

أسمدة وتسميد

تأليف

دكتورة

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دكتور

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مراجعة

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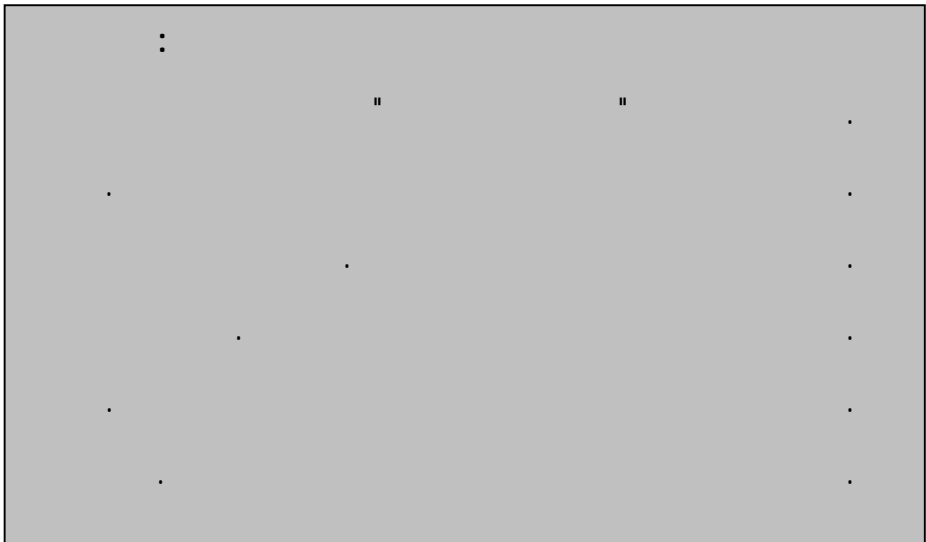


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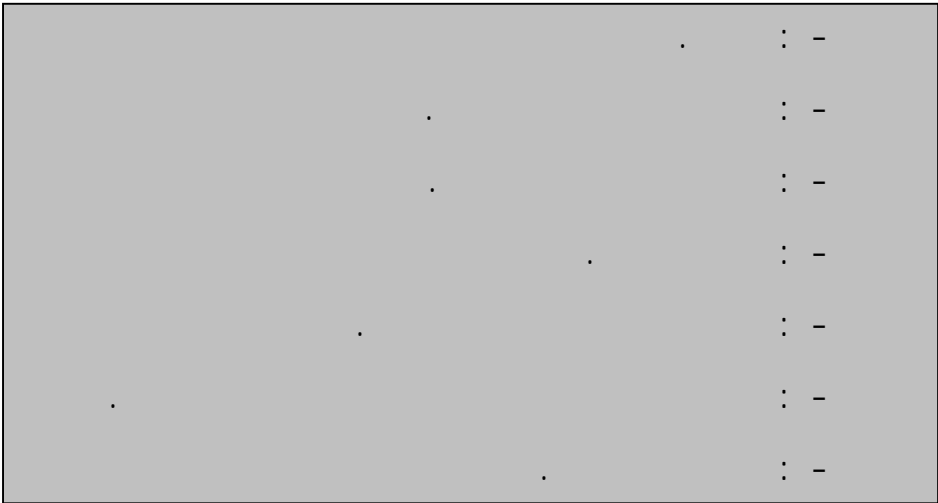




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Hyper Arid Zone

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Arid Zone

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Semi Arid Zone

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Semi)

.(Arid

Sustained ()

: Agriculture

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(Horizons)

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(Soil Reclamation)
(Land Reclamation)

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Essential Nutrient)

(Elements for Plant Growth

H₂) (O₂ C)

(O₂

N- P)

(K - Ca - Mg - S

Fe- Mn - Cu - Zn - Mo - B - Cl)

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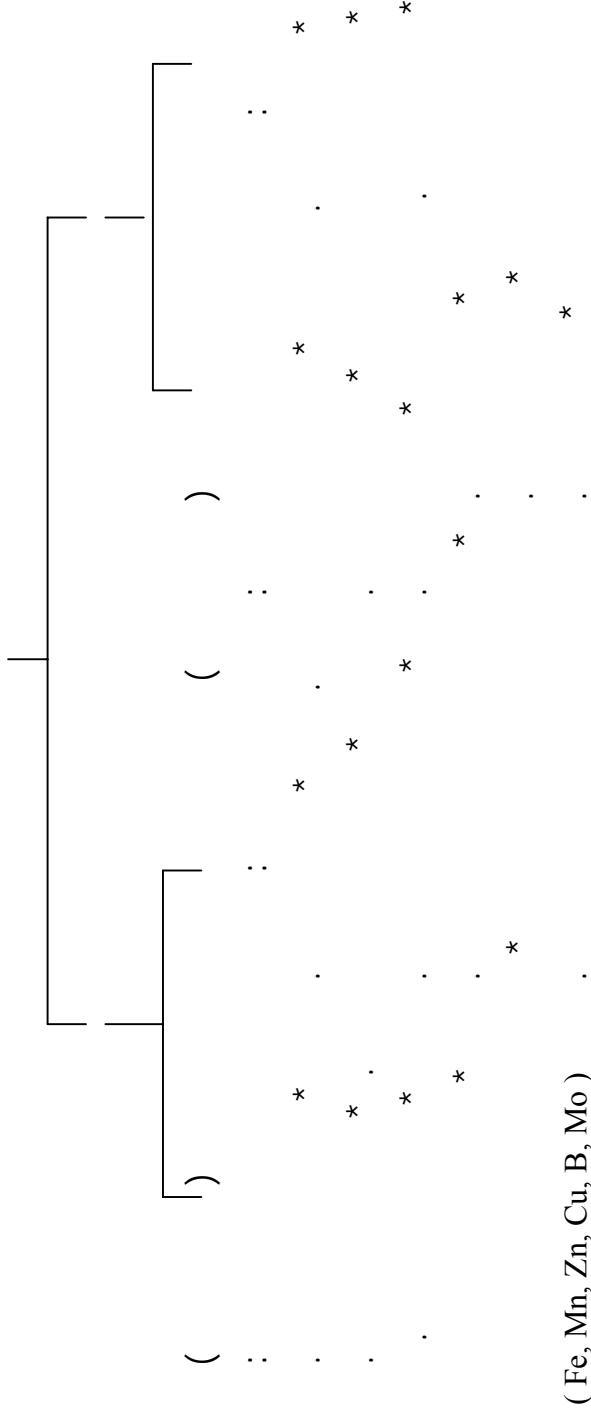
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Erosion

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Reserve Source

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Slow Release

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Intensive Farming

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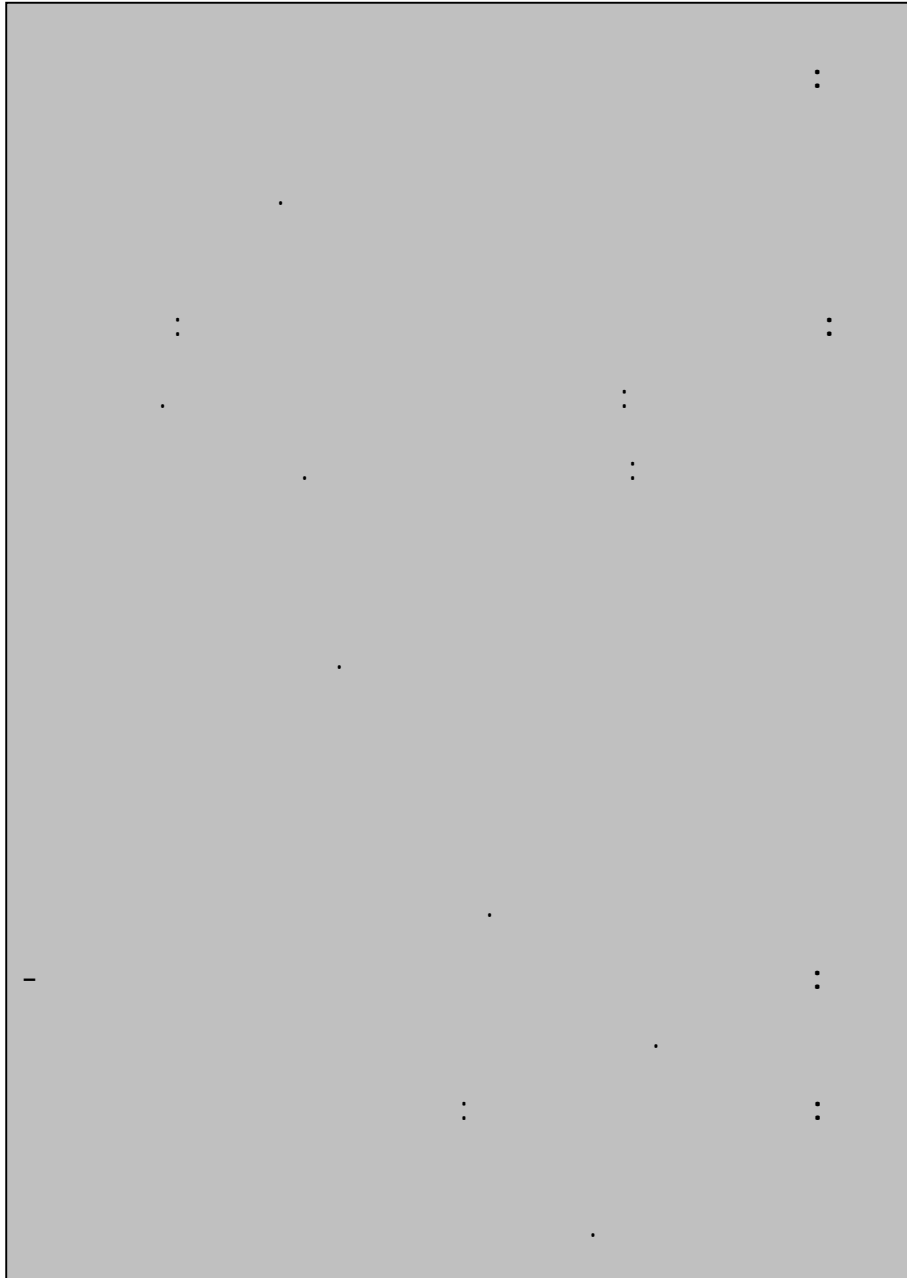
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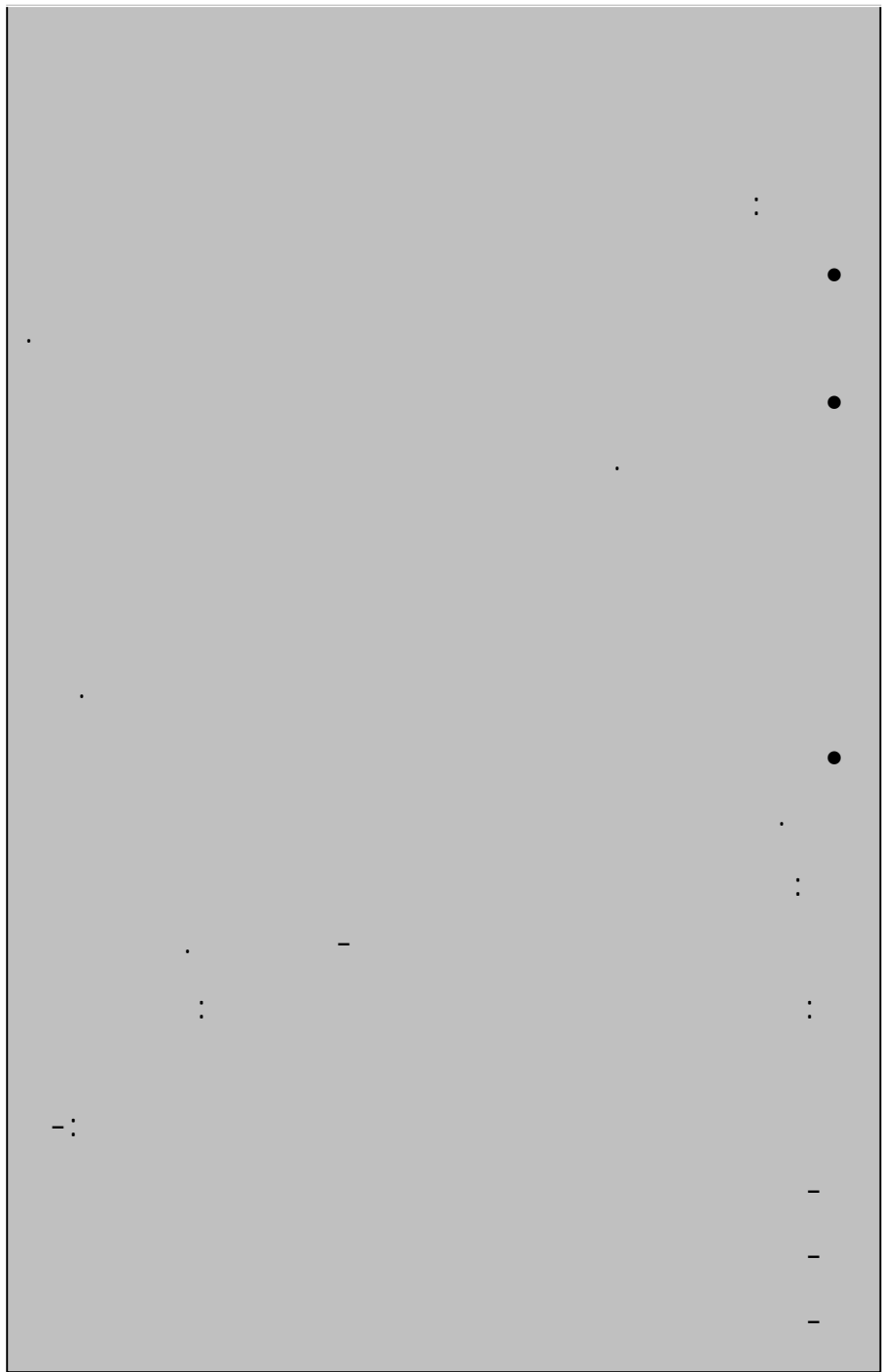
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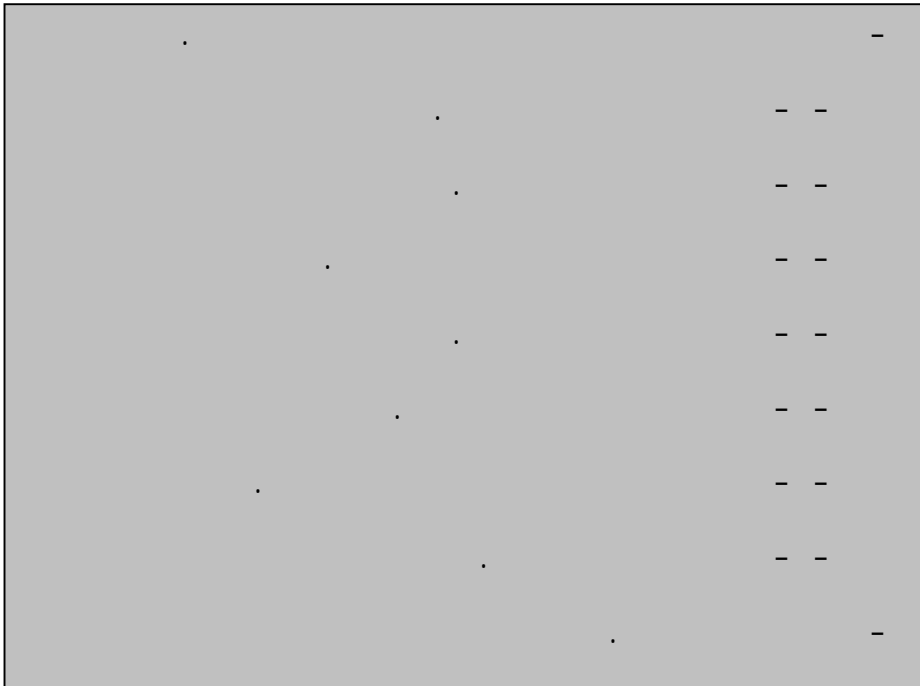




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(Feeding Power)

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(Cropping System)

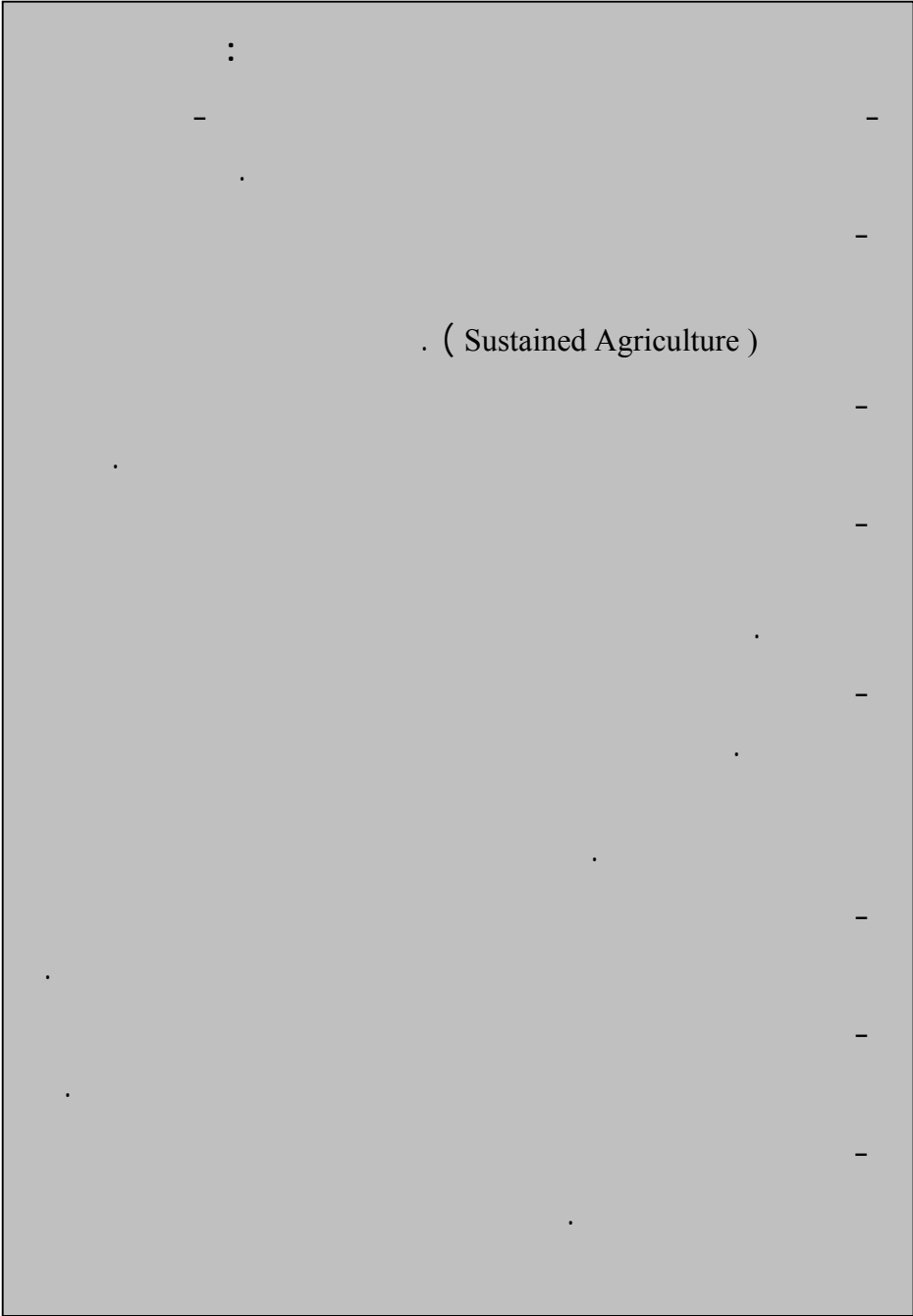
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-(Foliar application)
- (Circuitous) - (Fertigation)
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(Soil Application)

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[?]







Cu, Co, Cr, Cl, Cd, B, Ni, N, K, Mo, Mn, Pb, Fe, S, Mn, Ca :
Mg, Na, Al, P,

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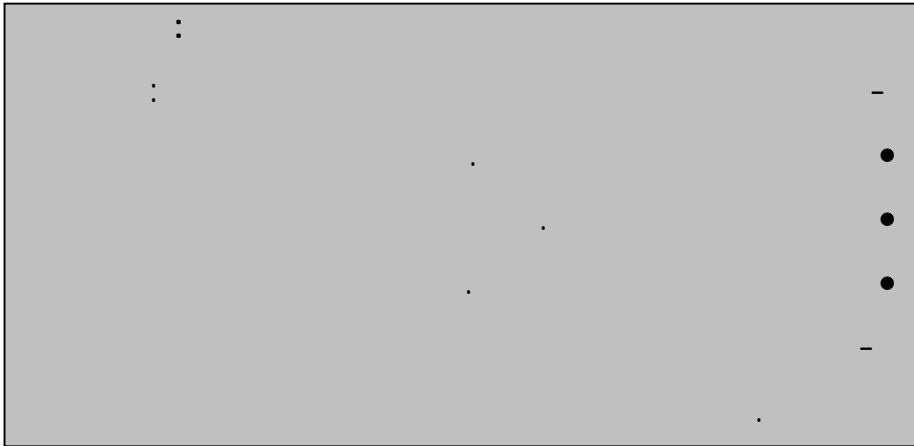
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Macro- Nutrient Fertilizers
(Nitrogen- Phosphours – Potassium)

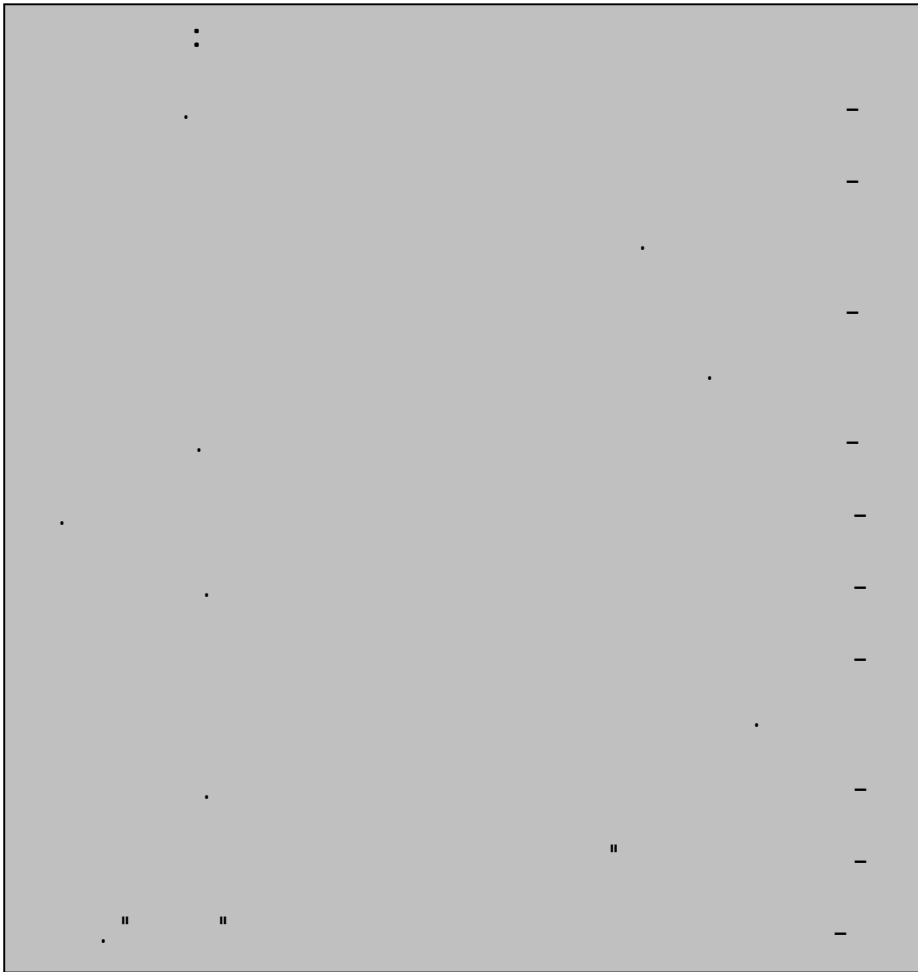
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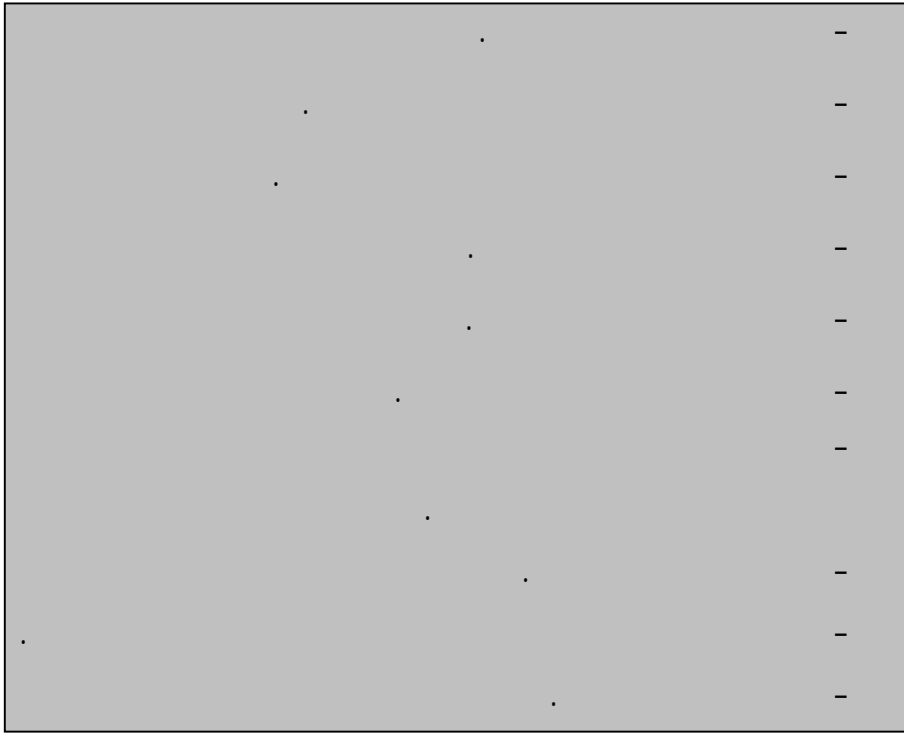


