Challenges in Developing an Organic Fertilization Program for Processing Tomatoes

Gene Miyao, Farm Advisor, UCCE, Yolo, Solano & Sacramento counties

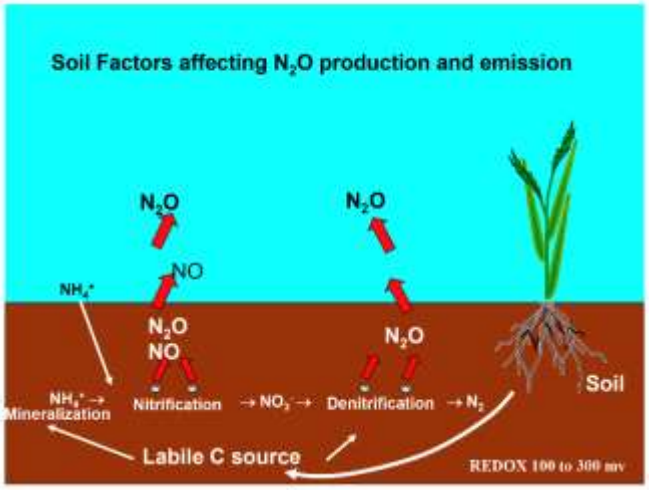

~ 2.5% of 2014 crop
'O' proc. tomatoes

Nitrogen balance for processing tomato :

TK Hartz

	lb N/acre
Seasonal fertilizer application	**190**
Crop N uptake	**240**
N removed with harvest	**150**
Application - crop uptake	**- 50**
Application - harvest removal	**+ 40**

Based on a 50 ton crop



Martin Burger

Steps to more efficient N management :

- Evaluate residual soil NO_3-N
- Credit N supply from organic amendments
- Control in-season leaching

Control in-season leaching :

TK Hartz

- **To estimate NO_3-N concentration in leachate, multiply soil NO_3-N by 3 or 4**
  Example: If root zone soil NO_3-N is 15 PPM, leachate is likely to be 40-60 PPM
- **Leachate NO_3-N x 0.23 = lb N per acre-inch**

In processing tomato production, NO_3-N loss is likely to be in the range of 5-15 lb N/acre inch of leaching

Evaluate residual soil NO_3-N :

- **Fields differ widely**

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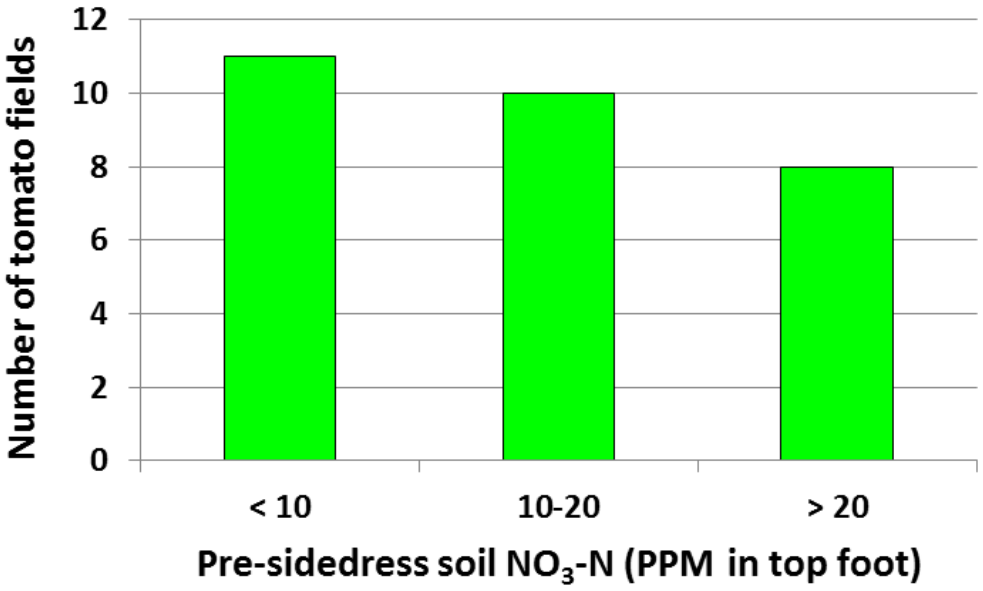
29 fields were monitored:



