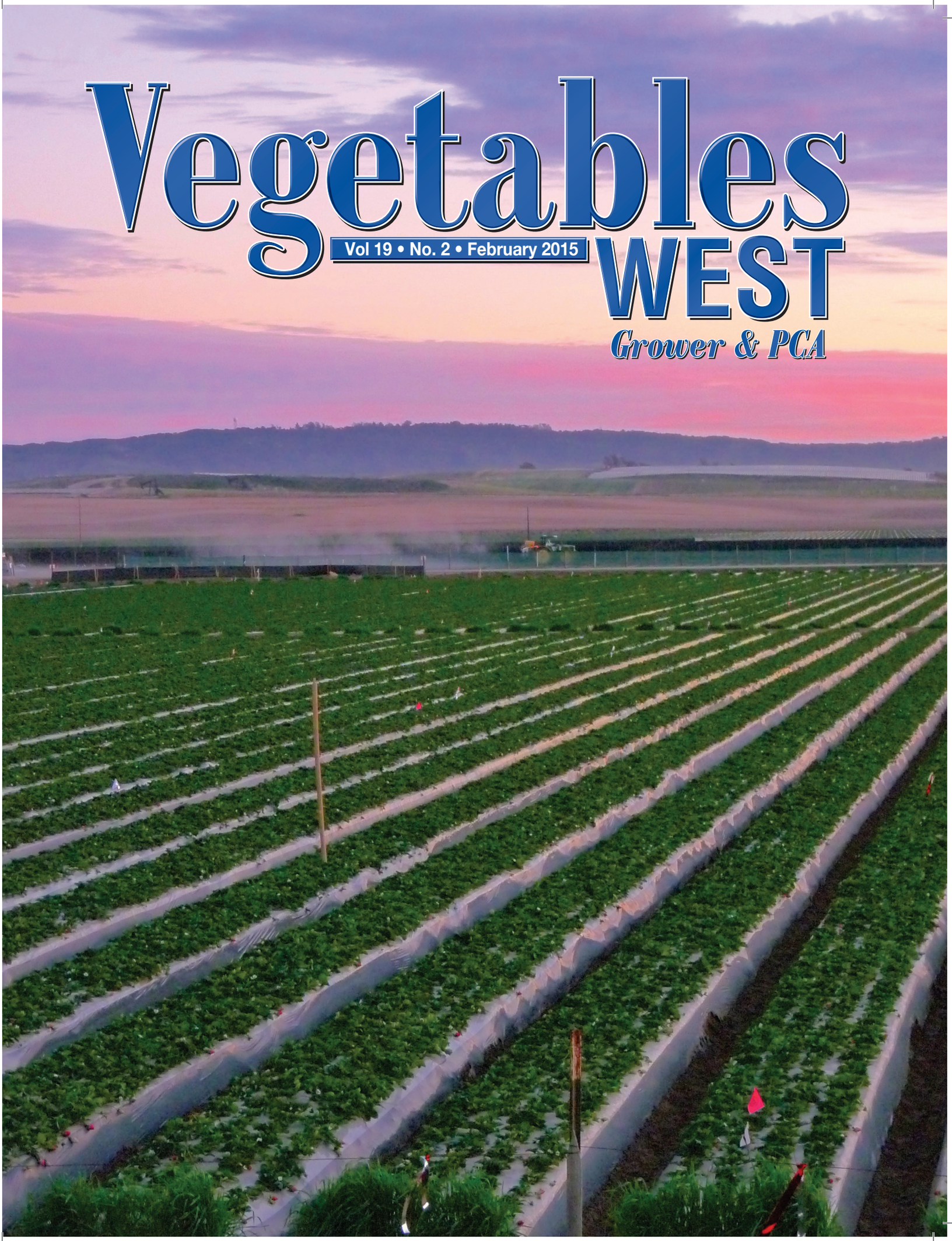

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Grower & PCA

Improving Flood Irrigation Systems

Water And Nutrient Conservation

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Efficiency of surface irrigation systems can be improved by several practical measures. Improvements in surface irrigation efficiency can be achieved by minimizing water losses associated with surface irrigation systems. Most of the water losses in surface irrigation systems can be reduced by managing surface runoff and deep percolation below the root zone. However, measures to improve flood irrigation can be competitive, i.e. measures that reduce deep percolation can increase surface runoff and vice versa. Some measures commonly recommended include the following:

