Alfalfa Responses to Phosphorus and Potassium Management

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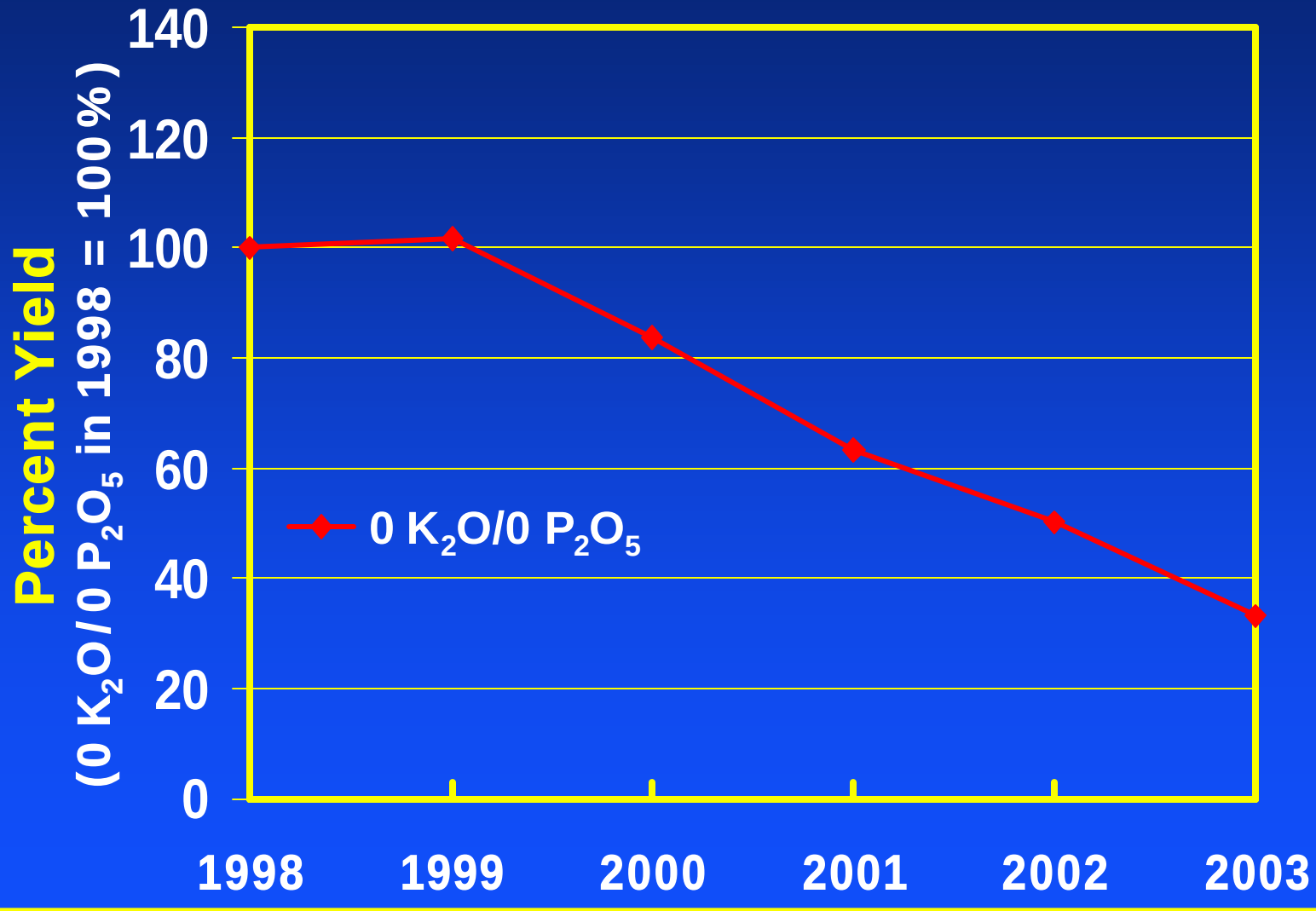
General Information

- 5 K treatments (0, 100, 200, 300, 400 lbs. K_2O/acre/year)
- 4 P treatments (0, 50, 100, 150 lbs. P_2O_5/acre/year)
- We apply half the specified amount of fertilizer after the first forage harvest and the remainder after the last forage harvest
- Initial Soil Test Levels: 80-100 mg K/kg and 5-10 mg P/kg
- We harvest 4 times annually for yield, mass/shoot, and shoots/area
- We dig roots in May and December to determine plant population
- We soil sample (0-2, 2-4, 4-6, and 6-8 inch depths) after each harvest and in spring after the plants break dormancy

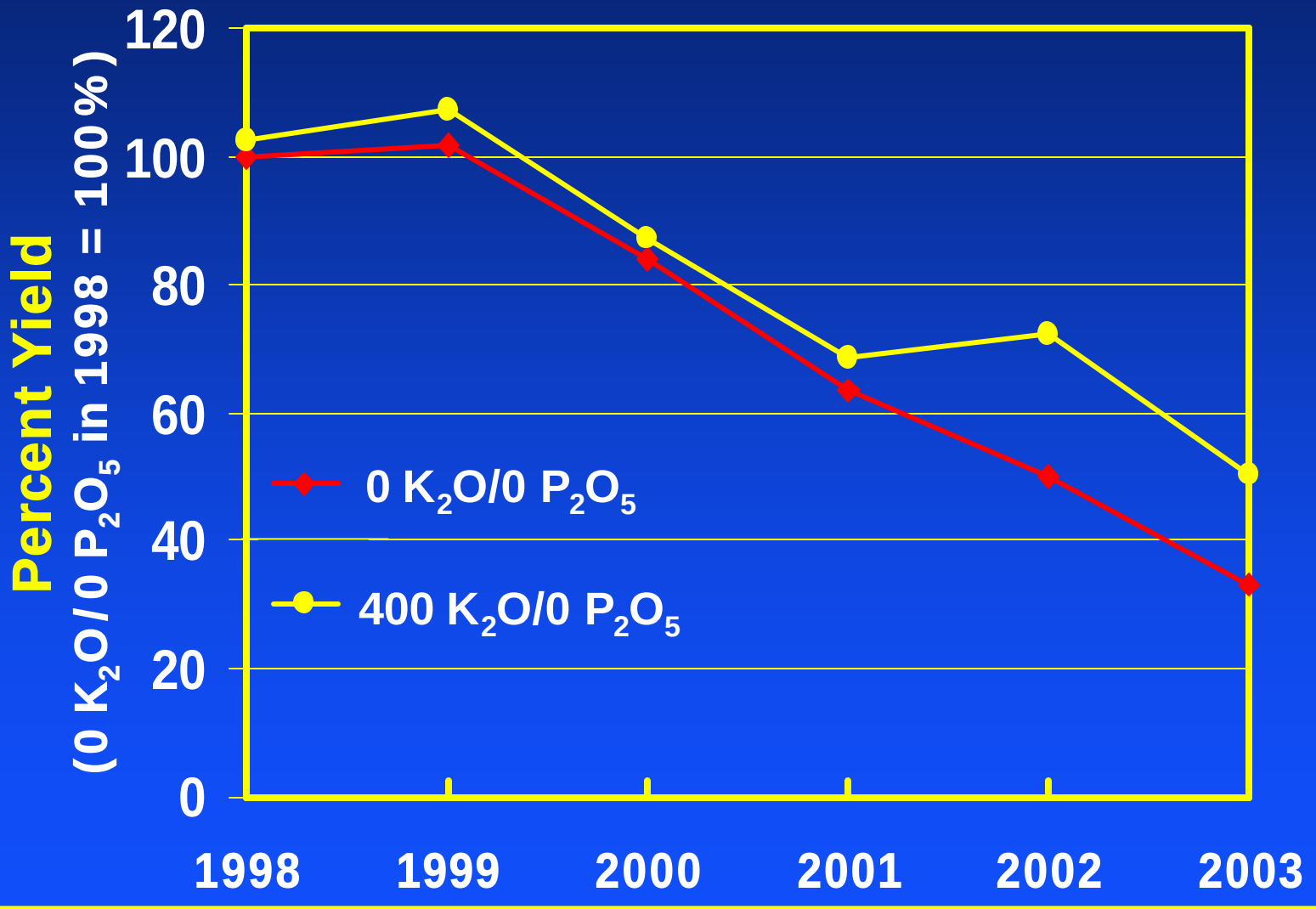
Questions We Will Address

- **How does P and K fertilization impact long-term yield?**
- **What plant factors are most closely associated with yield?**
- **When should soils be sampled?**
- **When should fertilizer be applied?**
- **Are there critical tissue test levels?**