How to use residual soil NO_3-N to modify N application program :

- **Each PPM NO_3-N represents about 4 lb N/acre in the top foot**
- **Therefore, N credit could be *as much as* 4 lb N/acre for each PPM NO_3-N above 5 PPM**


JOHN DEERE

TABLE 1. TYPICAL NUTRIENT CONCENTRATIONS FOR A MANURE-BASED COMPOST (DRY-MATTER BASIS)

Nitrogen	1.0 – 2.0%	Potassium	2.0 – 3.0%
Phosphorus	0.3 – 1.5%	Sodium	0.5 – 1.5%
Calcium	2.0 – 6.0%	Chloride	0.5 – 1.5%
Magnesium	0.5 – 1.5%		

M. Van Horn, 1995

TABLE 3. MAIN CRITERIA FOR AEROBIC COMPOSTING

Factor	Acceptable Range	Optimum Range
Starting Materials		
C:N ratio	20:1–40:1	25:1–30:1
Particle size	1/8"–2"	varies with material
Thermophilic Stage		
Water content	40–70%	50–60%
Oxygen concentration	>5%	>10%
pH	5.5–9.0	6.5–8.0
Temperature	110°–150°F	125°–140°F

Nitrogen Sources for Organic Crop Production

Better Crops, Vol. 92
2008, no. 4.

