اسمدة متقدم 13

*resistances to radiation .

*necessity of irradiation sterilization .

Fertilization Management

*What is Nutrient Management ?

providing the needed nutrients with possible max. efficiency for achieving economically optimum yield under conditions of a given farming system without depleting soil fertility or harming the environment .

* To optimize the use of fertilizers , accurate information on the following points should be available :

- yield expectations

  higher yield s remove higher amounts of nutrients which should be replaced through fertilization.
- Characteristics of the existing farming system.
- The nutrients needed to be used as fertilizers.
- Water quality and irrigation system used.
- The economics of the system.

Basically, nutrient management is influenced by the crop yield expectation and the soil characteristics. So, different crops are fertilized differently , even if they are grown on the same soil. The same crop is ,also fertilized differently when grown on different soils. Thus , the concepts of fertilizing the soil or the crop are not valid. Introducing high yielding verities also change the picture.

table – Differences in fertilizer doses (kg/ha) used in tomato according to variety (cultivar)

Cultivar	Average yield	N	$P_2\ O_5$	$K_2\ O$
Hybrids (intensive)	120 – 150 t/ha and higher	200-300	150- 200	320-400
Normal Varieties	25-30 t/ha	150-200	100-150	50-150

*Balanced Nutrient Needs

Balanced nutrients management leads to increase the efficiency of all nutrients applied and ,thus, decreasing the amounts of fertilizers used .

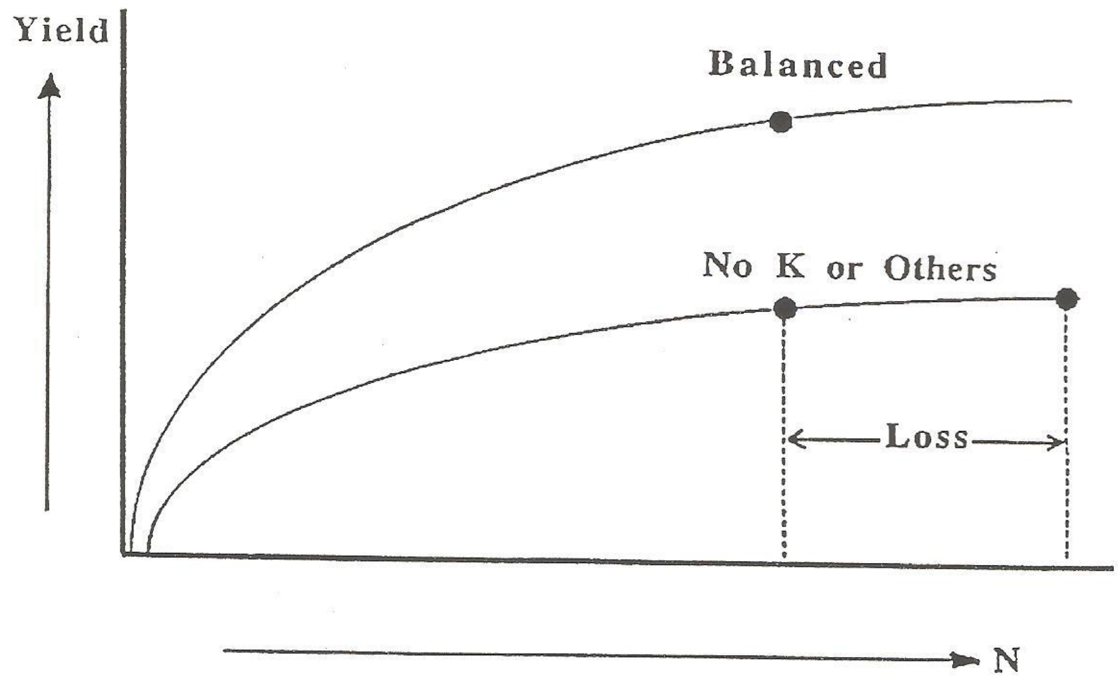
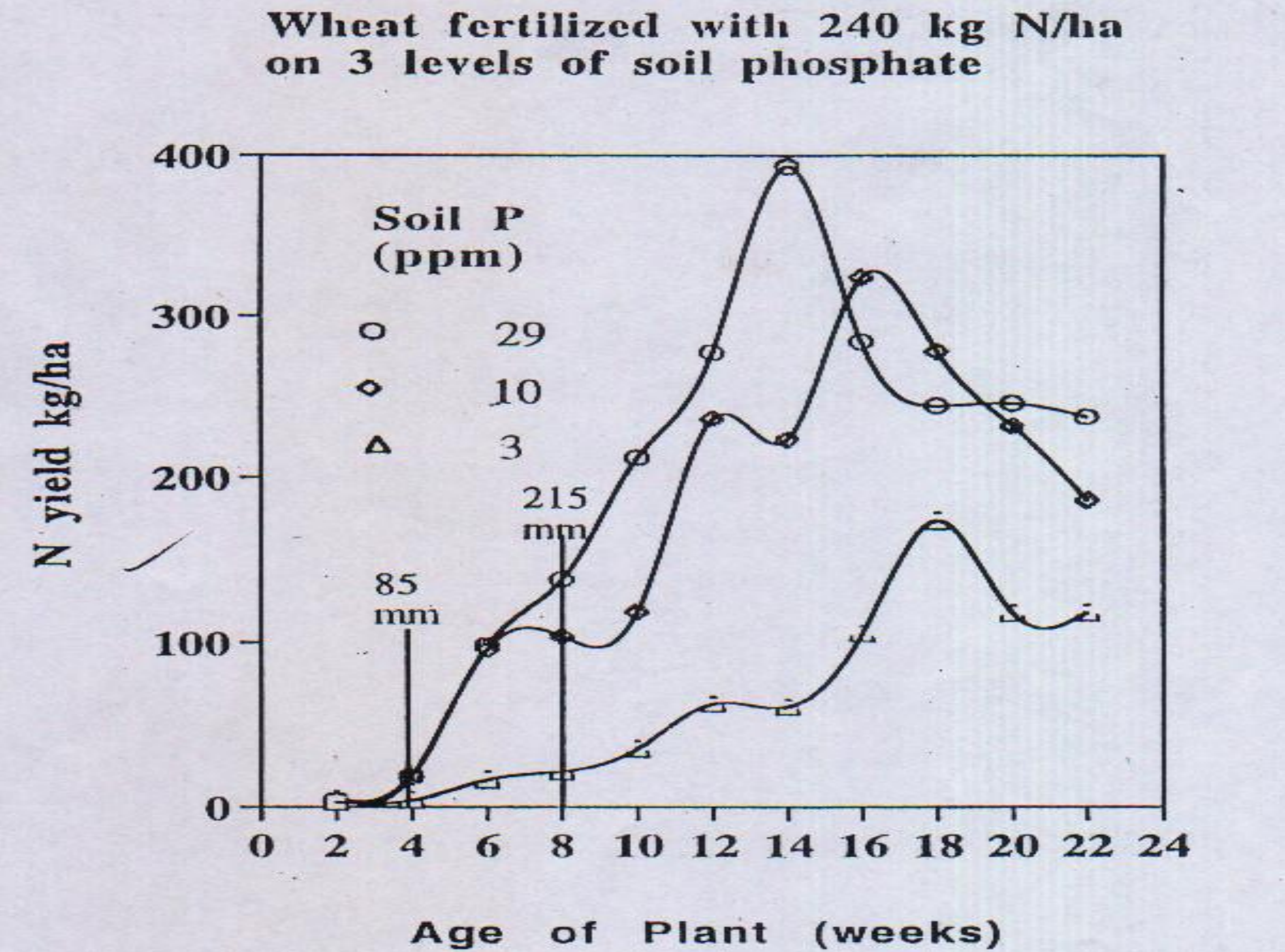