Nitrogen Phosphours

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Nitrogen Fertilization

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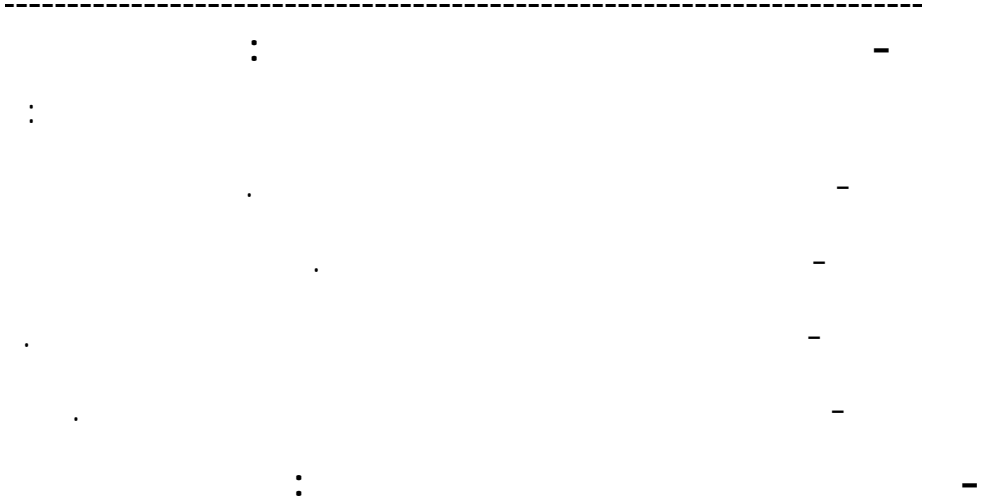
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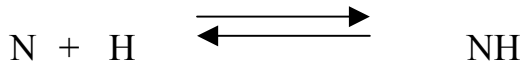
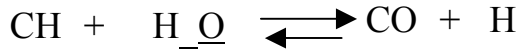
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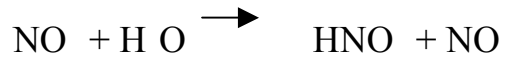
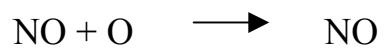
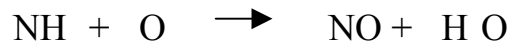
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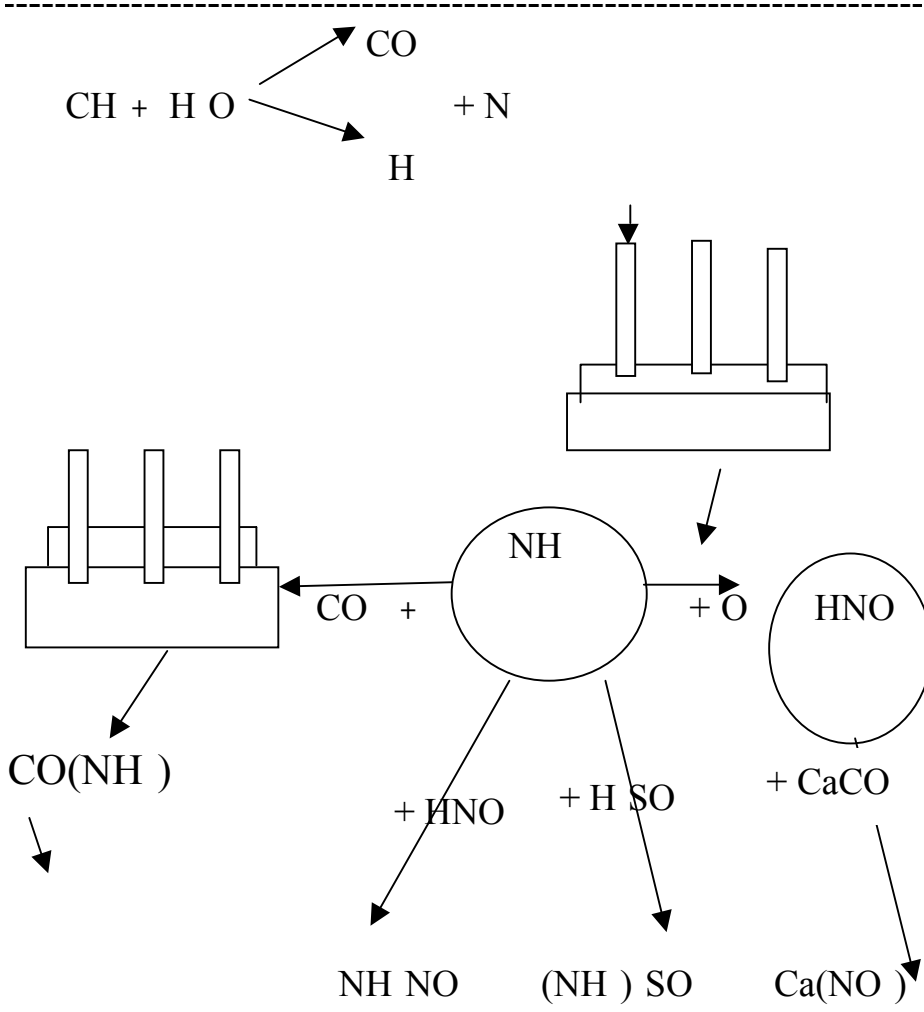
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(N % ,) Ca (NO) :

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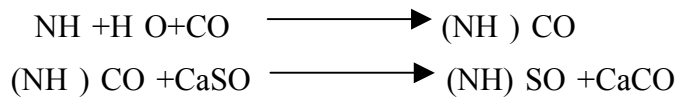
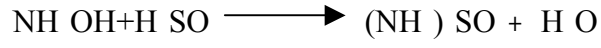
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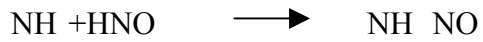
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(Retention)

pH

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(N% -) (NH NO) :



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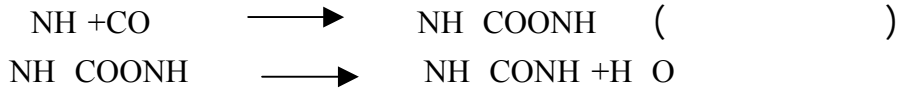
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:[CO (NH)]

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(Corrosive)

(granular)

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Urease

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.N %

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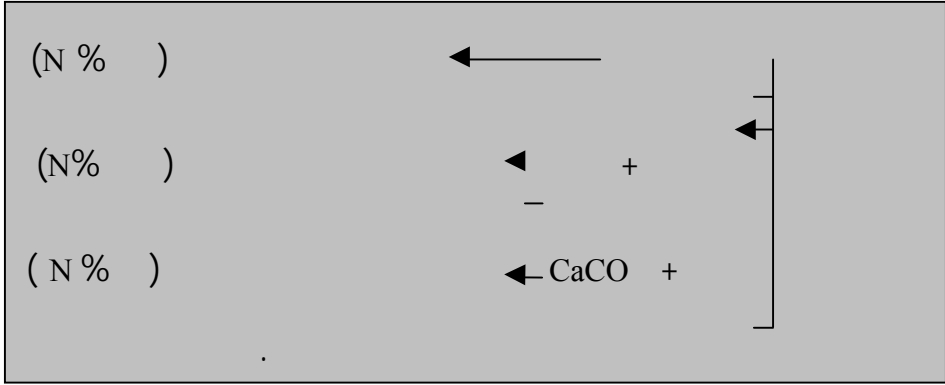
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pH

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Slow Release Nitrogen Fertilizers

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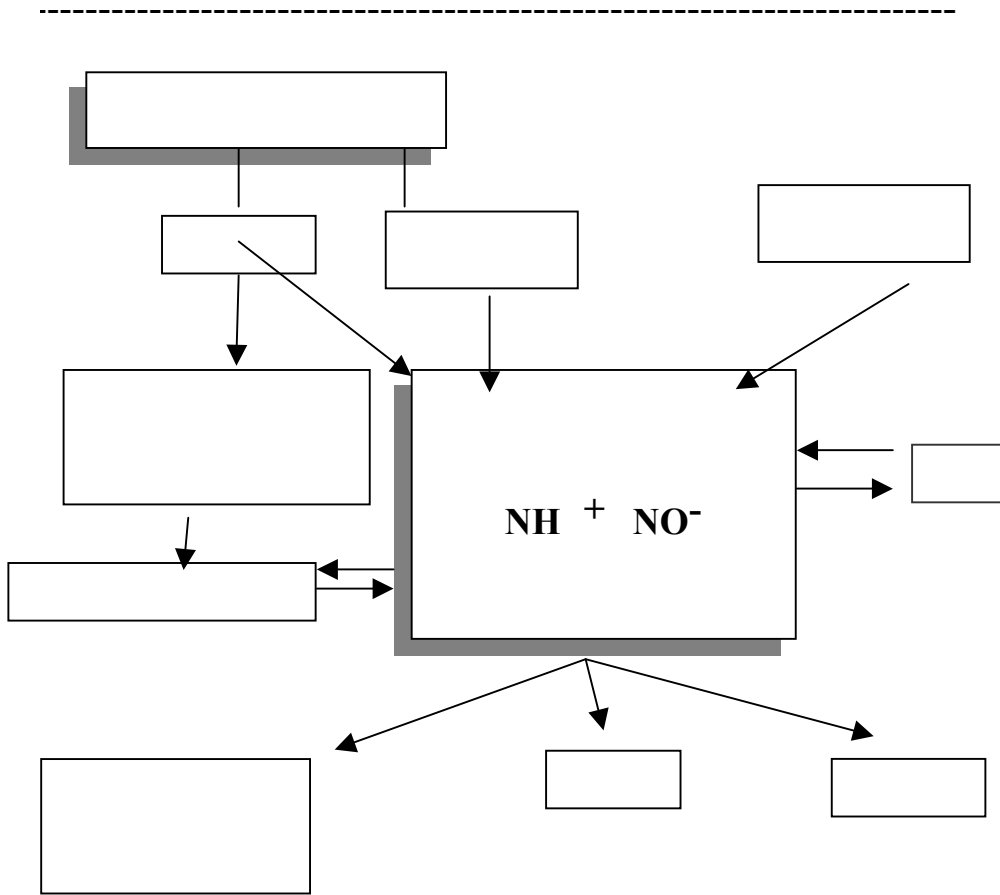
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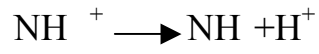


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(Hagin and Tucker , :)

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: Nitrification -



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C/N

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Nitrification

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Nitrification Inhibitors

(NO⁻)

(NH⁺)

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(NO⁻)

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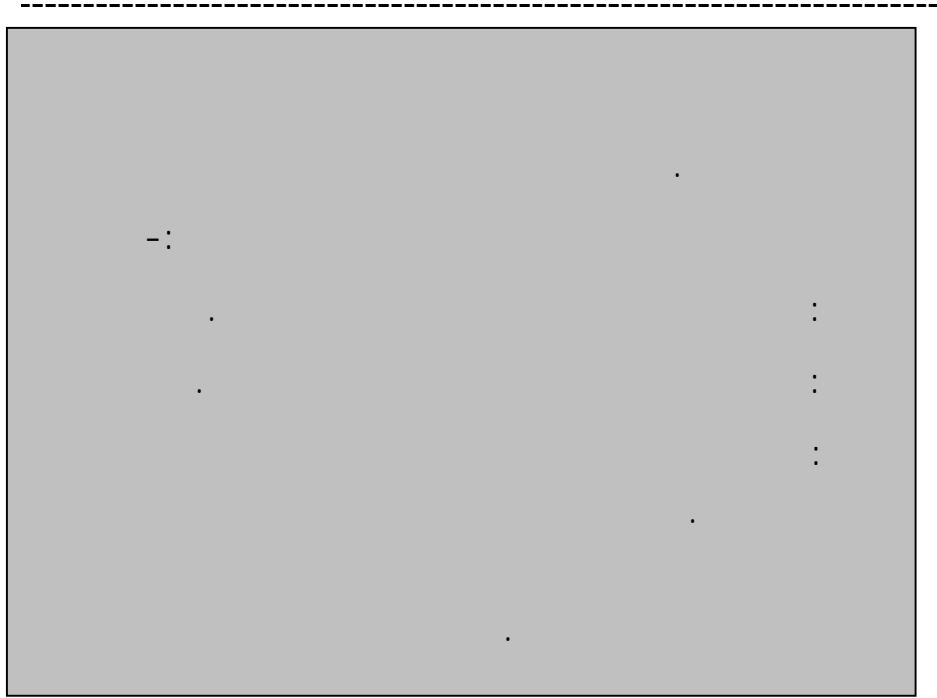
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(DCD) Dicyandiamide :

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(NH) SO -KNO -CO (NH)

= S = O = N = C = H :)

. (=K

: (NH) SO - :

=(x)+ + (x) =

= x =

. % = x / =

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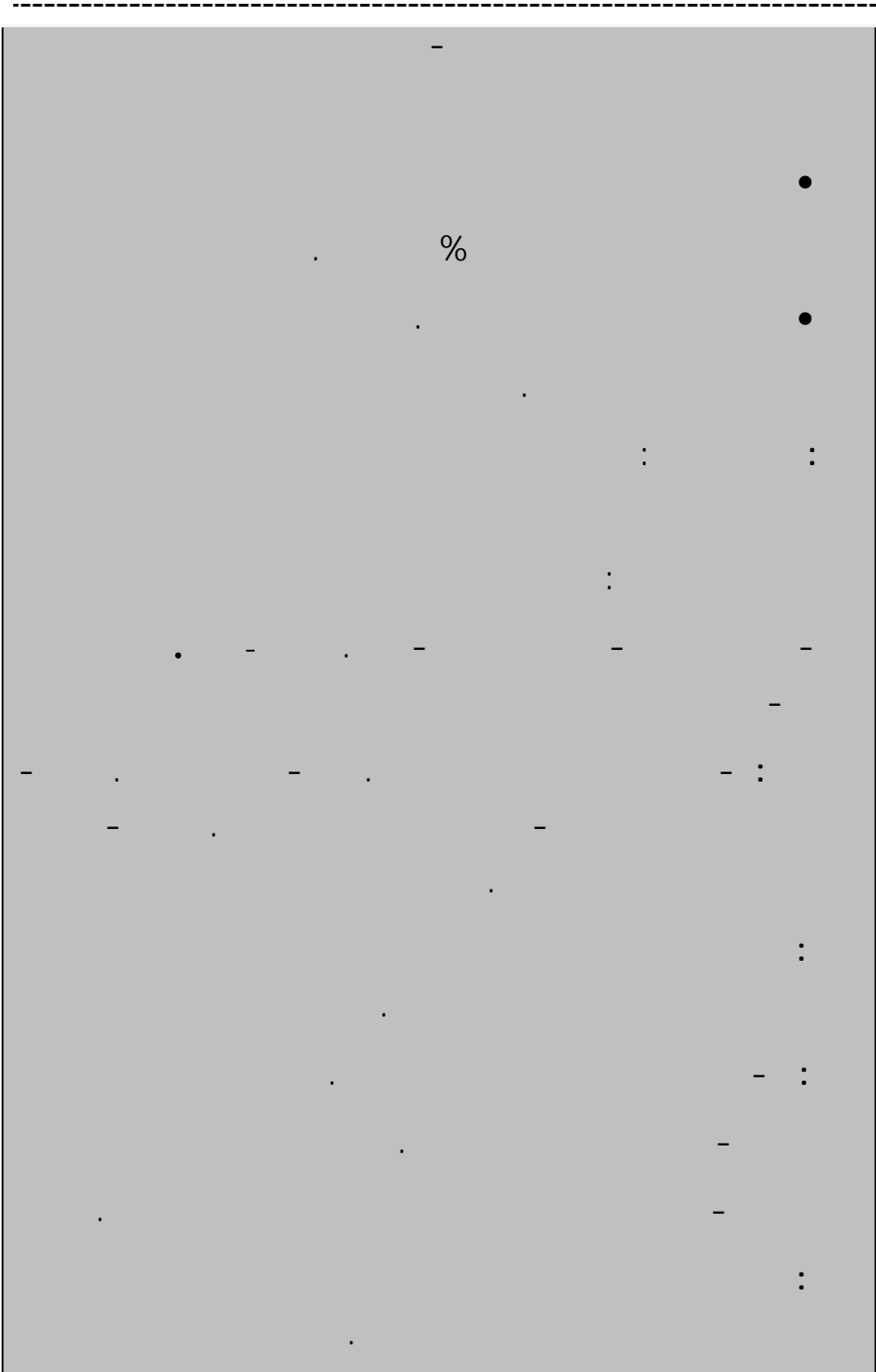
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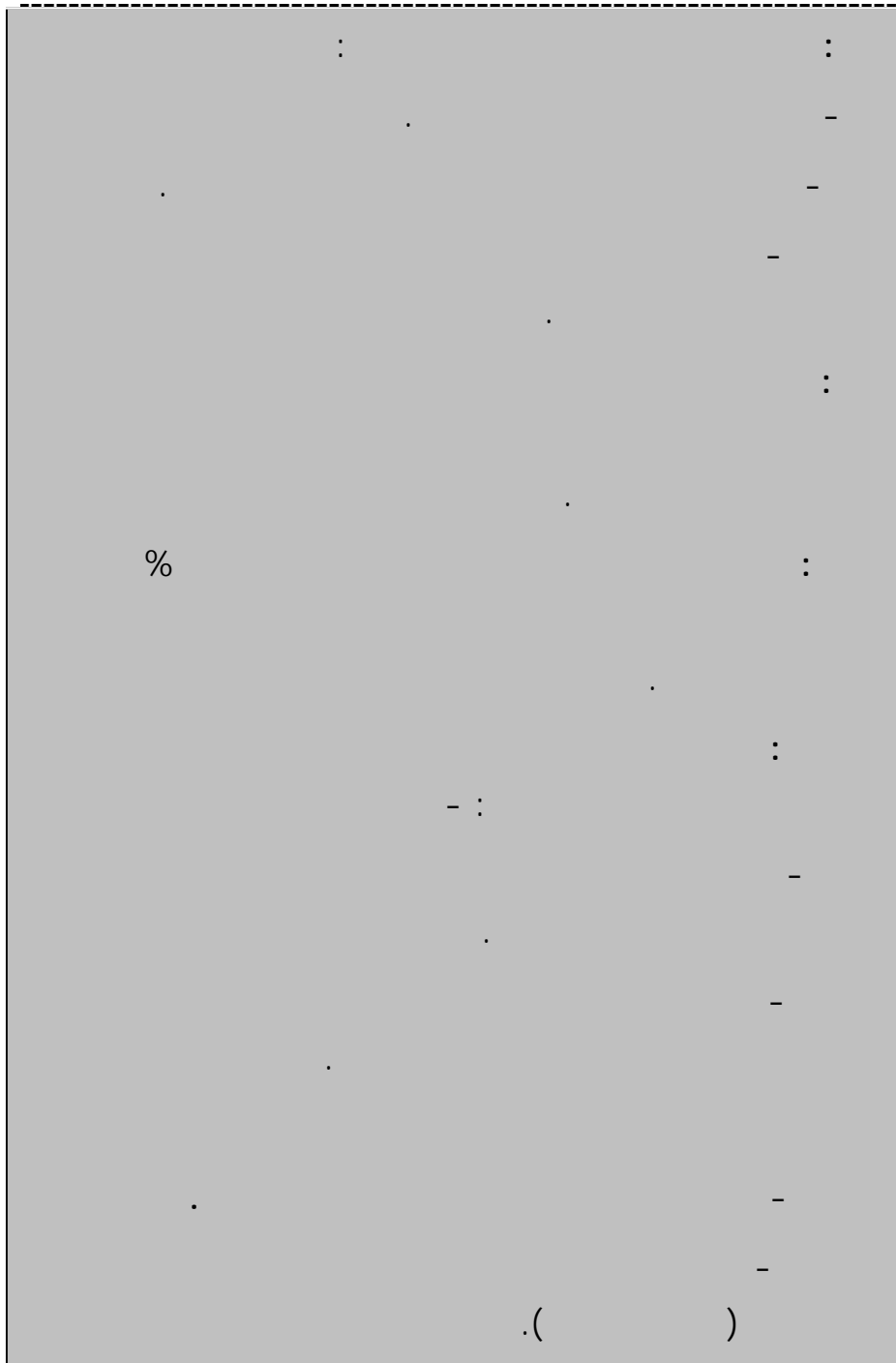
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Slow Release Fertilizers

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Sulfur Coated Urea

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Urea – formaldehyde

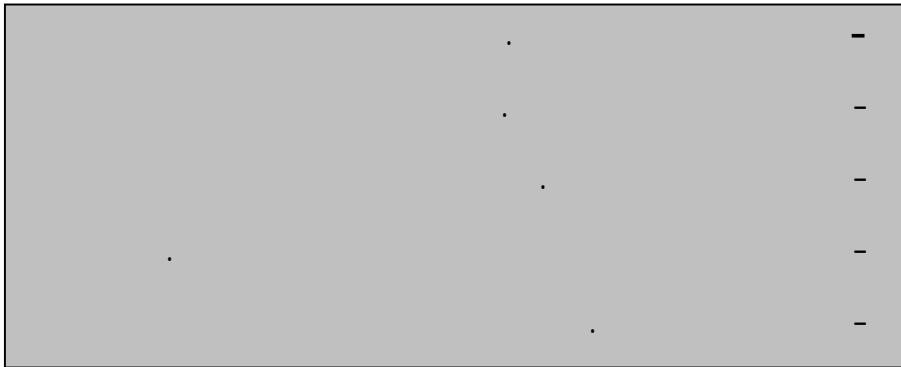


Phosphorus Fertilization

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Phosphorus Fertilization

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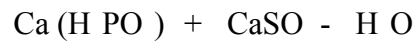


P₂O₅ % -



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(P O % -) :

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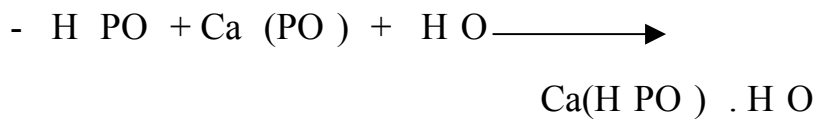
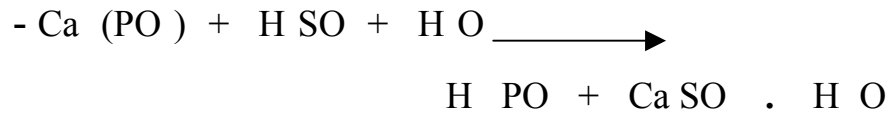
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P O % -

: (H PO) :

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(P O %)

. P O % -

: **Nitric phosphates**

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(P O % - N % -)

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(P O) %	-	-
(P O)% -		- ()
(P O) % -		-

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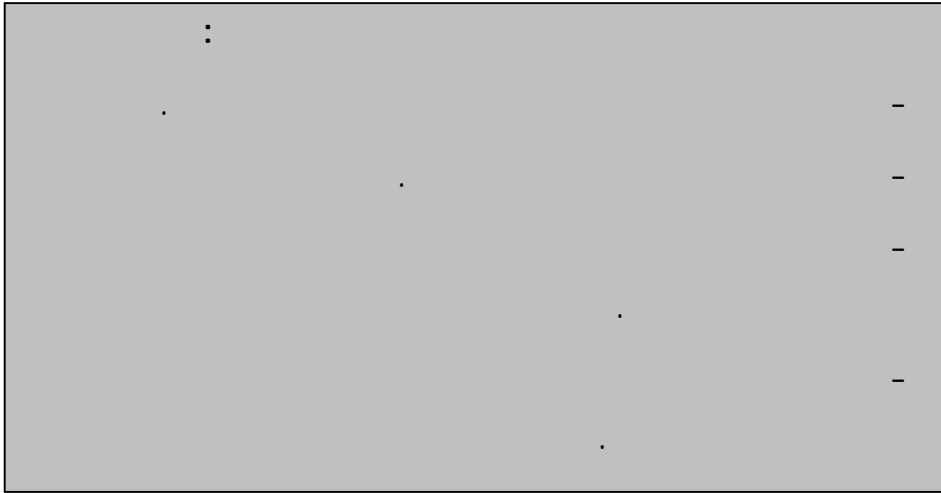
[?]