Recover and reuse surface runoff

Recirculation systems (commonly called runoff recovery, tailwater return systems, or storage-reuse systems), can dramatically improve efficiency of flood irrigation systems. Recirculation systems involve collecting the surface runoff in a small reservoir at the lower end of the field and then recirculating the water back to the "head" of the field during irrigation, using a low lift pump and a buried or portable pipeline. The recycled water should be used to irrigate an additional area of the field or mix it with irrigation water. Simply recirculating the runoff back to the same irrigation set that generated the runoff results only in temporarily storing the water on the field and will result in an increased rate of runoff.

Similarly, a storage/reuse system involves storing all of the surface runoff from a field and then using that water to irrigate another field at the appropriate time. This approach requires a farm with multiple fields, a relatively large reservoir and distribution systems to convey surface runoff to the storage reservoir and to convey the stored water to the desired fields.

Care should be taken that water quality is not degraded from the

storage-reuse systems. Pesticides have been found to infiltrate groundwater on some soil types, primarily from catchment basins. Steps to seal basins from subsurface infiltration may be effective at preventing contamination in light soils.

Runoff recovery systems could be used in the Imperial Valley to conserve water and nutrients and improve the quality of drainage water. The majority of the fields in the Imperial Valley are irrigated with surface irrigation systems (furrow and border-strip irrigation) and runoff or tailwater is necessary in furrow irrigation and in some border-strip irrigation to irrigate the lower end of the field and provide sufficient irrigation time at the end of the field for maximum uniformity. The surface runoff water could be collected in a pond at the end of the field and reused in the same or different field. The use of runoff recovery system is practical for all field crops in the Imperial Valley and most furrow-irrigated vegetable crops. However, with vegetable crops, additional measures may need to be implemented to comply with leafy greens marketing agreement and food safety standards.

Increasing check flow rate

This commonly recommended measure reduces the advance time to the end of the field, thus decreasing variability in infiltration times along the field length. However, caution should be exercised with this approach such that the increased flow rate does not increase soil erosion. This option may not be practical when the on-farm irrigation canals are not designed for high flow rates, as it is the case for most fields in the Imperial Valley. In addition, concerns about increased concentration of sediment in runoff water may increase the load of nutrients (mainly nitrogen and phosphorous) and pesticides in runoff water.

Reducing field length

This is the most effective measure for improving uniformity and for reducing percolation rate below the root zone. Studies have shown that shortening the field length by one-half can reduce percolation by at least 50 percent. The distribution uniformity (DU) of infiltrated water will be increased by 10 to 15 percentage points compared with the normal field length. The new advance time to the end of the shortened field generally will be 30 to 40 percent of the advance time to the end of the original field length. Thus, the irrigation set time must be reduced to account for the new set time. While this method is effective in increasing uniformity, a major problem with this method is the potential for increased surface runoff, which could be two to four times more runoff for the reduced length compared with the original field length (Hanson, 1989). This option may not be practical for most fields in the Imperial Valley and requires major and costly modifications to the irrigation system.

Selecting an appropriate irrigation water cutoff time

The amount of surface runoff or tailwater can be greatly reduced by decreasing the cutoff time of the irrigation water. This is the most effective measure for reducing surface runoff. The cutoff time for a given field may need to be determined on a trial-and-error basis. The cutoff time should occur before the water reaches the end of the field except for sandy soils with high infiltration rates. However, the cutoff time should allow sufficient water to infiltrate the end of the field. Some guidelines, however, are to cut off the irrigation water when the water advance is about 60% of the field length for fine-textured soil, 70% to 80% for medium texture soil, and near 100% for coarse textured soil. A procedure for estimating the cutoff time for cracking clay soil has been developed by the University of California (Bali et al., 2001).