Fig. 1. Effect of balanced nutrient management on yield and efficiency of fertilizers.



Wheat fertilized with 240 kg N/ha
on 3 levels of soil phosphate
Soil P
(ppm)
29
10
3
215
mm
85
mm
N yield kg/ha
400
300
200
100
0
0
2
4
6
8
10
12
14
16
18
20
22
24
Age of Plant (weeks)

Table: Efficiency of fertilizers in citrus

	Kg/t fruit yield			Yield (kg/ha)
	N	P2O5	K2O	
Nutrient removed	2.0	0.5	3.2	
Nutrient applied - in old soil	17- 23	3.3- 4.3	0- 2.0 Soil depletion	15-20
Nutrient recovery by the crop	9-12%	12-15%		
2- In the expt. (fertigation)	3.8	1.7	5.2	25
Nutrient recovery by the crop	-	-	-	25
	53%	29%	61%	

Table : Amount of nutrients applied to produce one ton orange and average yield in some countries

	N	P2O5	K_2 O	Average yield (t/ha)
USA	2.3	1.5	2.5	> 48
Morocco	4.6	3.0	4.5	36-48
Egypt	19.5	4.0	0.5	14-20

Table : increase of macronutrients uptake in shoot after foliar spray of Zn+ Mn + Fe.

Crop	% increase			
	N	P	K	Mg
Wheat	25	18	12	6
Rice	20	15	17	5
Maize	20	14	50	10
Fababean	30	11	35	14
Soybean	40	15	25	12
Cotton	29	25	40	11

Table : Response of potato to optimizing fertilizer

(less N + K + Micronutrients)

Dose (kg/ha)			Tuber yield (t/ha)
N	P2O5	K20	
455	190	0	23 (100%) With out micronutrient
370	190	115	27 (120%) With out micronutrients
280	190	115	32(139%) With micronutrients

* Nutrients needed differ according to growth stage

Absorption curves show the period of high demand of the plants for a particular crop and provides very important information for efficient management of the nutrient supply over the growth period.