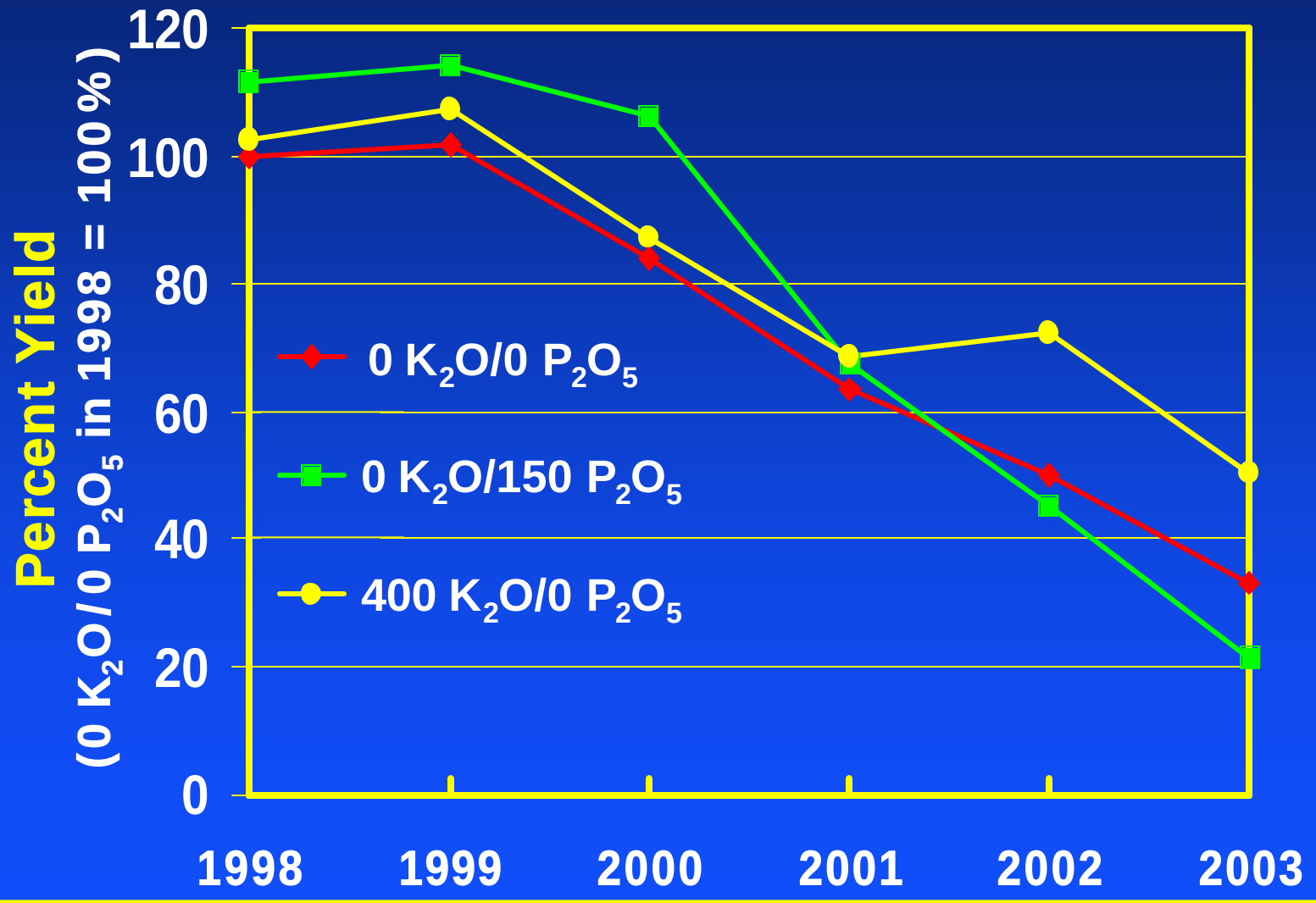
Control plot yield has declined steadily since 1999



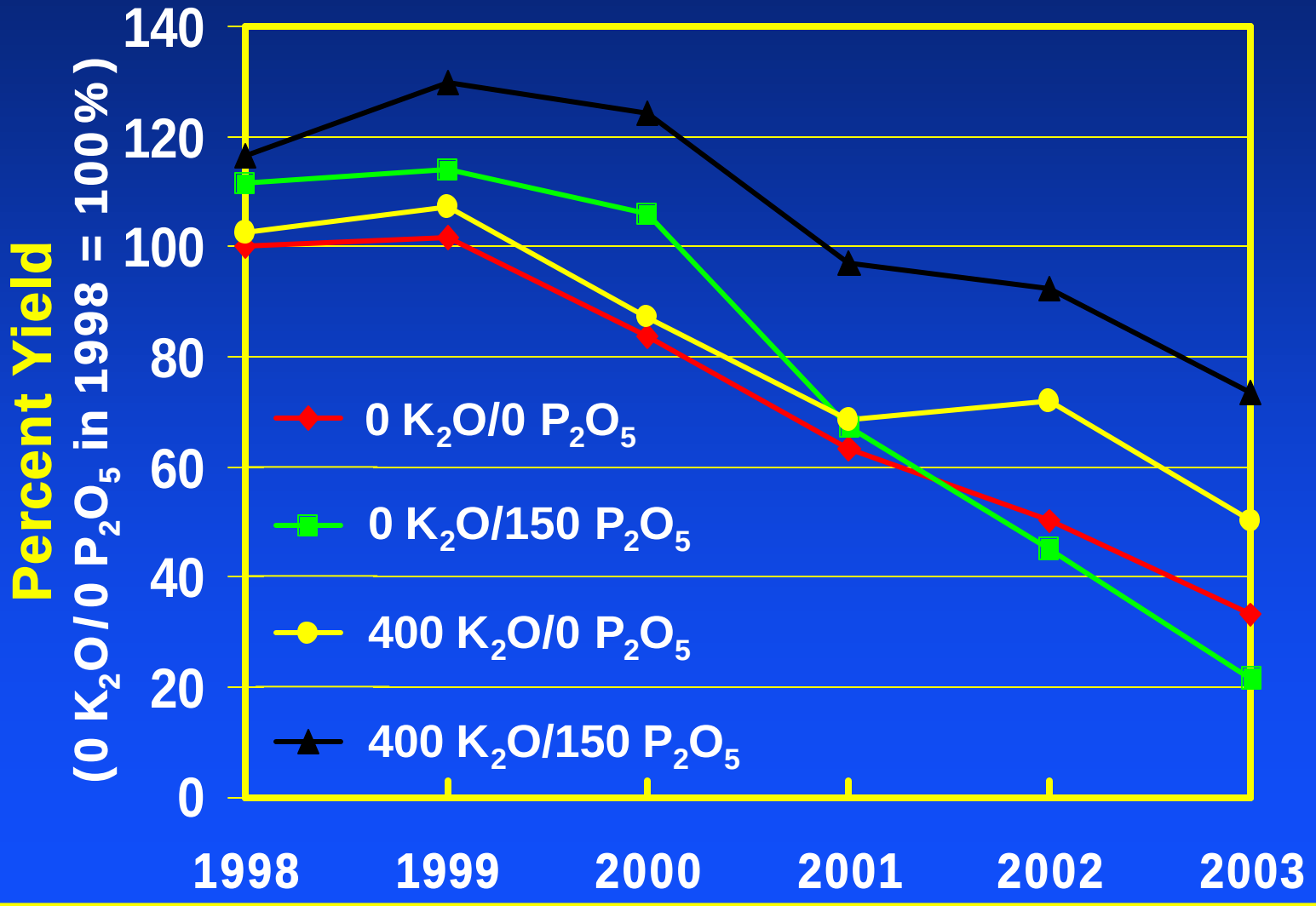
The 400 K_2O/0 P_2O_5 treatment did not really increase yield until 2002 and 2003



Yield increased with the 0 K_2O/150 P_2O_5 treatment from 1998 to 2000, but resulted in lower yields than the control plots in 2002 and 2003



With 400 K_2O/150 P_2O_5, yield increased from 1998 to 2000, and in 2002 and 2003 yields were twice those of the control plots



