Crop Monitoring and Water and Nitrogen Management for Irrigated Chile Production

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Crops need to be monitored during all stages of growth to best manage water and nutrient inputs. Taking crop condition into account and adjusting nutrient and water management accordingly is critical in achieving the optimum management of a crop and the best use of an irrigation system and fertilization program. This is often referred to as a "feedback" system of crop management (Silvertooth, 2001). This concept and approach to crop management can perhaps be most useful with an irrigated crop production system. Irrigated chile (*Capsicum annuum* L.) production in the desert Southwest is a good example and it demonstrates the benefits in crop management when coupled with a fundamental understanding of crop phenology (growth and development).

Increased efficiency is an important objective for developing sustainable chile crop production systems. Efficiency can be defined in economic (return on the investment), agronomic (crop system response), or environmental (impact on environmental quality) terms. Each of these concepts of efficiency can be successfully addressed simultaneously, which requires good management and attention to the changes that take place over the growth cycle of a crop.

When monitoring any crop in a production system there are several factors that are very important to consider including: 1) stage of growth, 2) crop vigor, and 3) yield potential. A feedback system of management can be useful in adjusting critical crop inputs such as water and fertilizer inputs (particularly N) in response to actual crop conditions. For example, in the case

of irrigated chile, if the crop is experiencing poor vigor and symptoms of stress, it would be very important to identify the source of the stress and make an effort to address or correct it. This could relate to several issues such as pest infestations (insects, weeds, or diseases), water stress, salinity stress, nutrient deficiency, etc. If for example a crop is experiencing poor vigor due to water stress, the application of additional N will not be effectively utilized by the crop until the water stress situation is adequately addressed. Alternatively, if a chile crop is experiencing very high vigor and excessive vegetative growth (often accompanied by a poor fruit load), a more conservative approach with N inputs would be warranted and at the same time it would be important not to impose a water stress *per se*.

Thus, monitoring a chile crop production system and having a gauge on basic factors such as stage of growth and the plant relationships to water and nutrient requirements are essential in realizing optimum efficiency regarding irrigation and fertilization inputs. Flexibility in management is required to better respond to the crop and production conditions that can change quite rapidly during a production season and will vary from season to season. Accordingly, managers need to be flexible in managing the system in response to the appropriate queues to realize the full potential from a crop production system. This type of agronomic system efficiency is important for both short- and long-term sustainability.

To optimize N management for a chile crop it is important to make fertilizer N applications in the "Nitrogen Application Window" (NAW) described in Figure 1 which provides a baseline for chile growth and development as a function of heat units accumulated after planting (HUAP, 86/55 F thresholds; Brown, 1989; Baskerville and Emin, 1969). Chile crop phenology as a function of HUAP is described in Extension Bulletin AZ1529 (Silvertooth et al., 2010). The NAW is positioned just prior to the period peak N demand by the chile crop during the phase of

growth when N demand is rapidly increasing after the crowning stage of development. Nitrogen applications made in this manner in advance of the N demand period increases the probability of fertilizer N uptake and recovery by the plant. Thus, the NAW extends from the crowning stage to just past peak bloom (~1200 – 2300 HUAP).

Chile crop water demand also increases quite rapidly during this same period of growth with maximum chile crop water demand occurring from early bloom until the completion of development of the primary pod set (~1600 – 2500 HUAP). For green chile this peak water demand will extend up to the time of crop harvest. For red chile, peak water demand declines as the crop transitions from ~ 50% green and 50% red chile on the plants, or the stage that is commonly referred to as the maximum "chocolate chile" stage.

For both water and N management it is important to monitor crop growth and development as well crop condition including vigor, fruit load, etc. Water stress should be avoided during these stages of growth and N management needs to be flexible in response to changes in crop condition during these peak periods of demand. Crop monitoring and flexibility are key elements to management for optimum crop production efficiency.

Nitrogen application rates will vary depending on other factors such as residual soil N levels, N concentrations in the irrigation water, previous N fertilizer applications, cropping history for the field and residual crop residues, as well as the current condition of the crop or field in question. Nutrient uptake studies have shown that approximately 180 lbs. N/acre is the maximum amount of total N required by green and red chile crops for optimum yields. Actual total fertilizer N amounts needed by an irrigated chile crop usually equate to a total of 100 – 150 lbs. N/acre for

the entire season. However, as previously stated, this rate can vary tremendously depending on actual crop and soil conditions.

Nitrogen management for irrigated chile should be directed to provide the total fertilizer N for a crop within the NAW with split applications toward a maximum target of approximately 100 – 150 lbs. N/acre. Late season N fertilizer applications can delay crop maturity and harvest. Crop and soil monitoring in-season is critical to allow appropriate adjustments in N fertilizer applications to best match in-season conditions in the field optimize this important facet of chile crop management.

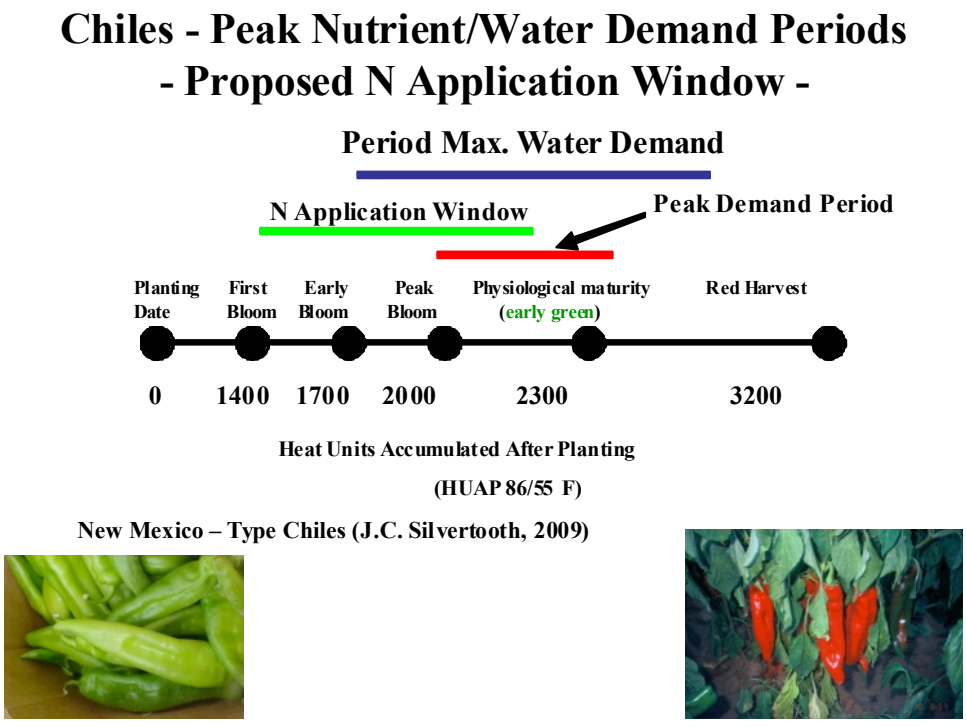

Figure 1. **Nitrogen (N) application window and maximum water demand period for New Mexico type chiles in the desert Southwest of the U.S.**

References

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