

اسمدة متقدم 1

Advanced soil fertility and fertilizers

This course is designed for advanced graduate students interested in soil fertility and role of fertilizers in increasing yield. The focus of the course will be on the factors and processes influencing availability of nutrients to plants. Various aspects of fertilizers transformation in soils and factors affected it will be covered.

OUT LINE

- 1- Introduction
- 2- Elements required in plant nutrition
- 3- plant growth and yield in response to fertilizers application
- 4- Soil and fertilizers Nitrogen
- 5- Soil and fertilizer Phosphorus
- 6- Slow release fertilizers
- 7- Soil and fertilizer K, Ca, and Mg
- 8- Plant nutrient behavior in flooded soil
- 9- Organic fertilizers

References

- 1- Soil fertility and fertilizers , Tisdale and Nelson
- 2- Soil Nitrogen , Agron. Mon, No. 10 , ASA ,
USA
- 3- Fertilizers technology and use , SSSA, USA
- 4- Soil testing : correlation and interpreting the
the analytical results , ASA special publication
No. 29
- 5- Nitrogen in crop production , ASA
- 6- Soil and plant nitrogen , ifa
- 7- Agronomical evaluation of fertilizers, principle
& practices , TVA , USA

8- principles of plant nutrition, Mengel and Kirkby .

Int. Potash Inst., Bern, Switzerland

9- Maximizing fertilizer use efficiency. Fertil. Plant Nutr. Bull.6. FAO Rome , Italy.

10- Fertilizer and food production.FAO Fertilizer programme, Rome, Italy.

Miscellaneous and internet.

Introduction

Why use fertilizers?

Use of fertilizers is needed for all types of long-term crop production in order to achieve yield worthwhile. levels which make the effort of cropping

The purposes of fertilizer use , especially for higher yields, is identical in temperate and tropical climates:

- to supplement the natural soil nutrient supply in order to satisfy the demand of crops with a high yield potential.

- to compensate for the nutrients lost by the removal of plant products or by leaching.
- to improve unfavorable or to maintain good soil conditions for crop production.
- large differences in fertility between soil type and sub-type. Some inductions are given below :
 - a- Soils of humid tropics
 - * are partly very acid (liming is required, generally to PH 5.5- 6.5)
 - * are often low in available P or liable to P- fixation(use of P- fertilizers is therefore, combined if necessary with liming)

- * in very humid areas are often low in available K, Mg, and S (therefore, there are high fertilizers requirement for these nutrients)
- * often have a low sorption or storage capacity for nutrients(so fertilizers application should be split between several dressings)
- * are often low in available N, although the decomposable organic matter is rapidly mineralized.

b- Soil of the sub-tropics are characterized by:

- * water shortage (so, without irrigation, fertilizer use must be suitably adapted to efficient water use)
- * N being the main critical nutrient, on account of the low humus content
- * widespread P deficiency , especially in sandy soil
- * neutral soil reaction (therefore, often a shortage of available Fe, and Zn)
- * a general good supply of S, Mn, and B
- * risk of salinity

c- Soils of humid temperate zones are marked by :

- * widespread soil acidity which requires liming.
- * partly obstacles to root growth (hard layers in subsoil).
- * often insufficient aeration (poor natural drainage of heavy soil).
- * generally shortage of available N and often P, K, and Mg.
- * low nutrients reserves in sandy soils, also only little storage and therefore, considerable leaching with water surplus.
- * partly fixation of P and Mo (due to neutral PH) and Cu (in organic soils).
- * climatic cold stress retarding nutrient uptake, etc.

The term “soil fertility” comprises a complex of properties which should be optimized as far as possible .

* Component of soil fertility

- Soil depth : most arable crops prefer about one meter without any obstructing layer.
- Soil structure: this determine the distribution of pore sizes which is decisive for the supply of air and water to the roots.
- Soil reaction.
- Content of nutrients in different degree of availability.

- Storage capacity for soluble nutrients from soil and fertilizers.
- Humus content and quality.
- Quantity and activity of soil organisms as agent of transformation processes.
- Content of detrimental substances, either natural occurring or man-made (pollution).