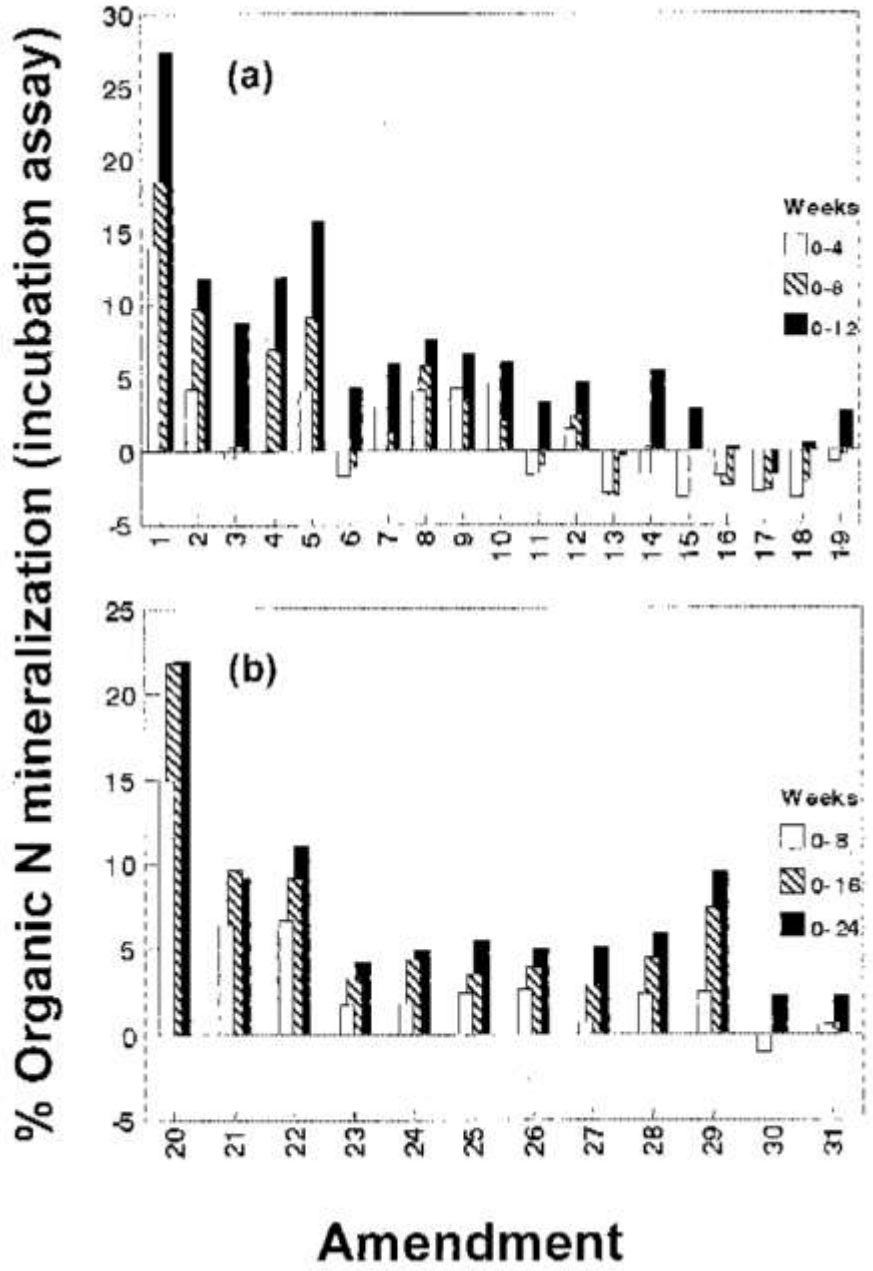
By Robert Mikkelsen and T.K. Hartz

**Nitrogen is generally the most
Cover crops and composts can
synchronize N release from th
organic N fertilizers are availa
Careful management of organ
avoiding undesirable N losses**

Table 1. First-year N availability coefficients for different manures and application methods (plant-available N).

Manure type	Soil incorporated	Surface applied	
		Broadcast	Irrigated
	Fraction of N available during the first year		
Poultry litter	0.6	0.5	–
Layer manure	0.6	0.4	–
Scraped swine manure	0.6	0.4	–
Scraped dairy manure	0.6	0.4	–
Swine lagoon effluent	0.8	0.5	0.5
Dairy lagoon effluent	0.8	0.5	0.5
Compost (C:N of 15:1 to 20:1)	0.05	0.03	
Compost (C:N >25:1)	0	0	

Source: Baldwin, K.R. and J.T. Greenfield. 2006. Composting on organic farms. http://www.cefs.ncsu.edu/PDFs/Organic Production - Composting.pdf
Various authors: http://www.soil.ncsu.edu/about/publications.php#AnimalWaste



TK Hartz
JP Mitchell
C. Giannini
HortSci, 2000

Credit N contribution of organic amendments :

TK Hartz

	< 2% N	> 2% N
Fall applied compost	**0**	**0-5%**
Spring applied compost	**0-5%**	**5-10%**

Can tissue analysis improve N efficiency?

- As currently used, tissue analysis more often leads to increasing a grower's normal N fertilization program than decreasing it
- Sufficiency level for leaf total N is well established, but petiole NO_3-N sufficiency level needs review

Leaf N data from 20 fields :

