Fertility Needs of No-Till Corn, Soybean and Wheat

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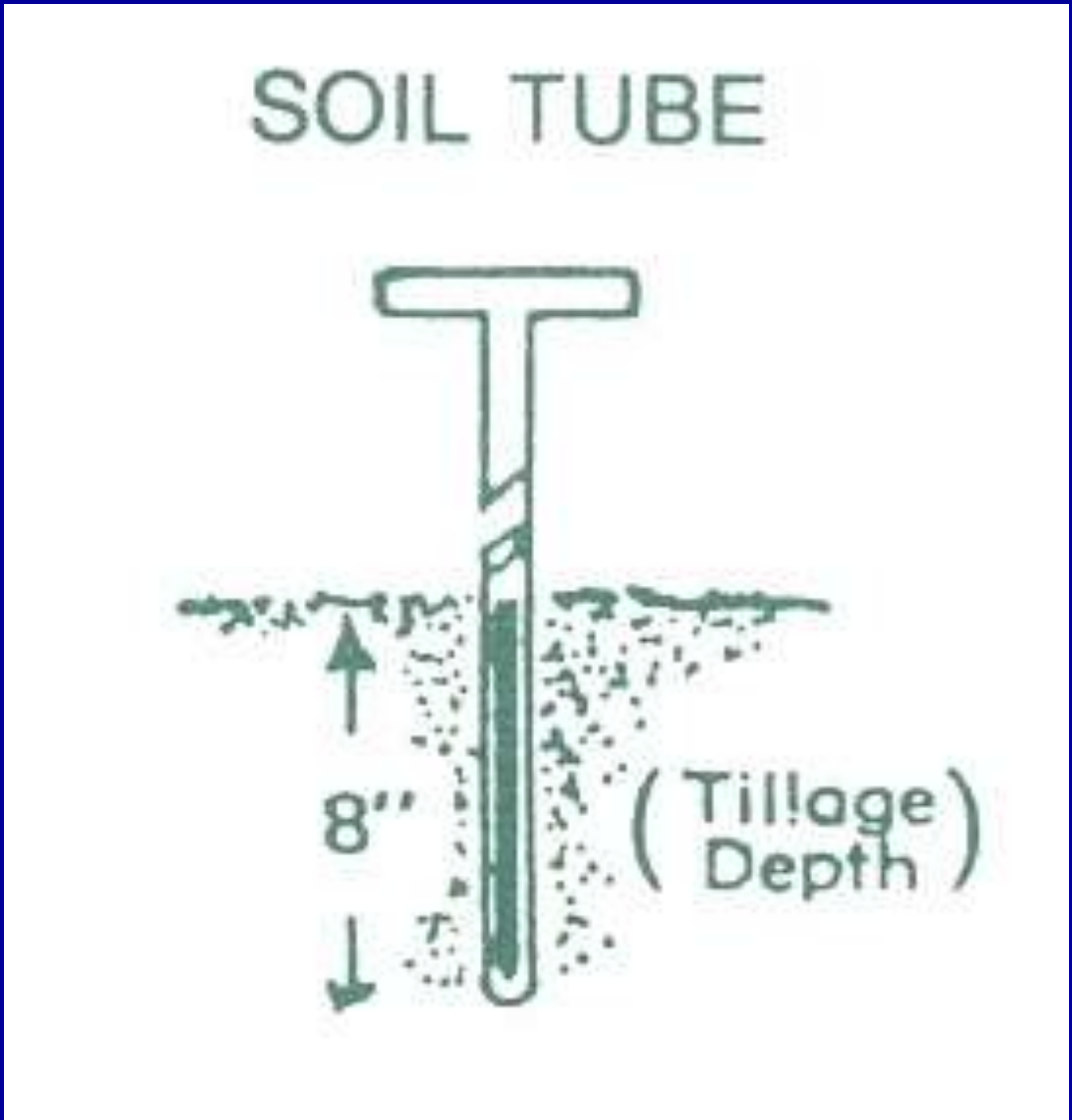
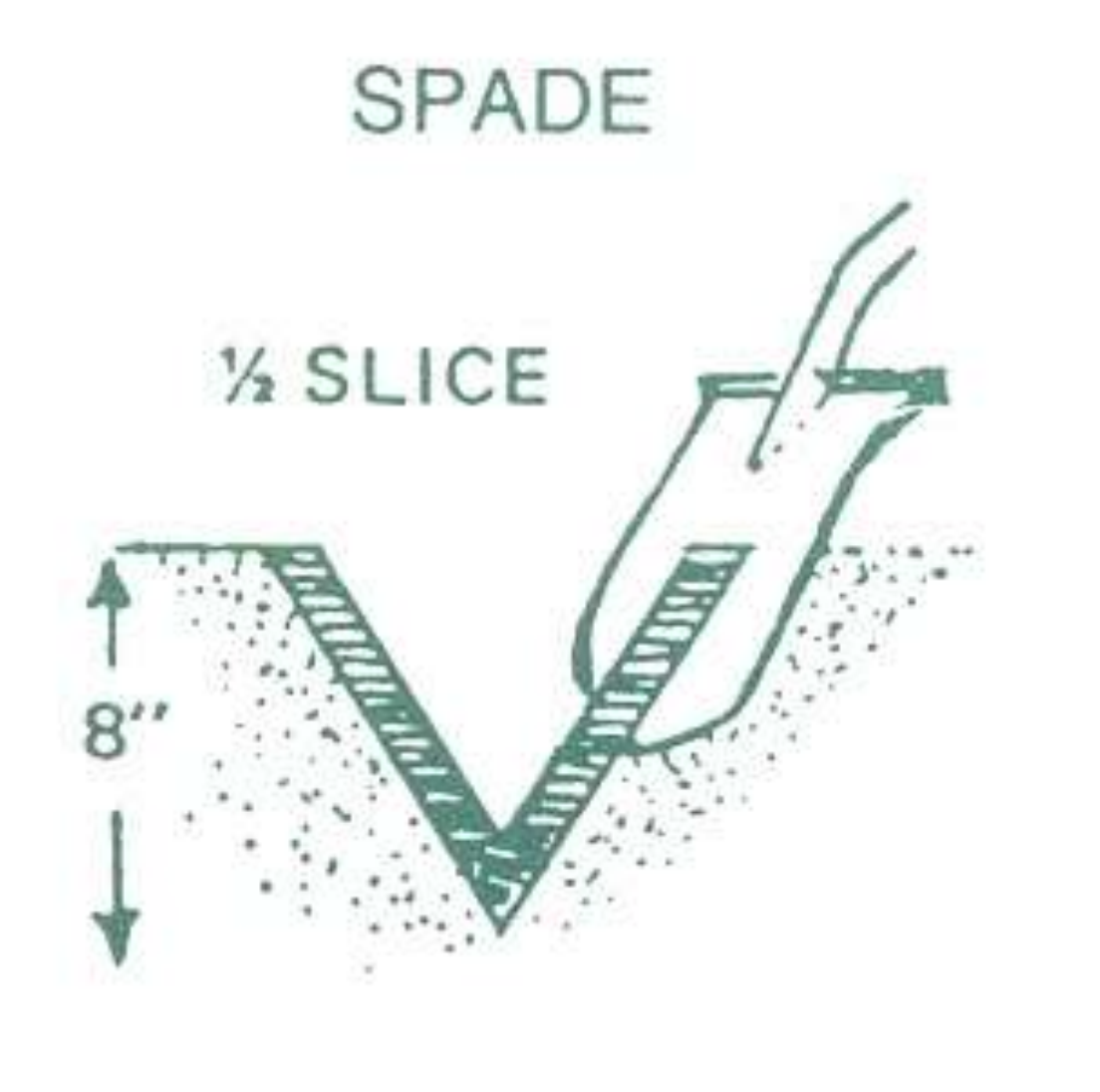
Soil Sample for Fertility