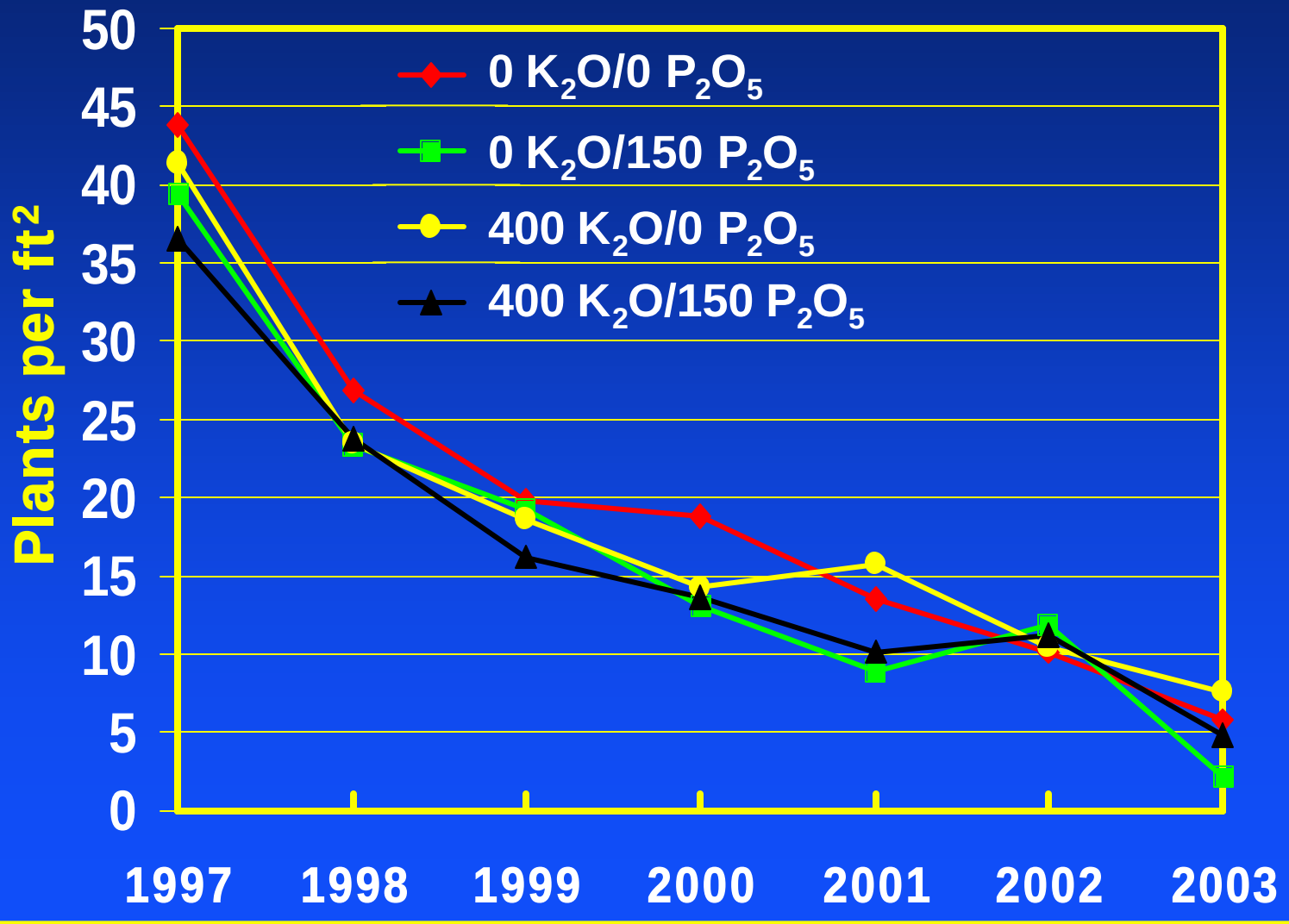
What Plant Factors Control Yield?

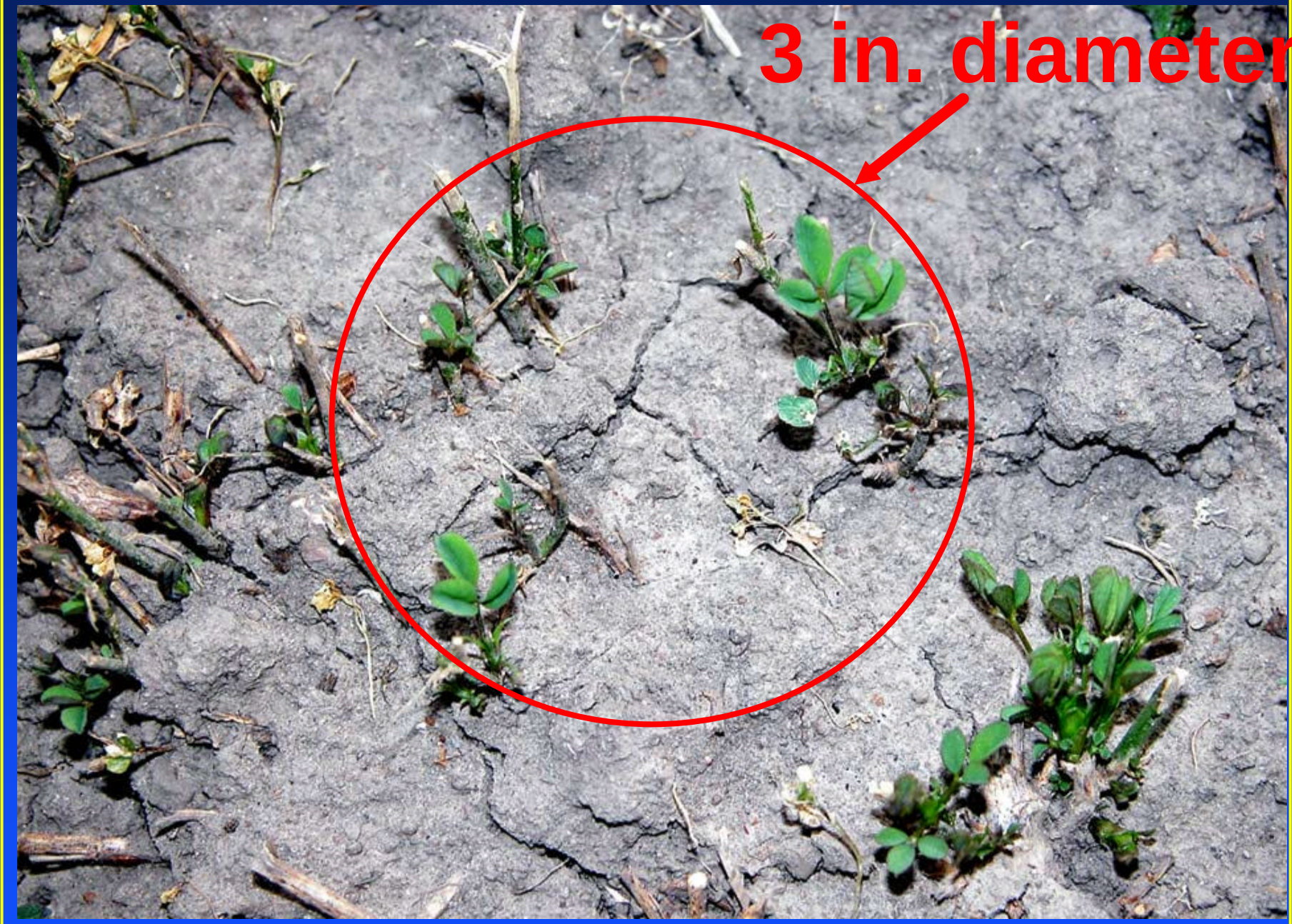
Yield component analysis permits us to better understand how alfalfa responds to phosphorus and potassium fertilization.