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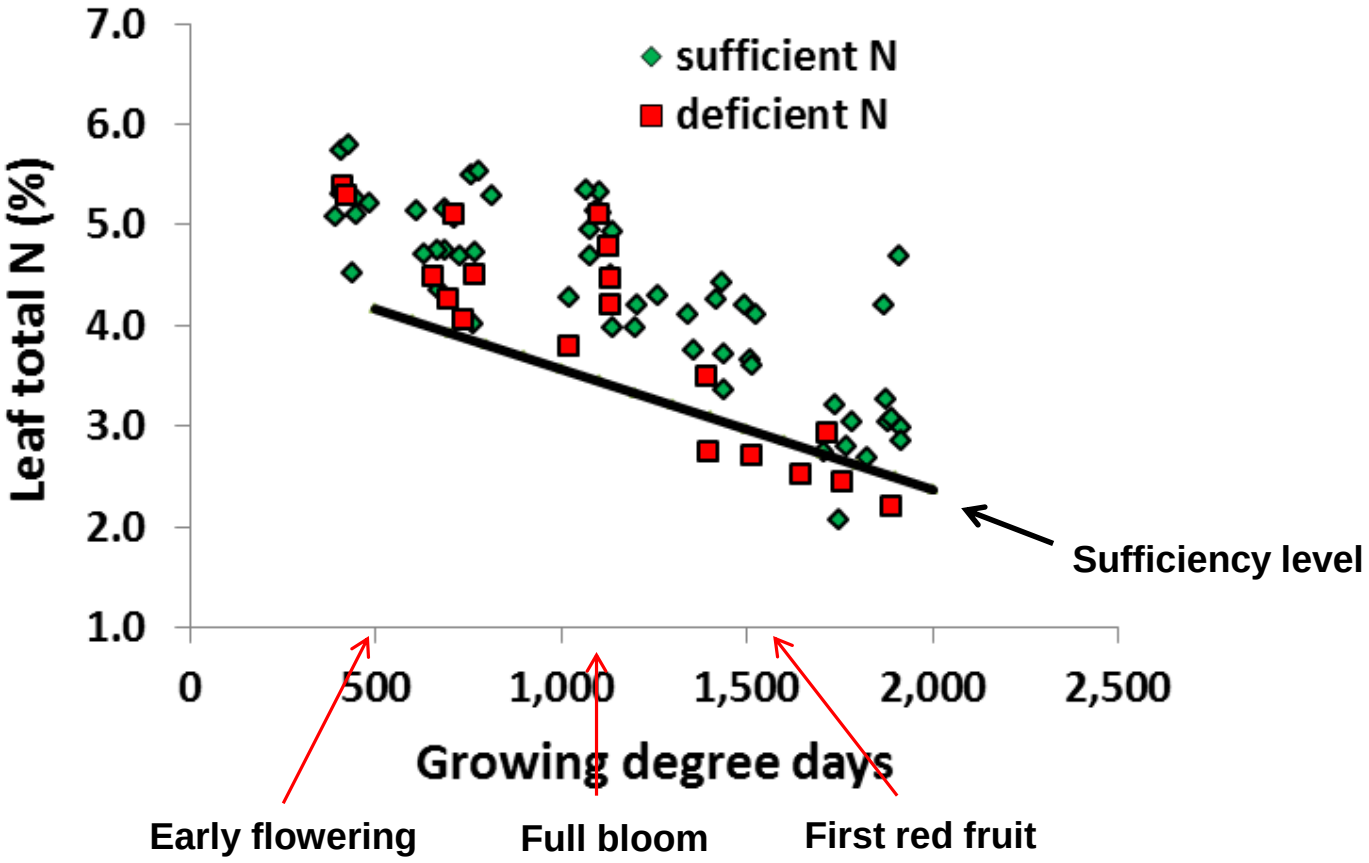
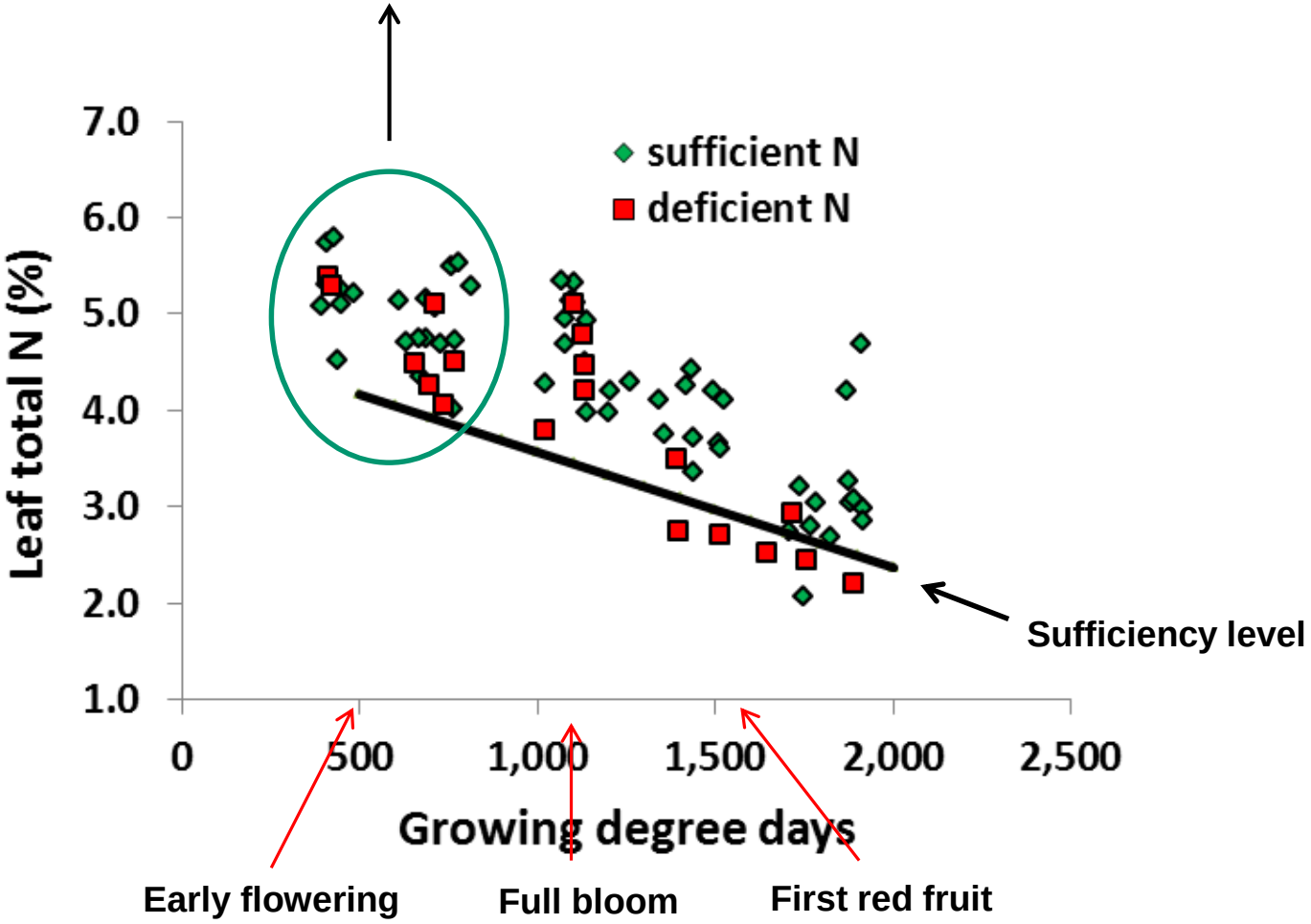