The Contribution of Commercial Fertilizer Nutrients to Food Production(2005).

W.M. Steward, D. W. Johnson, and T.J. Smyth

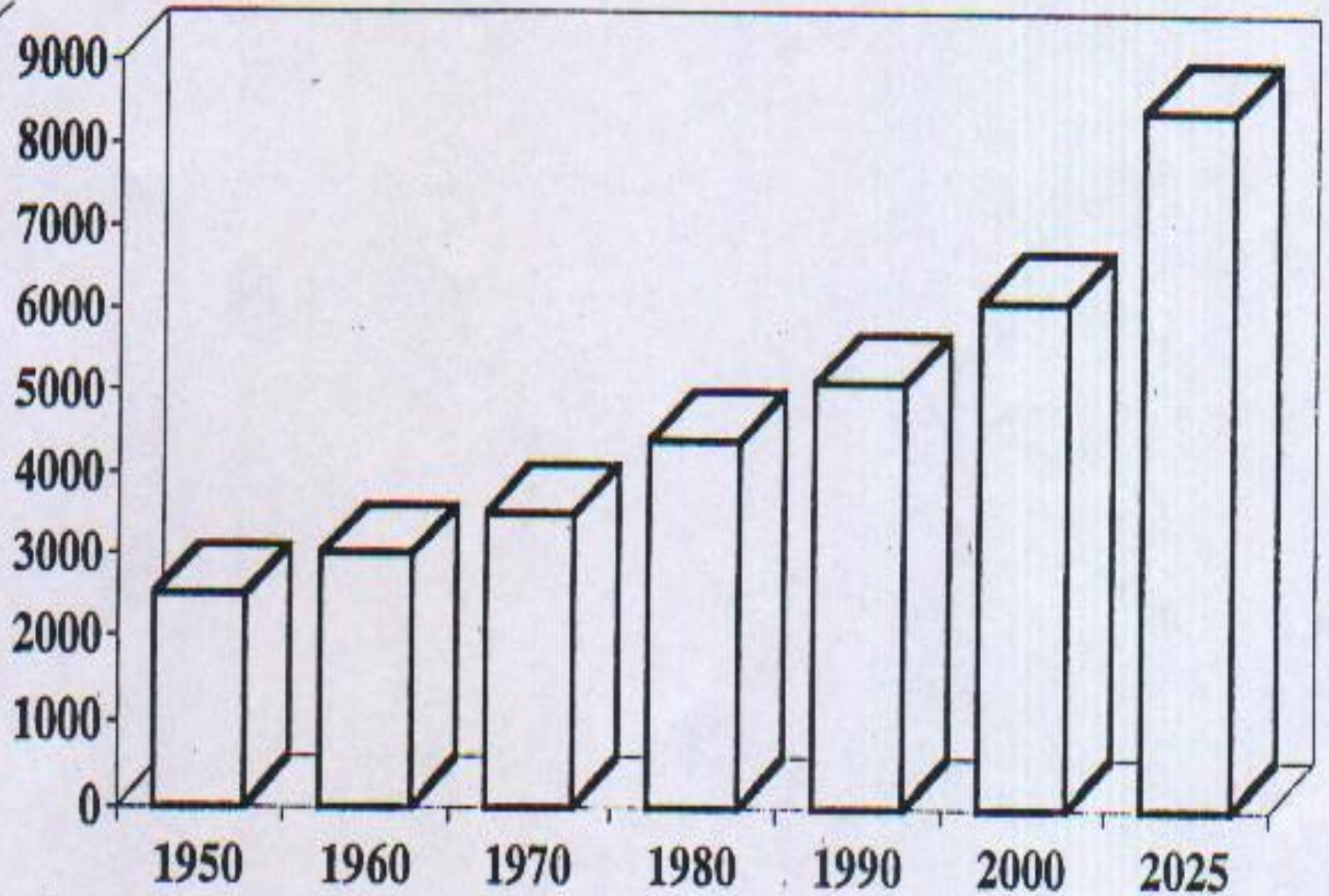