Yield = plants / area x shoots / plant x mass / shoot

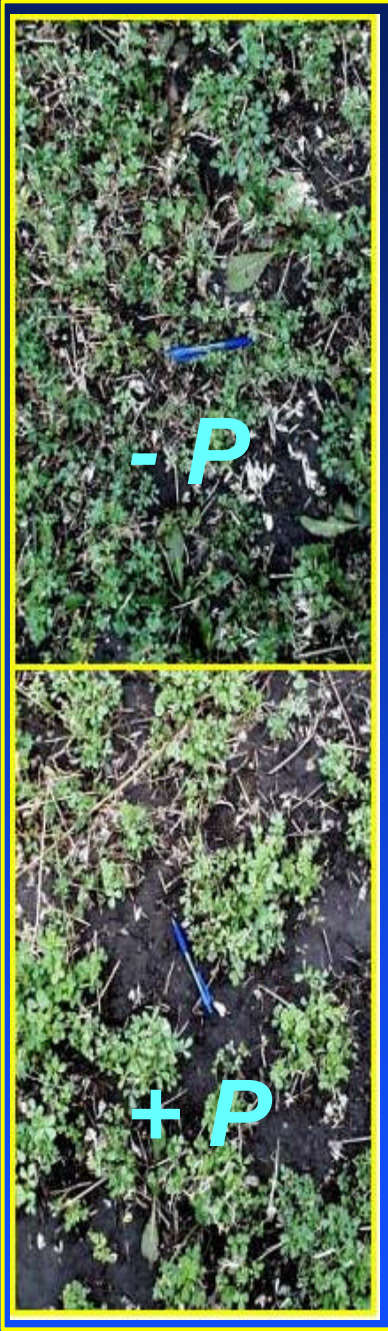
Shoots / area

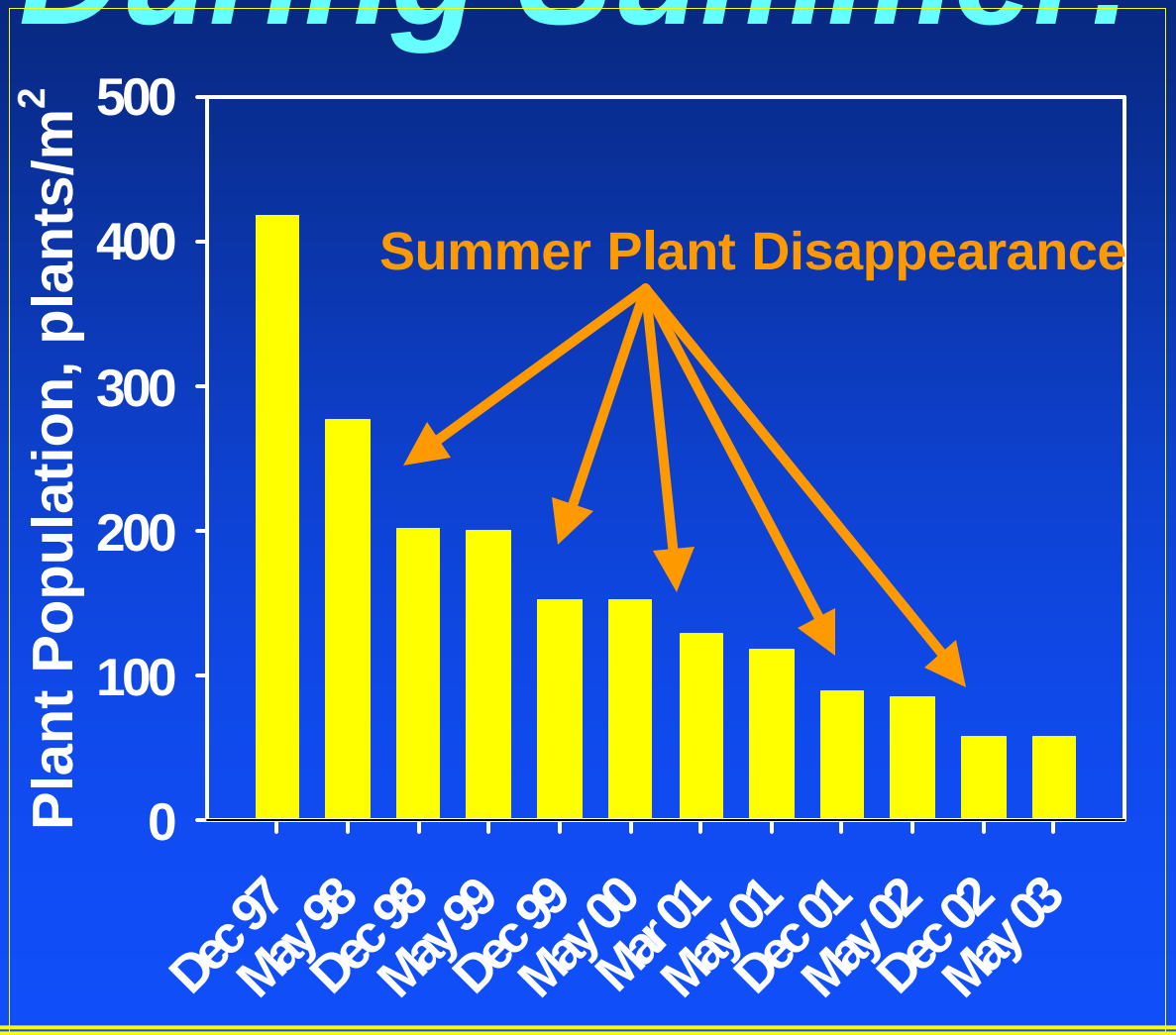
Plant population declined for all fertility treatments, and was not closely associated with forage yield



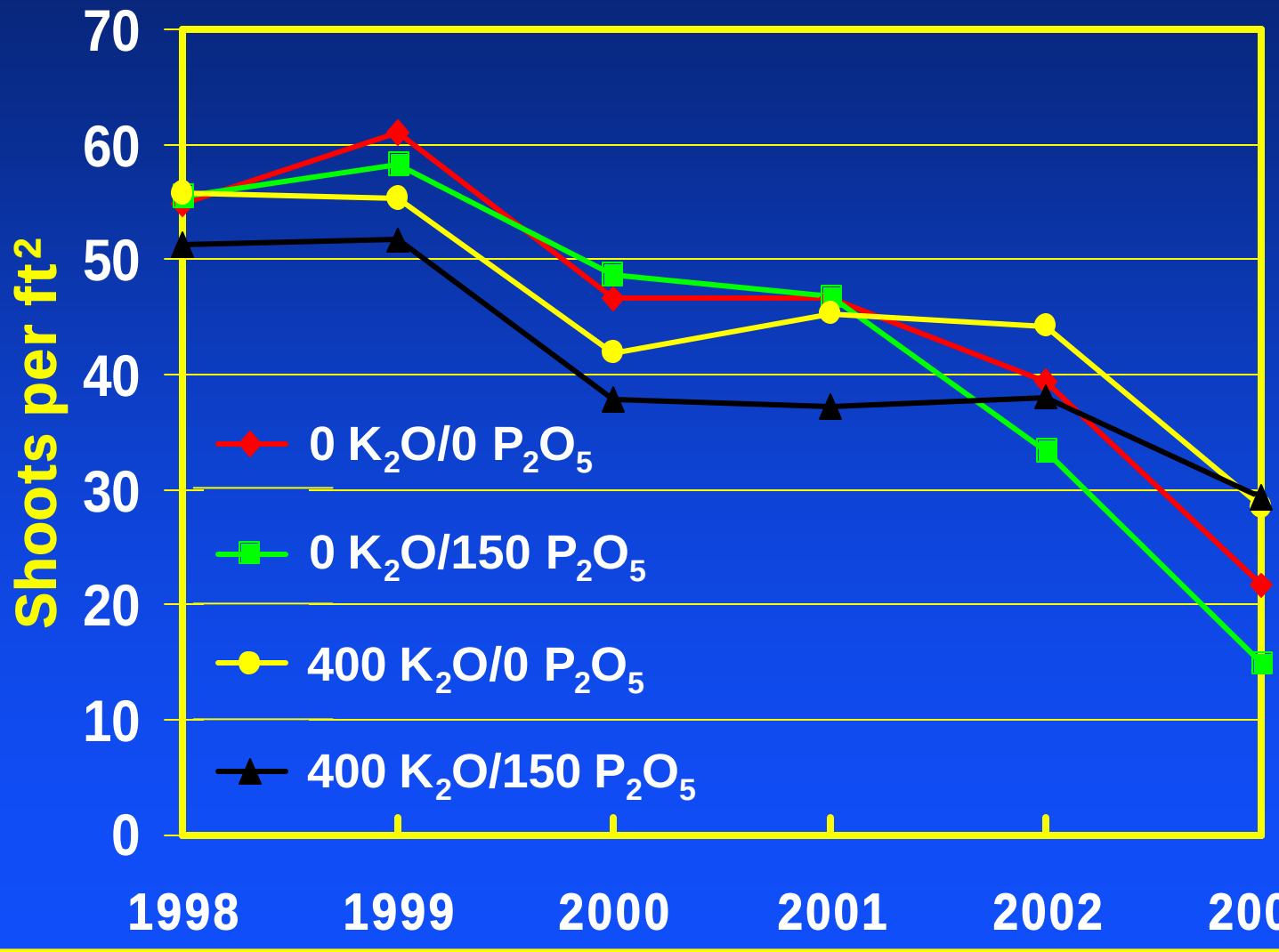

3 in. diameter

Plants Disappear During Summer!