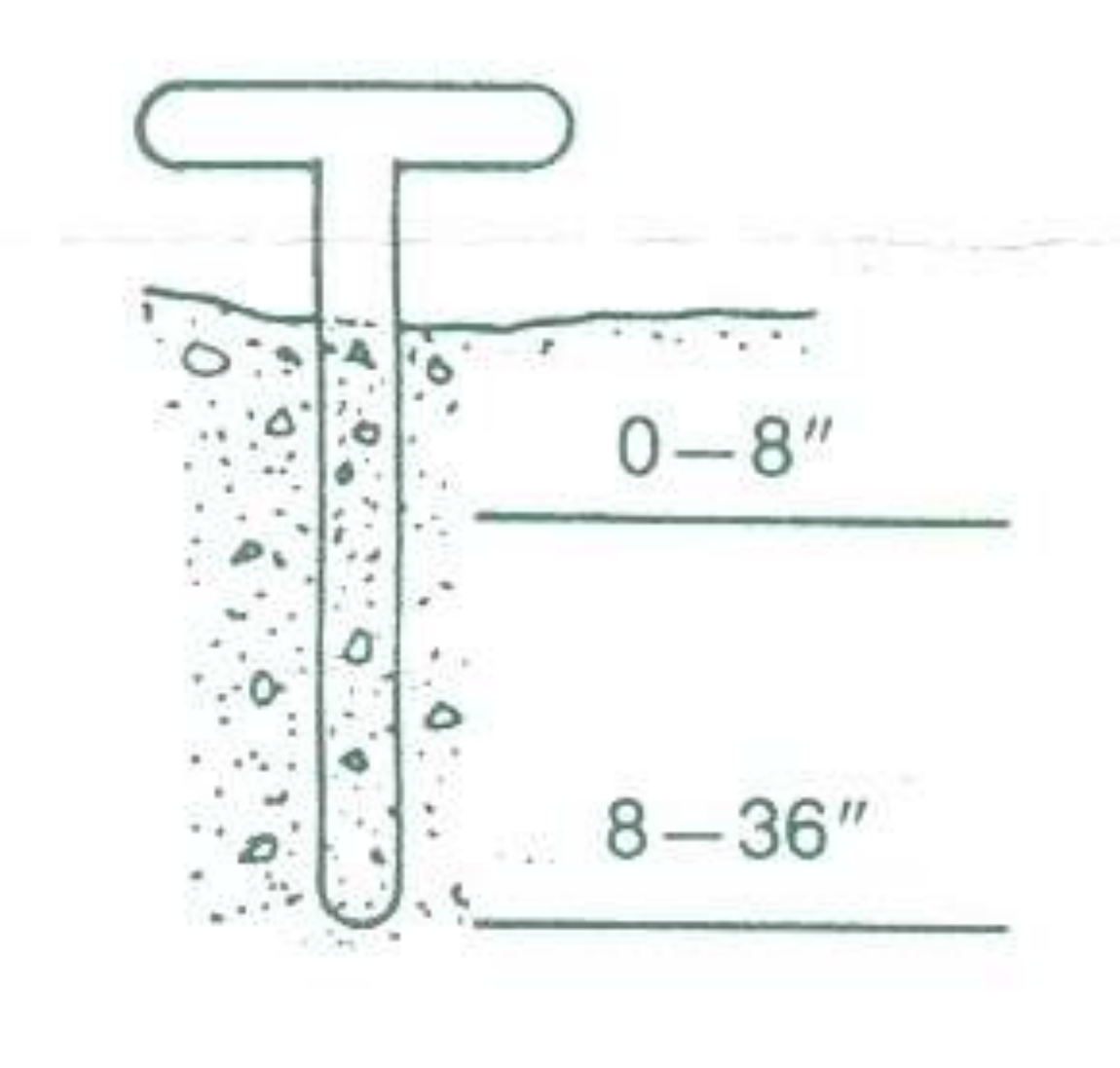


Dry or Frozen Ground

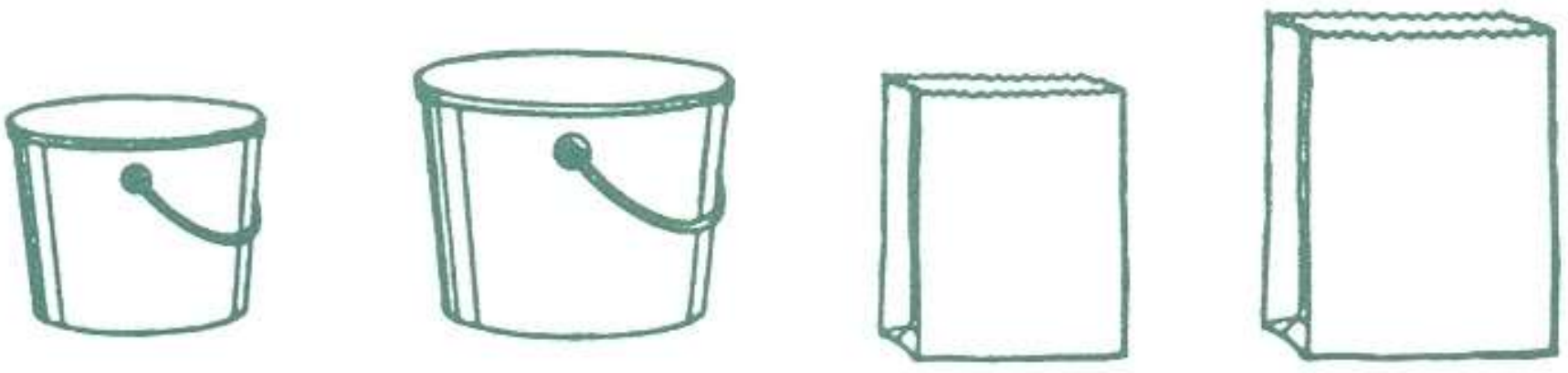
Uniform Slice



Top and Subsoil Sampling



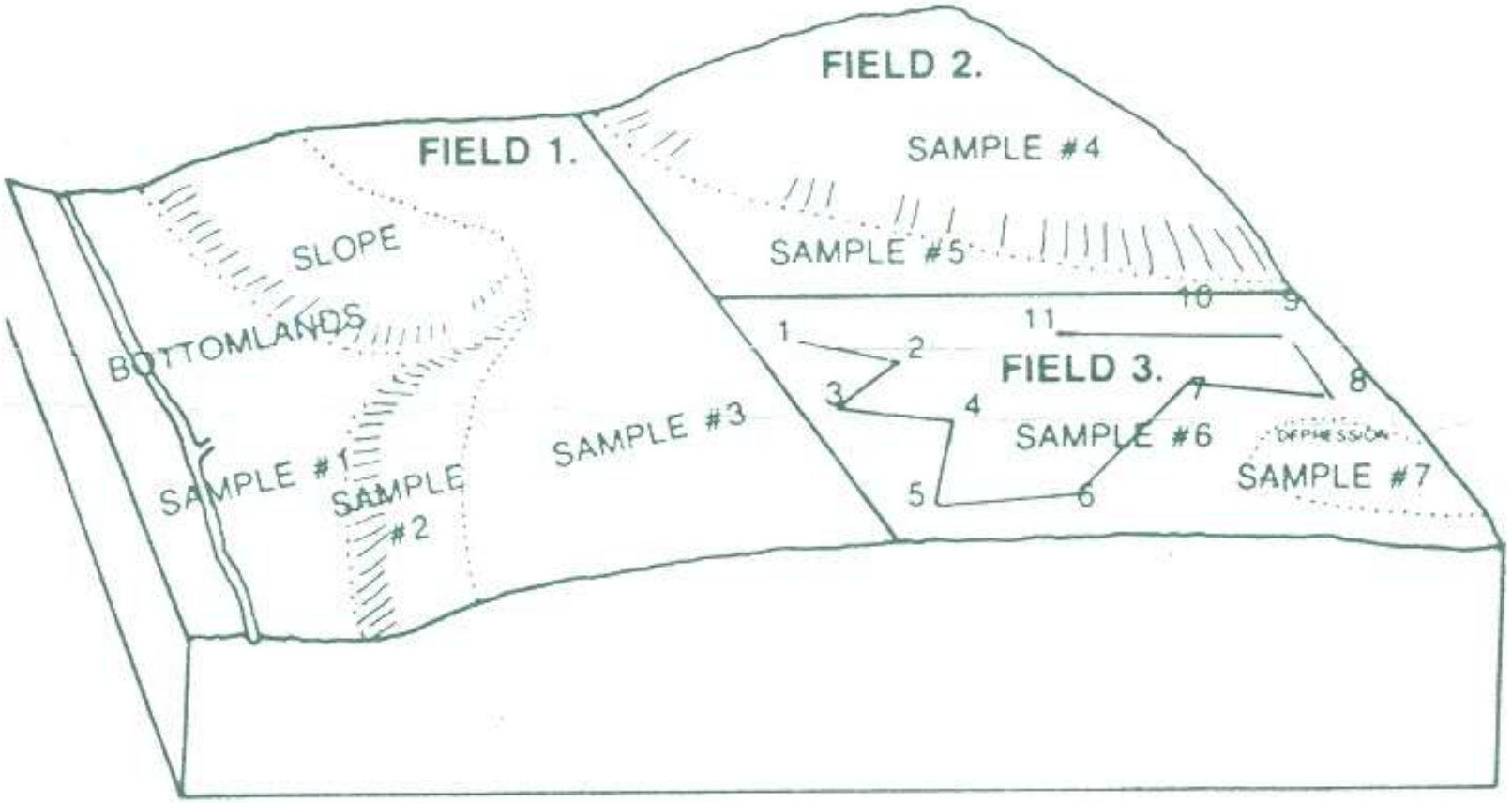
Clean Buckets and Sample Bags



Top Soil 8” Sub Soil 8-36” Top Soil Bag Subsoil Bag

USE PLASTIC PAILS

Field & Zone Sampling



Grid Sampling

- New technology using GPS, etc
- Point sampling usually every 2.5 acre
- Measures variability within the field
- Variable rate apply phosphate, potash, zinc and lime

Grid Sampling

– 1 2 3 4 5 6 7 8

– 9 10 11 12 13 14 15 16

– 17 18 19 20 21 22 23 24

– 25 26 27 28 29 30 31 32

Fertilizer Recommendations

- Crop and Yield Goal
- Past Crop
- Soil Test Values
- Then You Receive a Suggested Nutrient Rate
- You have to decide what method of application

Crop Nutrient Removal, lbs/Bu

Nutrient		Corn	200 bu/A
Nitrogen	N	0.75	150
Phosphorus	P2O5	0.33	66
Potassium	K2O	0.23	46
Sulfur	S	0.09	18
Zinc	Zn	0.001	0.2

Crop Nutrient Removal, lbs/bu

	Soybeans	60 bu/A
Nitrogen, N	3.60	216
Phosphorus, P2O5	0.77	46
Potassium, K2O	1.20	72
Sulfur, S	0.18	11
Zinc, Zn	0.003	0.18

Crop Nutrient Removal, lbs/Bu

Nutrient		Wheat	80bu/A
Nitrogen	N	1.20	96
Phosphorus	P2O5	0.52	42
Potassium	K2O	0.26	21
Sulfur	S	0.12	10
Zinc	Zn	0.003	0.24