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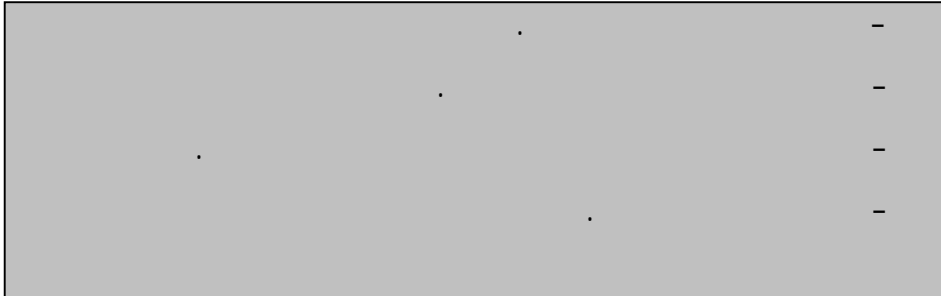


Potassium Fertilization

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Potassium Fertilization

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.(K+)

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:(KCl)

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(K %)K O %

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: K SO -
K O % -

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KCl+H SO → K SO + HCl
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(K O) % - .()	-	-
(K O) % - .()		-

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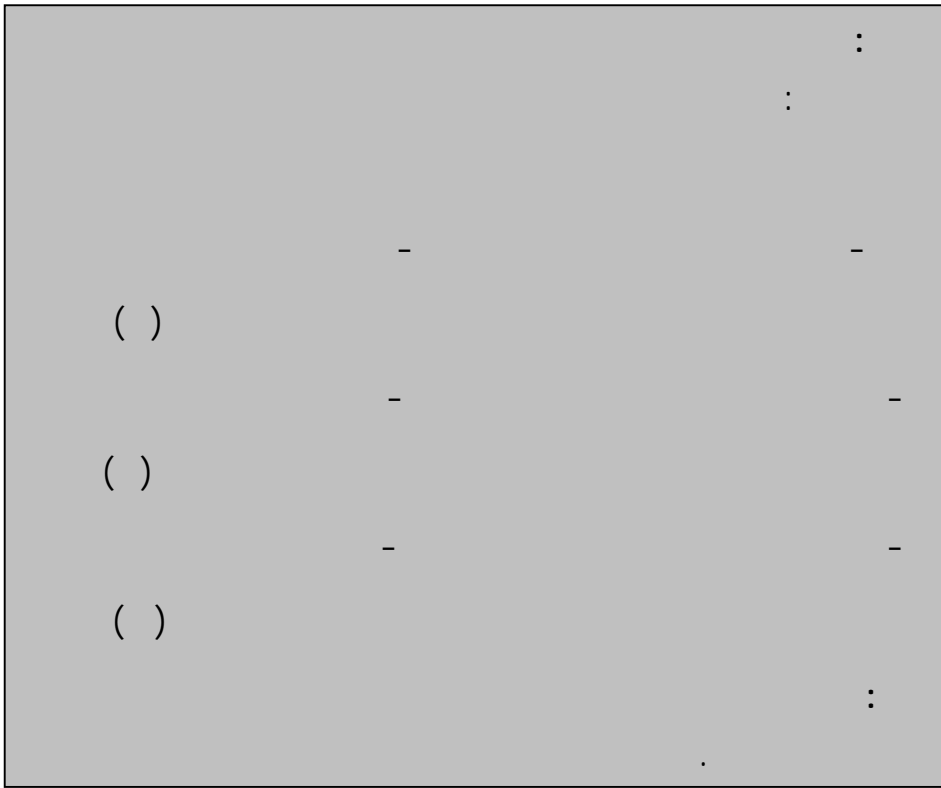
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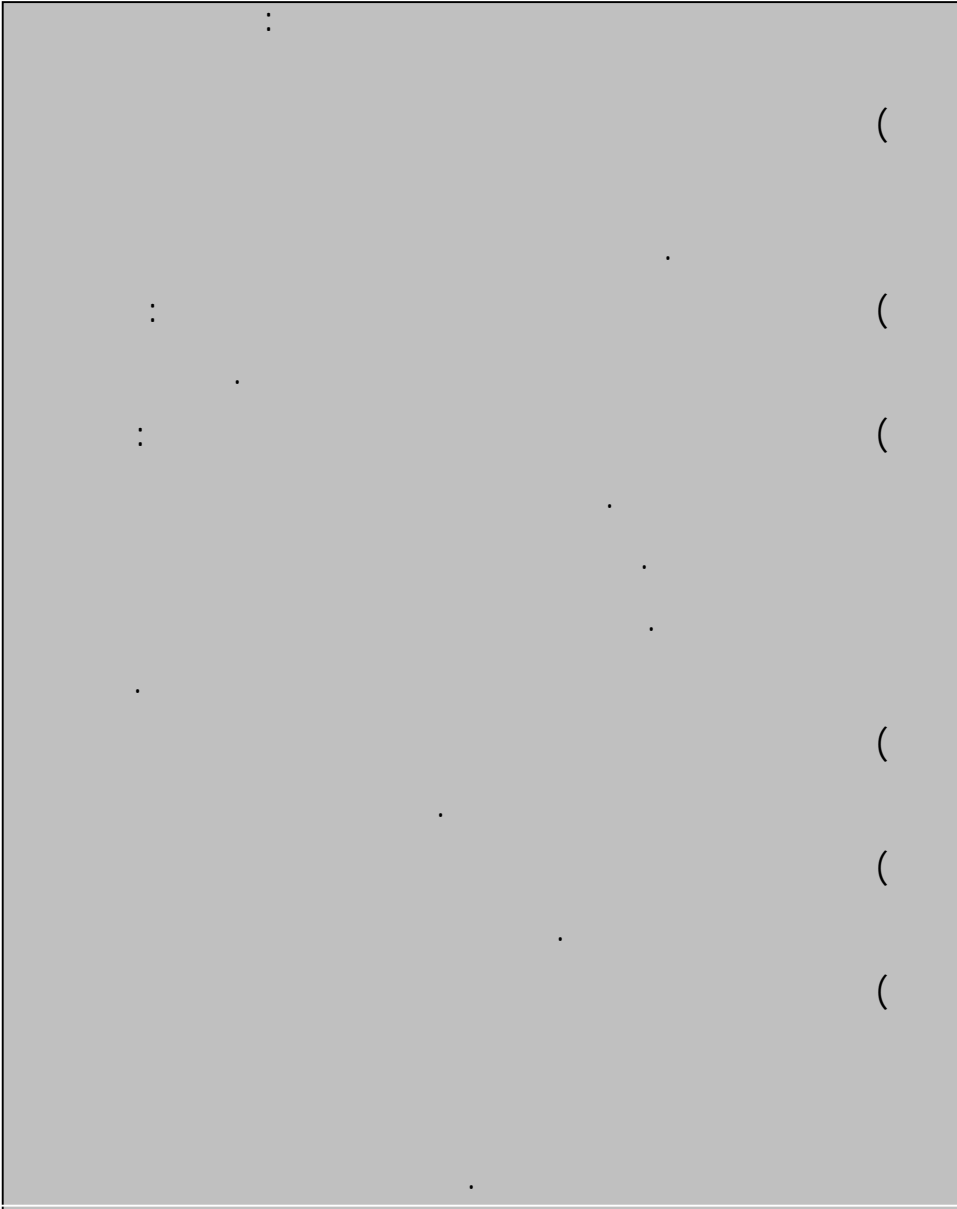
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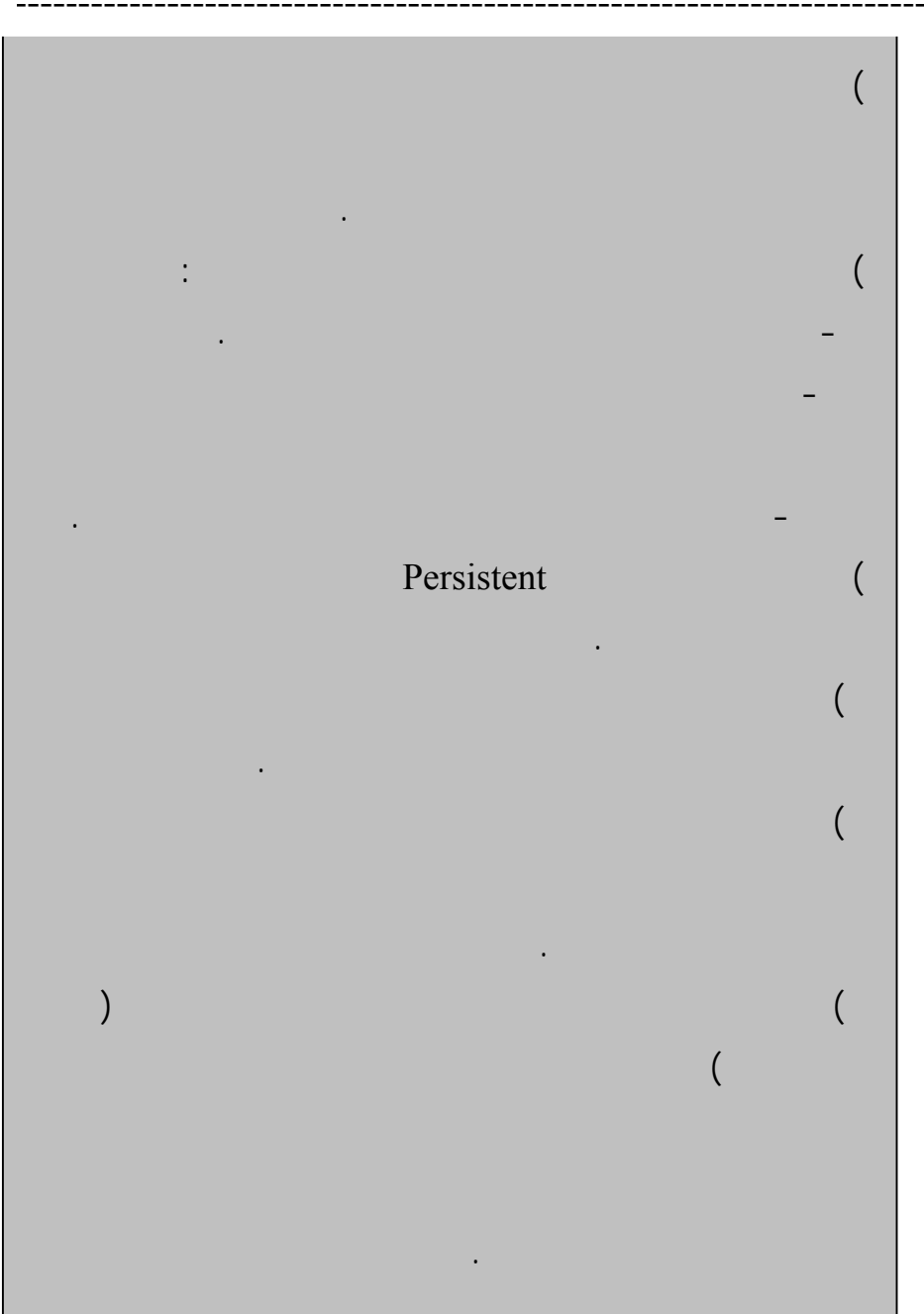
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[?]







١٣) إذا كانت الأرض قلوية يمكن استخدام سماد نتروجين ذى تأثير حامضى

مثل: فوسفات الأمونيوم أو نترات الأمونيوم فى الأراضى الجيرية .

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. K O %

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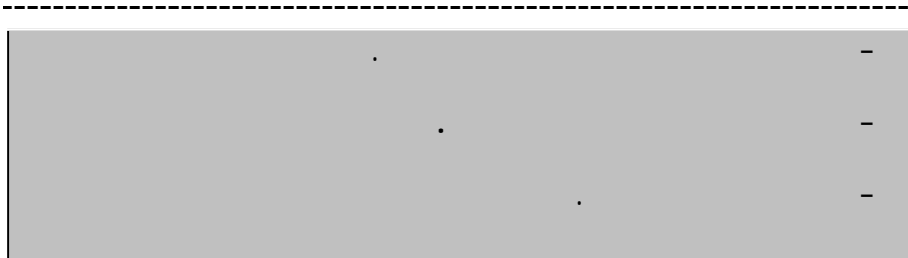
Micromutrients

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Micronutrients

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Lime

. induced chlorosis

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. EDDHA EDTA %

(Mn⁺⁺)

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%

MnSO₄ · H₂O

H O : :
(ZnEDTA : (%) H O (%)
related Zn Zn DTPA)

- %

%

% -

% ,

(Na B O . H O)

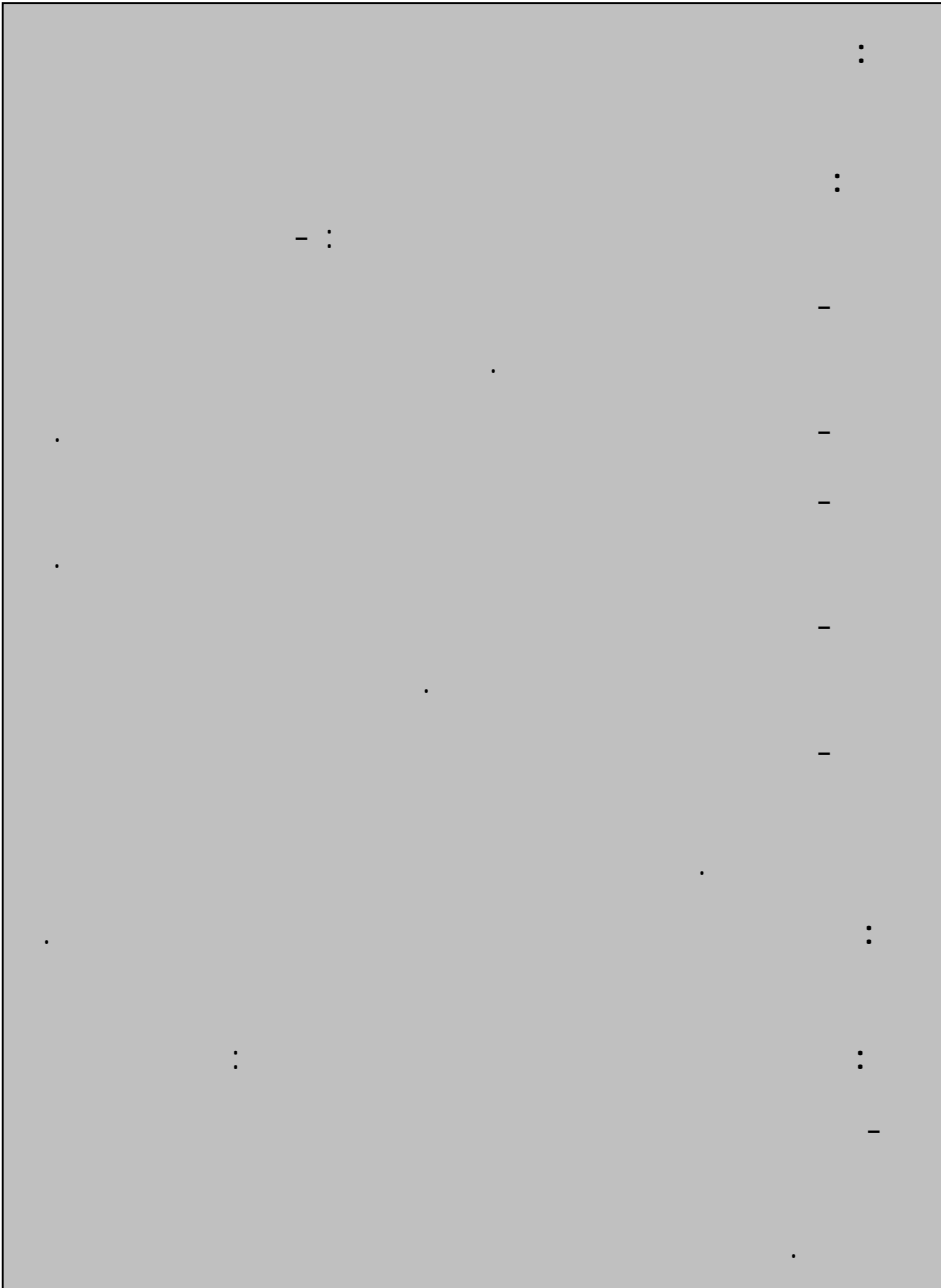
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	%			
/			FeSO ₄ · H ₂ O Fe-Chelate	Fe
, - ,			MnSO ₄ · H ₂ O	Mn
, , -	, - , , - , , - ,		ZnSO ₄ · H ₂ O (Zn) ZnSO ₄ · H ₂ O (Zn) Zn-Chelate	Zn
- -	- -	() ()	Cu SO ₄ Cu - Chelate	Cu
, -	-		Na B O ₃ · H ₂ O	B

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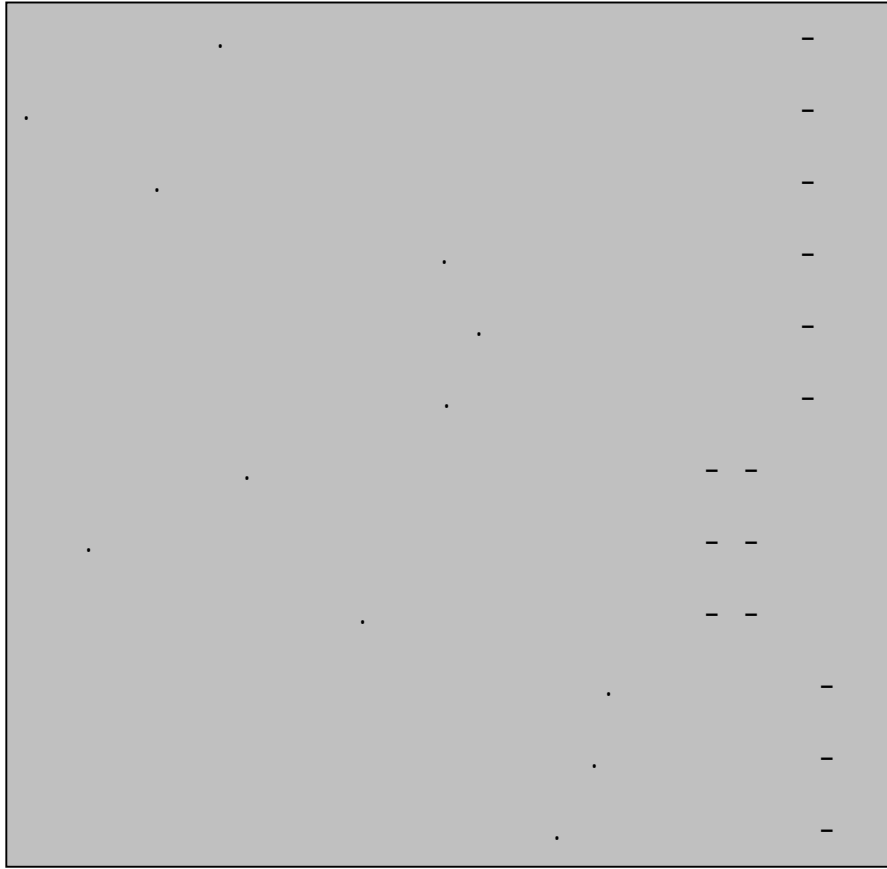
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Compound (Multinutrient) Fertilizers.

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Compound (Multi-nutrients) Fertilizers

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: (Fertilizer grade)

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K O : P O : N

K O % - P O % - N % . - -

: (Fertilizer Ratio)

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: (Complete Fertilizer)

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.K-P-N

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. K O-P O -N :

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Acidulation *

Ammonification *

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Granulation *

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Complete Fertilizers

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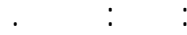
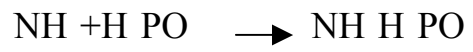
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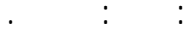
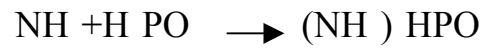
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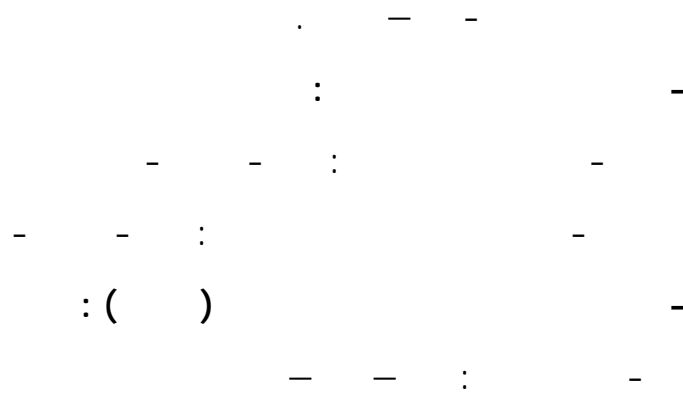


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(Special Fertilizers)