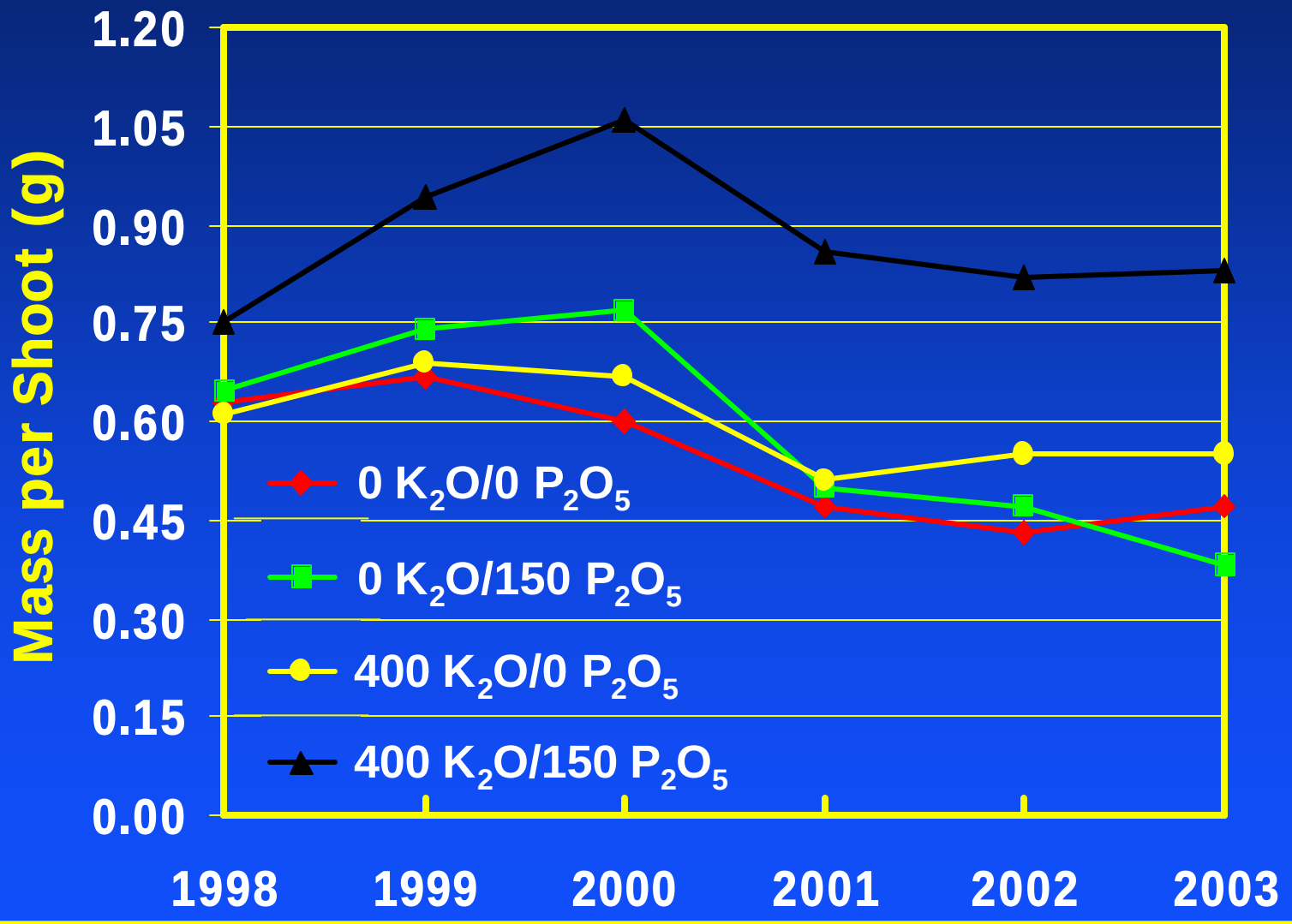




Shoots per square foot was not closely associated with forage yield



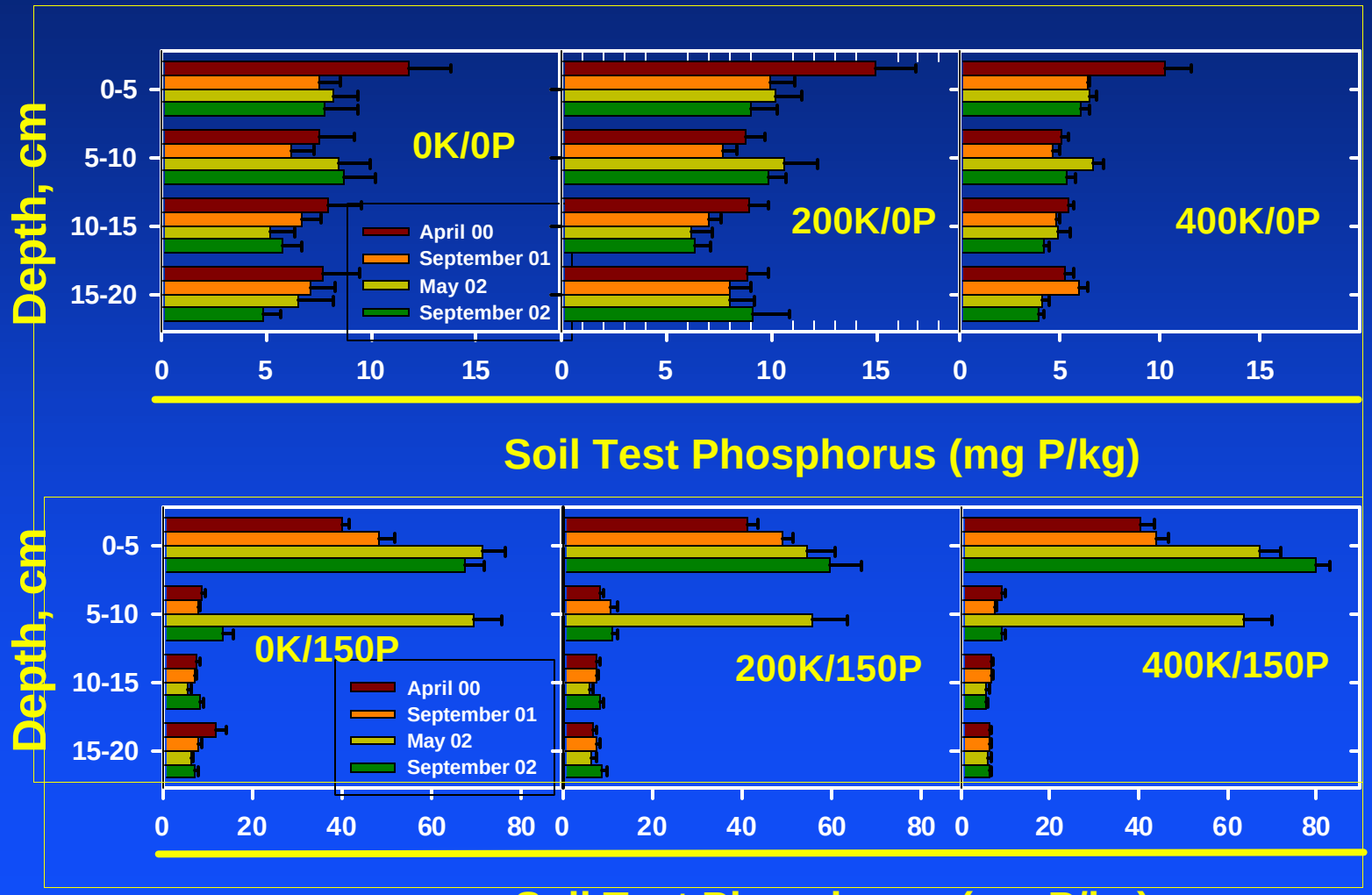
Mass per shoot was most closely associated with forage yield



