



Tissue and Soil samples

The root system of strawberry plants is relatively shallow. Even though roots may extend to a depth of two feet in light sandy soils, most active roots are found in the top foot of the profile. Soil samples are therefore generally taken from the top 6-10 inches of the profile.

Systematic plant analysis is a useful tool to monitor the nutritional status of strawberry plants. Leaf analyses are performed on young mature leaves. Approximately 30-40 leaves should be collected across the rows of a field or sampling block.

Optimum Leaf N, P and K concentrations

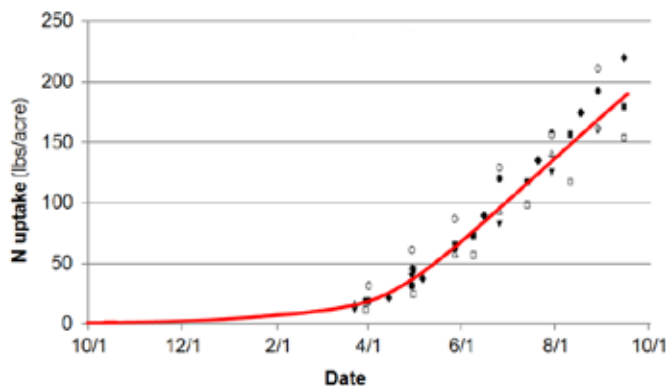
Sampling Stage	Nutrient Concentration (%)		
	N	P	K
Pre-harvest	3.1-3.8	0.5-0.9	1.8-2.2
Main harvest	2.4-3.0	0.3-0.4	1.3-1.8

Petiole nitrate N concentrations are much more variable and less reliable than leaf total N. Maintaining nitrate N levels above 1,000 ppm pre-harvest and above 400 ppm during harvest is likely adequate to ensure high productivity. This recommendation is in line with an earlier study carried out in San Jose, where the critical petiole nitrate N concentration was 500 ppm. Lower values indicated N deficiency, while very high nitrate-N values (above 10,000 ppm) generally resulted in excessive leaf growth and reduced yield.



Strawberry Nitrogen Uptake

Seasonal N Uptake



Information regarding strawberry fertility management, including placement, fertilizer source, phosphorus and potassium, is available at:

www.cdfa.ca.gov/go/FREPGuide



SELECTED REFERENCES

- Bottoms, T.G., Hartz, T.K., Cahn, M.D., Farrara, B.F., 2013. Crop and soil nitrogen dynamics in annual strawberry production in California. HortScience 48, 1034-1039.
- Hartz, T.K., 2012. Establishing nutrient management practices for high-yield strawberry production. California Strawberry Commission Annual Production Research Report 2011-2012.
- Cahn, M., 2012. Optimizing irrigation and nitrogen management in strawberries for improved water quality. Final Report to the Central Coast Regional Water Quality Control Board.



STRAWBERRY NITROGEN Fertilization Guidelines

Online nutrient guidelines for strawberry and other crops, as well as relevant references, are available at:

www.cdfa.ca.gov/go/FREPGuide

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Daniel Geisseler and William R. Horwath, Department of Land, Air and Water Resources, UC Davis, gathered and organized the guideline information through FREP grant agreement 11-0485.



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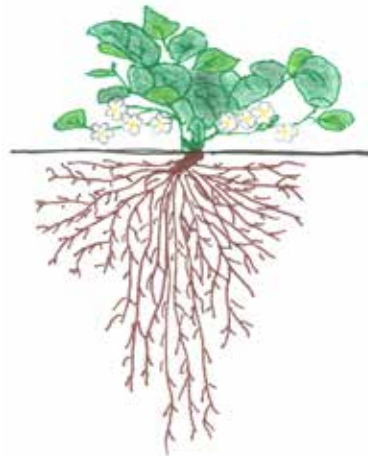


Nitrogen Fertilization PREPLANT and TRANSPLANTING

Soil nitrate N is typically high when strawberries are planted after vegetables. Monitoring soil mineral N during the winter and early spring can increase N use efficiency and reduce the risk of nitrate leaching during the winter months.

A moderate amount of preplant controlled release fertilizer, in combination with regular monitoring of soil mineral N during the winter, minimizes the risk of nitrate leaching, while ensuring that suboptimal N availability would be detected. Common controlled release fertilizers release N at a relatively steady rate over 6-8 months. This means that if applied in late October, more than half the N is likely to be released by the end of March. Nitrogen released in excess of crop N uptake is subject to leaching by rain or irrigation water. Preplant fertilizers are applied before the plastic mulch is spread.

In the northern production areas, N uptake of fall-planted strawberries is slow during the winter months. In a study carried out in 26 commercial fields in the Salinas and Pajaro Valleys, N uptake averaged less than 25 lbs/acre through March. In the Ventura area, where strawberries are planted in early fall, early N uptake was higher.

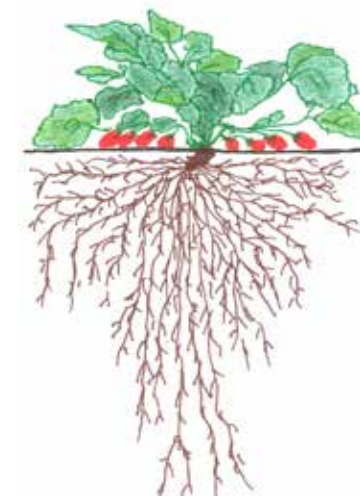


Nitrogen Fertilization IN-SEASON FERTIGATION

Split applications have been found to produce higher yields compared to a program where all the N is applied preplant. In a study carried out in the Salinas and Pajaro Valleys, N accumulation in the aboveground biomass increased linearly by 1 lb/acre per day from April through mid-September, reaching 200 lbs/acre by mid-September. The consistent crop N uptake rate over the entire fruiting season suggested that a program of small, uniform N fertigations throughout that period is an efficient practice that minimizes summer nitrate loss potential.

Nitrate in the irrigation water and nitrogen released from controlled release fertilizer applied in fall need to be taken into account when calculating the application rates for fertigation.

Locascio and coworkers found no difference in strawberry yield when N and K were applied either daily or weekly with drip irrigation.



Modes of NITROGEN FERTILIZATION

Fertigation

Fertigation is a very efficient way to apply N. It is best to irrigate before injecting the fertilizer to keep it within the root zone. To ensure even distribution of N throughout the field, the system needs to run until the fertilizer is flushed from the drip tape farthest from the point of injection.

Foliar Applications

When soil fertility is managed properly, foliar-applied N-P-K fertilizers applied during flowering, fruit enlargement and/or flower initiation generally have minimal effects on strawberry production. The flexibility of N fertigation with drip irrigation systems reduces the need for foliar N even further. When root uptake is limited, foliar-N applications may be an effective way to supply N.

For Oregon, Hart and colleagues recommend limiting the N applied with foliar urea to 10 lbs N/acre per application.



For more information and references about N management in strawberries, access the crop fertilization guidelines at:

www.cdфа.ca.gov/go/FREPguide