Leaf N data from 20 fields :

Very low leaf N may indicate limited soil N availability, but plant N uptake is not yet rapid enough to put a strain on soil N supply, so high values do not necessarily indicate high soil N

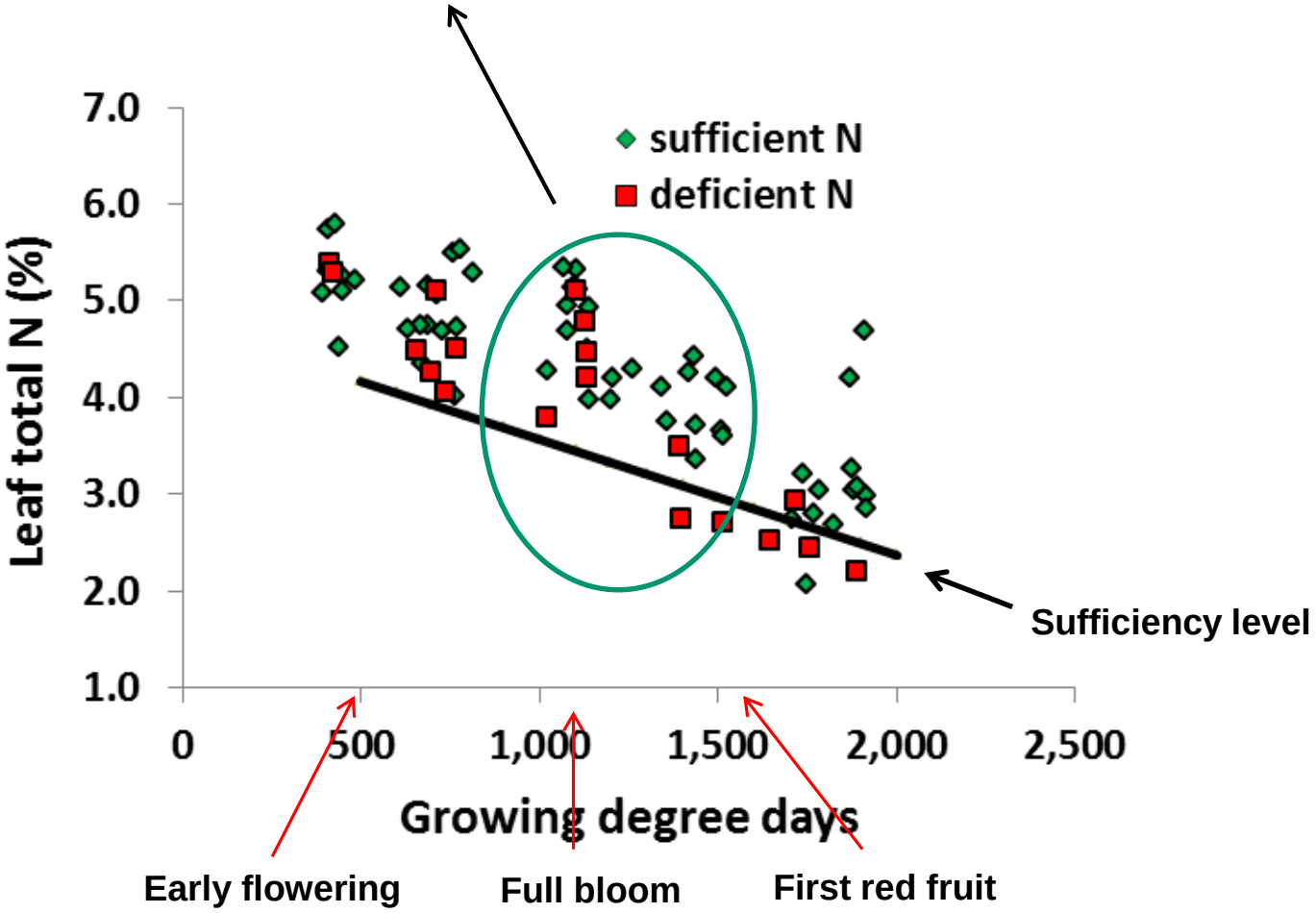
TK Hartz



Leaf N data from 20 fields :

This is the period of peak N uptake, and leaf N can fall rapidly; by the first red fruit stage leaf N comfortably above the sufficiency level indicates that N fertigation can stop

TK Hartz



Leaf N data from 20 fields :

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After first red fruit only fields with very low leaf N are candidates for continued fertigation; high leaf N at preharvest indicates excessive N application