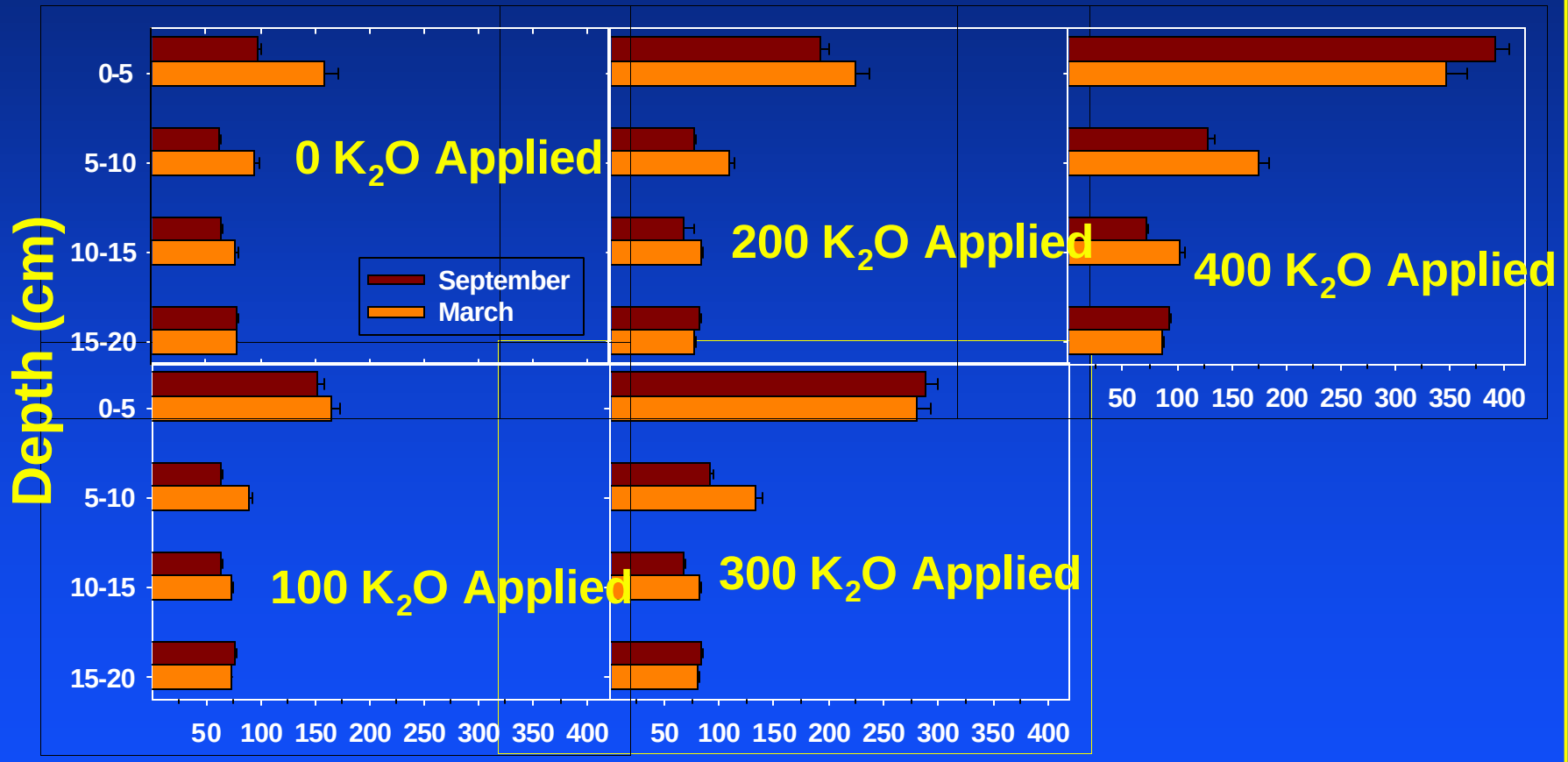

Bigger Plants with P and K
Low K and P
High K and P


400 K_2O/150 P_2O_5
0 K_2O/0 P_2O_5

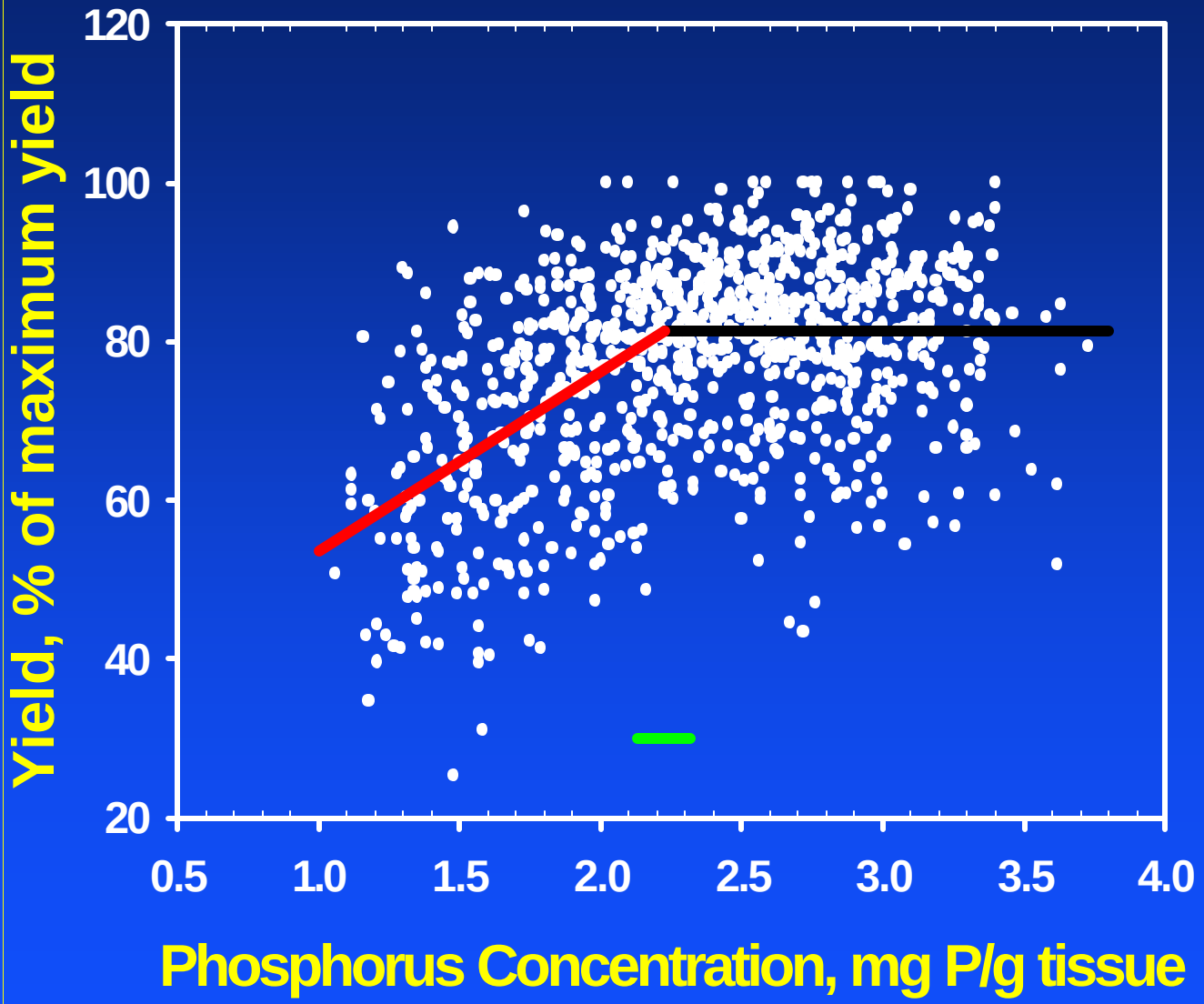
Phosphorus fertilization increased soil test P levels in all K treatments