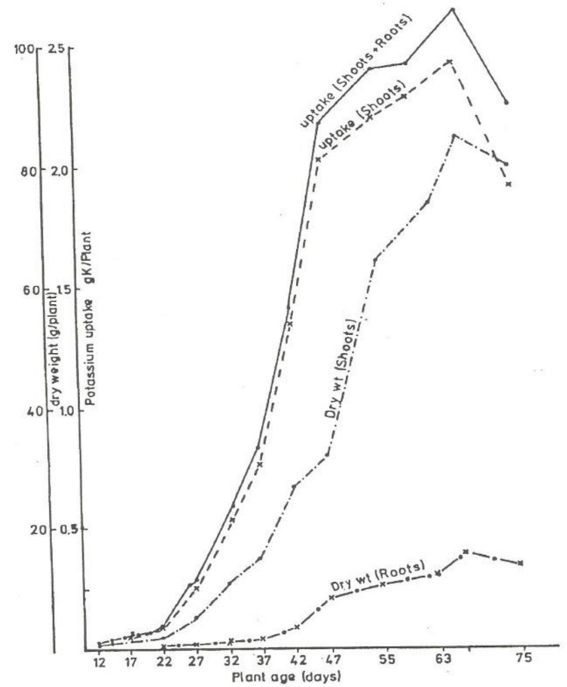
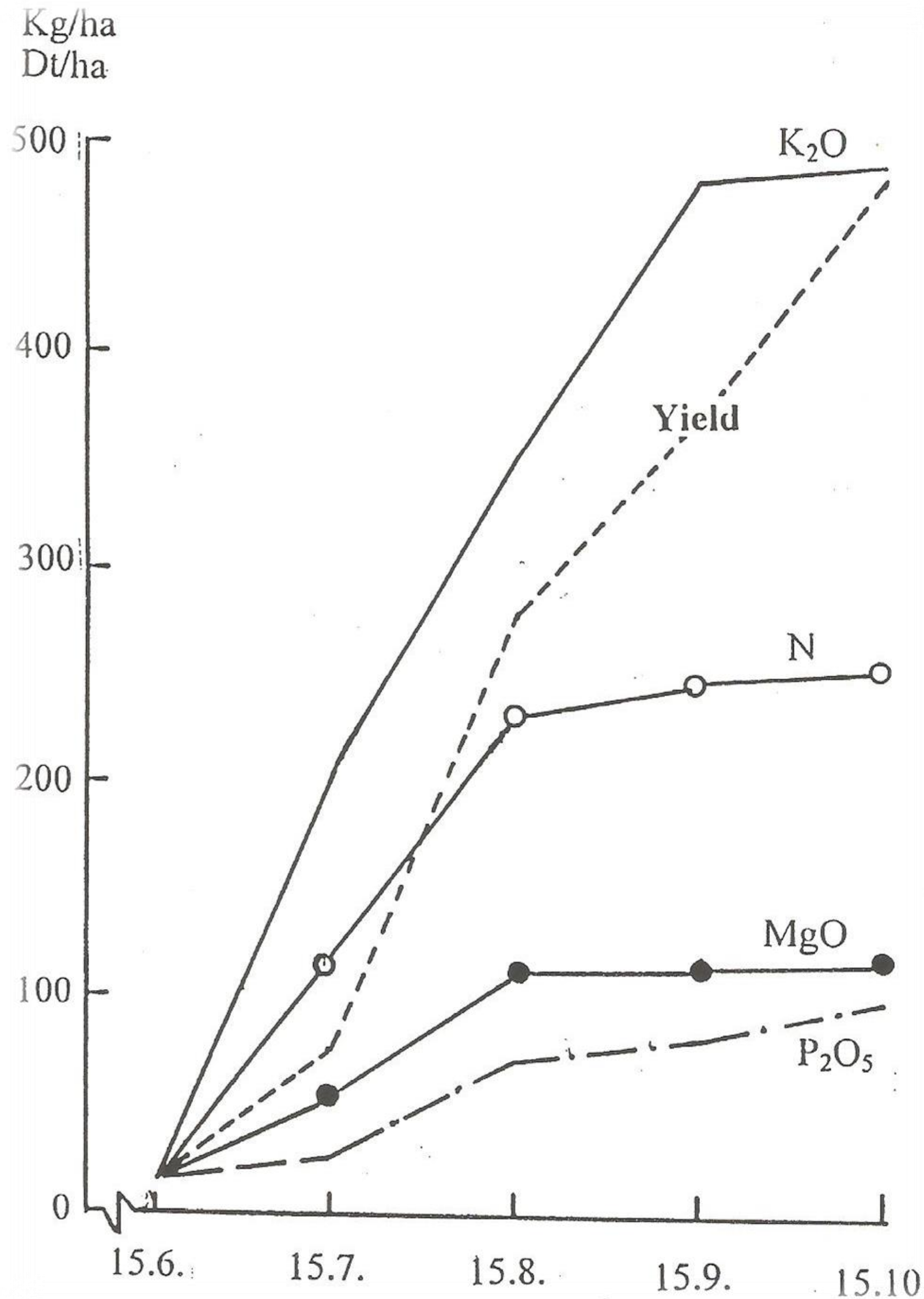


Fig. 4. Uptake curve for K by Maiz (Source : El-Fouly *et al.*, 1991)



Kg/ha
Dt/ha
500
400
300
200
100
0
K2O
Yield
N
MgO
P2O5
15.6.
15.7.
15.8.
15.9.
15.10.