Agronomy Journal, vol.97 : 1-6

Table 1

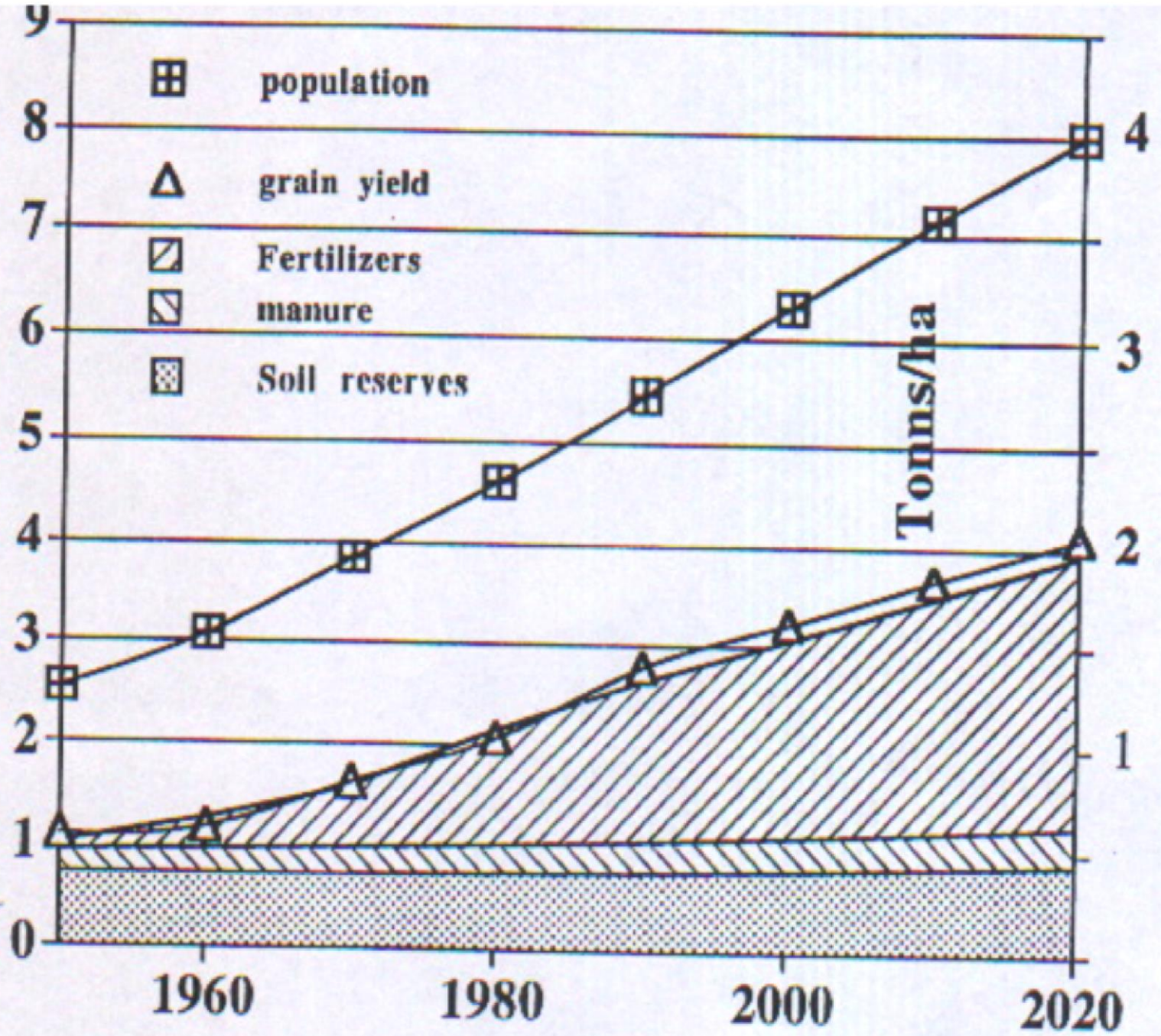
Estimated effect of eliminating N fertilizer on U.S. crop yield.

Figs 1 , 2, 3, etc.

