Improving Metam Potassium Lateral Movement in Fumigated Beds using Integrate

Bielinski M. Santos* and Tyler P. Jacoby

Gulf Coast Research and Education Center, IFAS, University of Florida, 14625 CR 672, Wimauma, FL 33598

Additional index words. Cyperus rotundus, Cyperus esculentus, soil fumigation, isothiocyanate, nutsedge

Metam potassium is recommended to control purple and yellow nutsedges (Cyperus rotundus and C. esculentus, respectively) in fumigated beds. However, lateral movement of metam potassium is limited due to its low vapor pressure. When metam potassium is injected through the drip lines, untreated strips (each 4 to 6 inches wide) on the bed shoulders occur. This translates into nutsedge actively growing in those untreated bed sides. Integrate® (triblock copolymer 61% and glucoethers 19%) is a liquid polymer used to improve soil wetting. The objective of this study was to evaluate the performance of metam potassium against nutsedge when Integrate® was applied to the soil. Treatments consisted of: a) metam potassium (60 gal/acre and 5.5% v/v), b) Integrate® (1 gal/acre and 5.5% v/v) followed by metam potassium, and c) a non-fumigated control. The soil-wetting polymer was applied 1 d before the fumigant. Addition of the soil-wetting polymer to the soil prior to the fumigation improved nutsedge control and soil moisture at the 5-inch depth in both trials. In three trials, plots treated with the soil surfactant and metam potassium had 50%, 52%, and 39% fewer nutsedge than plots receiving metam potassium only.

Florida is the second largest fresh market vegetable and small fruit producing state in the country. More than 30,000 acres of tomato (Solanum lycopersicum) and 10,000 acres of strawberry (Fragaria ×ananassa) are planted each year in Florida (NASS, 2012). Soil fumigation is the cornerstone for management of soilborne pests, including weeds. Growers have historically relied on methyl bromide but with the loss of it due to environmental concerns, most growers are now using 1,3-dichloropropene (1,3-D), chloropicrin (Pic), and metam potassium as alternatives. These three fumigants, even when combined together, lack the reliable broad-spectrum activity that methyl bromide possesses.

Purple and yellow nutsedge are two economically important weeds in tomato, pepper (Capsicum annuum), and strawberry production. They are the most invasive weeds of fruiting vegetable crops in the southern U.S., competing for light, water, nutrients, and space (Webster, 2006). Previous research demonstrated that high nutsedge populations can reduce pepper yield by up to 73% (Morales-Payan et al., 1998; Motis et al., 2003) and tomato yield by 51% (Gilreath and Santos, 2004). Most small fruit and vegetable growers in Florida are now using 1,3-D, Pic, and isothiocyanate (ITC) generators as alternatives to methyl bromide. These growers are now looking for ways to improve the long-term efficacy of these programs, while complying with new regulations and reducing costs.

Metam potassium is an ITC generator that provides adequate to excellent nutsedge control when the tubers are exposed to the appropriate concentration (Santos and Gilreath, 2007). Metam potassium can be sprayed or rototilled into the soil, but drip application is most common because it results in the most consistent control. Research with this fumigant has established the proper rate and placement needed to achieve consistent pest control. However, to get adequate bed coverage, drip application of metam potassium at a concentration of 5,000 to 6,000 ppm applied with 1-acre inch of water requires two or more drip tapes on bed tops to ensure complete bed wetting of the bed shoulders. When applied through drip irrigation, metam potassium breaks down as a weak gas and therefore only moves laterally in the beds as far as the water front allows it. In the deep sandy soils where tomato, pepper, and strawberry are produced, lateral water movement may be limited to 8–10 inches on each side of the drip tape (McRae, 2010). When this occurs, application of metam potassium effectively controls nutsedges at the bed center (as far as the wetted zone goes), but fails to do so at the bed edges. A 3-year study showed a significant increase in nutsedge shoot emergence over time in tomato for four of the most used fumigant systems, which and was attributed to actively growing nutsedge tubers likely located in the under-fumigated bed edges (Jacoby, 2012). Therefore, alternative practices must be devised to increase lateral movement of metam potassium in hope of improving nutsedge control on the bed edges. Among these alternative practices, the use of soil surfactants could help improve the lateral movement of drip-applied fumigants.

Integrate® is designed to reduce surface tension and improve lateral movement of water. This surfactant is made of alkoxylated polyols and glucoethers and can be applied through drip irrigation or a conventional sprayer. The objective of this study was to evaluate the performance of metam potassium against nutsedge when Integrate® was applied to the soil.

Materials and Methods

Three trials were conducted, one each in the spring, summer, and fall of 2012, at the Gulf Coast Research and Education Center of
the University of Florida in Wimauma to evaluate the performance of metam potassium against nutsedge when Integrate® was applied to the soil. The treatments included a) metam potassium (60 gal/acre and 5.5% v/v), b) Integrate® (1 gal/acre and 5.5% v/v) followed by metam potassium, and c) a non-fumigated control (water only). Both treatments were applied to plastic covered raised beds through a hydraulic injector (Dosatron®, Dosatron International, Inc., Clearwater, FL) using a single drip tape (0.45 gal/100 ft of bed per min) with 1 ft between emitters, with Integrate® being injected 1 to 2 d before metam potassium. Plots were 30 or 60 ft long, and arranged in a randomized complete-block design with six replications. The majority of the nutsedge population in the experimental fields was purple nutsedge, which is typical of most fields in our Florida production region.

Results and Discussion

After 1 h of irrigation through a single drip tape, the control provided 31% coverage of the soil moisture field, compared to the Integrate® treatment, which increased coverage to 52% of the soil moisture field, a 68% total increase. At 6 weeks after treatment in the Spring of 2012, the nutsedge population in the control was >350 nutsedge/60 ft of row, compared to the metam potassium treatment, which had 300 nutsedge/60 ft of row, and the metam potassium plus Integrate® at 240 nutsedge/60 ft of row, showing differences (Fig. 1). The nutsedge population in the Summer of 2012 showed the same differences over all sampling dates and between each treatment as in Spring of 2012 (Fig. 2). At 5 weeks after treatment in the Summer 2012 trial, soil moisture percentage was significantly higher on the middles and sides of the beds in the metam potassium plus Integrate® plots, compared to the metam potassium alone plots (data not shown). The vertical moisture field was improved by 68% when a single drip tape was used. In the Fall of 2012, at 60 d after fumigation there was a 30% difference in nutsedge population between the metam potassium alone and metam potassium plus Integrate® treatments (data not shown), showing the positive effect of the soil surfactant.

Nutsedge control was improved by 25% to 30% when Integrate® was combined with metam potassium, apparently due to increased lateral movement of the metam potassium carried in water (Fig. 3). These results of increased nutsedge control could possibly lead to the need for only one application of Sandea® (halosulfuran) herbicide in tomato. Also, there are currently no POST herbicide options for pepper for nutsedge control.

Literature Cited