* Estimation of fertilizers requirement

a- Deficiency symptoms

- can be used to determine the need of crop for a particular nutrient.
- deficiency symptoms of a nutrient may be masked by deficiency of other nutrient.
- hidden hunger.
- need expert person.
- do not give any quantitive information about fertilizers recommendation.

b- Field trials

- can be used first to identify the deficiencies in the soil by simple response trial.
- can be used for estimating the quantitative need of nutrient under particular conditions.
- trials become complex , when requirements from many nutrients should be examined .
- field trials cannot be the only way to estimate fertilizers requirements , but they are still of importance.

C- soil testing

- good technique for estimating nutrient requirements .
- results can be calibrated with yield responses and used as base for fertilizers use.
- reliable method as long as only one nutrient is to be used . As long as more than one nutrient should be used , calibration of soil testing becomes more difficult and even not reliable.

- availability of a given nutrient for crop is not only a function of the content of the nutrient in the soil.
- it might takes many years prior to become to be conclusive results. However, it gives good information , which can be used tentatively and considered as a step further beyond the field trials.
- soils can be identified according to its content of each nutrient in 5 categories

Nutrient content	Nutrient needs
A(Very low)	High
B (Low)	Slightly high
C (medium)	Adequately removal
D (High	Slightly high
E (Very high)	No

e- Plant analysis

- using different plants parts depending on plant and of sampling.
- it gives more conclusive information.
- disadvantage : too late to remedy deficiency in same season .

f- Nutrient balance

- make use of different techniques to come to nutrient requirement estimation, which is crop, location and environment specifics.
- based on the determination of the outputs of the different nutrients, the availability of each and calculation of difference, which should be applied as fertilizer.

* Estimation of crop fertilizer requirement based on nutrient balance

- when talking about nutrient balance, it necessary to distinguish first between two expression :

  i- Removal

  nutrient removal is the amt. of a nutrient removed from the field by a definite yield.