Factors Affecting Active Nutrient Uptake

Oxygen

Temperature

Ion Interference

Nutrient Uptake and Root Structure

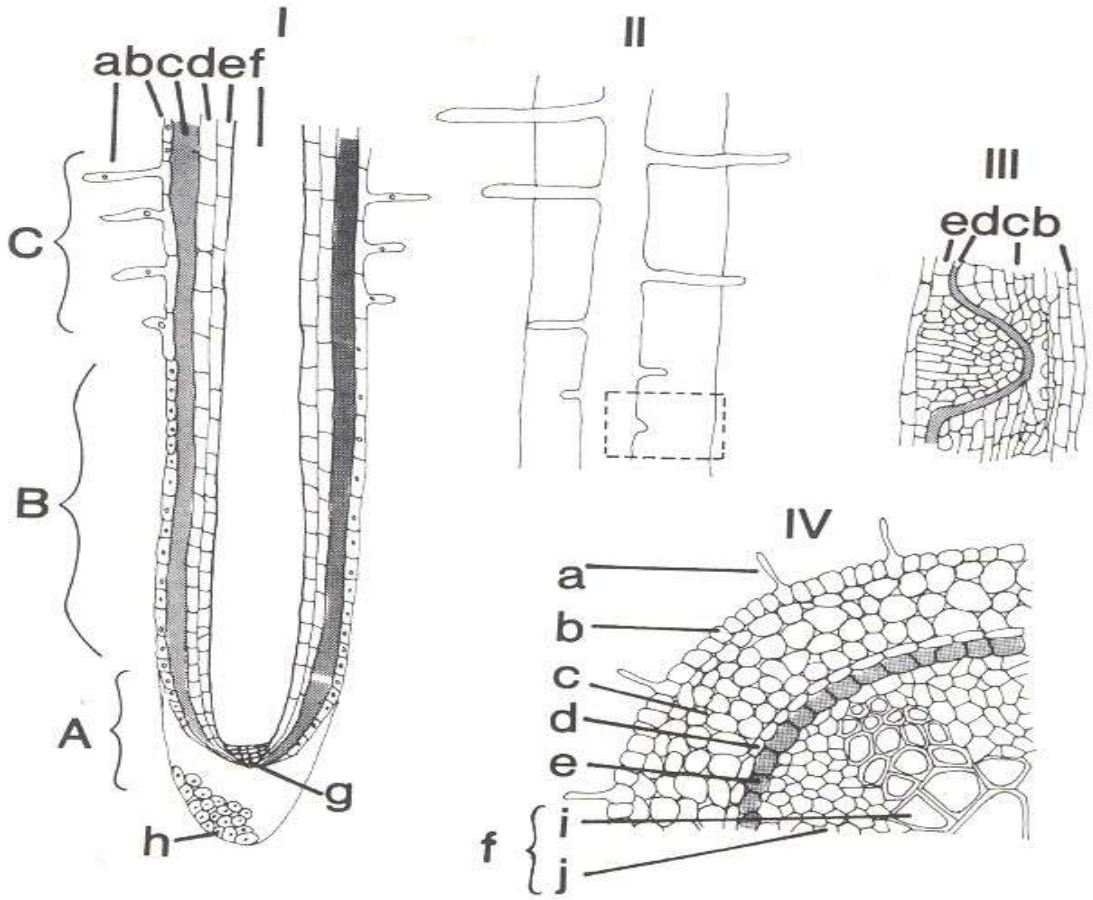
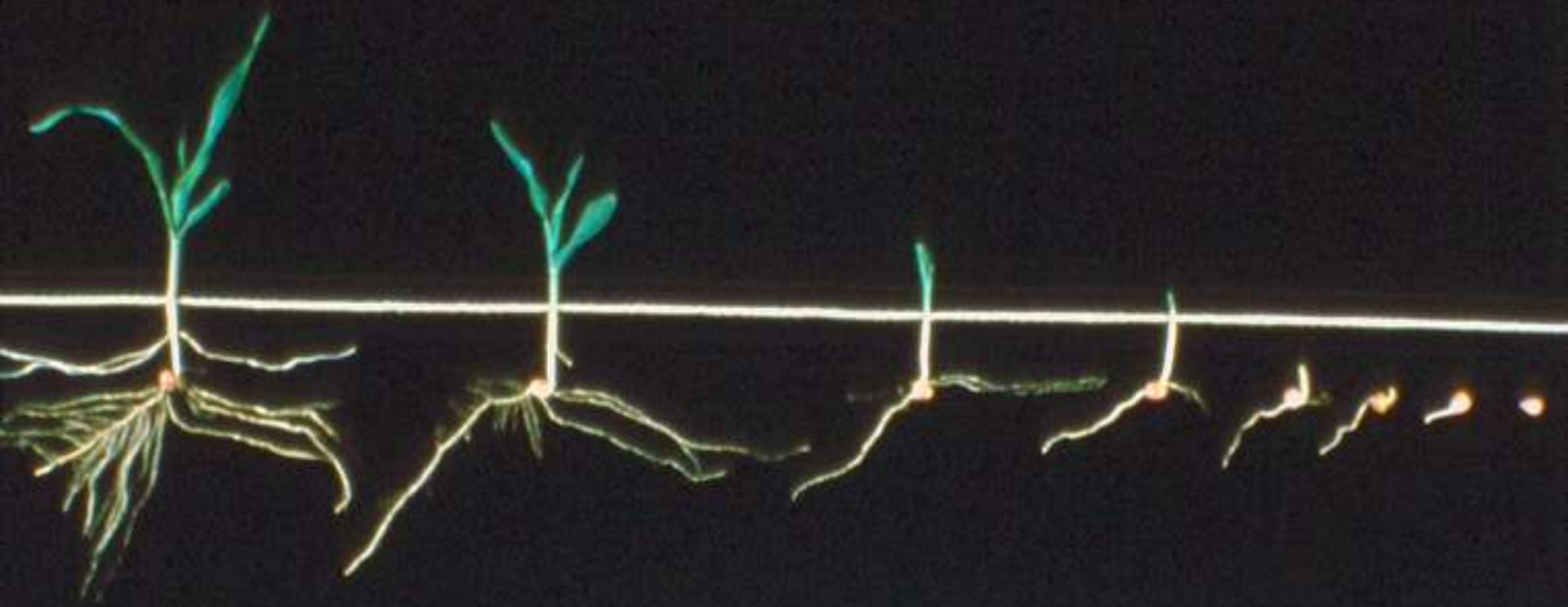
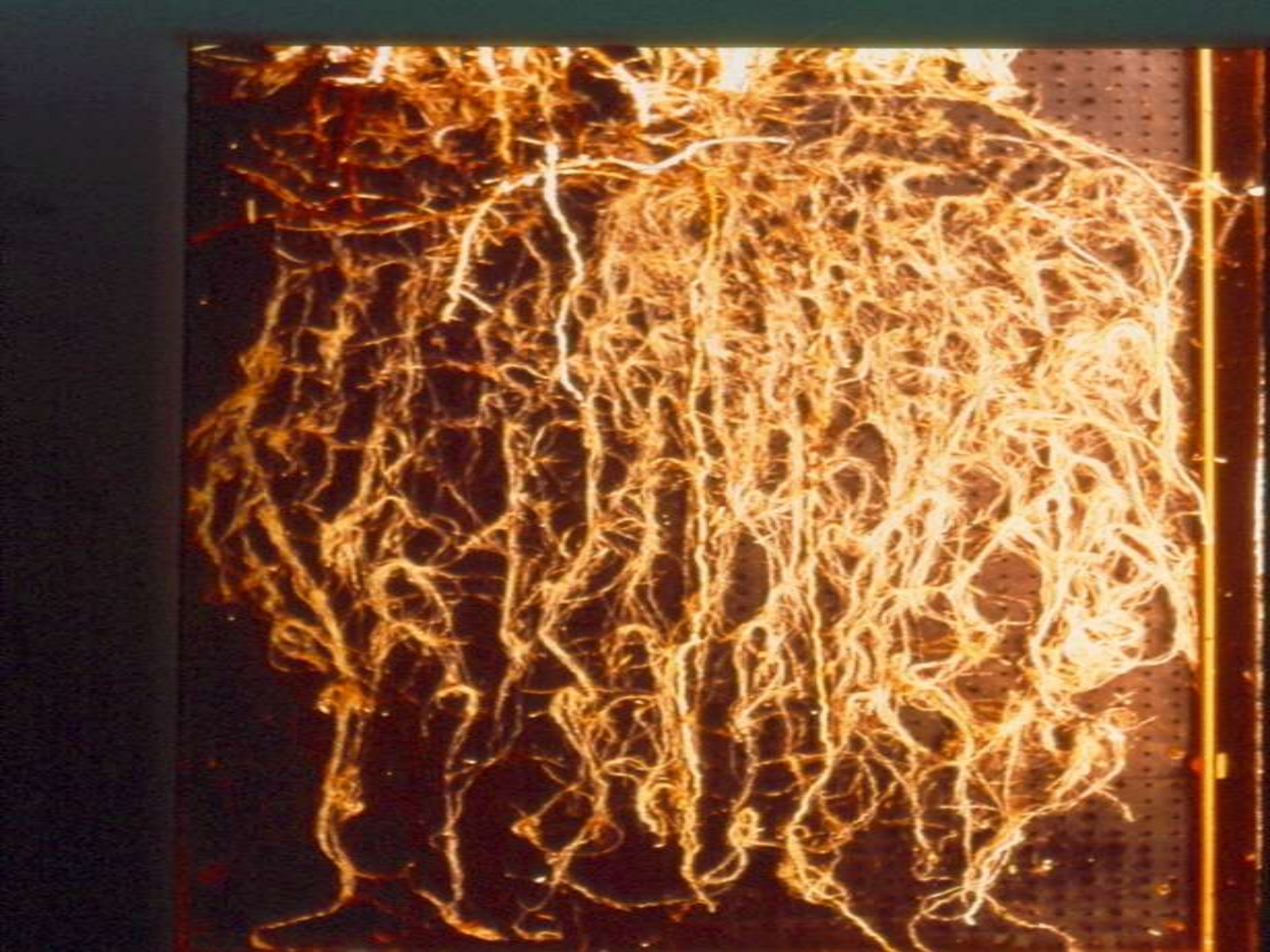