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pH

Superphosphoric acid

P O % N%

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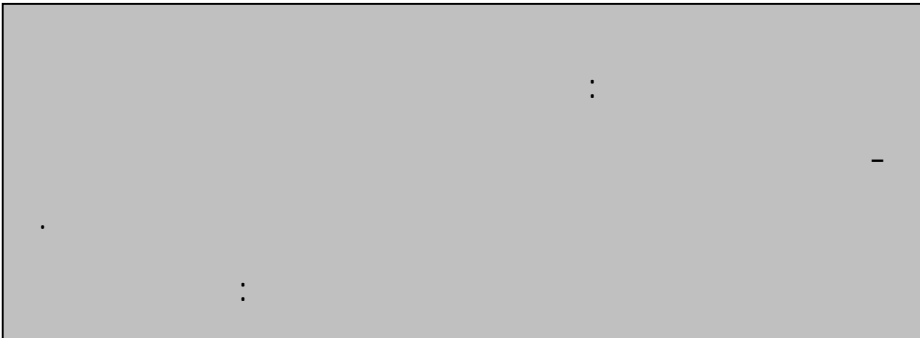
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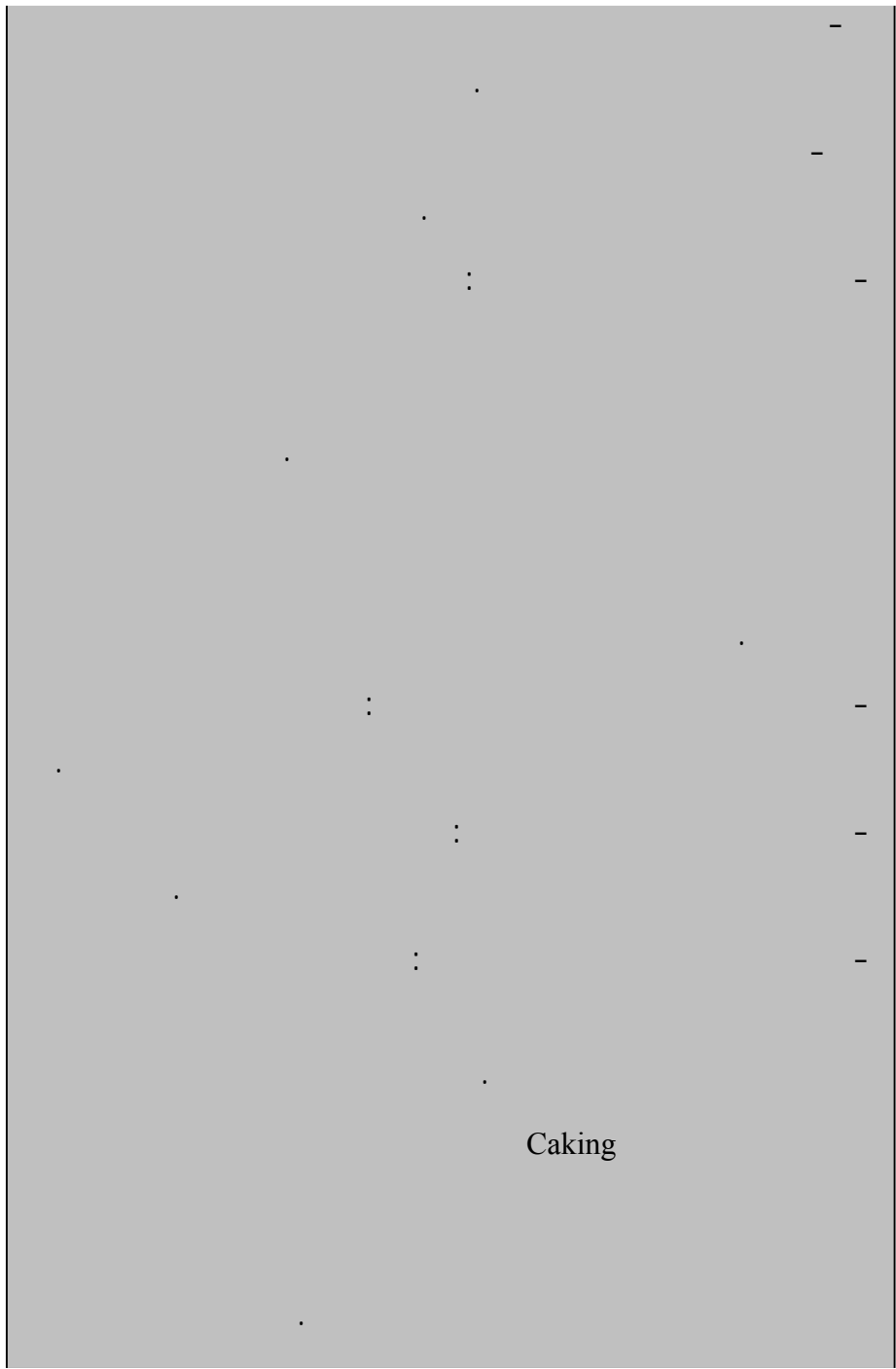
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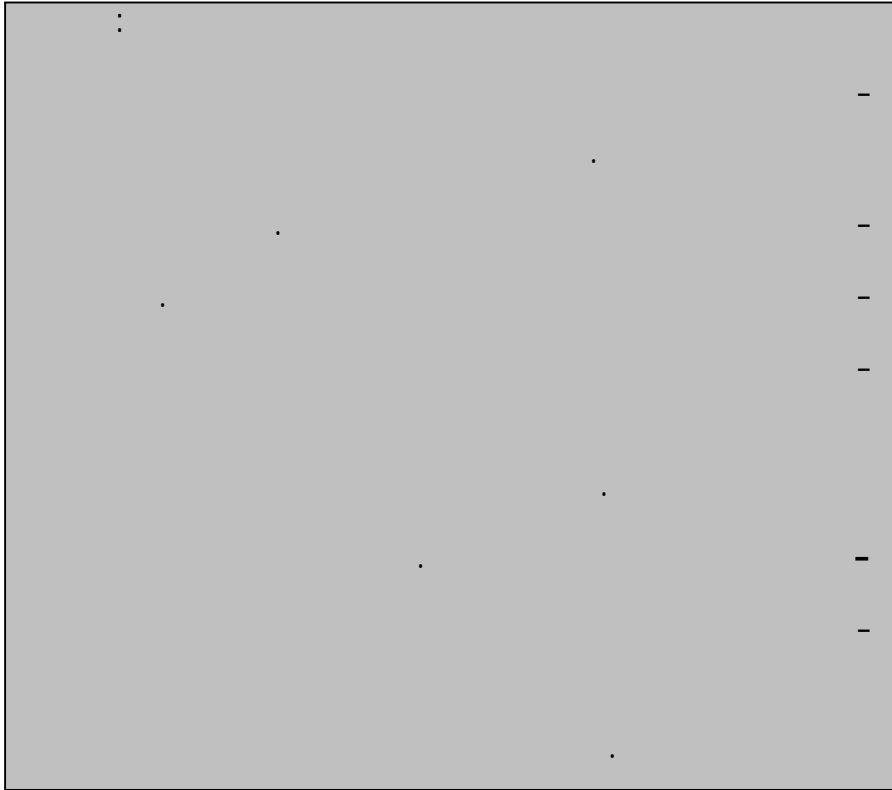
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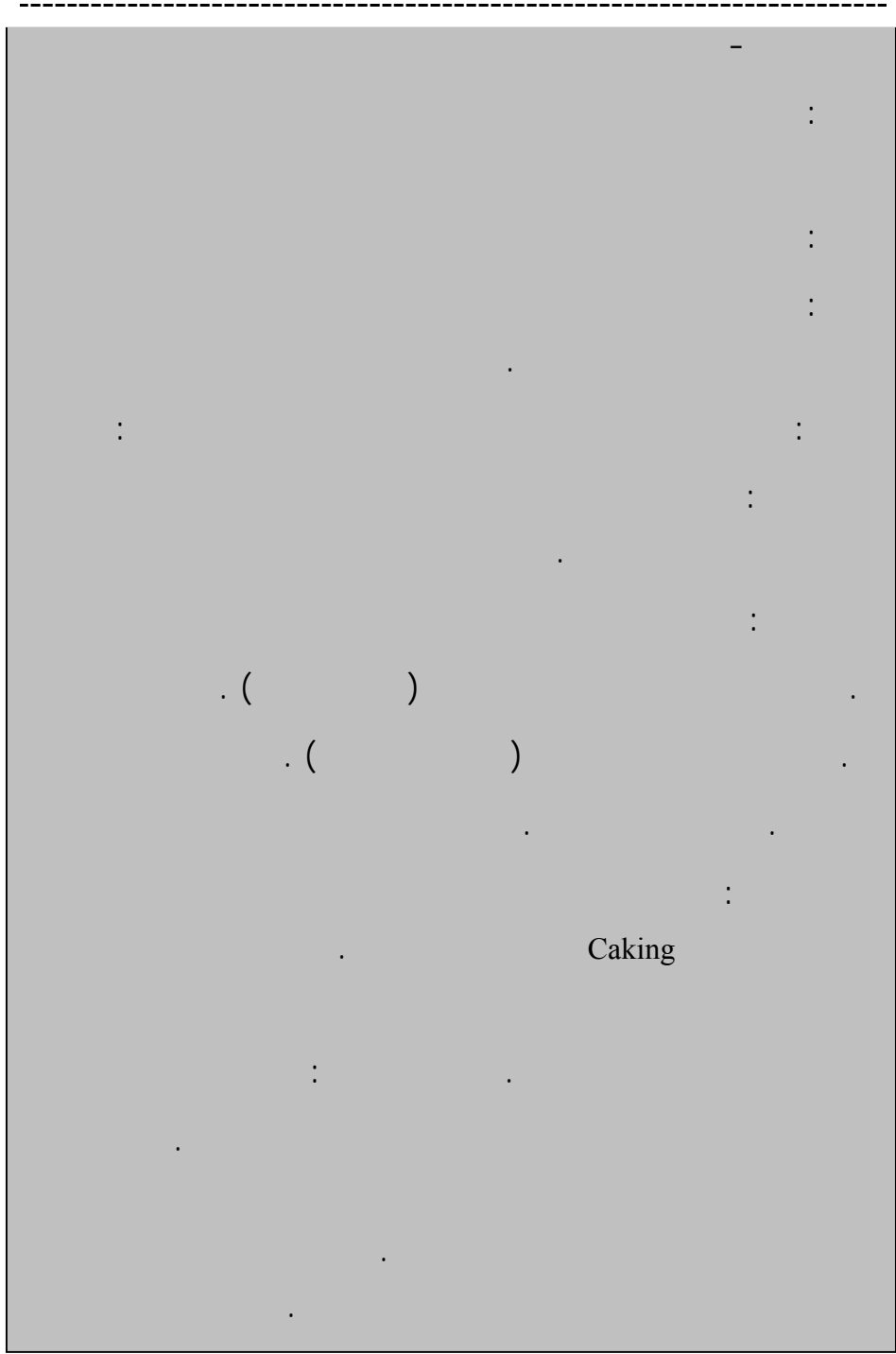
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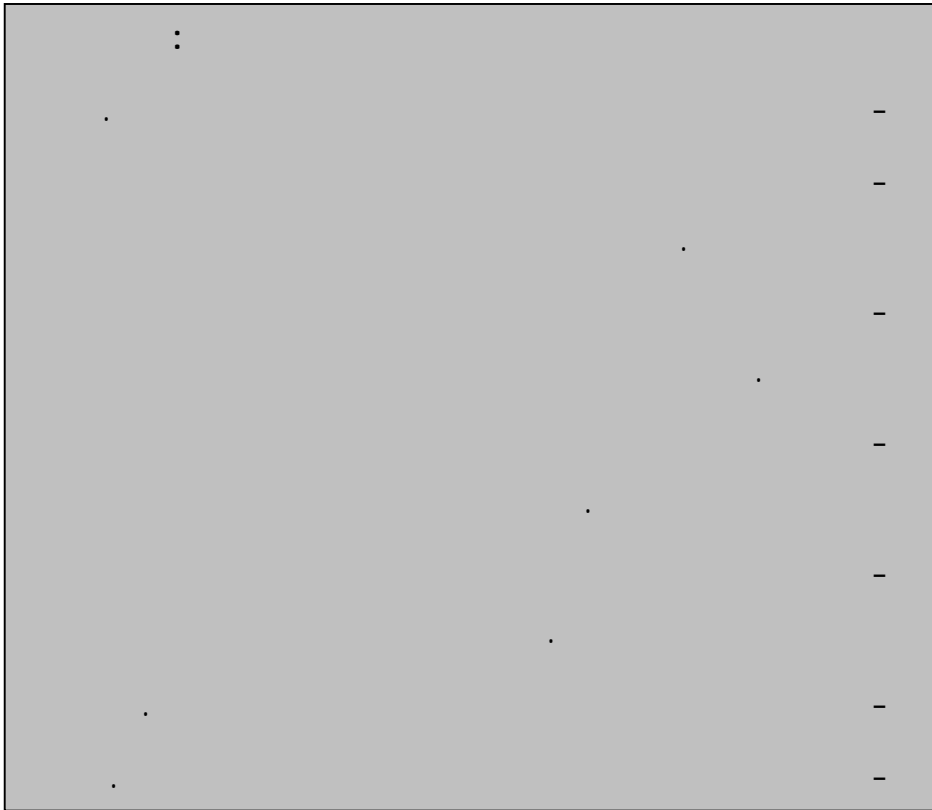
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Methods of Fertilizer Application

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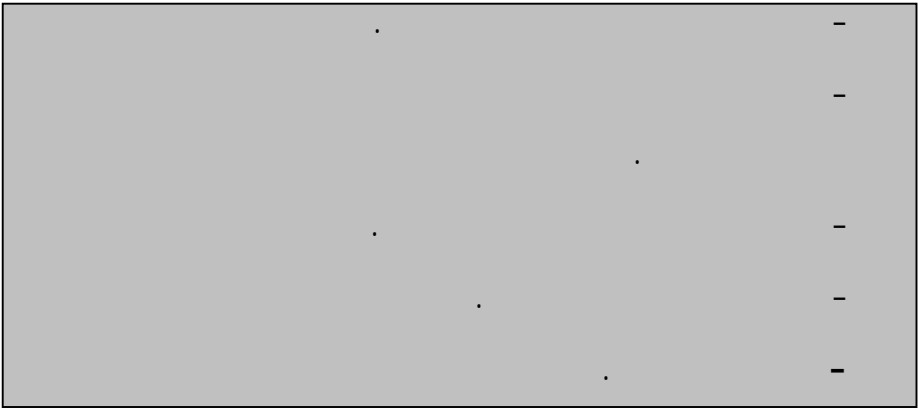


.(Foliar Application)	-	-
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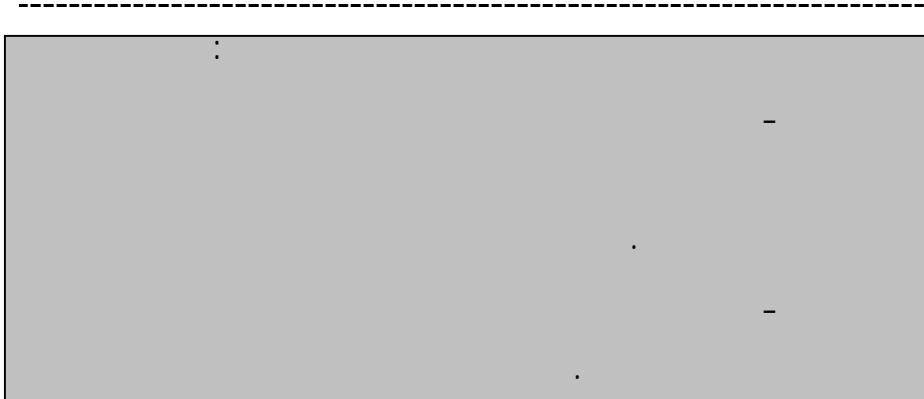
Methods of Fertilizer Application

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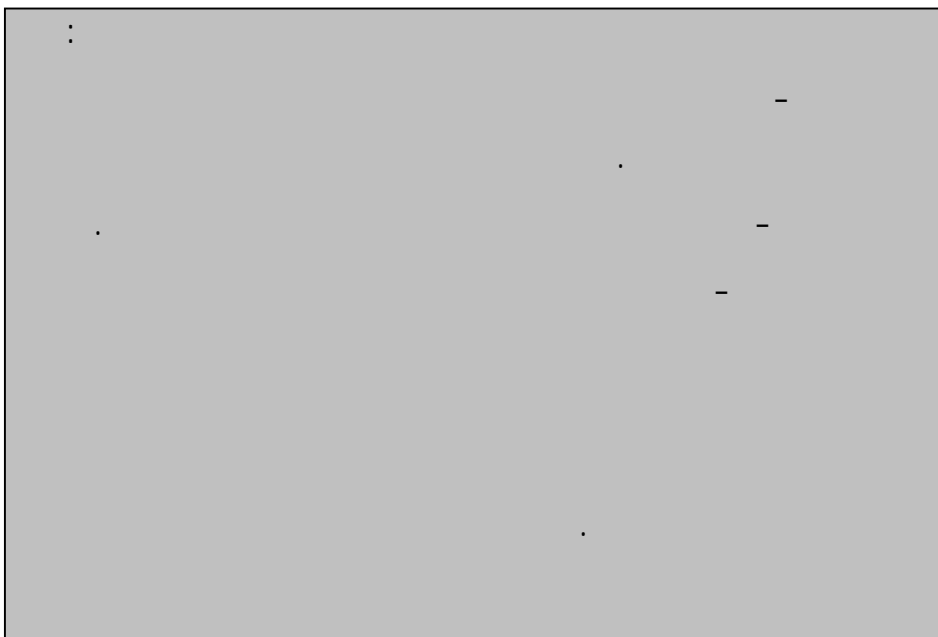
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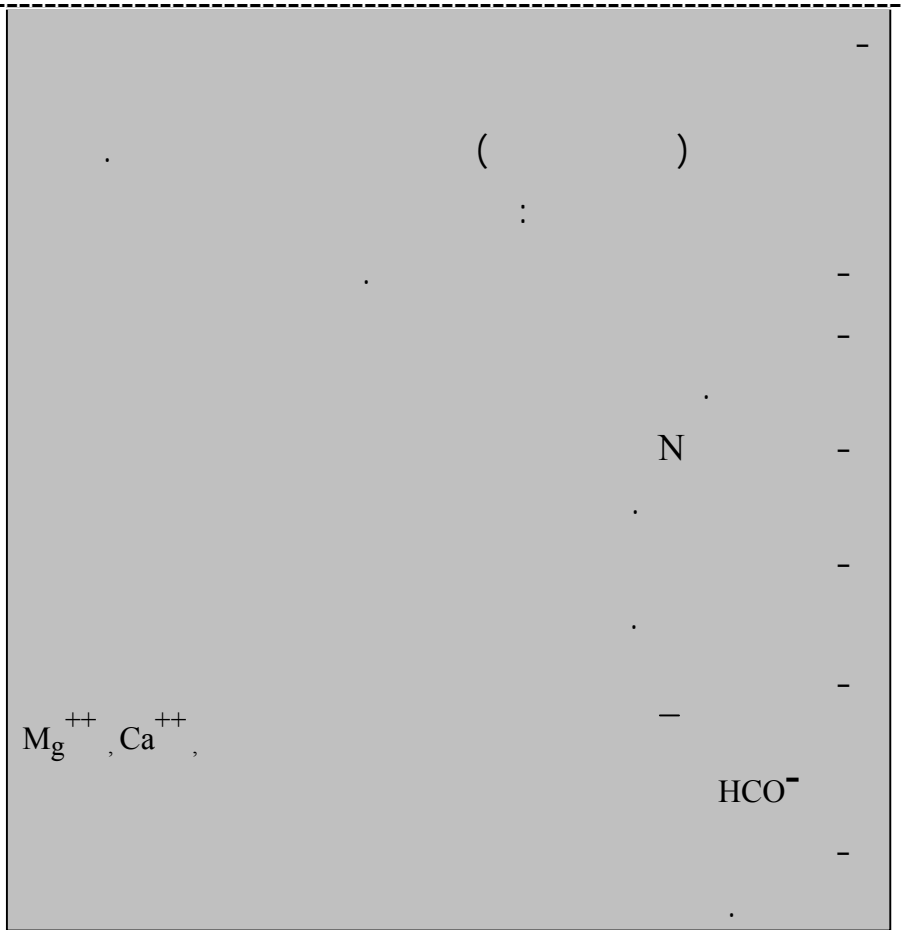
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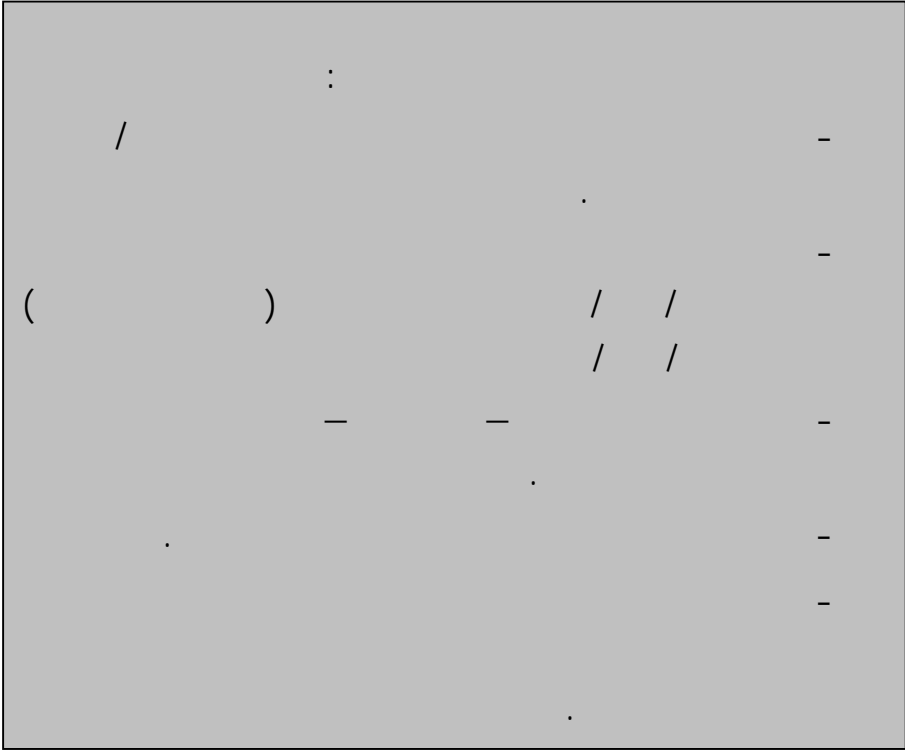
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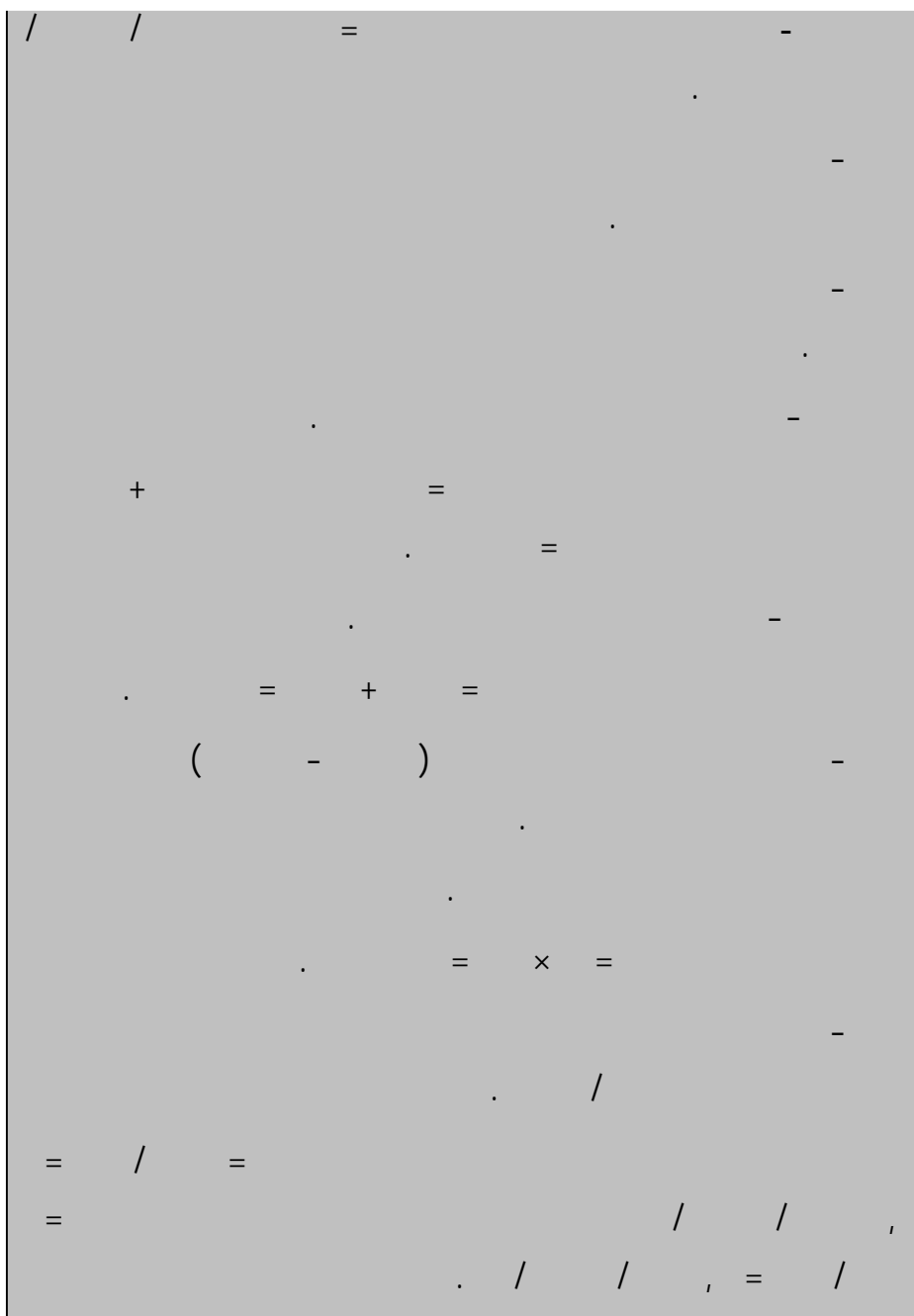
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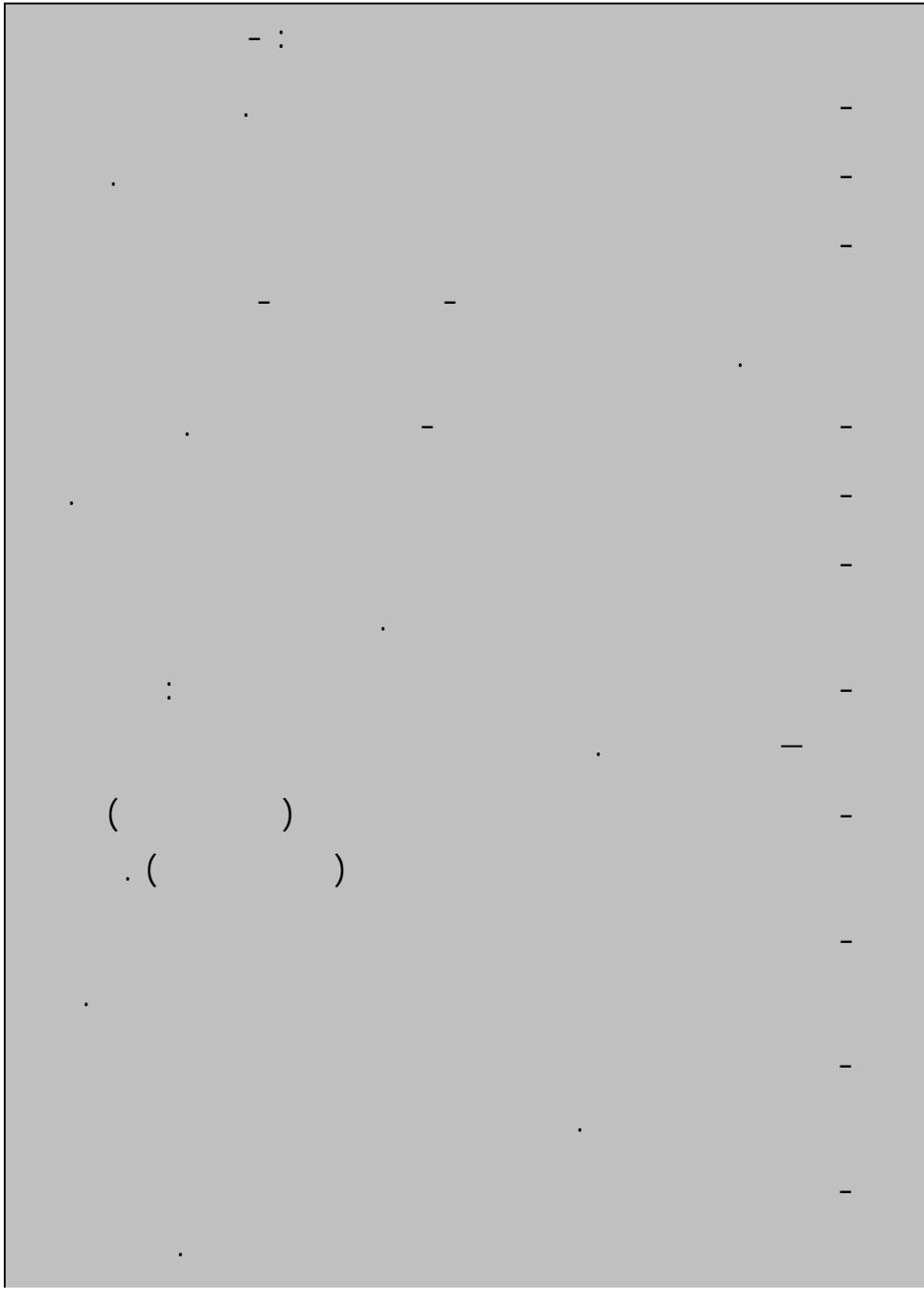
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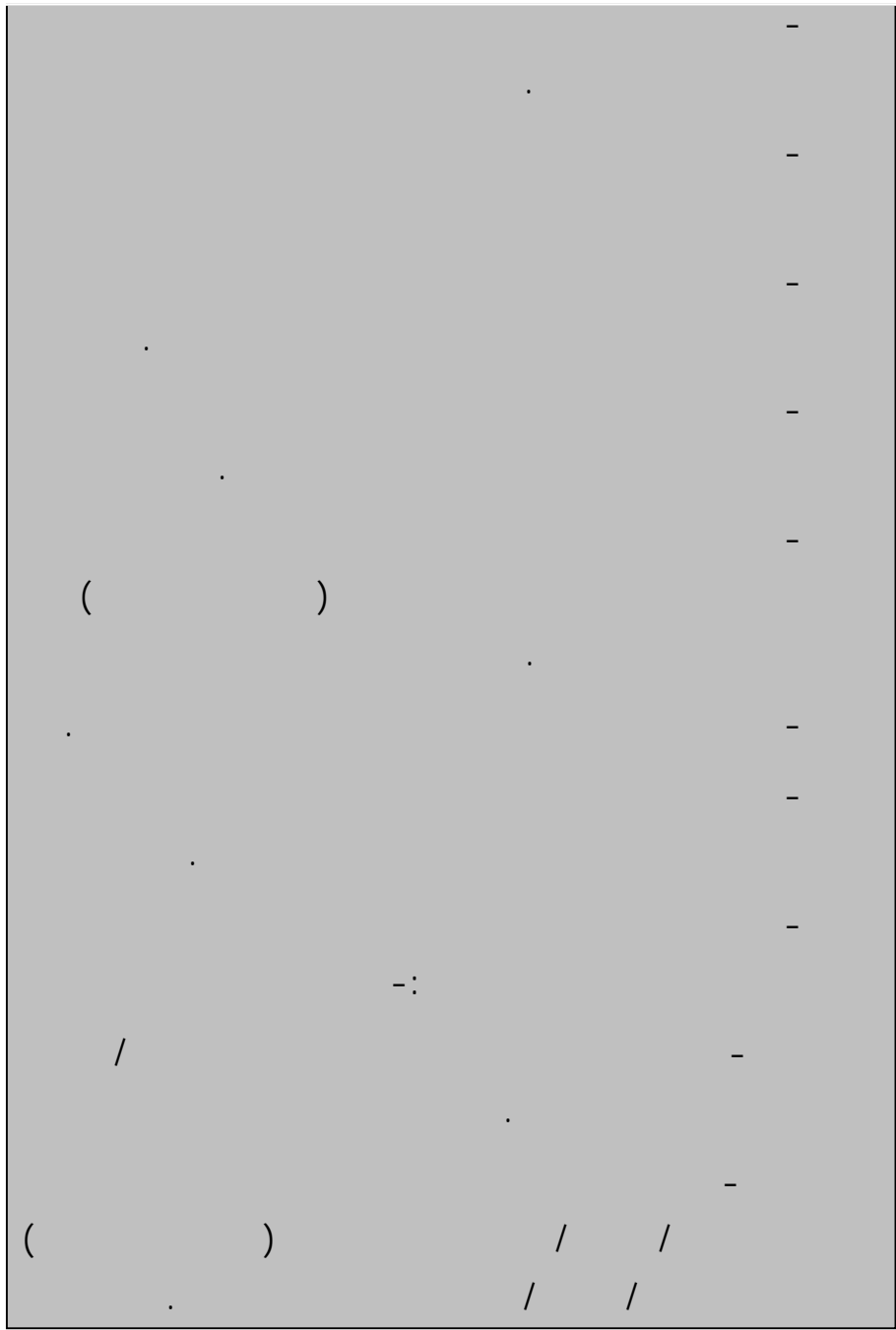
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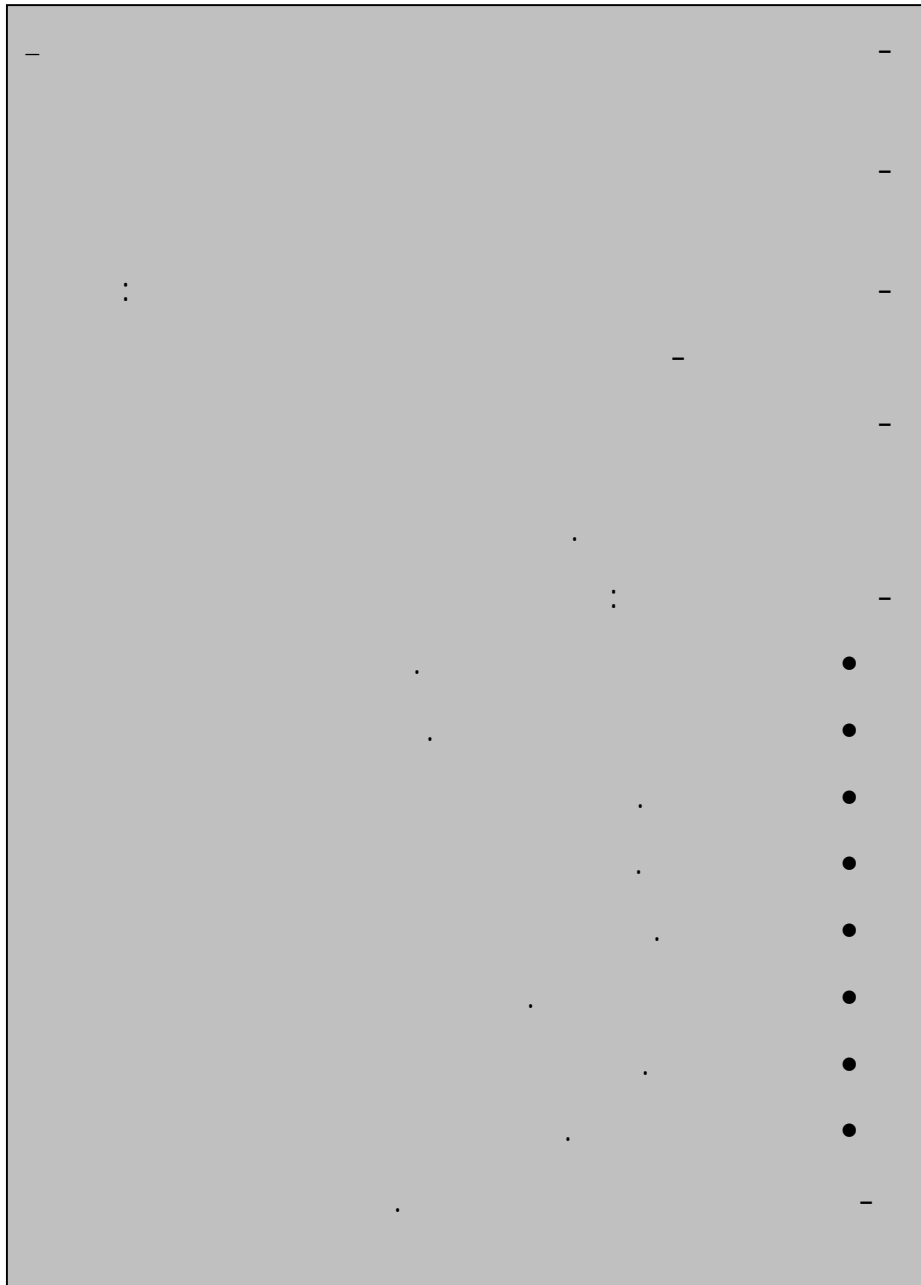