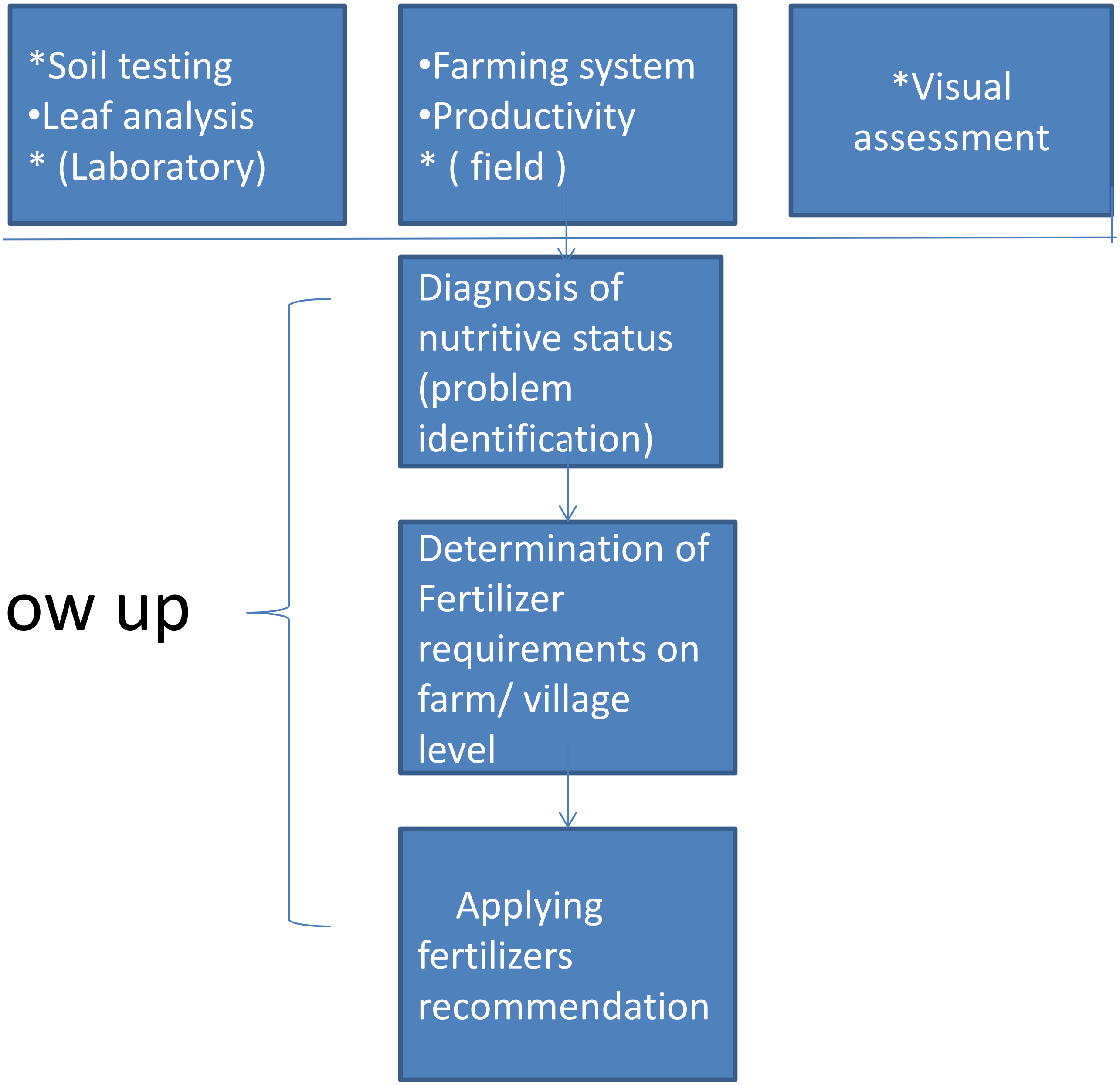
  ii- Uptake

  nutrient uptake is the max. amount taken up by a plant during the vegetation period . Normally uptake> removal.

- The nutrient balance has two different aspects :
    - i- output (removal from the field)
    - ii- the balance between the need for different crops as fertilizers and the availability of the nutrient from all natural sources (soil, air, water, and other including organic manure)
        - Nutrient needs= output – original input
        - fertilizer needs =

nutrient needs x nutrient content of the fertilizer x efficiency of use of fertilizers%

- Systematic determination of fertilizer requirement,



- Follow up

* Manual for fertilization :

a- Nutrient requirements

- Estimation of nutrient needs.
- Removal / uptake of major crops under different agroecological conditions.
- Nutrient physiological requirement at different growth stage.

b- Determination of nutrient status /needs

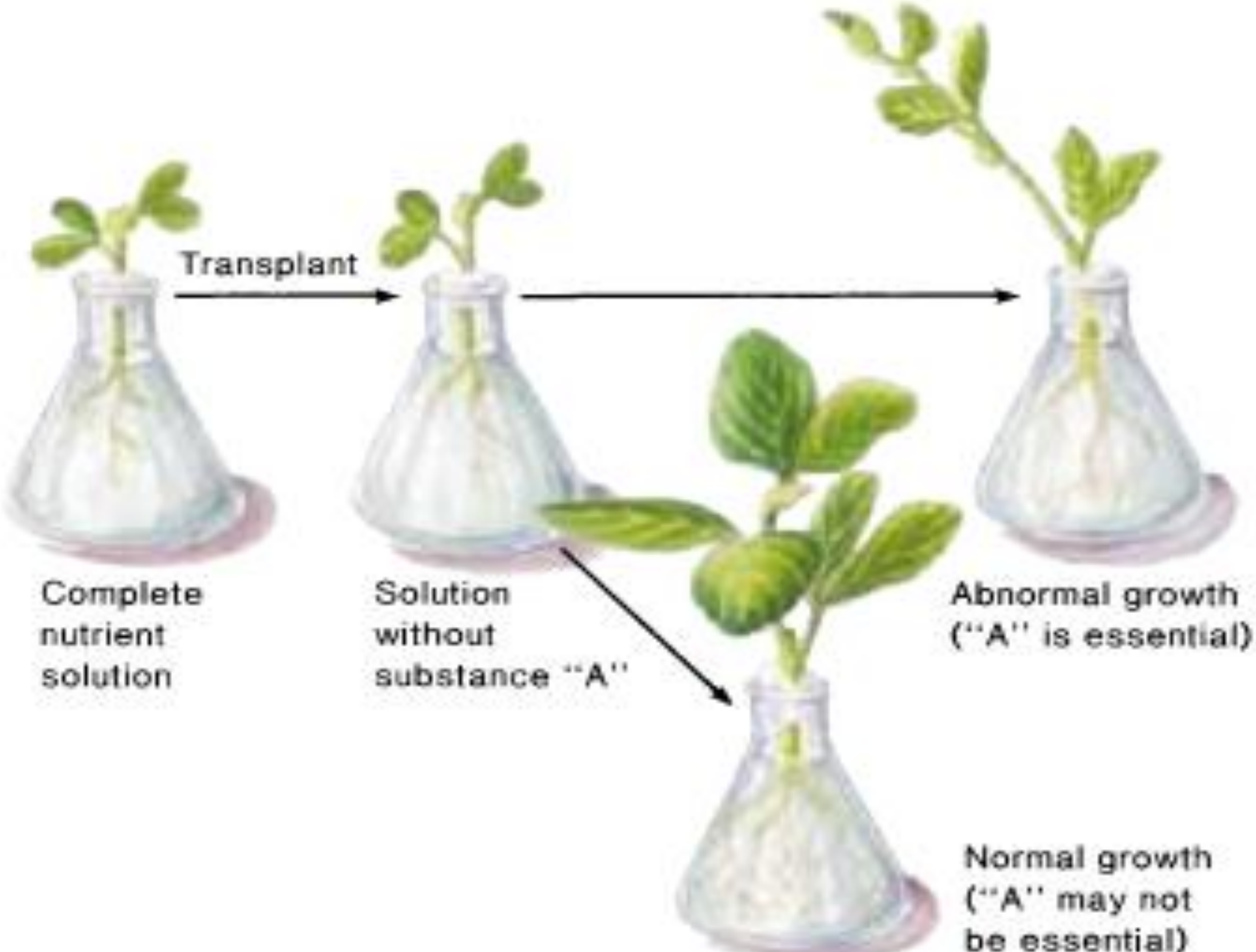
- Soil testing (method used).
- Plant analysis(plant parts to be analyzed)
- Balance method.
- general interpretation of results.

