<http://nue.okstate.edu/N_Fertilizers/NUE_definition.html>

1. The Difference Method (Varvel and Peterson,1990, Agron. J. 82:935-938)

= **Yield** N Fertilized Plot \* %N grain – **Yield** 0N-check \* %N grain/ Rate of N Fertilizer Applied

or = PFR = (NF)-(NC) / R

NF = (**Yield** \* %N grain + stover, fertilized plot)
NC = (**Yield** \* %N grain + stover, unfertilized plot)

R = rate of fertilizer applied
<https://doi.org/10.2134/agronj1990.00021962008200050019x>

1. Macro Statistics (Raun and Johnson, 1999, Agron J. 91:357-363)

= (**Yield** \* %N grain – est. N from soil/rainfall) / N fertilizer applied

<https://doi.org/10.2134/agronj1999.00021962009100030001x>

1. NUE Isotopic Recovery (plant N derived from fertilizer) (Hauck and Bremner, 1976, Adv. Agron. 28:219-266
[https://doi.org/10.1016/S0065-2113(08)60556-8](https://doi.org/10.1016/S0065-2113%2808%2960556-8)

= (Nu – Nt)/(Nu – (Nf/n))

Nu = atom % 15N in unfertilized plants

Nt = atom %15N in fertilized plants

Nf = atom%15N in the fertilizer (example 0.006%)

1. Mass Balance (Davis et al., 2006, J. Plant Nutr. 26:1561-1580) (<https://doi.org/10.1081/PLN-120022364>)
2. account for all N applied
3. **Yield** \* %N to account for N removed in the grain
4. **Yield** \* estimated plant N loss as NH3 (% loss based on yield level)
5. account for denitrification, nitrate leaching
6. account for non-symbiotic N fixation, N applied in the rainfall
7. estimate of total soil N (0-30 cm) beginning and end of the experiment
see Table 6 (<https://www.tandfonline.com/doi/full/10.1081/PLN-120022364>)