Population in millions

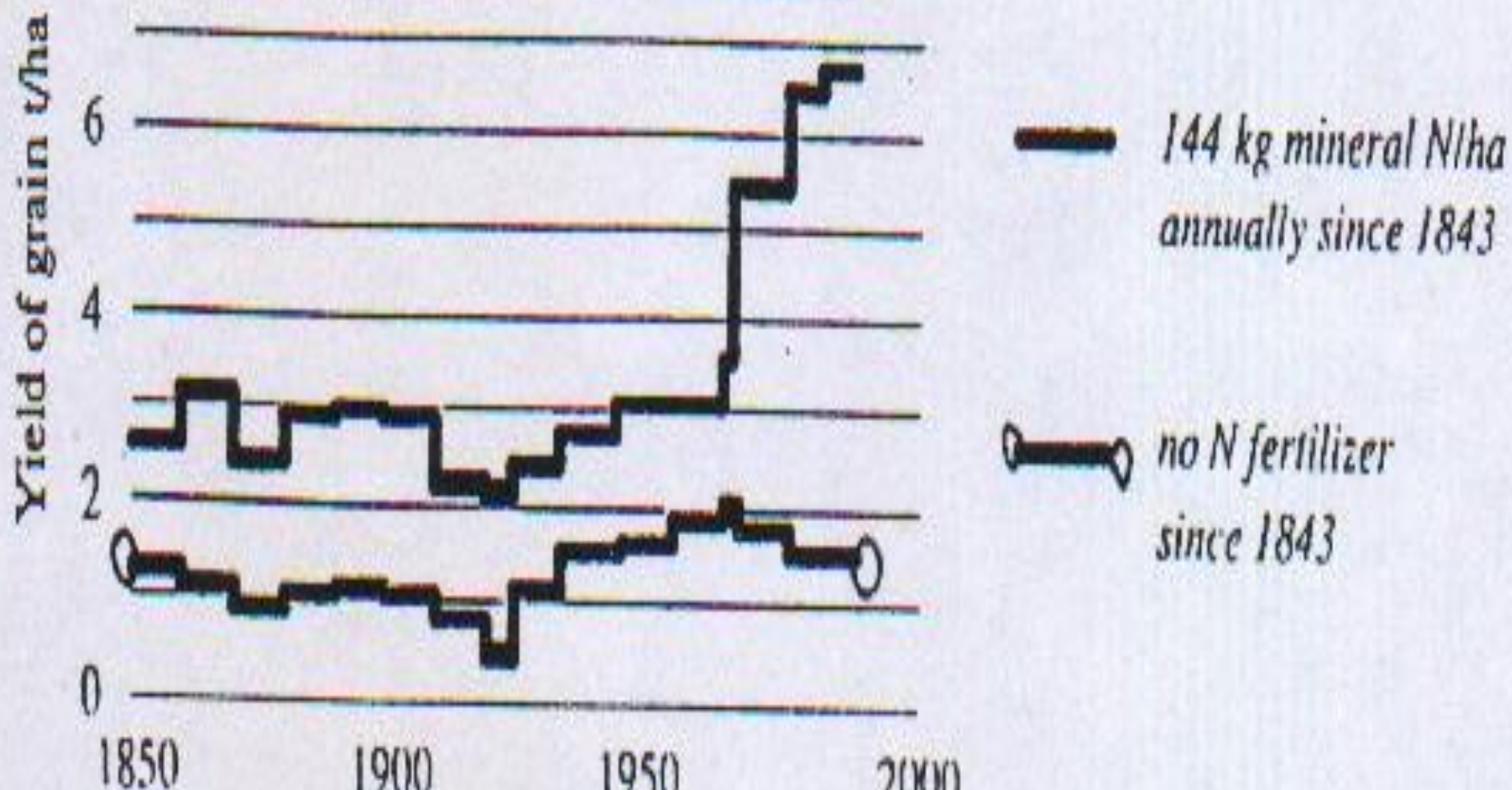


Population in billions

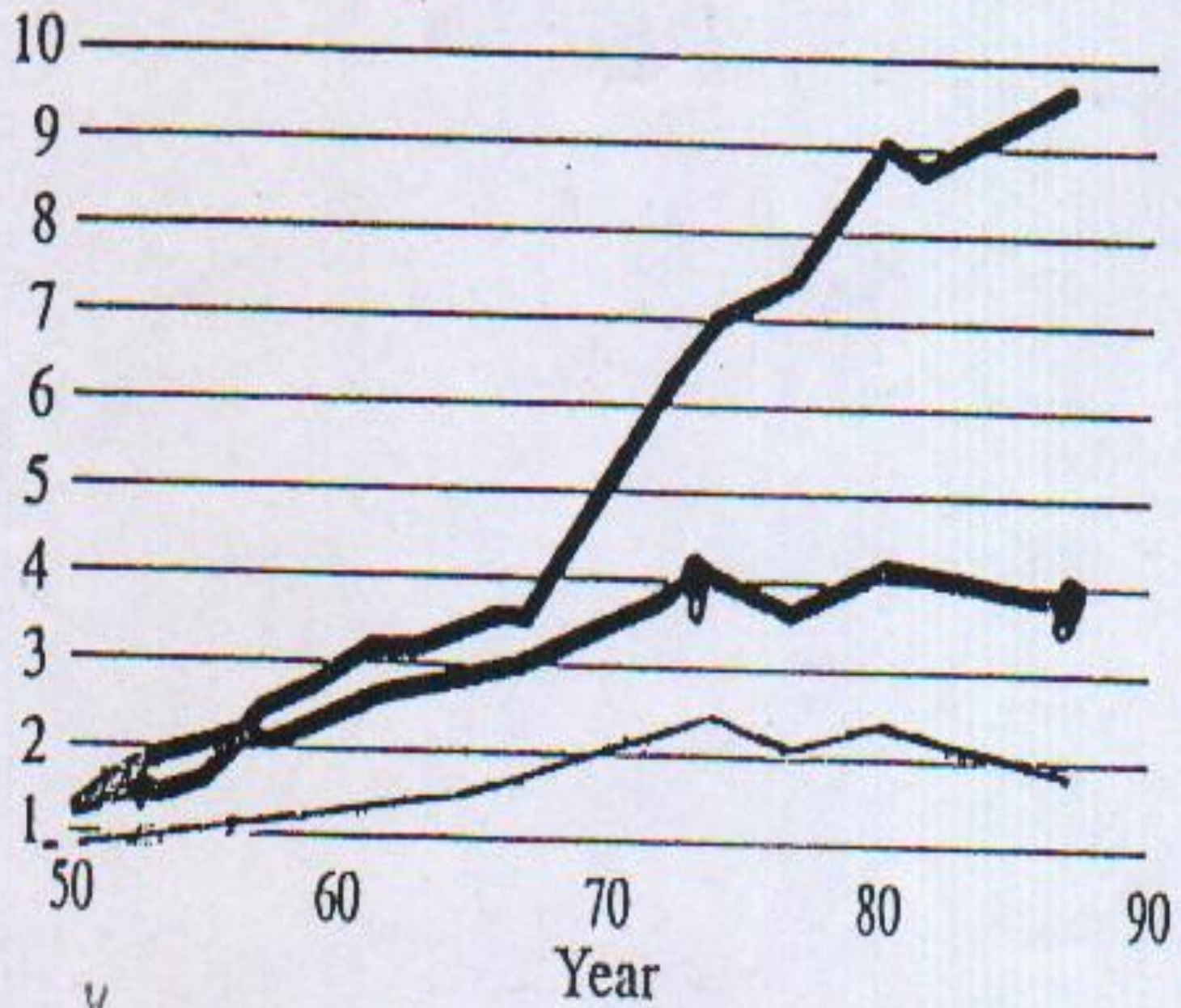


The Rothamsted experiments

Variety	Red Rostock	Red Club	Squarehead's Master (mainly)	Flanders Capelle	Flanders Brimstone
	[]		[]	[]	[]



