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Natural Resources Research Update

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Title: USE OF CROP CANOPY SIZE TO ESTIMATE WATER REQUIREMENTS OF VEGETABLE CROPS

Planting time, plant density, variety, and cultural practices vary widely for horticultural crops. It is difficult to estimate crop water requirements for crops with these variations. Canopy size, or factional ground cover, as an indicator of intercepted sunlight, is related to crop water use. We used a weighing lysimeter to measure daily crop water use and a multi-spectral camera to measure fractional ground cover for three vegetable crops – head lettuce, bell pepper, and garlic, and related ground cover to basal crop coefficient (1). The crop coefficient increased linearly from about 0.15 for a very small canopy cover to about 1.2 for a mature crop with fractional ground cover of 0.9. The relationship was similar for these lettuce and pepper but tended to be higher for the garlic crop. Because light interception other than at mid-day will depend on the canopy structure, adjustment may be needed for canopy height and structure.

Fractional ground cover has also been related to aerial or satellite based normalized difference vegetation index (NDVI). We measured grounds cover of 12 different horticultural crops in various growth stages on 35 fields on the west side of the San Joaquin Valley in California with a hand-held multi-spectral digital camera (2). We also estimated ground cover with simple measurements of crop size and spacing and calculated the NDVI for each field from Landsat 5 satellite imagery. The NDVI was linearly related with measured canopy cover up to a canopy cover of 80% across the wide range of crops. Dimensionally estimated canopy cover also compared well with the photographic measurements.

A generalized ground cover: crop coefficient relationship will allow weather-based irrigation scheduling for a wide range of horticultural crops based on canopy measurements or remotely-sensed vegetation indices. Water use estimates from remote sensing over wide

geographic areas will allow irrigation water suppliers to estimate water use for irrigation districts and river basins.

1. Trout, T. J. and L.F. Johnson. 2007. Estimating crop water use from remotely sensed NDVI, crop models, and reference ET. Proc.USCID fourth Intern'l Conf on Irrig. and Drainage. Sacramento, CA. Sept 30-Oct 5.

2. Trout, T.J., Johnson, L., Gartung, J.L. 2008. Remote Sensing of Canopy Cover in Horticultural Crops. HortScience. 43(2):333-337.