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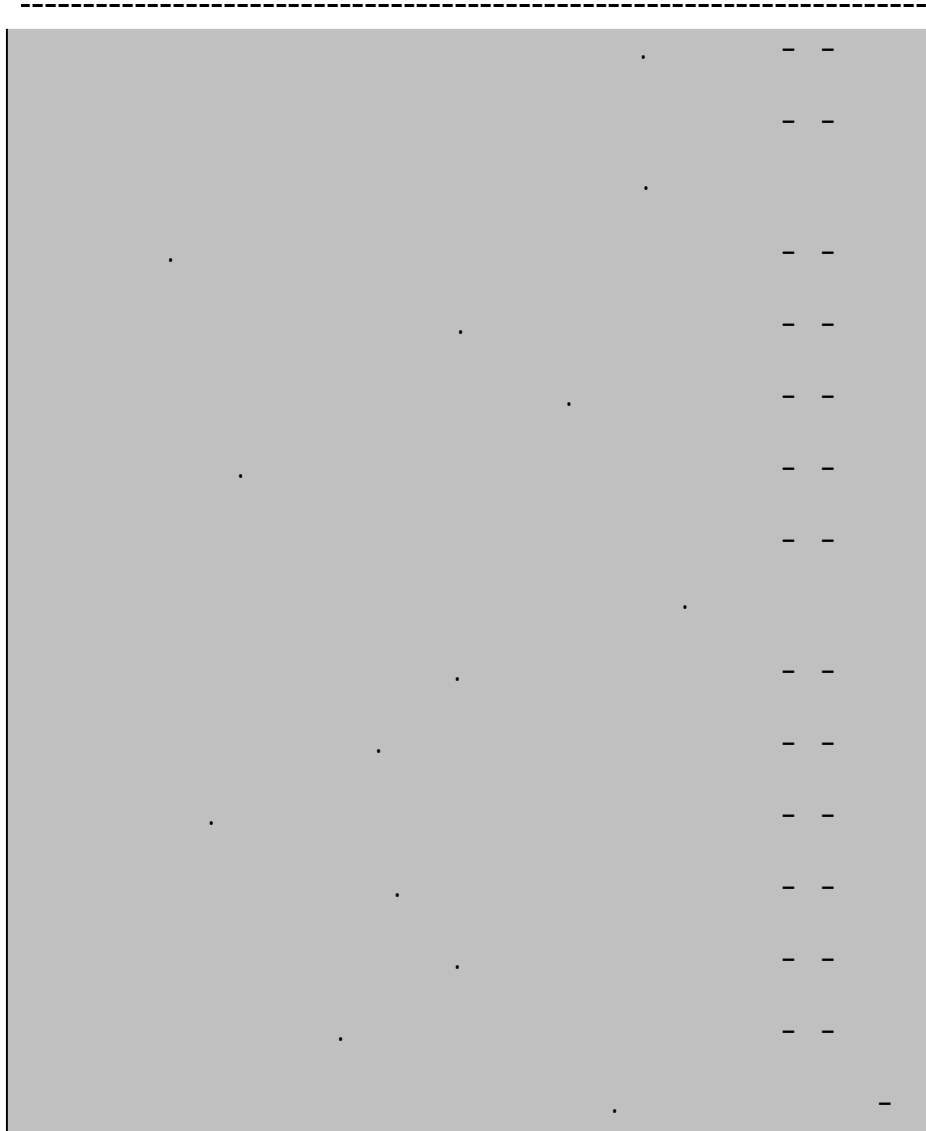
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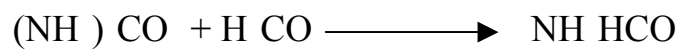
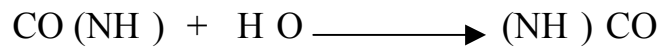
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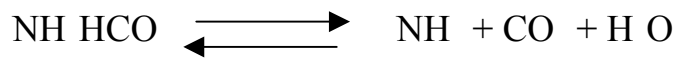
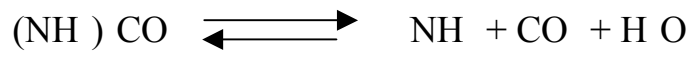
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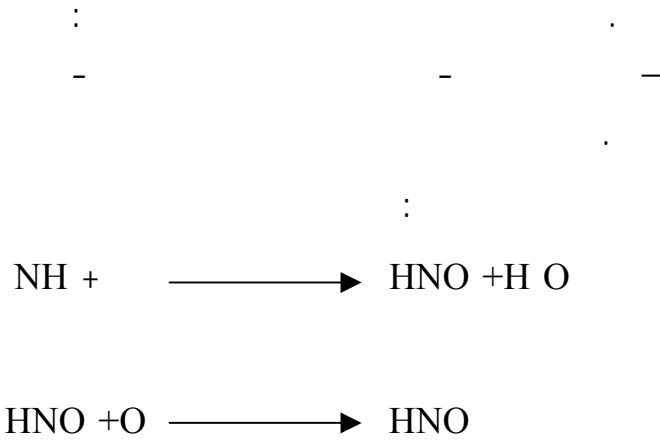
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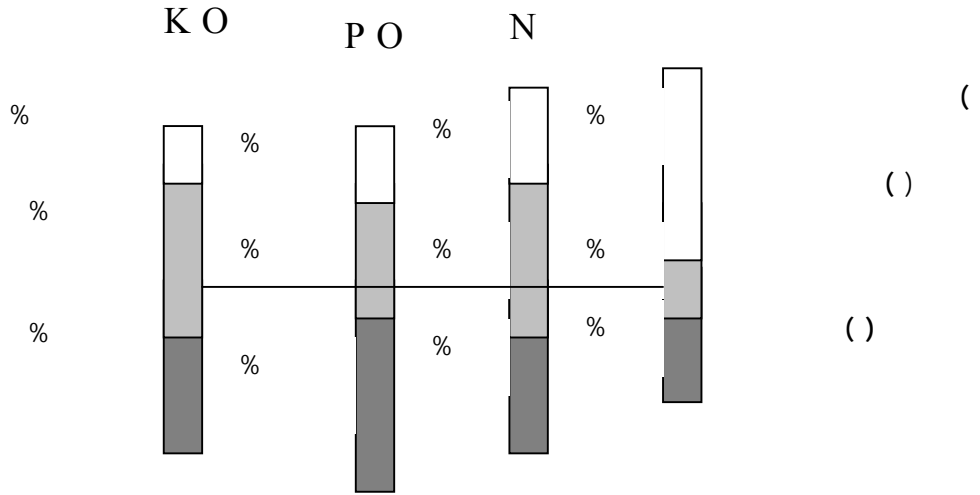
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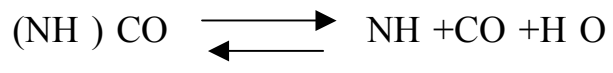
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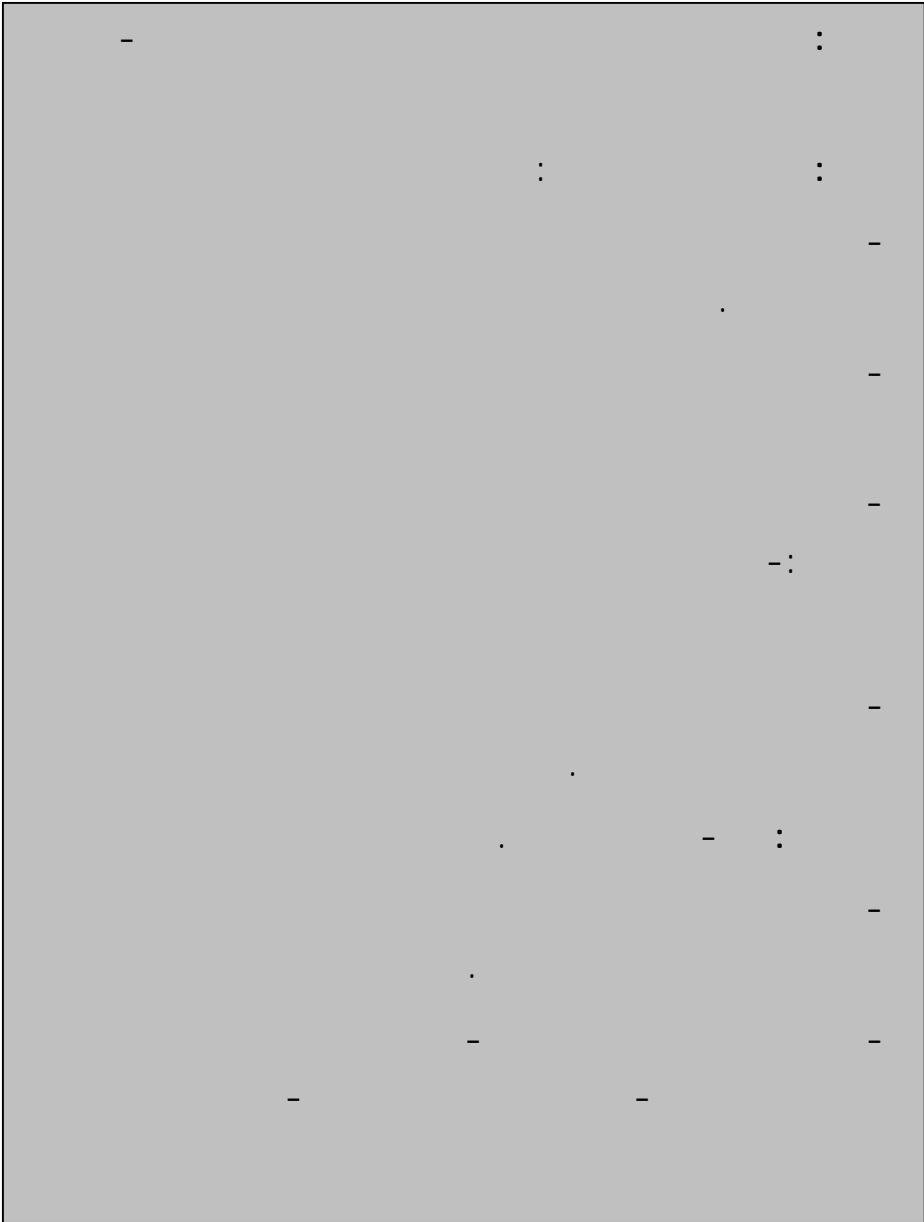
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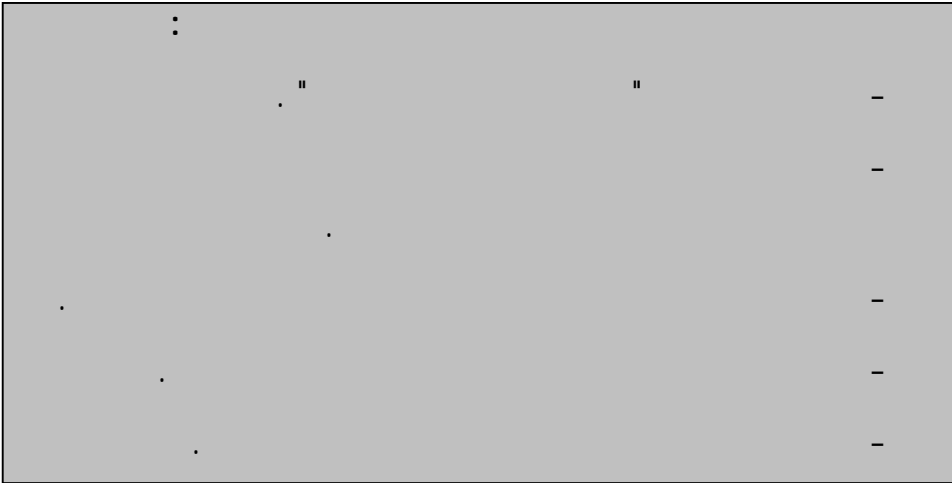
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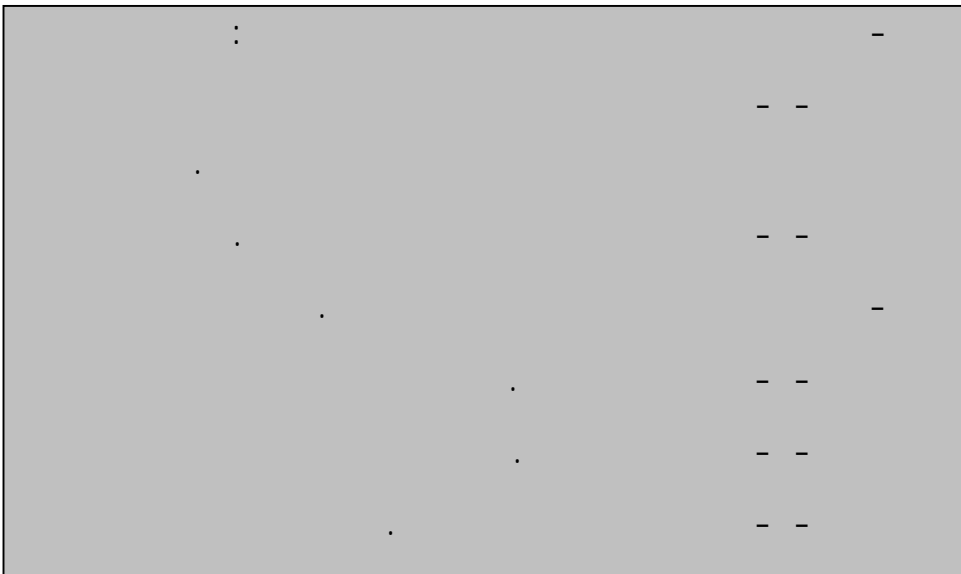
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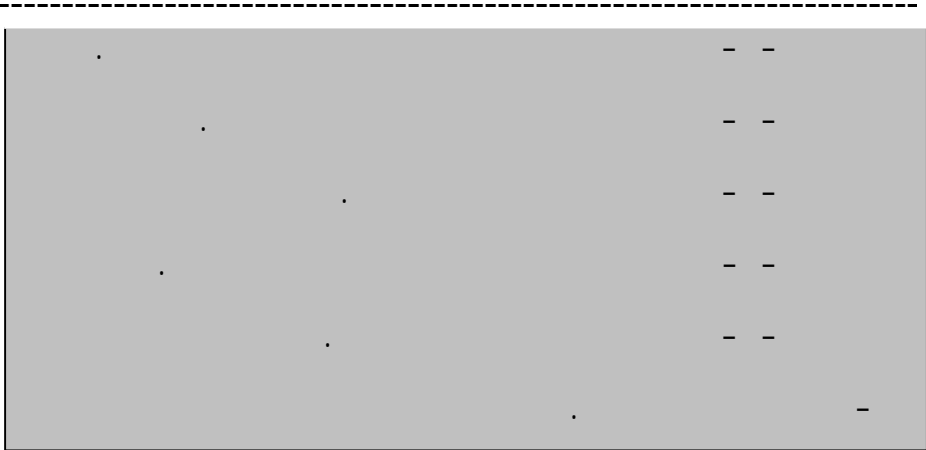