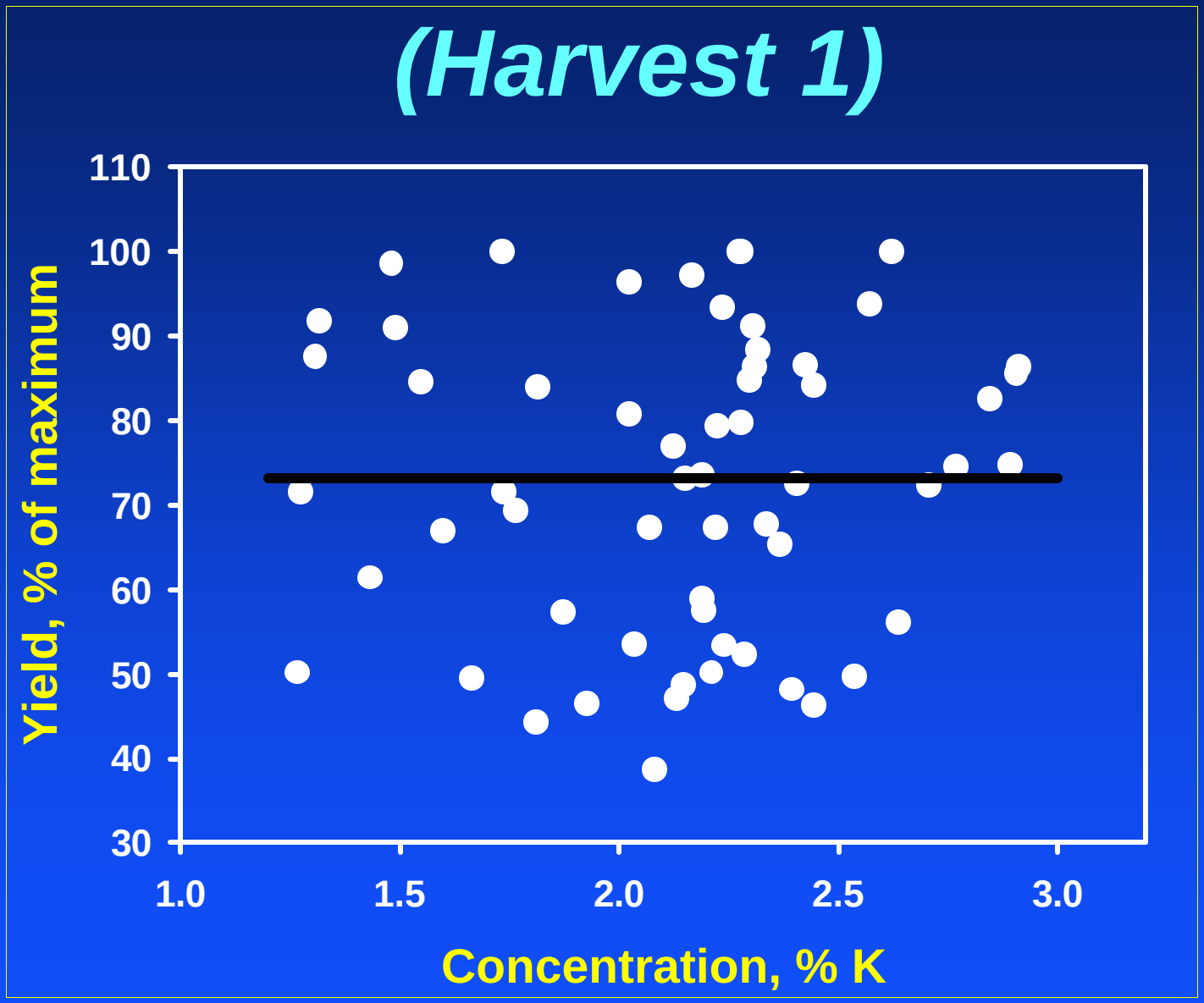
Soil Test K Increased Between September and March Without K Application



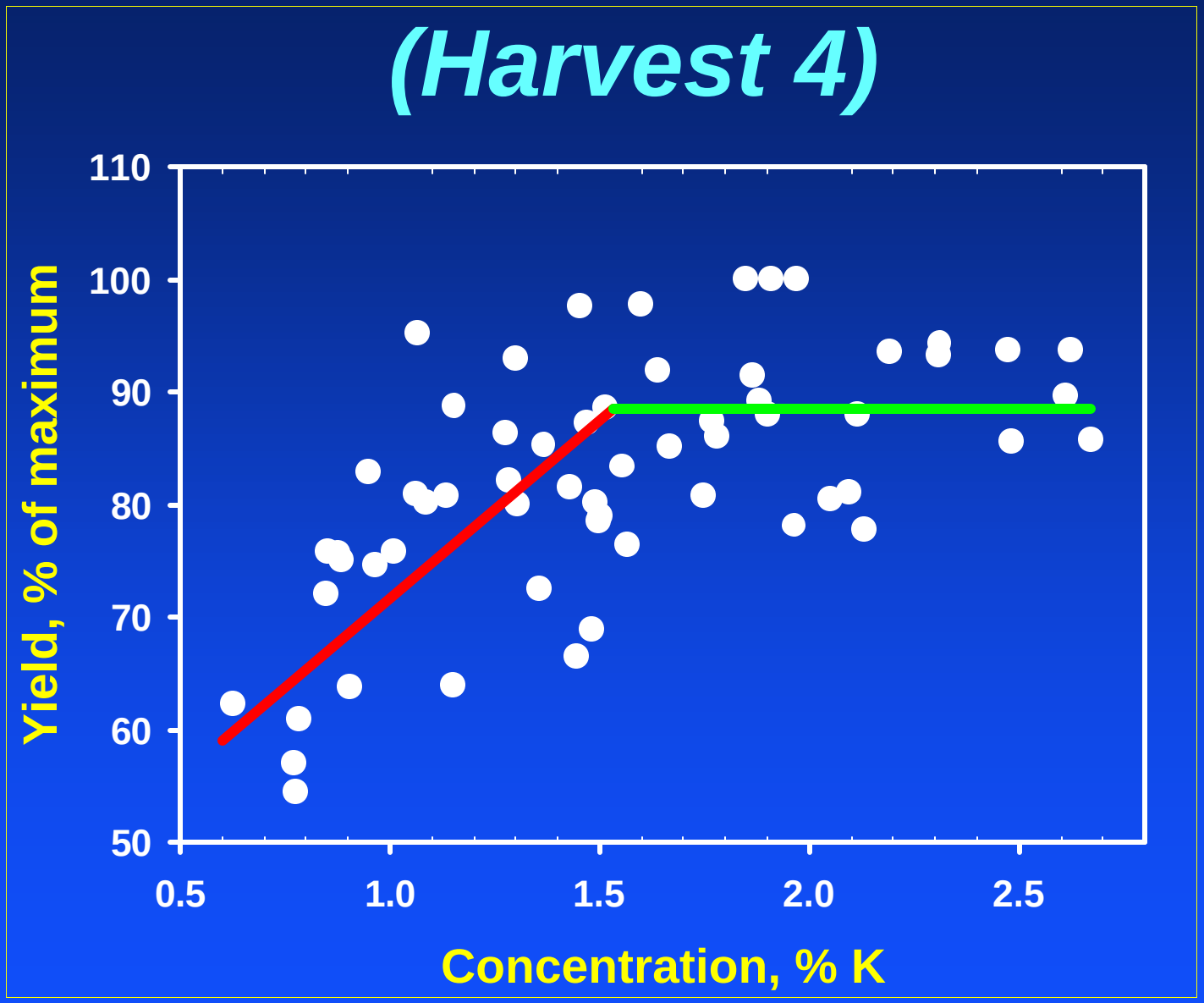
Critical Tissue P Concentration?



Critical K Concentration? (Harvest 1)



Critical K Concentration? (Harvest 4)