c- Fertilizers used

- Kind of fertilizers suitable for the system.
  (single, multinutrient, ready to use ……)
- Solubility of fertilizers.
- Mixing of fertilizers.
- Salt index.
- Criteria for selecting fertilizers.
- Micronutrient fertilizers.
- Foliar fertilizers.
- Organic manure.

D- Methods of fertilizers application.

- type of crops to be fertilized.


Transplant
Complete nutrient solution
Solution without substance "A"
Abnormal growth ("A" is essential)
Normal growth ("A" may not be essential)

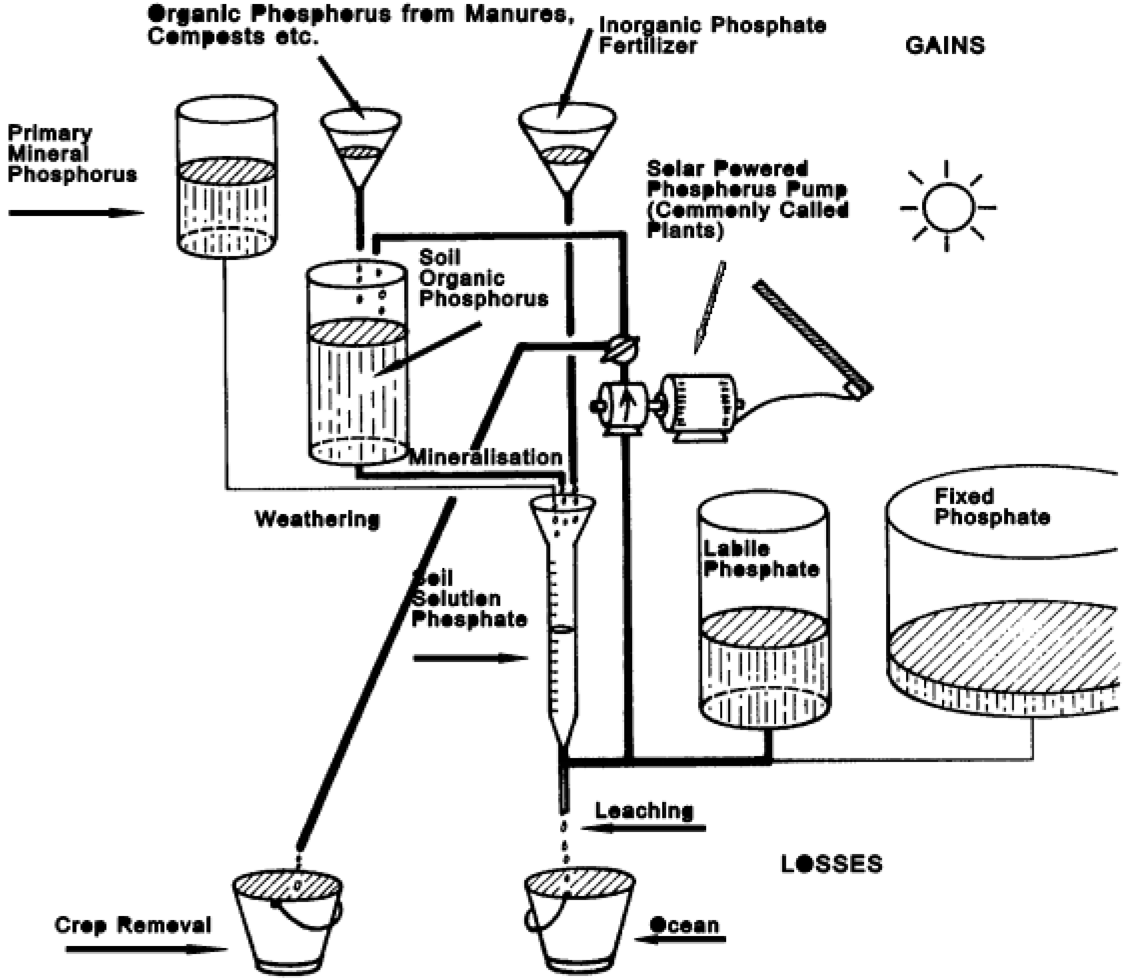


Figure 5 - Schematic diagram of the phosphate cycle

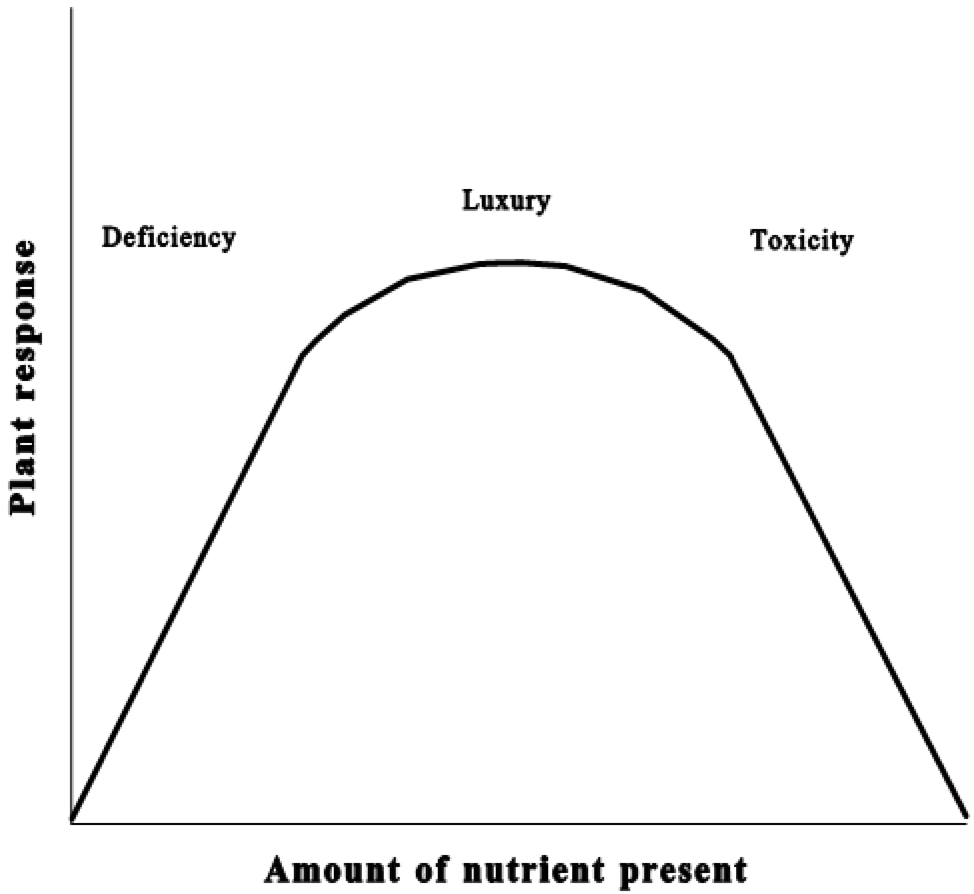