Fig. 10.2. Longitudinal section of herbaceous dicot root. *I.* Root tip with regions of cell division (*A*), elongation (*B*), and maturation (differentiation) (*C*). *II.* Section of mature root with lateral roots in varying stages of development. *III.* Meristem of a lateral root arising from the pericycle. *IV.* Cross section of a young root. Differentiated tissues: root hair (*a*), epidermis (*b*), cortex (*c*), endodermis (*d*), pericycle (*e*), central cylinder or stele (*f*), meristem with quiescent center (*g*), root cap (*h*), xylem (*i*), phloem (*j*).





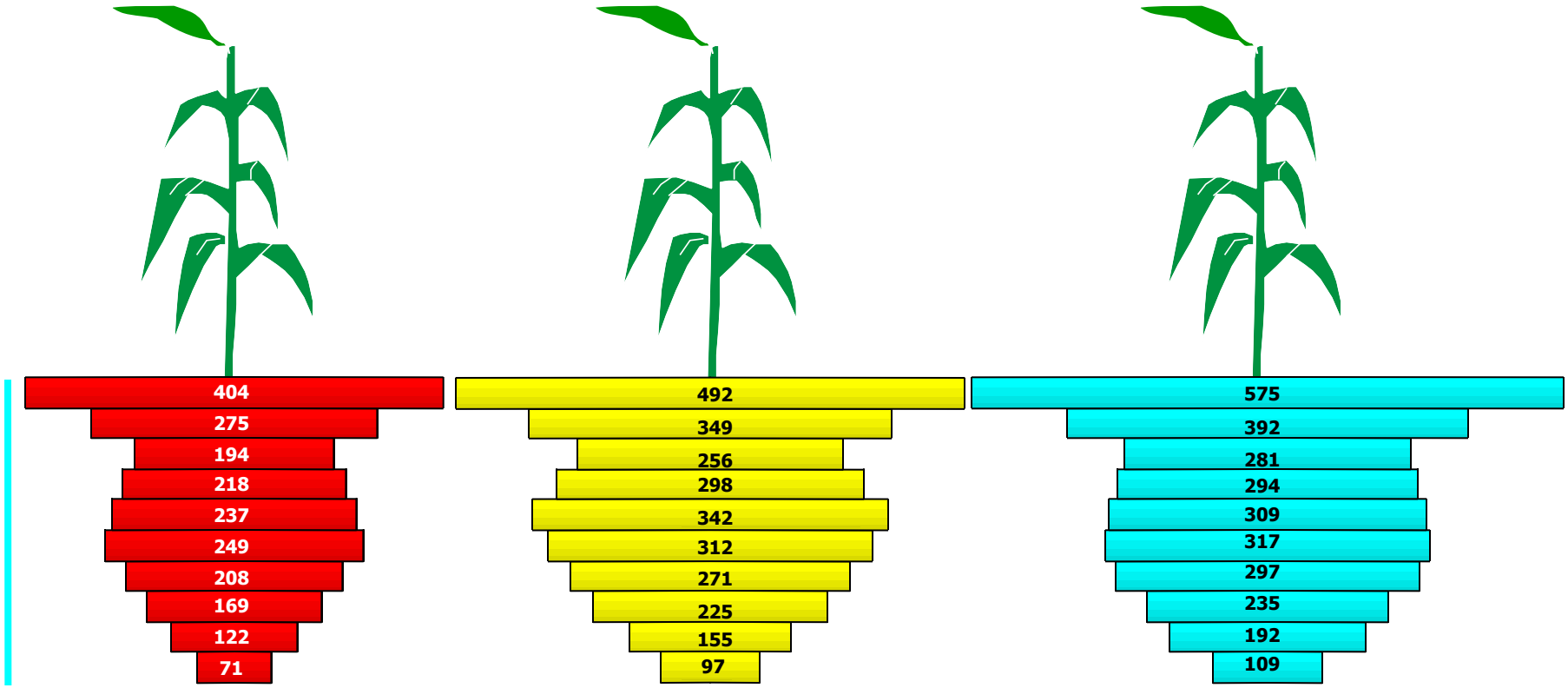

General view of the research plots (Ponta Grossa - PR)


No residue


5 ton/ha


10 ton/ha

Effect of the amount of residue in the corn root system distribution with depth (Mean 13 hybrids / residue treatment)



Soil pH (1:1)

Acid	Neutral	Basic
4.0	7.0	8.5
Strongly acid	pH 4.0 to 5.2	
Moderately acid	pH 5.3 to 5.7	
Slightly acid	pH 5.8 to 6.2	
Neutral	pH 6.3 to 7.2	
Slightly alkaline	pH 7.3 to 7.7	
Strongly alkaline	pH 7.8 to 8.3	