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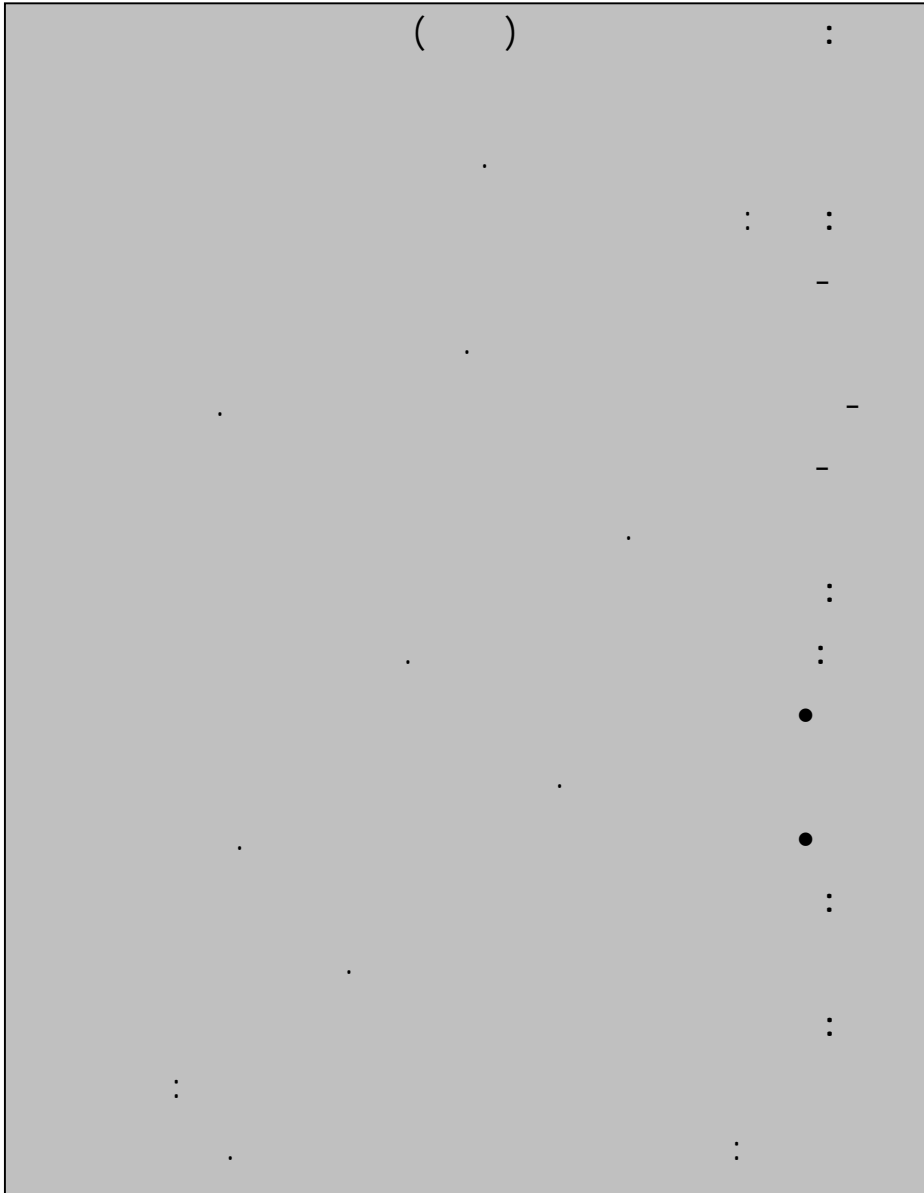
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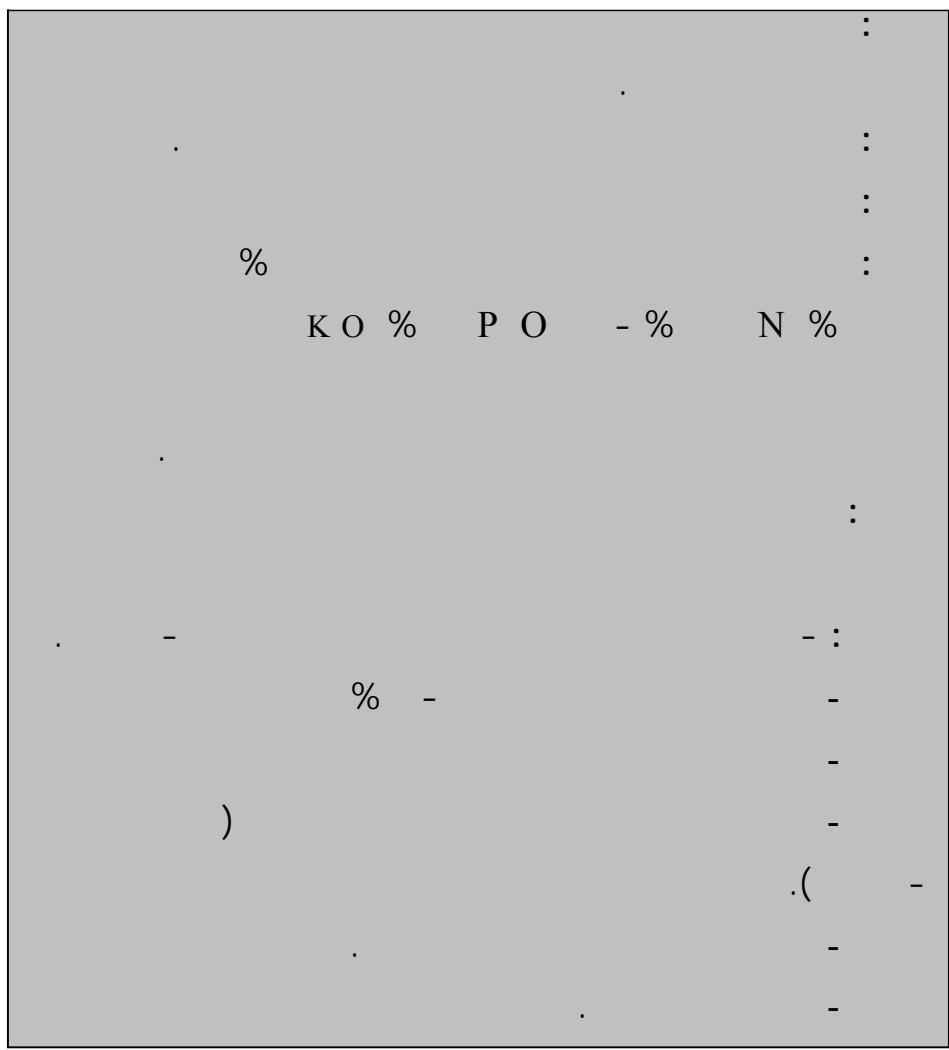
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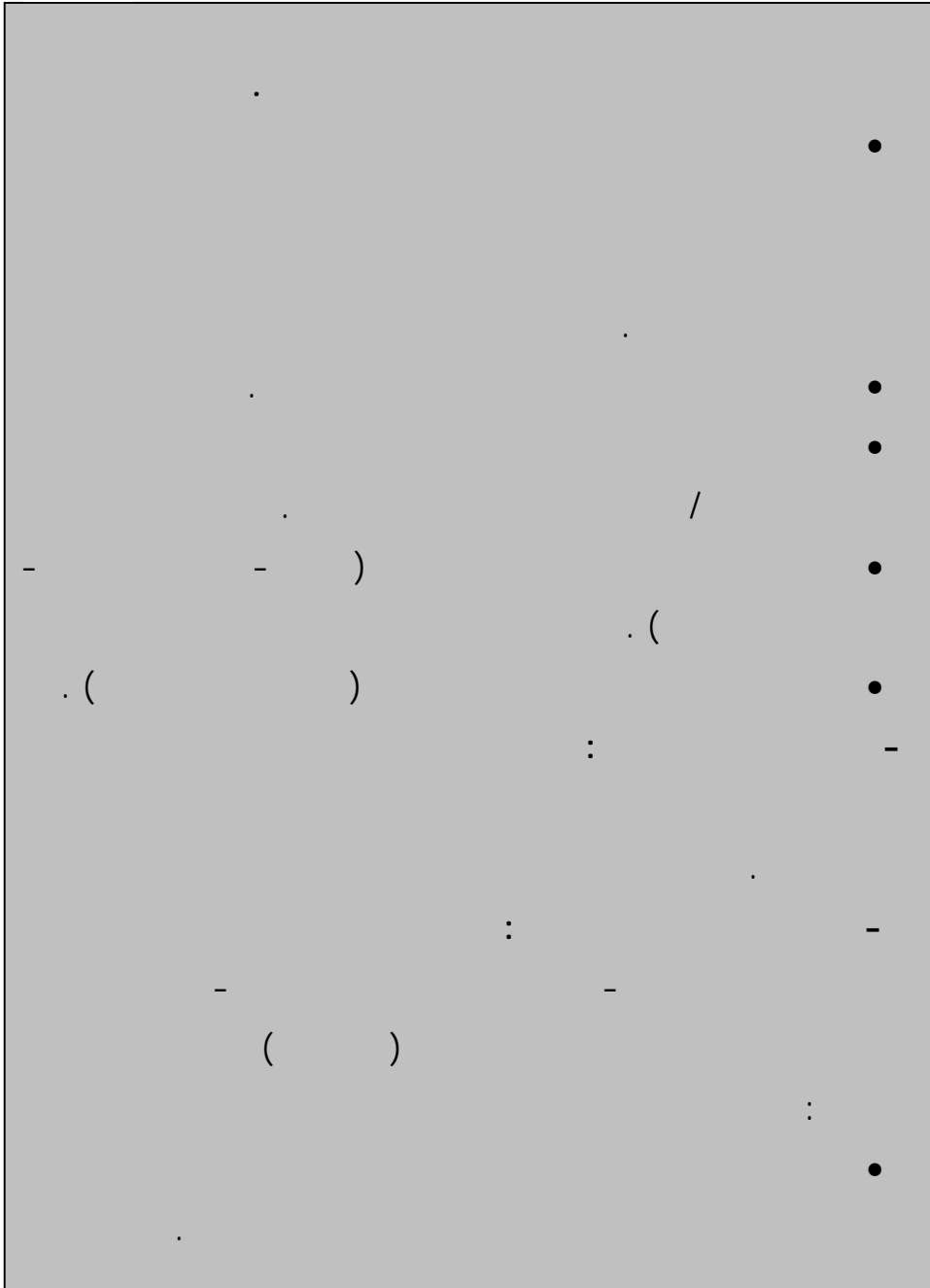
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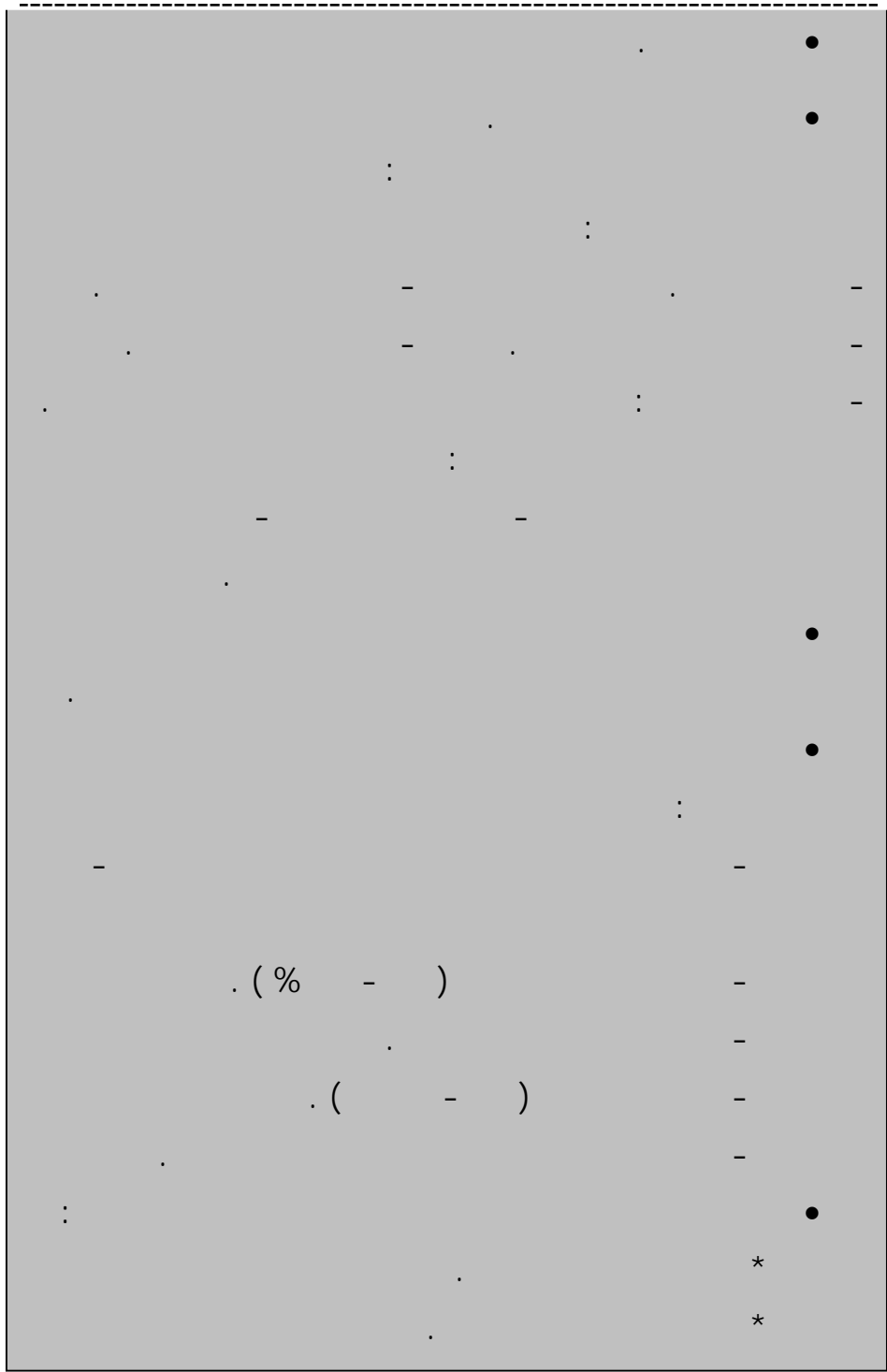
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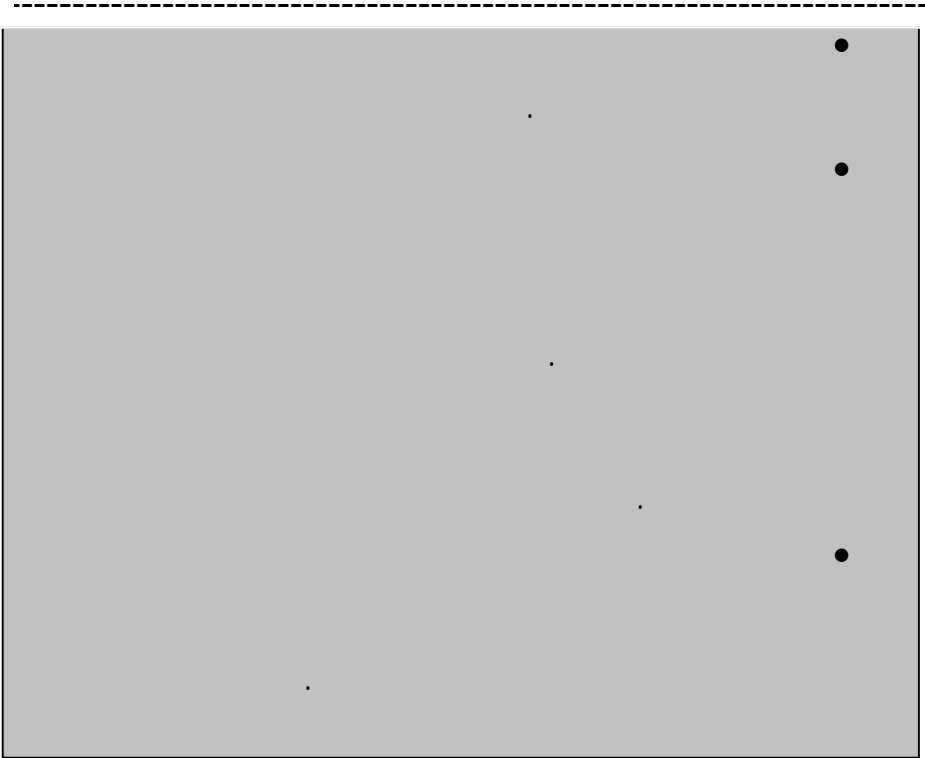
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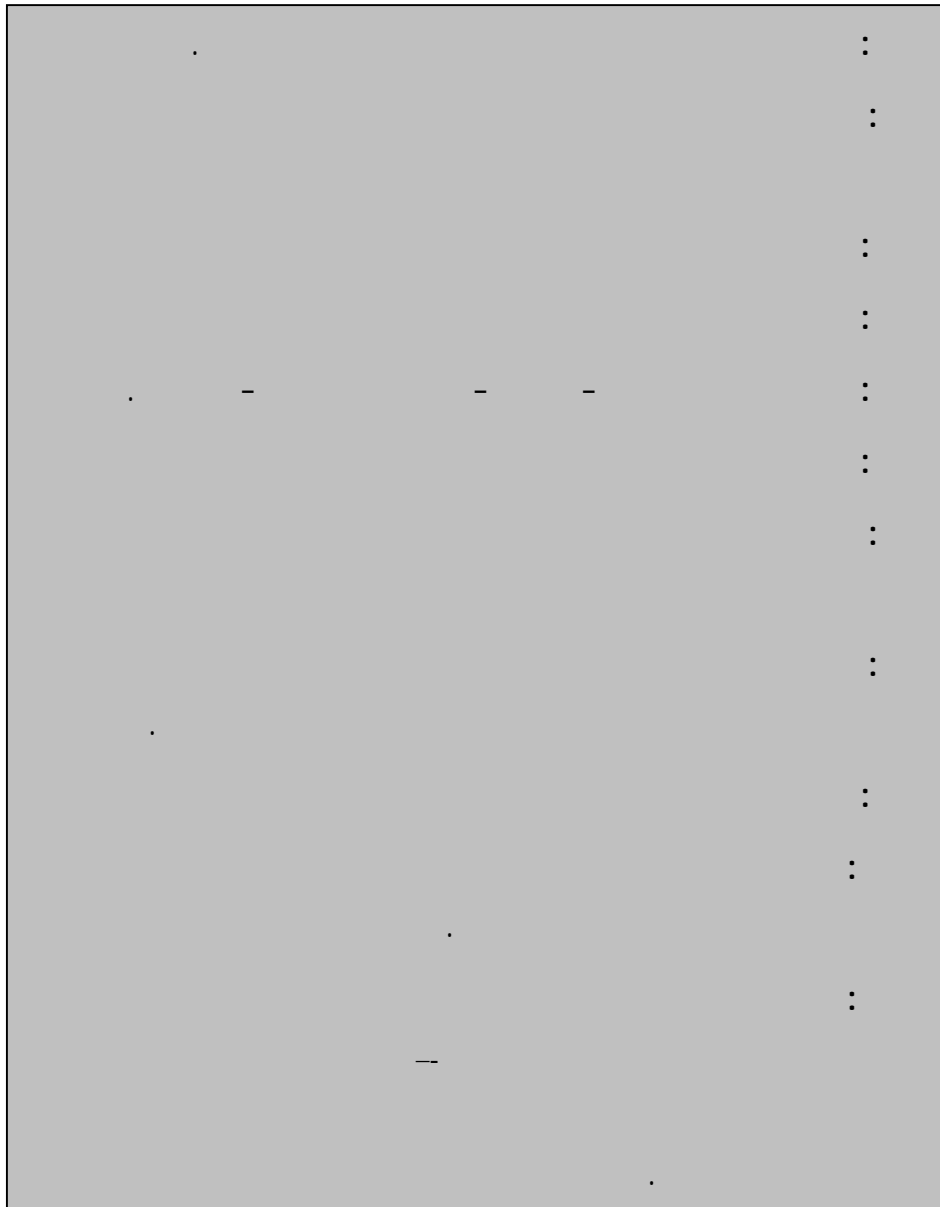








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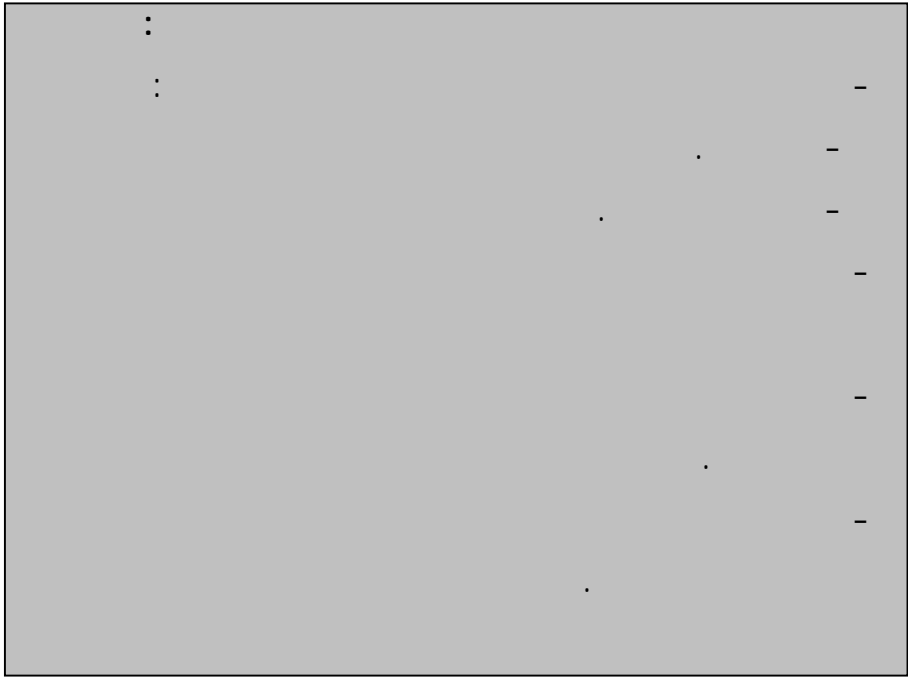


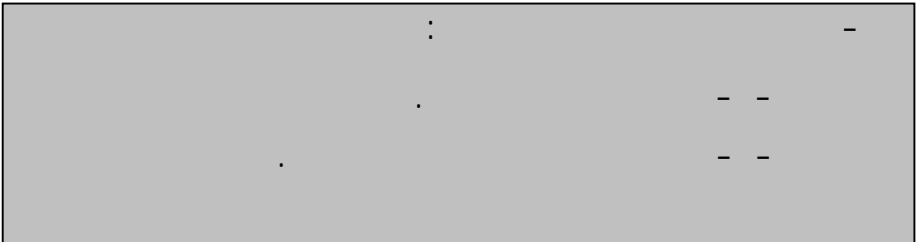
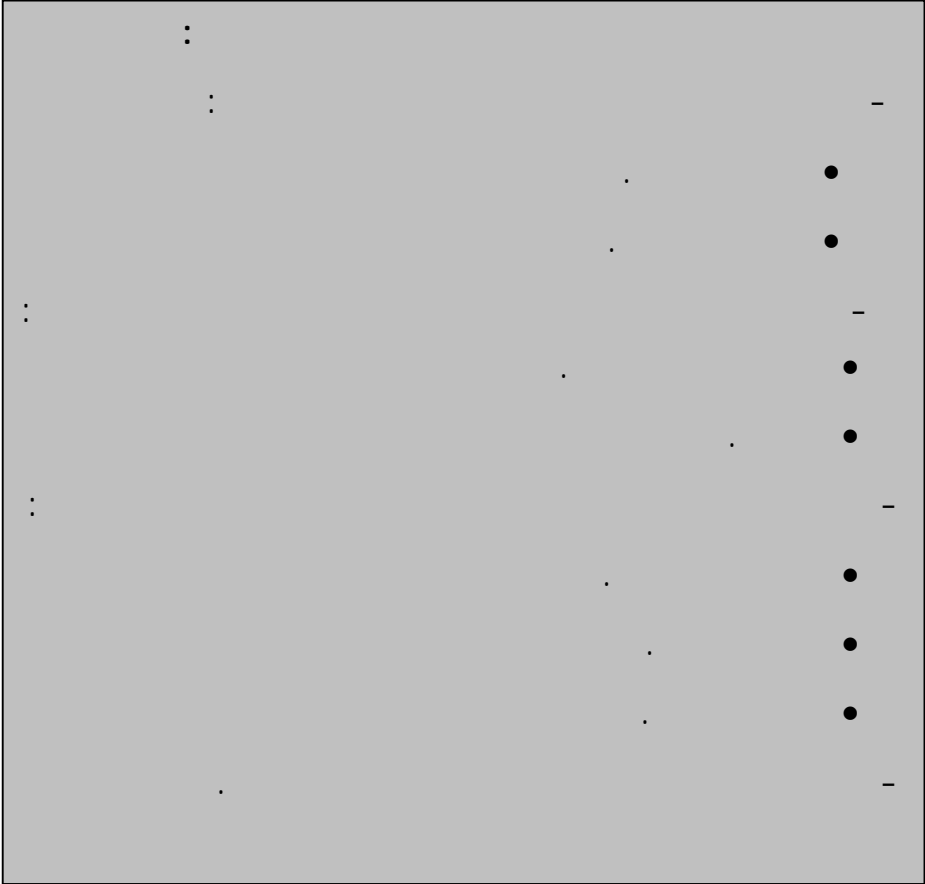
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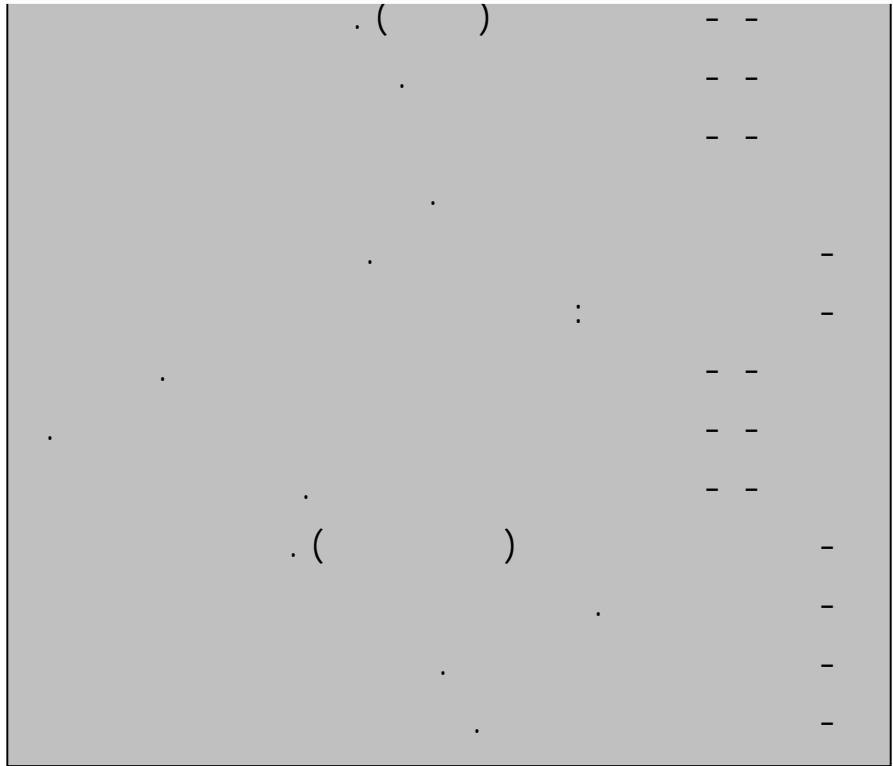
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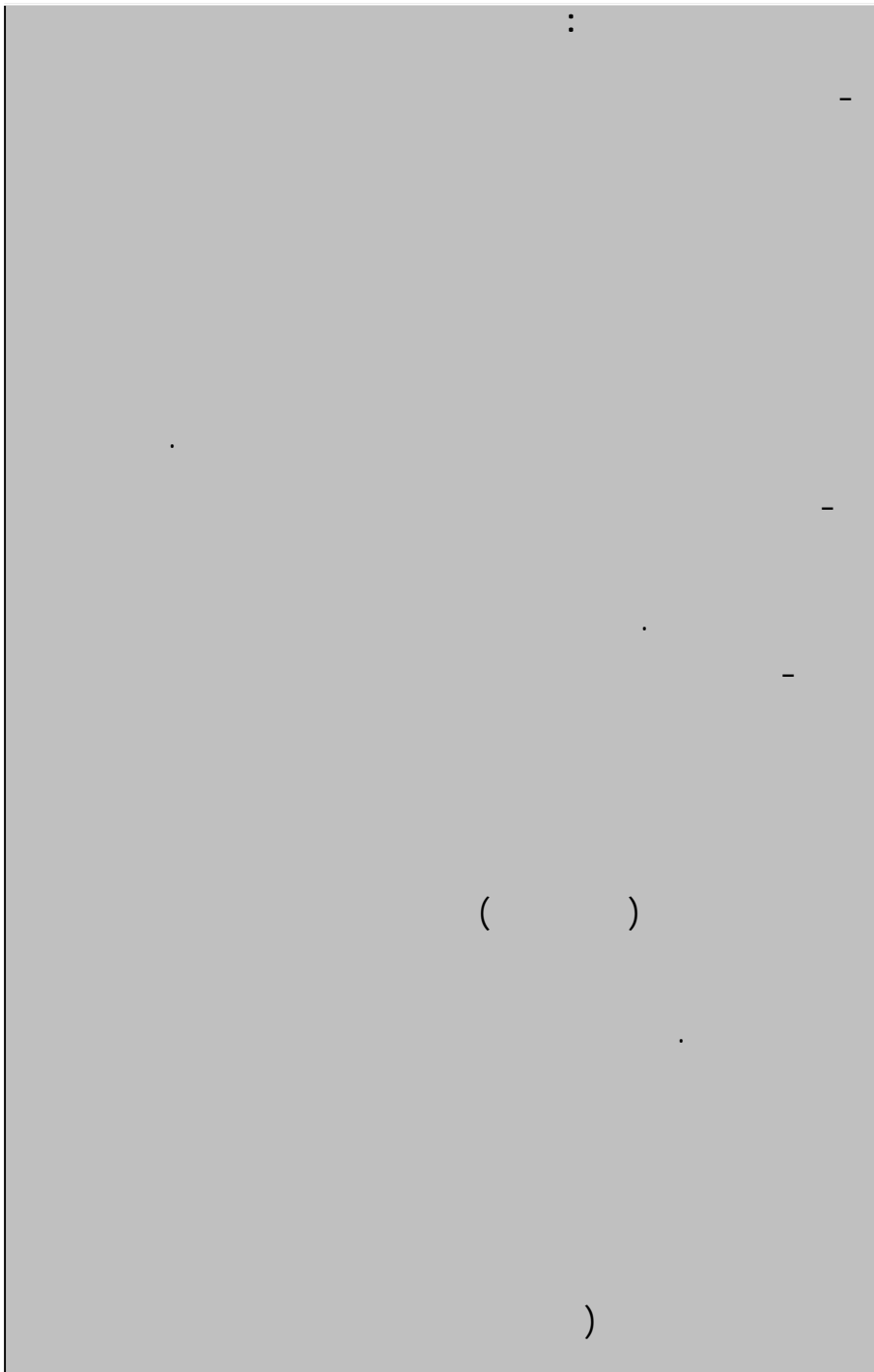
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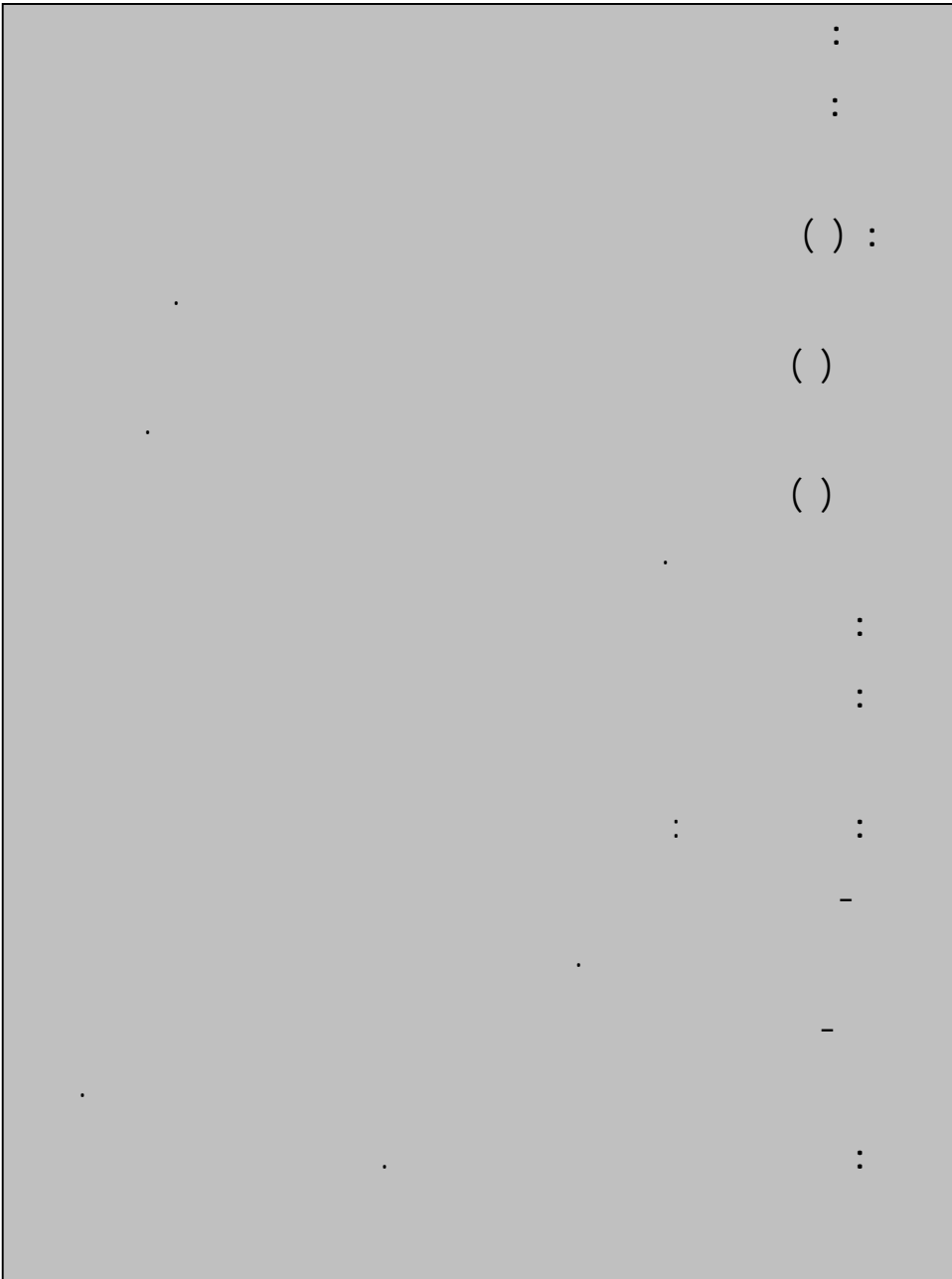
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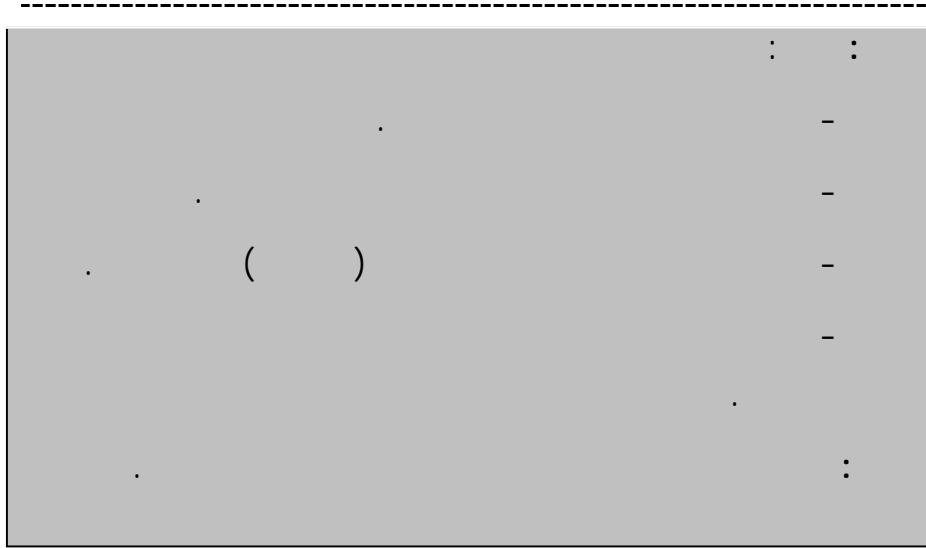
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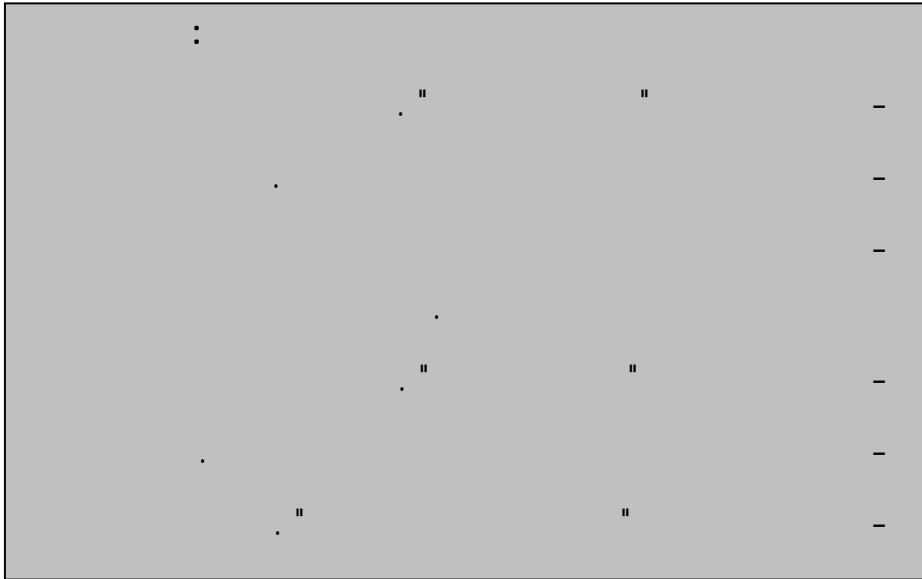
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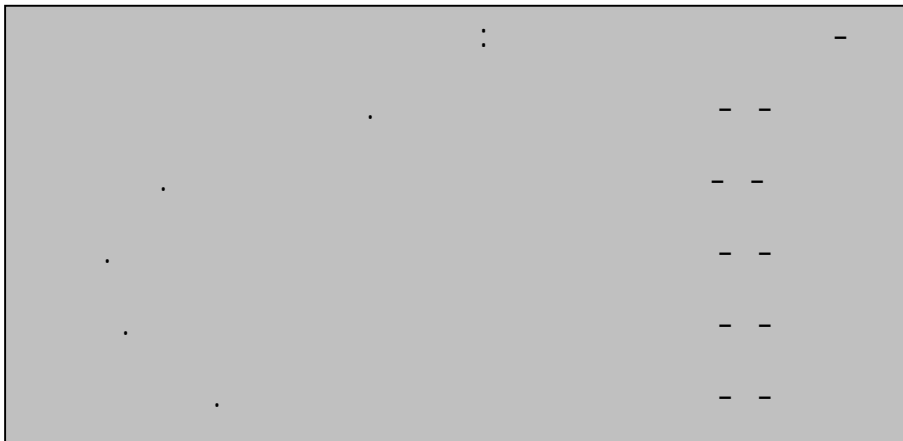


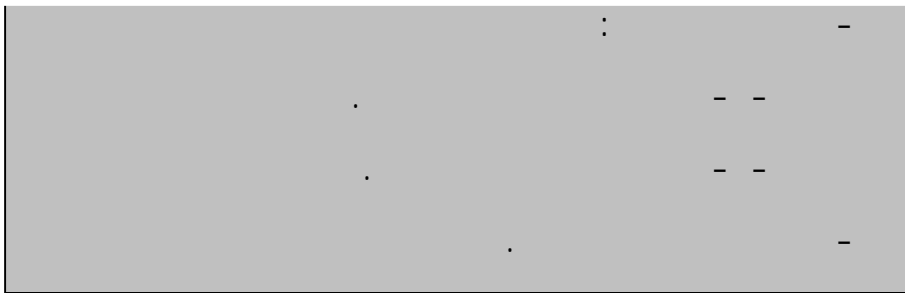


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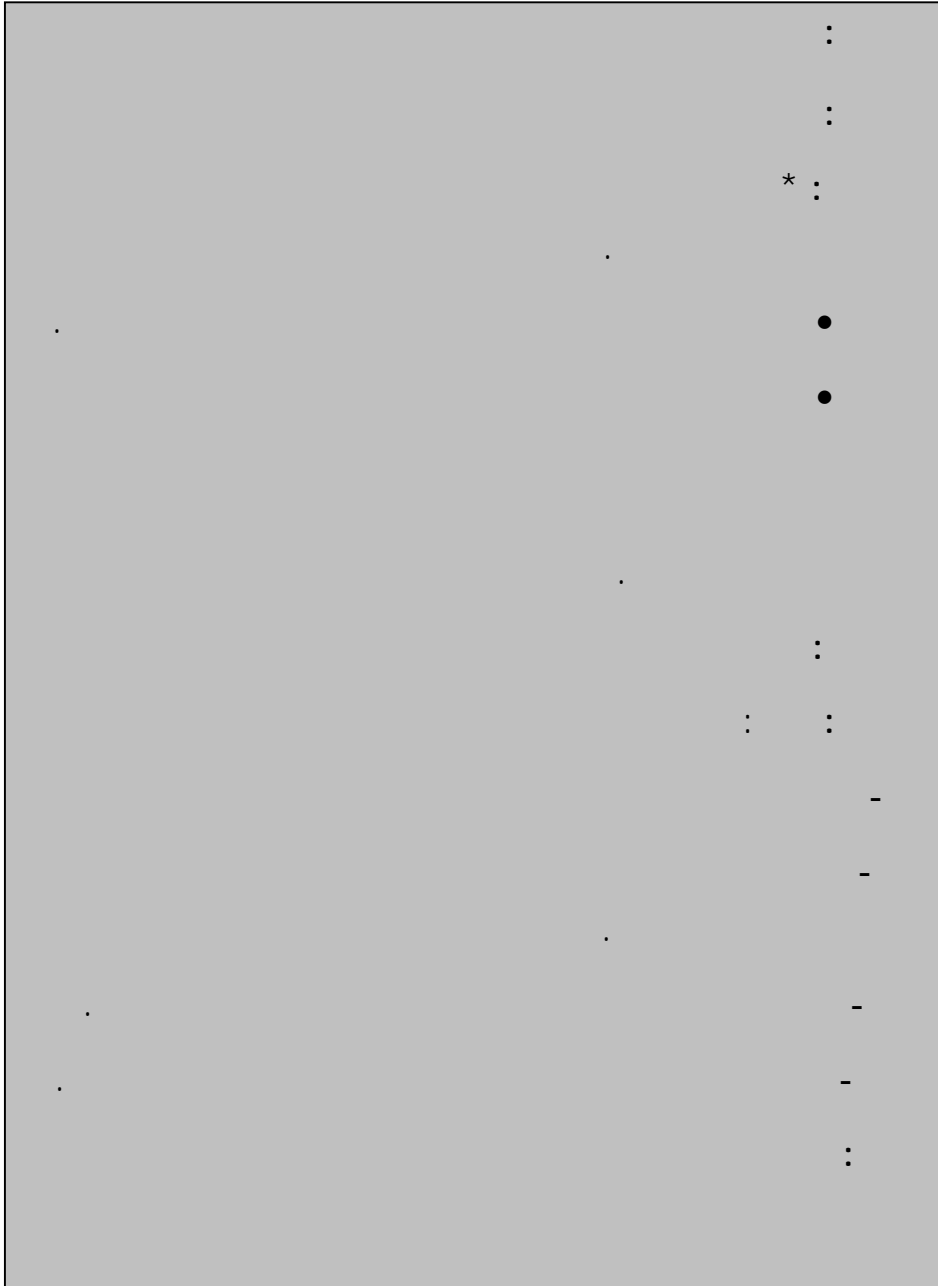
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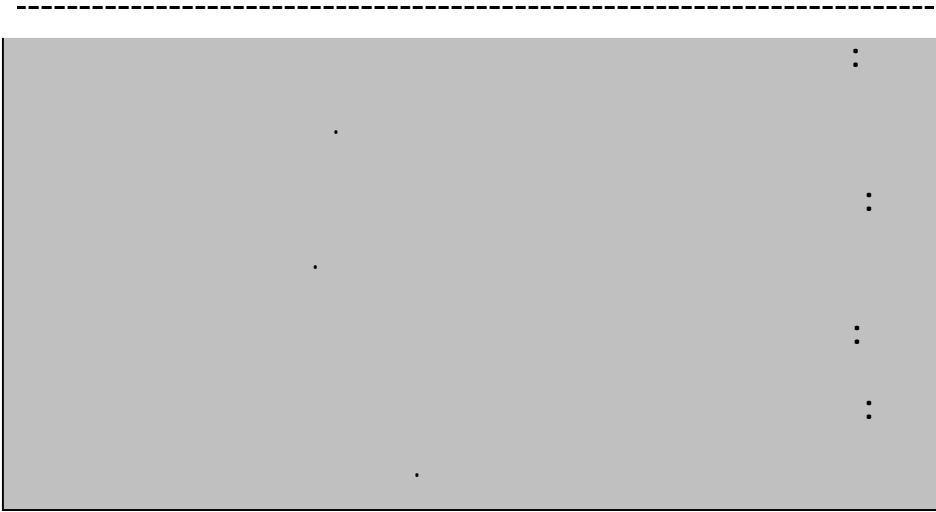
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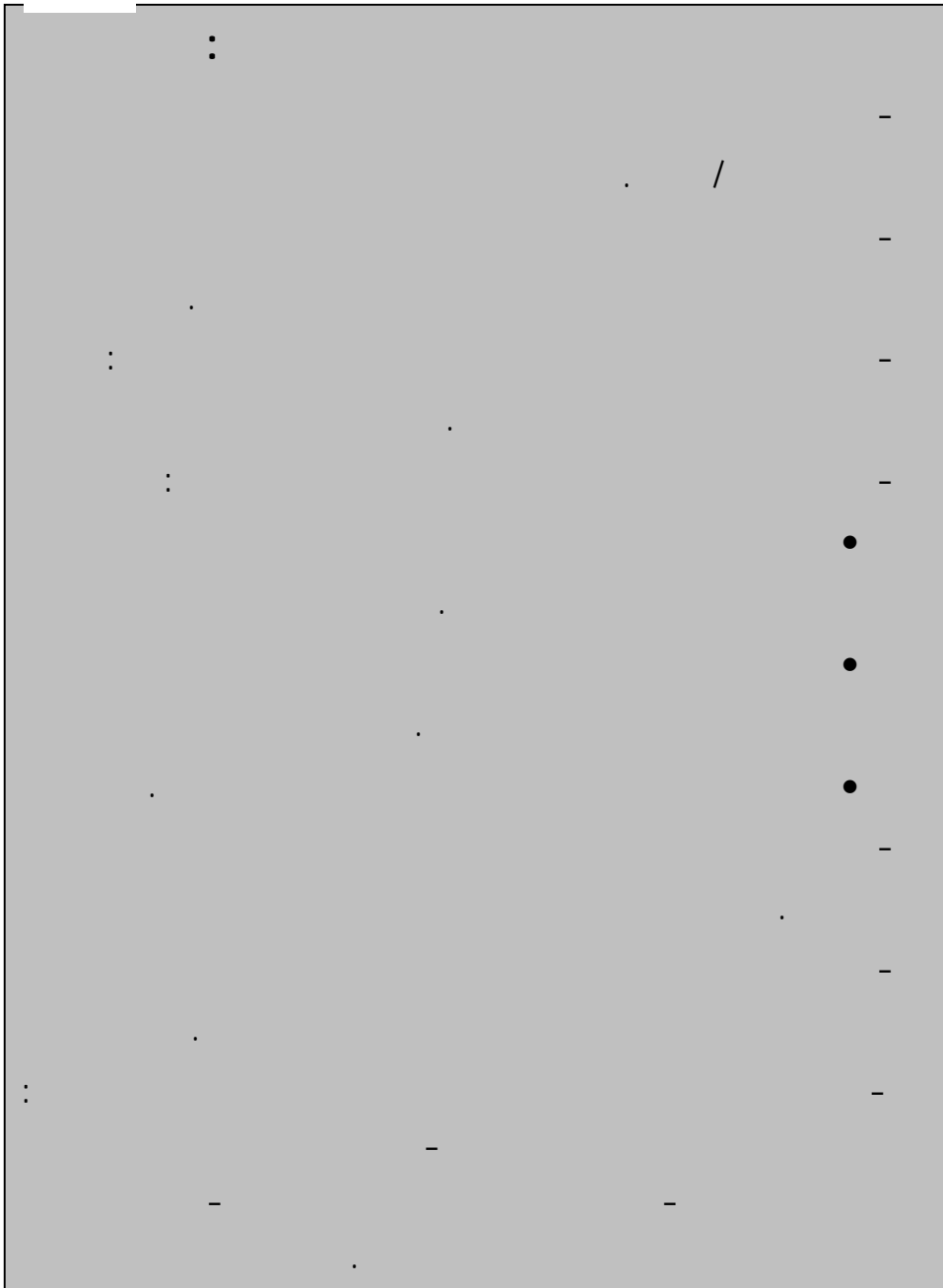
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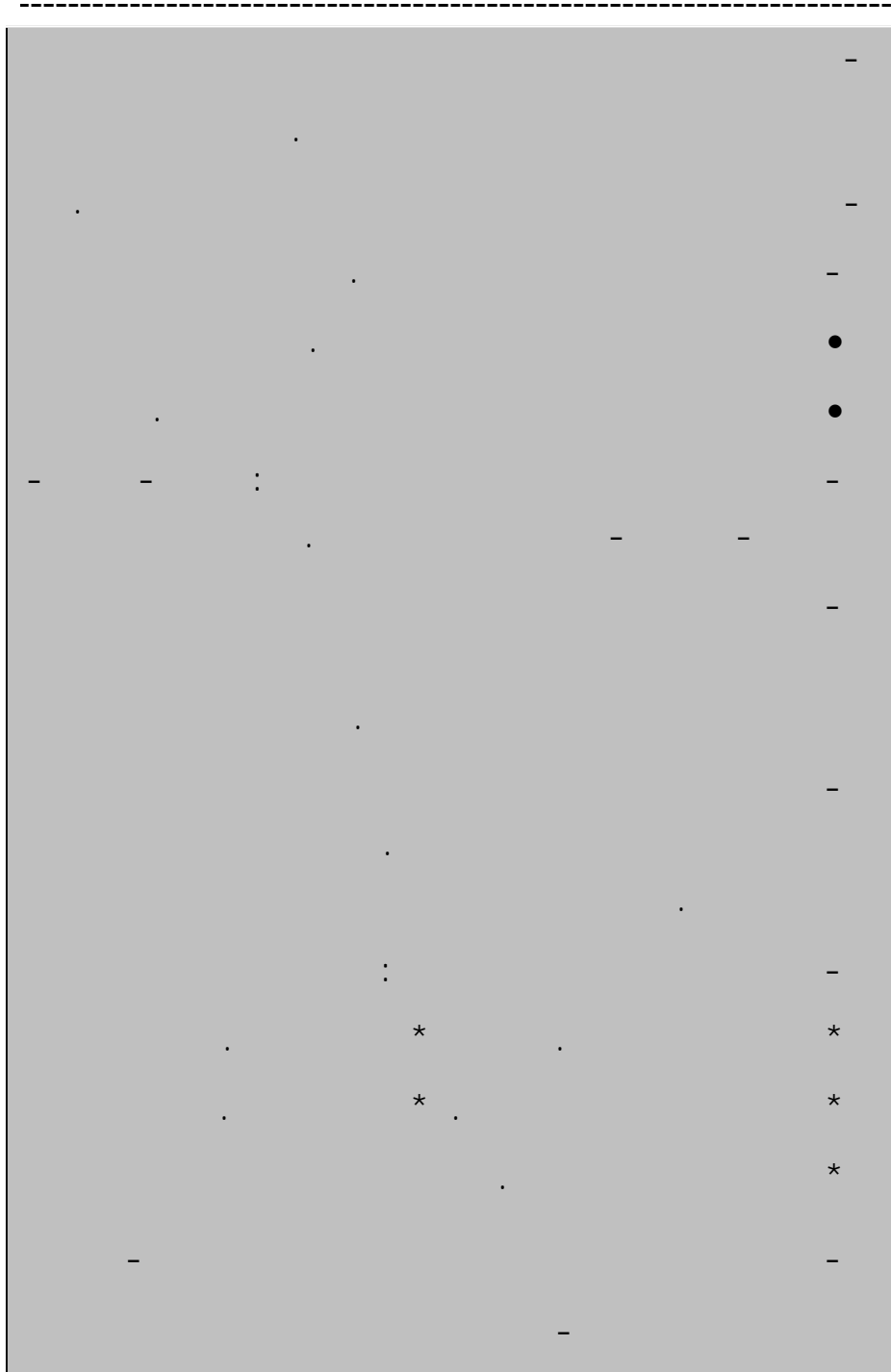
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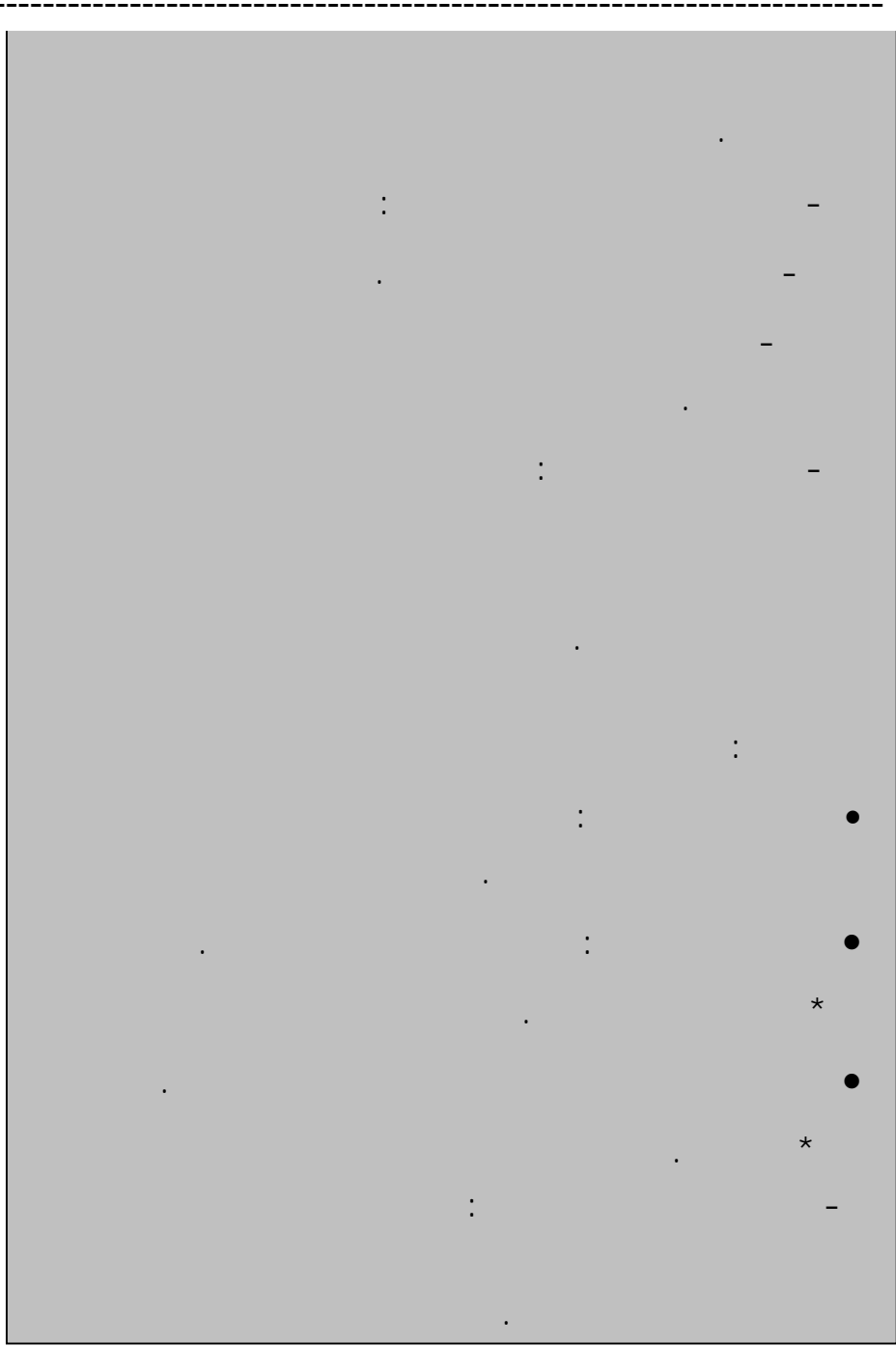
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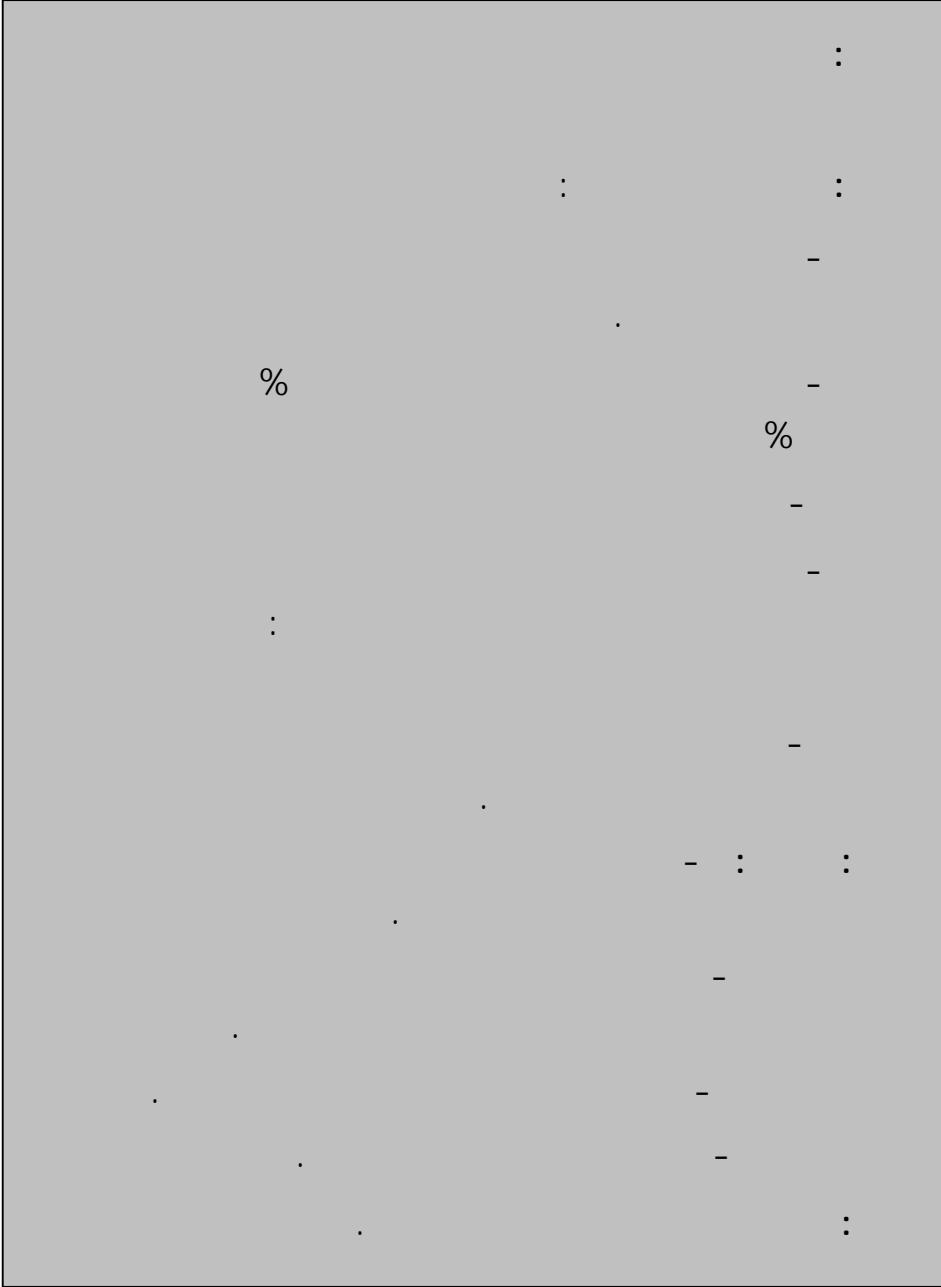






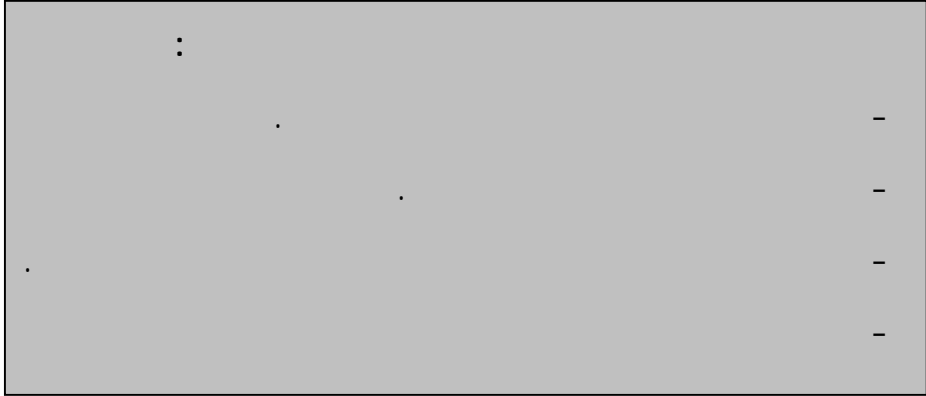
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Determination of Fertilizer Requirements

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Determination of Fertilizer Requirements

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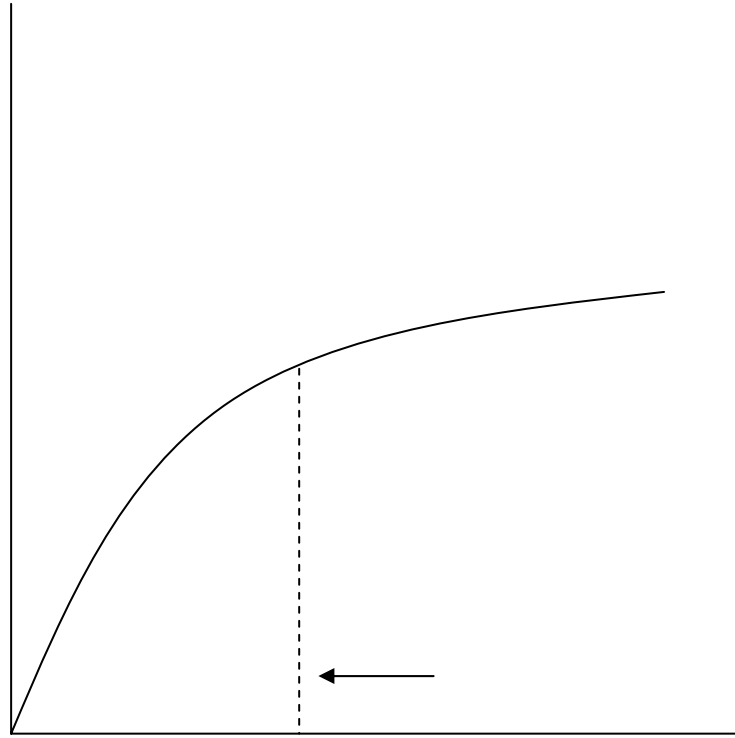
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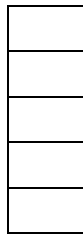
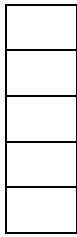
Randomized Complete Blocks Design

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(P)

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 .(NPK) + + -

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O	P	N+K
P	K	N+P
N+K	N+P+K	N
K	P+K	N+P+K
N+P	N	P
N+P+K	N+K	O

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6.0	6.6	6.9	8.7	28.8
⁵ O	⁶ K	⁷ P	⁸ PK	
4.6	5.0	4.1	5.1	18.8
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(N-O) (NK-K) (NP-P) (NPK-PK)
 1.4 1.6 2.8 3.6
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$$- 0.5 = (P-O) 7 \quad 5 -$$

$$0.9 = (NP-N) 3 \quad 1 -$$

$$0.1 = (PK-K) 8 \quad 6 -$$

$$2.1 = (NPK-NK) 4 \quad 2 -$$

$$2.6 =$$

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$$0.4 = (K-O) 6 \text{ مع } 5 -$$

$$0.6 = (NK-N) 2 \text{ مع } 1 -$$

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Factorial Design :

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$P_0, P_1, P_2,$

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$K_0, K_1, K_2,$

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 NoPoK2

No P1 Ko
 NoP1K1
 NoP1K2

No P2 Ko
 NoP2K1
 NoP2K2

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N₂ N₁ (N₀)

N₂ N₁ N₀

N₁ () N₀

N₂

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	N ₀ N ₂ N ₁ N ₂ N ₁ N ₀ N ₁ N ₀ N ₂	N ₀ N ₂ N ₁ N ₁ N ₀ N ₂ N ₂ N ₁ N ₀	N ₀ N ₁ N ₂ N ₂ N ₀ N ₁ N ₁ N ₂ N ₀	N ₀ N ₁ N ₂ N ₁ N ₂ N ₀ N ₂ N ₀ N ₁	K ₀ K ₁ K ₂
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Latin Square Design

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$$Y = a + bx + cx^2$$

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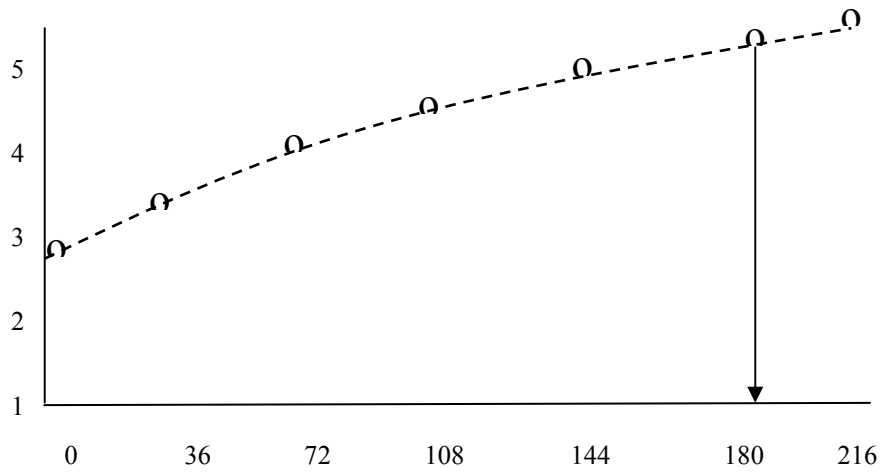
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$$Y = 2.876 + 0.01869x - 0.00005131x^2$$

$$Y = \quad /$$

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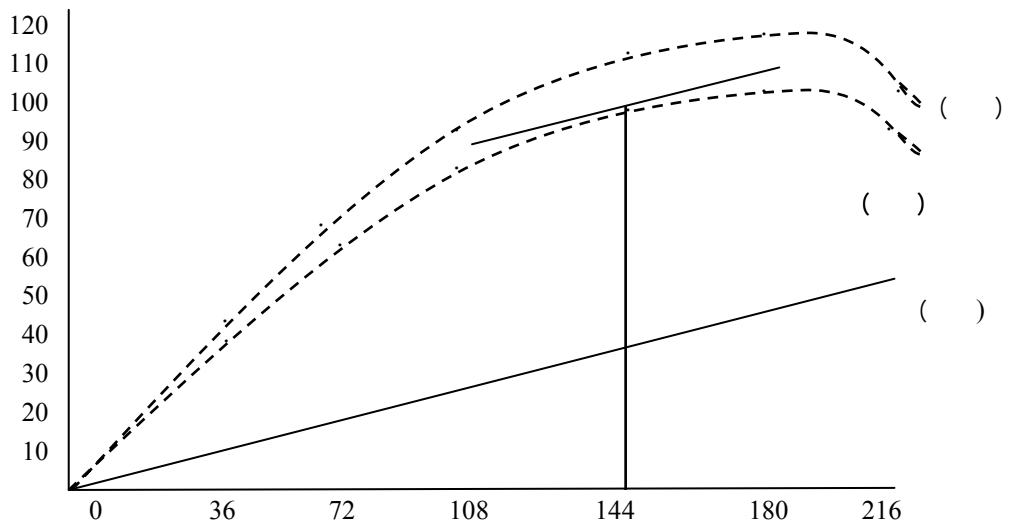
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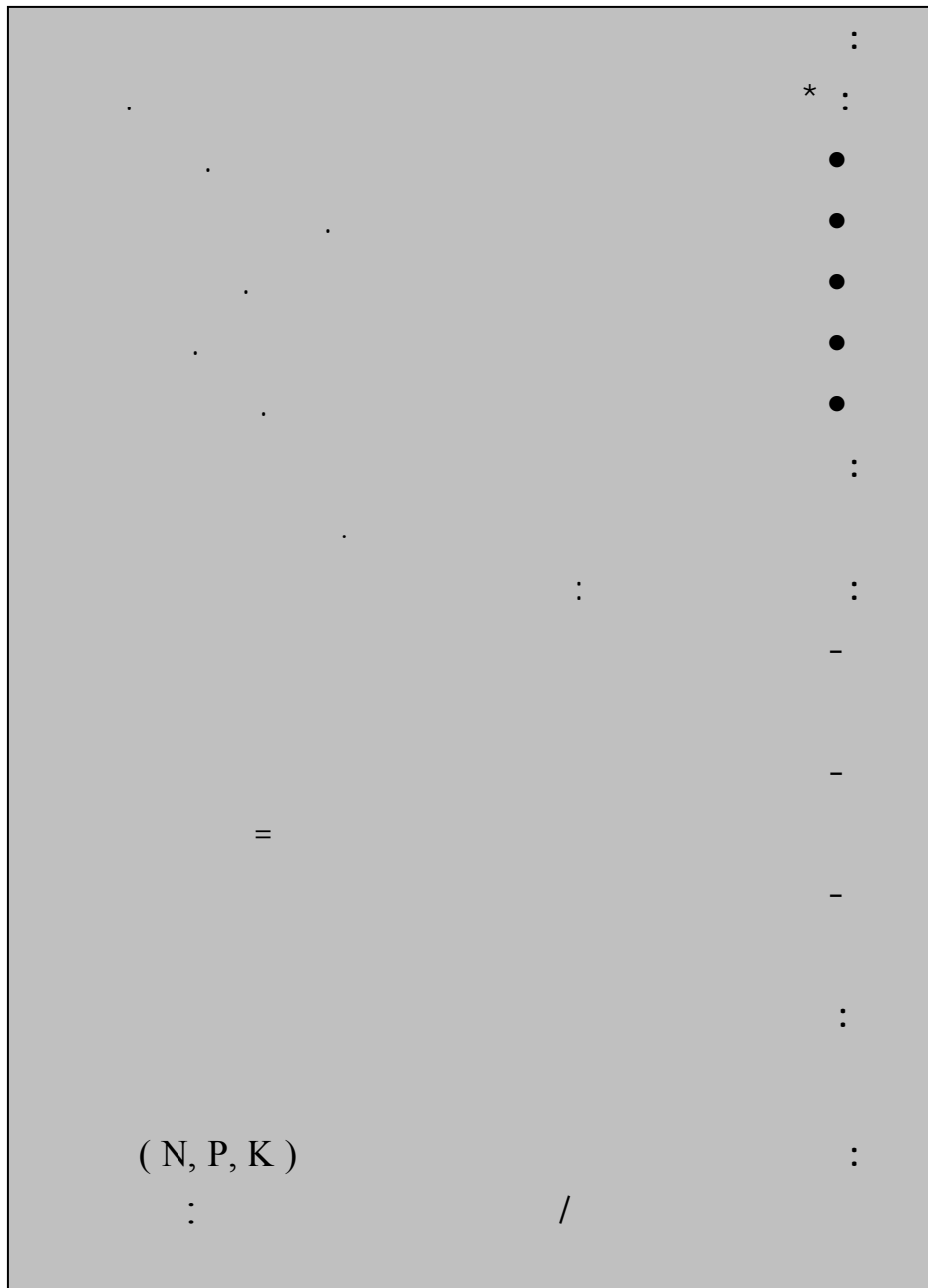
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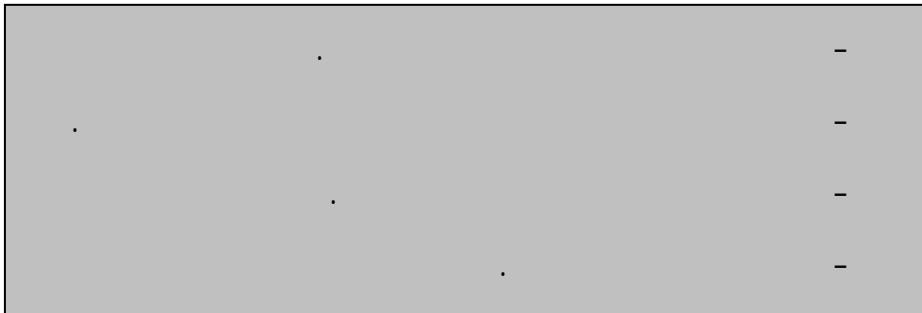
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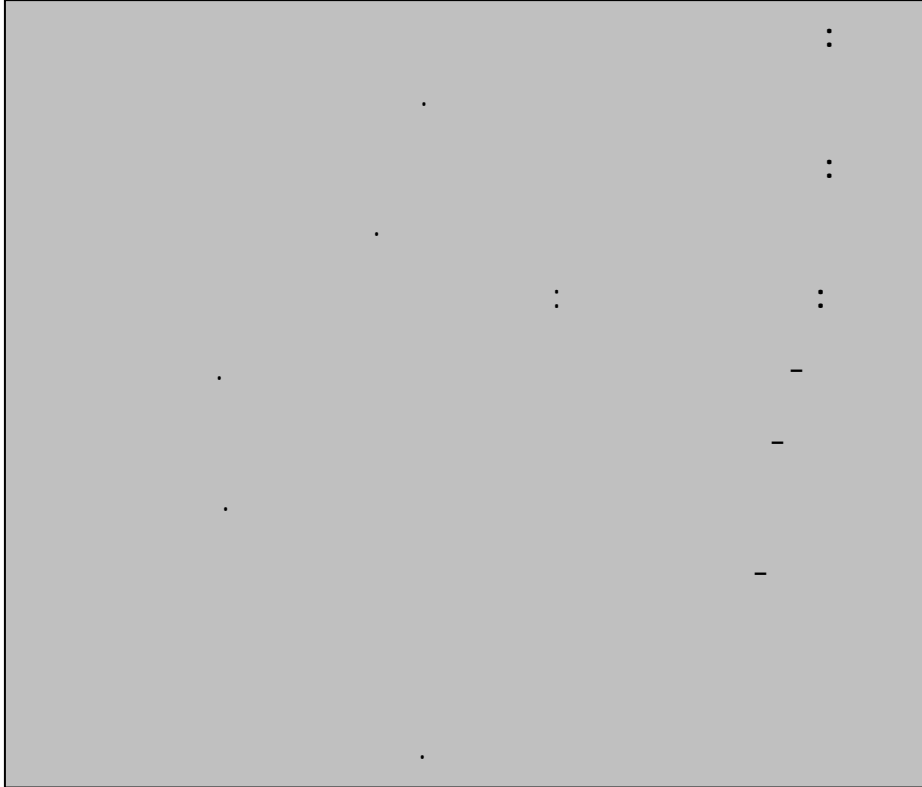
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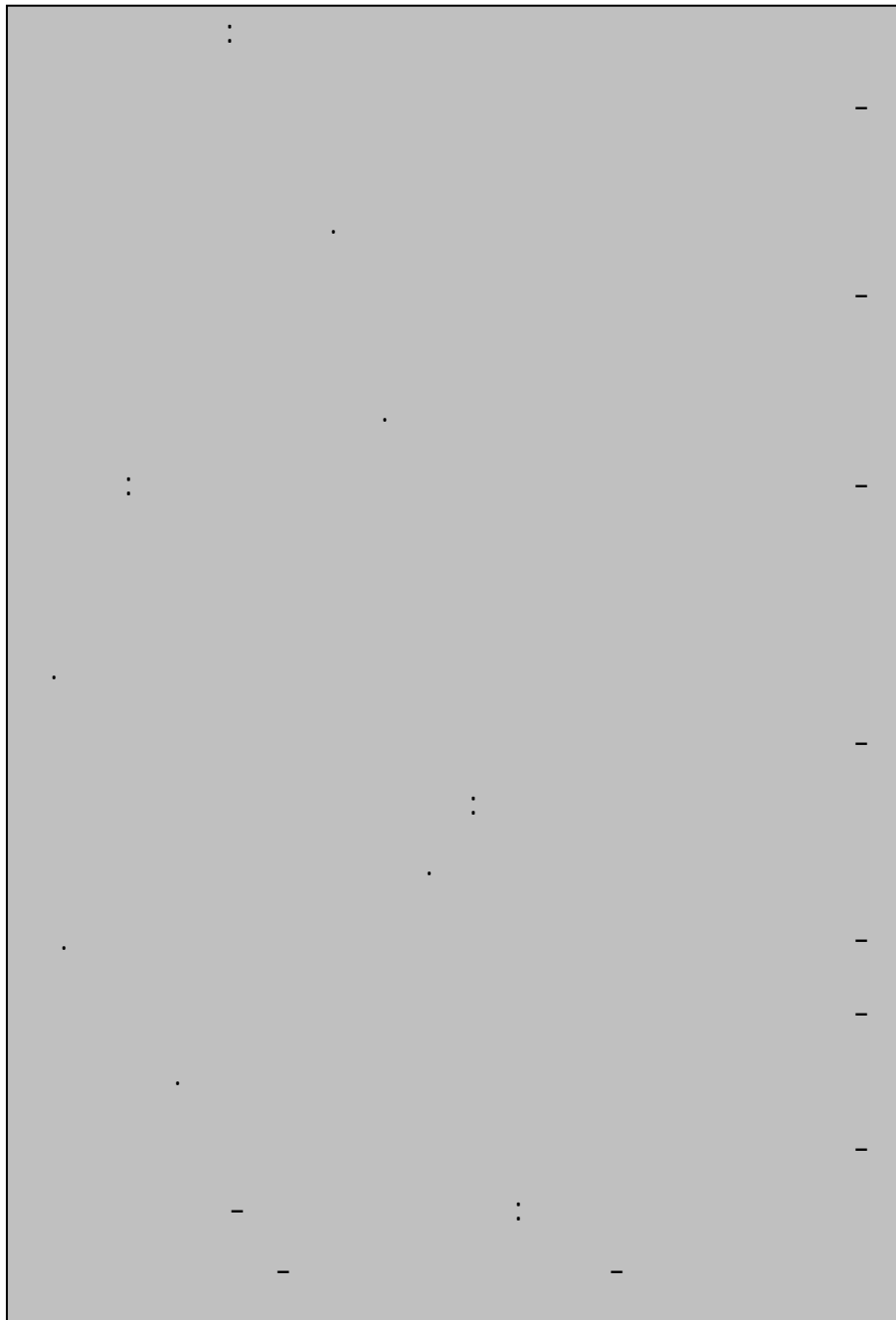
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- 13- Alla El- Din (1982). Biogas technology with respect to Chinese experience. Organic materials and Soil productivity in the near east, FAO Soil Bullet. N. 45.
 - 14- Cooke, G.W. (1964) .Fertilizing for maximum yield. E.L.B.S and Crosby, Lockwood Staples .London.
 - 15- Elgabaly M.M. (1966) .Resources surveys for land reclamation. Publications of the ITC Unesco Center for Integrated Surveys.
 - 16- EL Tobgy, H.A. (1976) .Contemporary Egyptian Agriculture , 2nd ed.
 - 17- Frank, J.B., Marla, A.J (1984)..Agriculture soils. MacMillan Publishing Co. Inc. New york .
 - 18- Hagin, J., and Tucker, B (1982) .Fertilization of dry land and irrigated soils. Springer – verlag .New york.
 - 19- Hamissa, M.R.(1980). Fertilizer Requirements for some major field Crops under irrigated agriculture of arid and semi arid regions "proceedings of the fertilizer slow conference" . Row Material Recourses, Needs and Commerce in Asia and the Pacific. Hanolulu, East West Center.
 - 20- Ignatieff, V., and Page, H.J. (1958). Efficient use of fertilizers. Food & Agricultural Organization of the U.N., Rome
 - 21- Millar, C.E., Turk, L.M., and Foth, H.D., (1965). Fundamentals of Soil Science , 4th ed . John Willey & Sons, Inc , New York .
 - 22- Roland, D.H., Gyles W.R., Wells, K.L. and Jhon, J.H.(1985). Fertilizer Technology and Use (Engelstad, O.P ed.) . Soil Sci Soc of America, Inc. Madison, Wisconsin, USA.
 - 23- Russell, E.J. (1951) .A Student's Book on Soils & Manures. 4th ed. Cambridge, University Press.

- 24- Thampson, L.M., and Troeh, R.F. (1979) .Soils and Soil Fertility.
4th ed . Tata McGraw. Hill Publishing Company Ltd., New
Delhi.