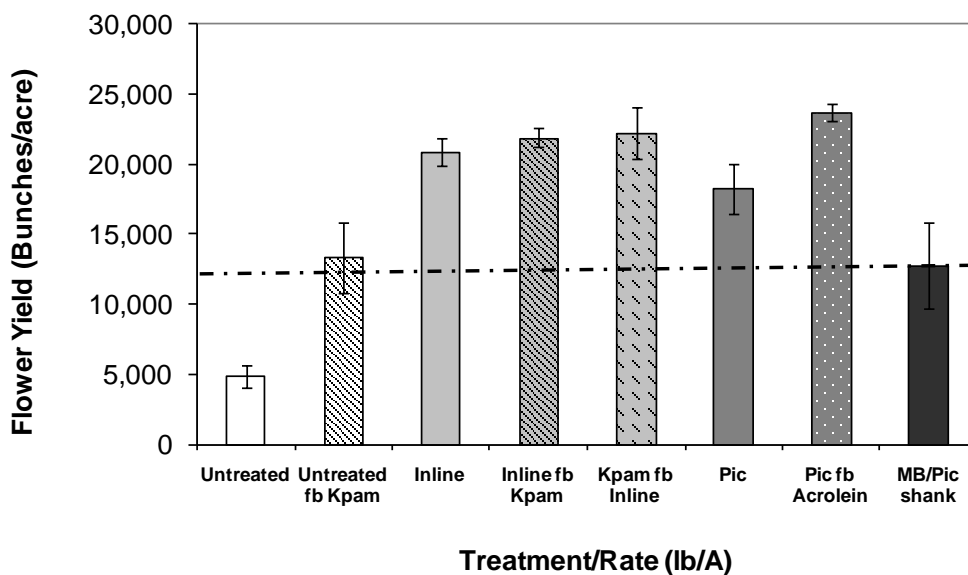


Fig. 6. Flower yield from soils drip-fumigated with MB alternatives in the 2007/2008 field trial in Carlsbad, CA (dotted line represents the MB/Pic shank standard).