EC (soluble salts) mS/cm

- **Soluble Salts mS/cm (mmho/cm)**

  0-1.5 No crop hazard

  1.6-3.0 Yield reduction on sensitive crops

  3.1-5.5 Moderate yield reduction

  5.6+ Severe yield reduction

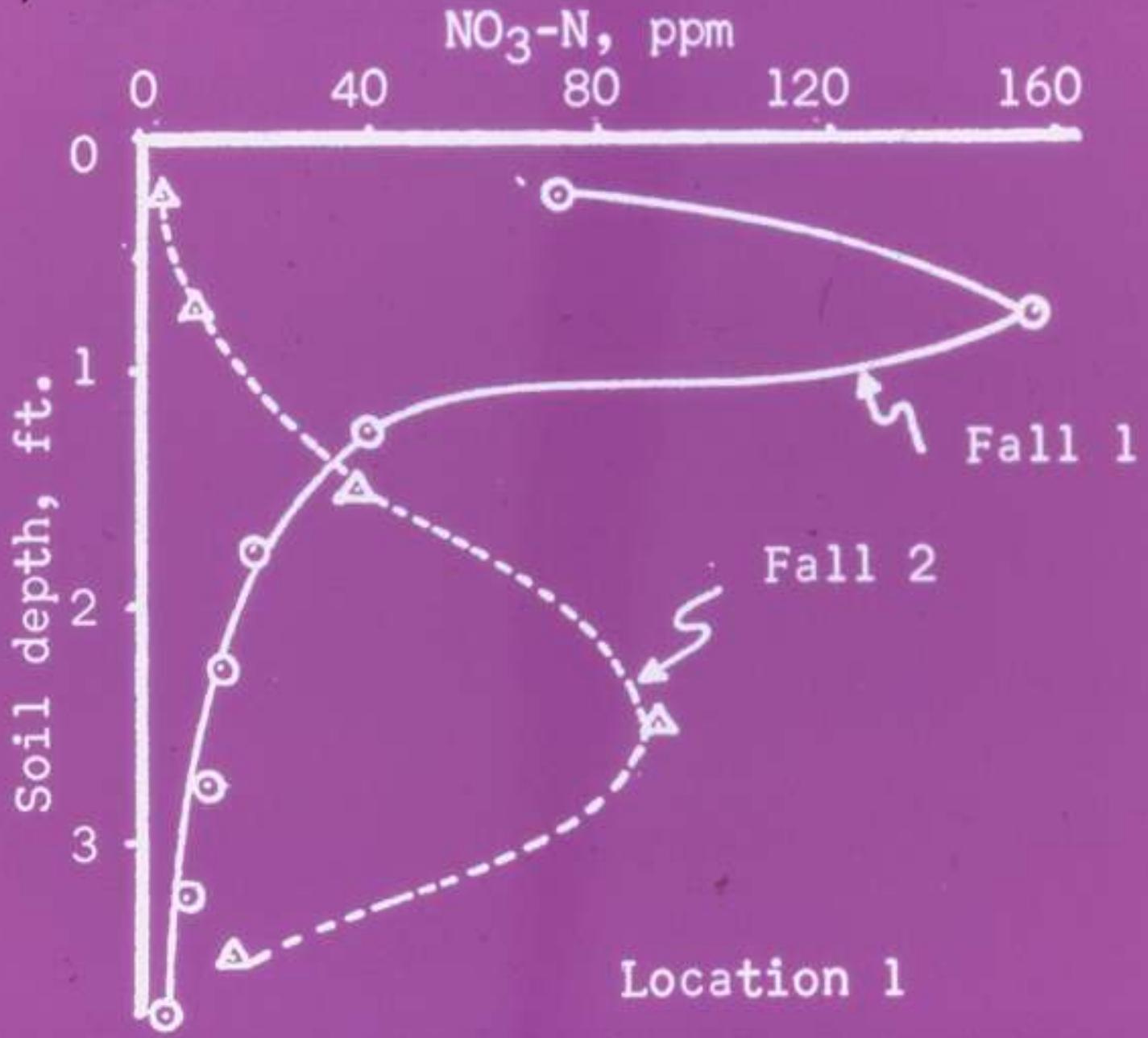
Nitrate Soil Test Ratings

End of Growing Season < 5 ppm NO3-N average for 0-36 inches

Potential movement below root zone if higher than 5 ppm

Iowa Pre-Sidedress Nitrate Test

0-12 inches at 4 to 5 leaf stage <25 ppm NO3-N


NO_3-N, ppm
0
40
80
120
160
Soil depth, ft.
0
1
2
3
Fall 1
Fall 2
Location 1

No Till Fertilizer Program

- It is best to “knife in” nitrogen
- Do not do a weed and feed program for N
- Phosphorus and other nutrients can be broadcast or placed in a band
- Second alternative for N is stream on UAN or broadcast urea
- Split application is necessary for sandy soils.

Nitrogen Application – Kansas Milo, bu per acre

N Rate Lbs N/A	Application Method	Riley County	Greenwood County
0		59	63
100	Broadcast	124	85
100	Dribble	133	83
100	Knife	137	91

No Till Nitrogen Application
Missouri 9 Site Years 1988-1990

N rate	Average Yield
lbs N/A	Bu/A
0	80
60	102
120	121
180	134

N Products	Continuous Corn	Corn-Soybean Rotation
	Yield, Bu/A	
AN 34% N	113	149
Urea 46% N	100	142
UAN 32% N	91	132
UANS 32% N 5% S	91	135

UREA

- Urease breaks urea down to ammonia and CO2
- Need about ½ inch of moisture to get urea in the soil
- Do not apply urea when residue is moist and it is forecast to get hot and windy

Fertilizer Rates for 2010

- Crops do not respond to prices
- Proper rate of nitrogen cannot be reduced without yield loss
- Sulfur may be needed in no-till systems
- Non-mobile nutrients should be applied at rates suggested by soil test. Strive at least to have P at 25 ppm P and K to 200 ppm K

Nitrogen Requirement

- Corn 1.2 lbs N/Bu
- Wheat 2.4 lbs N/Bu
- Milo 1.1 lbs N/Bu
- Grass 40 lbs N/Ton
- