COOPERATIVE EXTENSION SERVICE
UNIVERSITY OF KENTUCKY • COLLEGE OF AGRICULTURE

Water Quality Guidelines for Tobacco Float Systems

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Water quality testing is available through the University of Kentucky's Soil Testing Laboratory for farmers using the tobacco float transplant system. Table 1 lists the measurements that will be made and their desirable ranges. It is expected that the water provided by most municipal water systems will be acceptable for tobacco transplant production. However, some water districts that use ground water sources may have high levels of alkalinity and conductivity. The primary purpose of the water testing service is for those who plan to use water from private wells in their float beds.

Table 1. *Water quality parameters to be measured by the University of Kentucky and desirable ranges for these parameters.*

Parameter (units)	Desirable Range
pH	6.0 — 7.5
Conductivity (mmho/cm)	0.0 — 0.75
Alkalinity (ppm)	50 — 100
Nitrate-Nitrogen (ppm)	0.0 — 5.0
Phosphorus (ppm)	0.0 — 5.0
Potassium (ppm)	0.0 — 5.0
Calcium (ppm)	40 — 100
Magnesium (ppm)	15 — 50
Zinc (ppm)	0.0 — 2.0
Copper (ppm)	0.0 — 2.0
Iron (ppm)	0.0 — 2.0
Manganese (ppm)	0.0 — 2.0

Table 2. *Recommendations for tobacco float bed water with alkalinity levels between 100 and 200 ppm CCE.*

Alkalinity (ppm CCE)	Calcium level (ppm)	Recommended Action
125	above 38	None
	below 38	Use acidifying fertilizer
150	above 45	None
	below 45	Use acidifying fertilizer
175	above 53	Use acidifying fertilizer
	below 53	Acidify with acid to 100 ppm CCE
200	above 60	Use acidifying fertilizer
	below 60	Acidify with acid to 100 ppm CCE

Alkalinity

The water quality factor which will be of most importance to tobacco producers is the alkalinity. Alkalinity refers to the capacity of the water to neutralize acid or to resist a lowering of the water pH. The major contributors to alkalinity in natural waters are bicarbonates. Alkalinity influences plant growth by causing the pH of the growing medium to increase. At high pH, some nutrients become less available, resulting in nutrient deficiencies. High alkalinity can also contribute to the accumulation of ammonia in the growing medium, causing poor plant growth.

Alkalinity will be reported in terms of calcium carbonate equivalent (CCE) in parts per million (ppm) on water test reports. Occasionally, alkalinity may be reported as the concentration of total carbonates (TC) in milliequivalents per liter (meq/L). Total carbonates in meq/L can be converted to alkalinity in ppm with the following formula:

$$\text{alkalinity (ppm CCE)} = \frac{\text{total carbonates (meq/L TC)}}{0.02}$$

Recommended Treatment for Alkalinity

At low alkalinity levels, less than 50 ppm, the water has very little capacity to buffer against a pH decrease so a non-acid fertilizer is recommended. If the alkalinity is between 50 and 100 ppm no corrective action is needed. For alkalinity levels between 100 and 200 ppm the recommended action will depend on the calcium level of the water (Table 2). Calcium in the water acts as a natural control on the activity of bicarbonate, so more alkalinity can be tolerated in the presence of a higher level of calcium.

When the alkalinity is greater than 200 ppm, it is recommended that the bicarbonate be neutralized to a level of 100 ppm. The addition of mineral acids will be necessary to reduce the alkalinity to an acceptable level. The amount of acid needed will depend on the type and concentration of the acid used.

As an example, assume a sample has an alkalinity of 250 ppm. We need to neutralize 250 - 100 = 150 ppm. To calculate the amount of acid needed, you need to know the concentration of the acid. Acid concentration is given in units called normality (N). A common source of acid is battery acid. Many farm implement dealers and auto parts stores have battery acid, but you should ask for virgin battery acid. Recycled battery acid may contain some impurities that are harmful to plants. The most common type of battery acid is 9.19 N (35%) sulfuric acid. The amount to add can be determined:

$$\frac{\text{ppm CCE alkalinity x 2.56}}{\text{normality of acid}} = \text{oz. acid per 1000 gallons water}$$

For the example above:

$$\frac{150 \times 2.56}{9.19} = 42 \text{ oz. battery acid per 1000 gallons water}$$

If a different type of acid is used you must substitute the normality of that acid into the equation above. Note that not all "battery acid" is the same concentration, but the 35% concentration is most commonly used in automotive type batteries. If a different type of acid will be used, please contact your county extension office for assistance in determining the rate of acid to use.

The appropriate amount of acid should be carefully added to the float bed and mixed one to two days prior to seeding. If you plan to inject acid, select equipment specifically designed for acid injection, since acids will corrode pipes and equipment.

Conductivity

Another water quality factor which needs to be considered is the conductivity. High conductivity indicates a high level of salts. Conductivity levels greater than 0.75 mmho/cm (a reading of 8 on the Dist-4) indicate that soluble salts may be high enough to cause injury to young seedlings. The remedy in most cases will be to suggest a different water source. In the event that this is not possible, it is recommended that a fertilizer with a lower salt content be used.

Other Measurements

For the other measurements, unless extreme values are reported no action will be recommended. High levels of nitrate, phosphorous or potassium may indicate surface contamination of the water source. This raises concern that the water might also contain levels of some pesticides which could cause injury to tobacco seedlings. If levels of micronutrients over 2 ppm are found, consult with your county Extension office before using the water.

Acknowledgment

Much of the information contained in this publication came from: *Producing Tobacco Transplants in Greenhouses: Water Quality*. W. David Smith, Gerald F. Peedin, Fred H. Yelverton, and C. Ray Campbell. Published by North Carolina Cooperative Extension Service. AG-488-3.

WARNING!

Strong acids will result in **very serious burns** to the skin and **damage to the eyes**. When using any acid be extremely cautious to avoid contact with the material. The chemical reaction between acid and water can cause acid to splash into eyes or onto skin and clothing.

Always **add acid to water**, not the reverse. Add the acid in small portions with complete mixing before adding more.

Always **wear safety goggles** with splash guards, rubber gloves and a chemical resistant apron. Have plenty of clean water available to immediately wash off any acid. **Do not use acids alone**. Have someone nearby who can summon medical assistance if necessary.

Safety information can be found on a material safety data sheet (msds). The msds for a product should be available from the product's manufacturer.

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