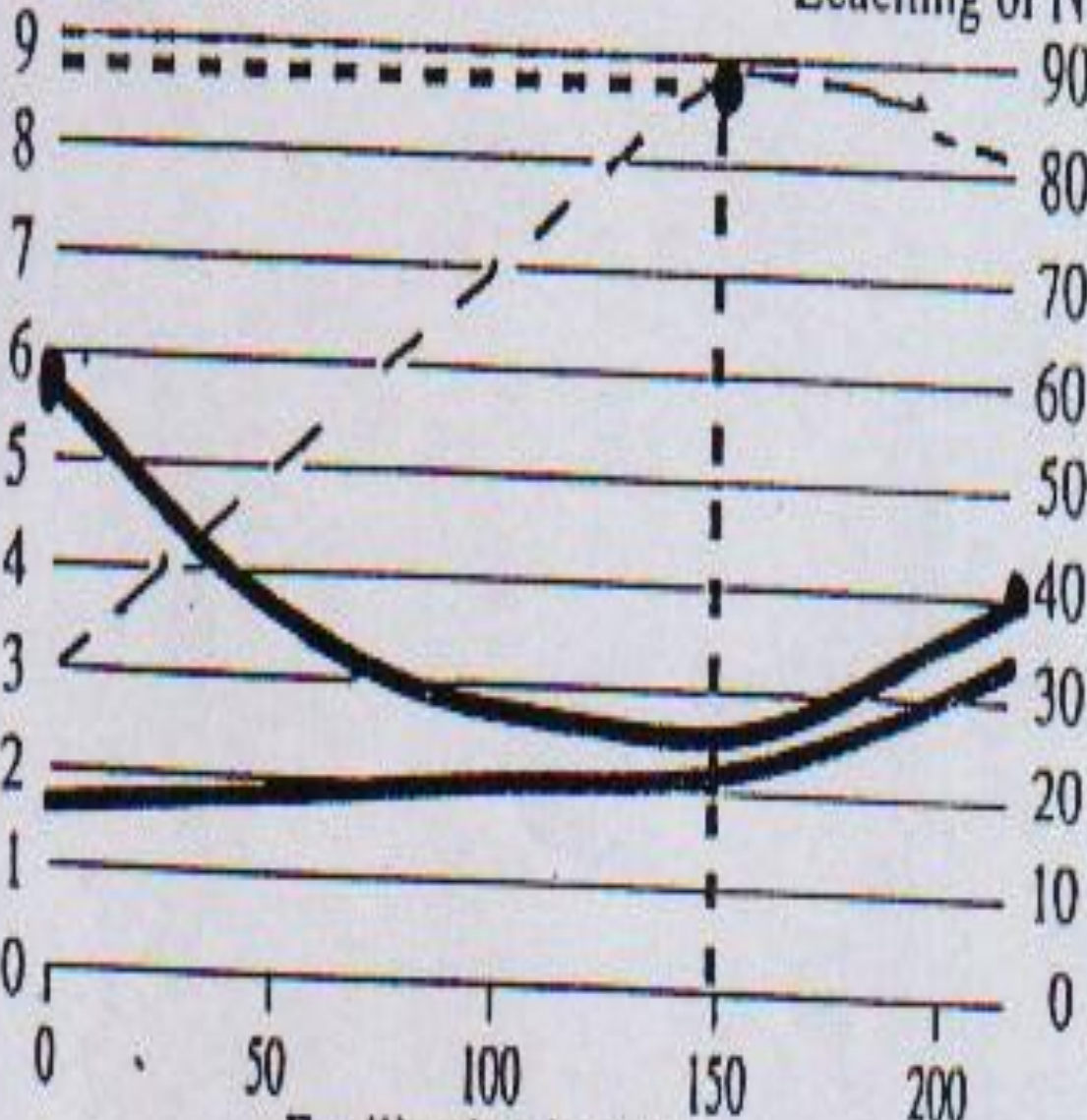
Million tonnes nutrient



N
P
K

Yield of wheat

Leaching of N



● Economic optimal yield

--- Yield tonnes/ha

→ Leaching g N/10 kg of grain

— Leaching kg N/ha