

**Management of Weeds in Cool Season Vegetables.** Richard Smith, Vegetable Crop and Weed Science Farm Advisor, University of California Cooperative Extension, Monterey County

The summer-time cool season vegetable production areas of California include the coastal production districts of the Salinas, Santa Maria and Oxnard valleys. Cool season vegetable production in these areas is characterized by short-season crops with short turn around intervals. The high-value nature of these crops allows for excellent production practices such as precise cultivation and rotations with crops that generally also have good weed control. As a result, weed populations in these areas tend to be relatively lower than other areas dominated by long-season crops which are subject to multiple flushes of weeds that often set seeds. Weed seed populations tend to be lowest in cropping systems that specialize in production of high density vegetables such as spinach, baby lettuces and spring mix crops. These crops mature before many weeds set viable seed. The end result is a reduction in weed seed populations in the soil seed banks. Other rotations with crops such as broccoli allow for more weed seed set and soil seed banks will be tend to be higher where this crop is common in rotations. In spite of the generally lower weed populations in the cool season vegetable production areas, there is a continuous need of effective weed control strategies to maintain the economic viability of these crops.

There have been few new herbicides registered in the last 10 years for use on cool season vegetables. Exceptions include flumioxazin on artichokes, asparagus, celery and garlic, and carfentrazone for use in thinning lettuce. New uses of older chemistries such as linuron and prometryn for use on crops like cilantro and other carrot family crops have been approved. Retaining registrations for key herbicides such as pronamide on leaf lettuce which was lost in 2009 has been a struggle; however, much progress has been accomplished by Dow AgroSciences and it looks like pronamide will soon be reregistered.

New production practices such as the potential for expanded use of transplants in lettuce production may affect weed control practices in this crop. Currently transplanting lettuce costs approximately \$397 more than direct seeded romaine lettuce on 80-inch wide beds with 6 seedlines. Recently developed automated transplanters such as Plant Tape<sup>®</sup> and the AutoPlanter<sup>®</sup> transplanters, have the potential to reduce the cost of transplanting lettuce and thus make it a more realistic option for general lettuce production. Pendimethalin and S-metolachlor are both in the registration process for use on transplanted lettuce. The combination of the shorter season for transplanted lettuce and the use of these herbicides has the potential to nearly eliminate the need for hand weeding in transplanted lettuce.

The following are two examples of weed control research that is underway in cool season vegetables. Phenmedipham is currently registered for use on freezer and seed spinach, but not for fresh market spinach. The fresh market spinach industry is completely intolerant of phytotoxicity on the leaves; in addition, there are not enough days in the production cycle to allow the plants to grow out of any damage. However, research indicates that applying phenmedipham in the evening can reduce phytotoxicity. We evaluated 0.5 and 1.0 pint rates of phenmedipham in trials conducted in commercial spinach production fields with cooperating growers in 2015. Both 0.5

and 1.0 pint/A of phenmedipham controlled purslane and black nightshade. The 1.0 pint/A treatment reduced the yield of spinach in one trial. No necrosis or other signs of phytotoxicity were observed in either trial even in the morning applications. Given the value and sensitivity of this crop more evaluations will need to be conducted to confirm the safety of phenmedipham on fresh market spinach and if evening applications can improve its safety.

Two automated weeders that are capable of cultivating the seedline were available for the first time in the Salinas Valley in 2105. Both machines use cameras to detect plants, and a computer to process the image and calculate which plants to keep and which to remove. The computer activates split knives which close between the crop plants and open up to go around the crop plants. The two machines used in these studies were the Robovator, Frank Poulsen Engineering: <http://www.visionweeding.com/Products/Intra%20Row%20Weeding/ROBOVATOR.htm> , Denmark and Steketee IC Weeder, the Netherlands: <http://portal.steketee.com/> . On average there is a trend that indicates that the automated weeders reduced the stand of lettuce by 5.6%. This may be due to incidental damage from the knives opening or closing at the wrong time. This type of damage can be managed by adjustments on the machine that affect the aggressiveness of the blades. On average, mechanical weeders removed 51.4% of the weeds in the seedlines and reduced follow up hand weeding in the fields by 37.1%. These machines did not completely eliminate the need for hand weeding, but they did reduce the time to hand weed the crop in these evaluations over hand weeding alone.