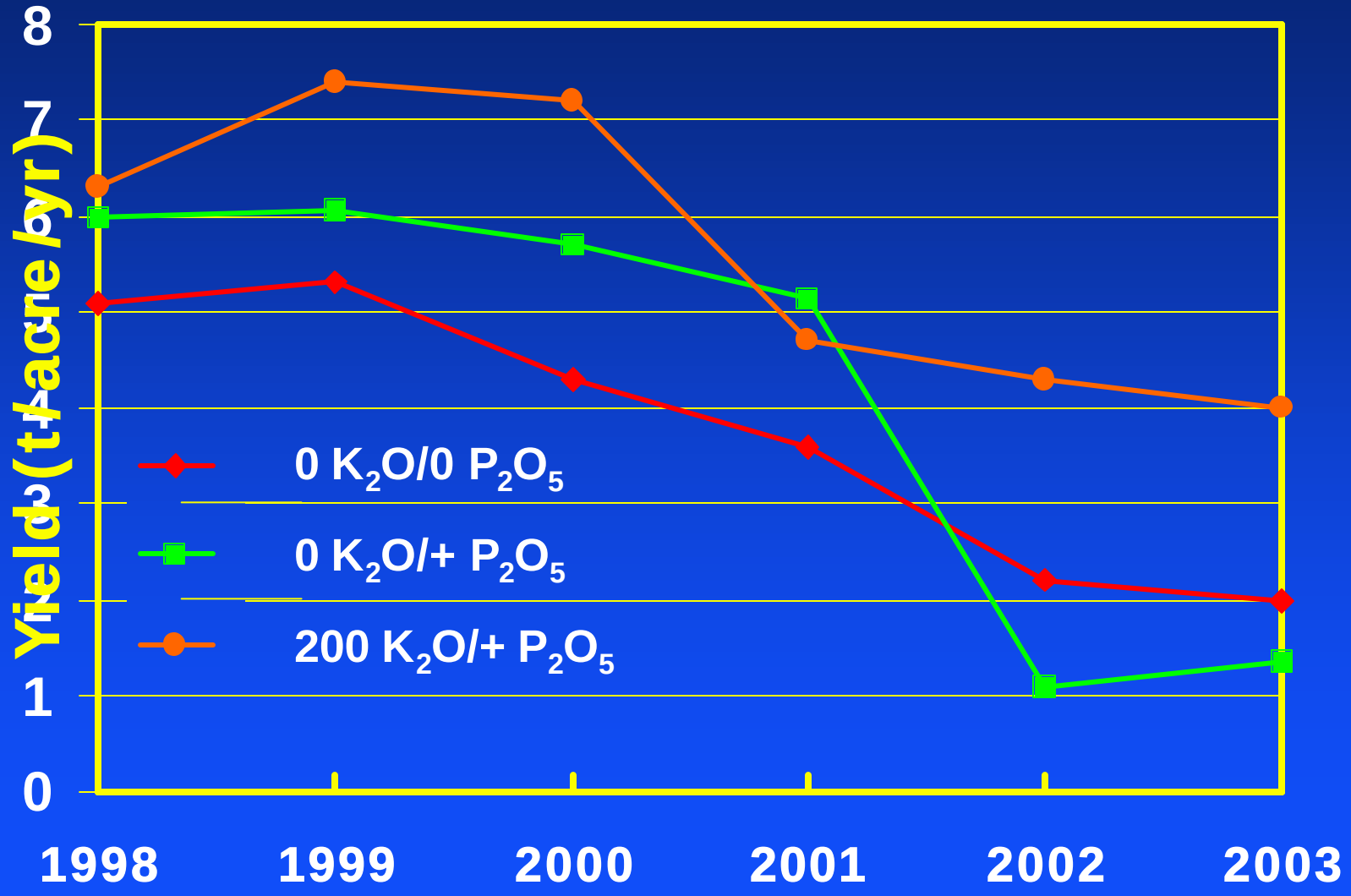
Answers To Our Questions

- **How does P and K fertilization impact long-term yield?**
- **Generate larger plants that make bigger shoots**
- **What plant factor is most closely associated with yield?**
- **Mass per shoot**

Answers To Our Questions

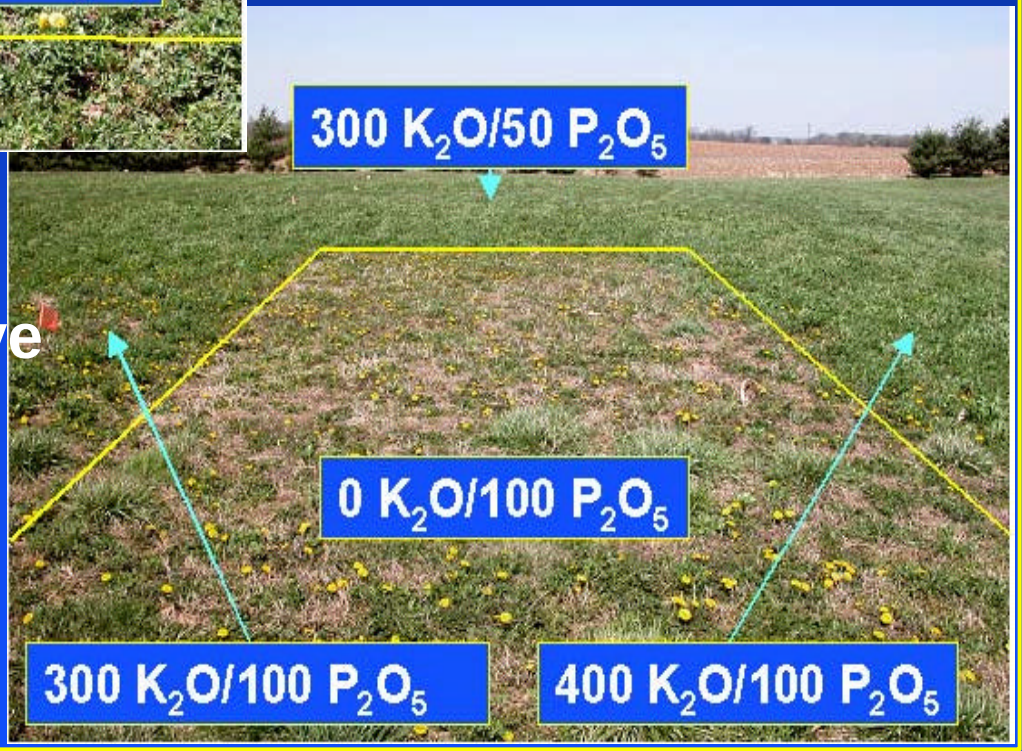
- When should soils be sampled?
- Fall is better, but be consistent
- When should fertilizer be applied?
- 50% after first harvest and balance possibly after last harvest
- Are there critical tissue test levels?
- Yes, but we are not sure what they are yet

Stand Survival and Yields are Poor When K-Stressed Alfalfa is Fertilized with P Alone

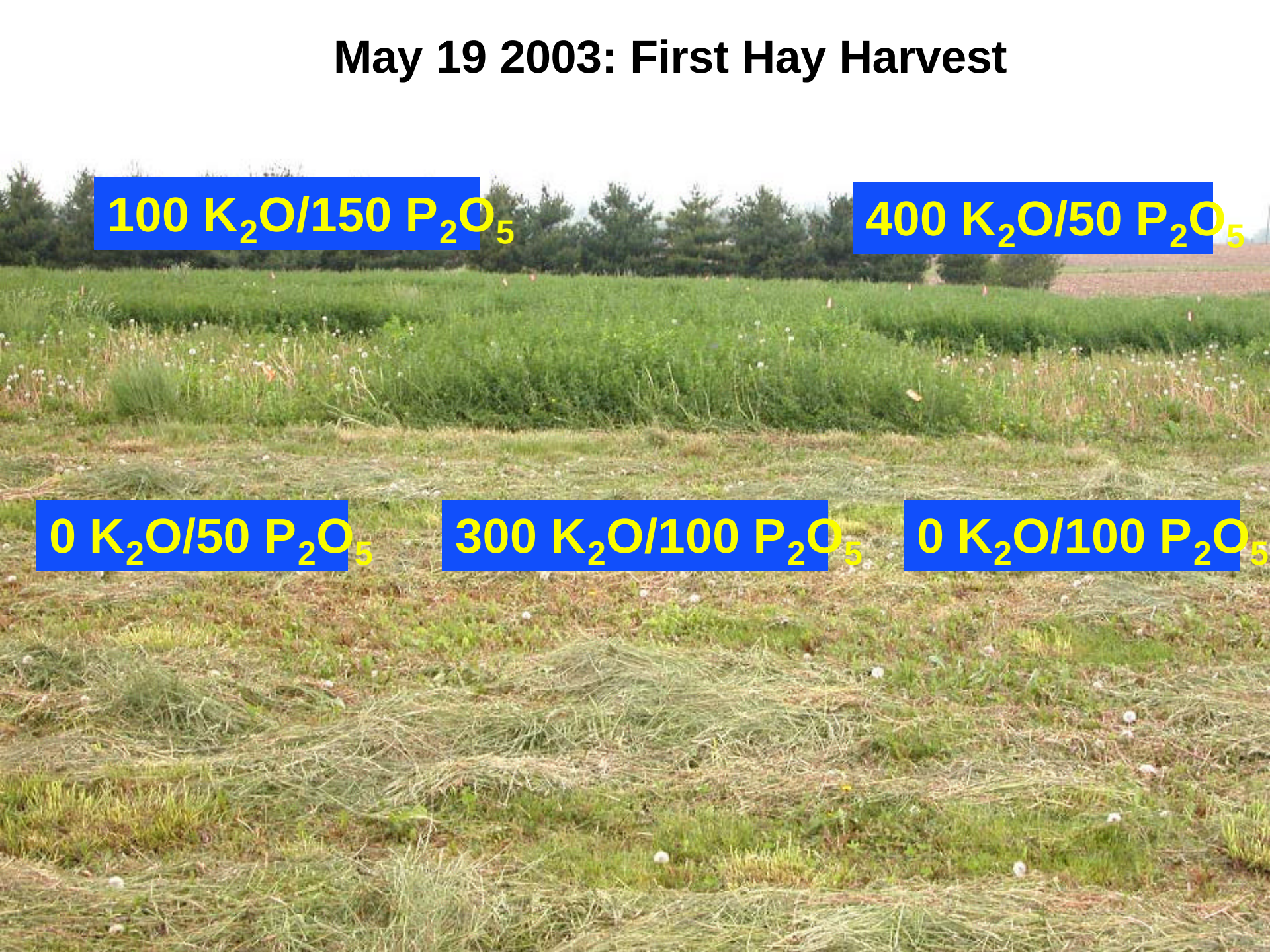


Control plot regrowth rates are slower and have led to significant weed infestation and yield reductions

Severe stand losses have occurred where P has been applied without K



May 19 2003: First Hay Harvest




Questions?