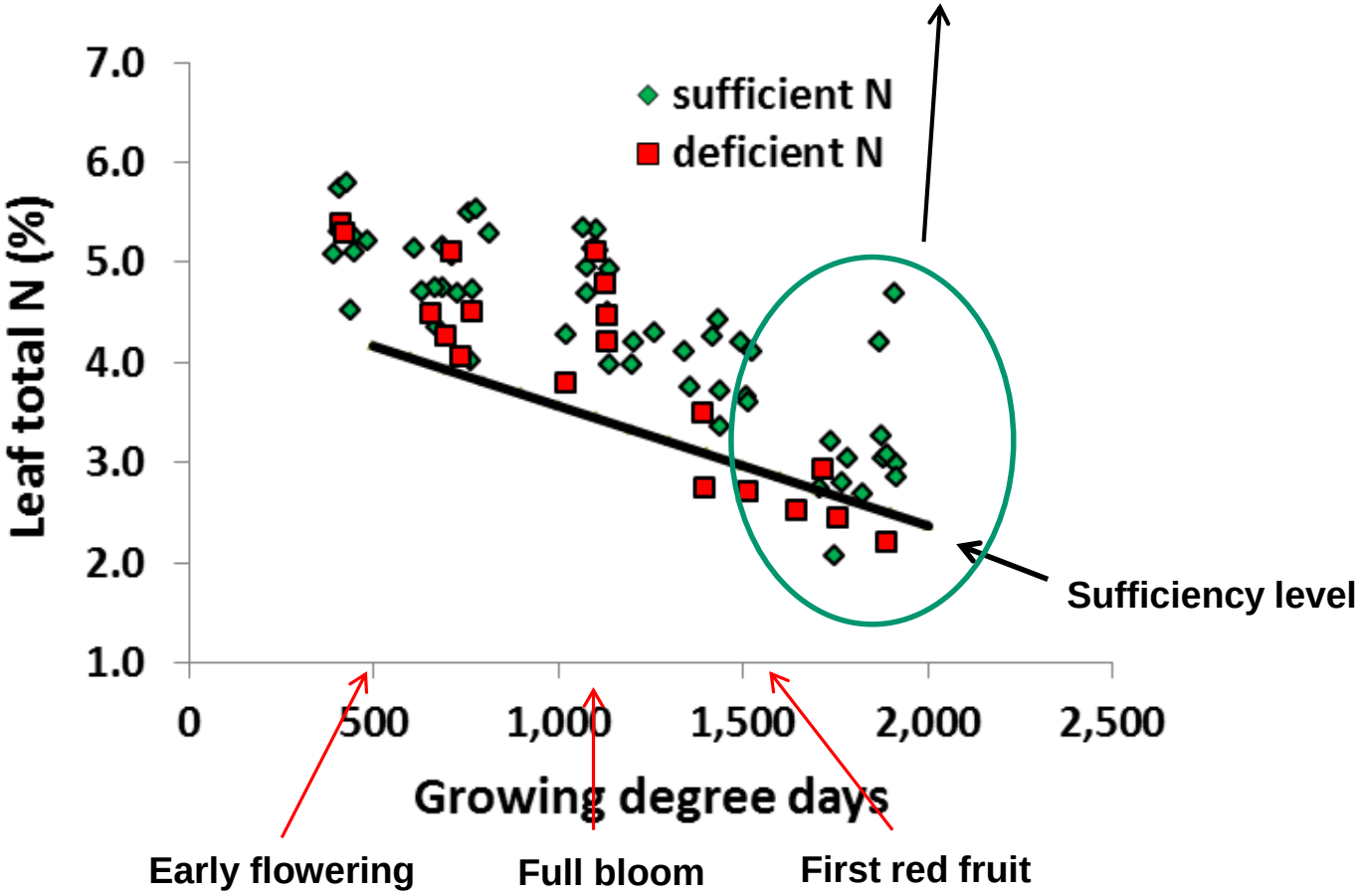

Table 3. Organic fertilizer nitrogen (N) availability and relative cost per kilogram, based on net N mineralization during 8 weeks of incubation.

Material	Product cost ($/kg total N)	N availability[z] (%)		$/kg available N[y]	
		10 °C[x]	25 °C	10 °C	25 °C
Fish powder	28.00	57	65	49.10	43.10
Blood meal	6.80	60	70	11.30	9.70
Feather meal	4.60	55	63	8.40	7.30
Sea bird guano	6.60	61	74	10.80	8.90

[z]Mineralized N + initial inorganic N, expressed as a percentage of initial total N.
[y]$1.00/kg = $0.4536/lb.
[x](1.8 × °C) + 32 = °F.

TK Hartz and PR Johnstone
HortTechnology Jan-March 2006

Steps to more efficient N management :

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