Figure 2 - Response of plant to amount of one nutrient

Table 2 - Typical composition of soil solution

cation	conc. / mmol L^{-1}	anion	conc. / mmol L^{-1}
Ca^{2+}	10	NO_3^-	5
Mg^{2+}	3	SO_4^{2-}	4
K^+	1	Cl^-	2
Na^+	1	HCO_3^-	2
NH_4^+	0.5	HPO_4^{2-}, $H_2PO_4^-$	0.01

Figure 4.
Illustration of the co-existence of oxidized and reduced zones/layers in flooded zones (a), in soil aggregates (b) and around roots of aquatic macrophytes (c)

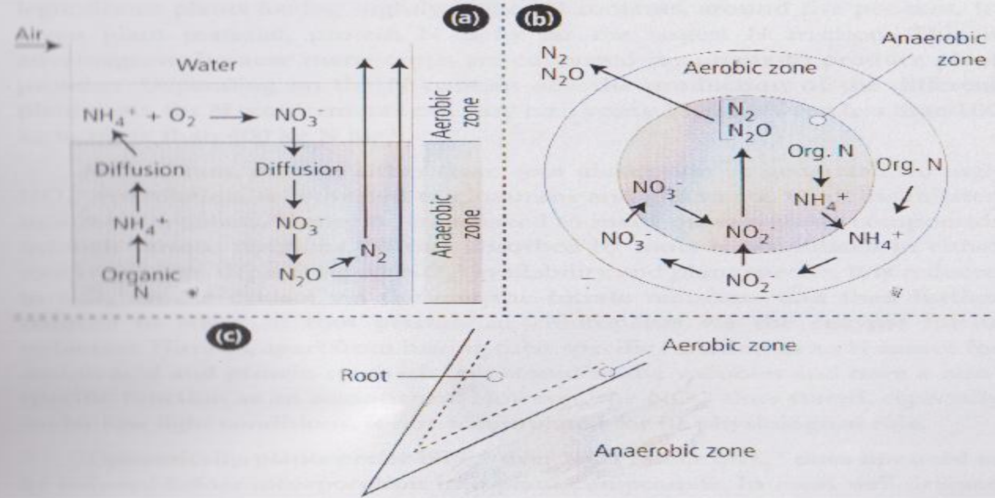


Figure 5.
Schematic presentation of the processes and equilibria of NH_4^+ in respect to NH_3 volatilization

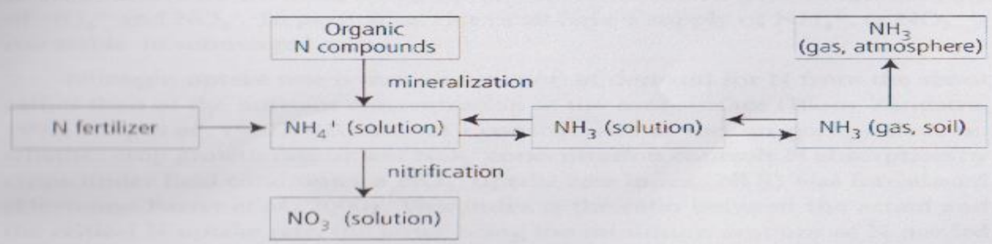


Figure 6.

Influence of the pH on the equilibrium between NH_4^+ and NH_3 (Court *et al.*, 1964)

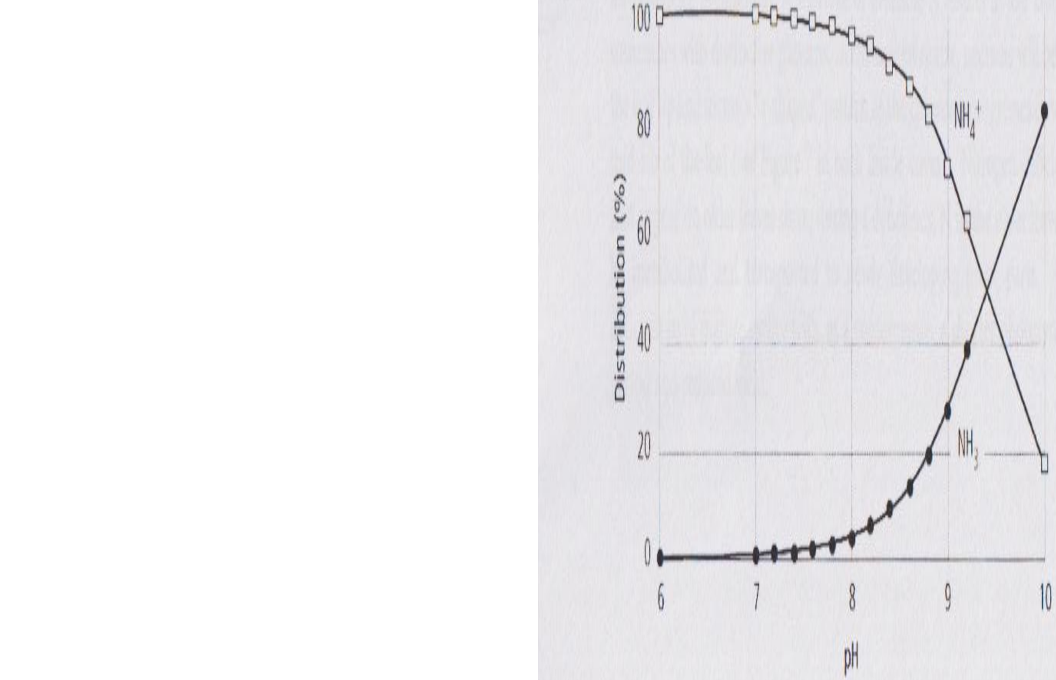
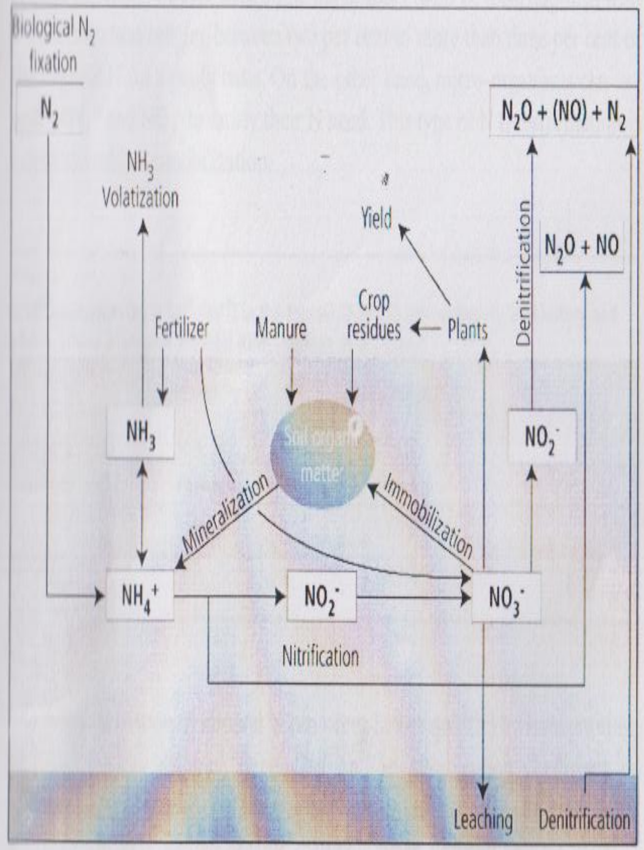


Figure 1.
A simplified N cycle



Lightning can convert atmospheric N_2 gas (valence 0) to various N-oxides and finally to nitrate (NO_3^-) (valence +5), which upon deposition can be taken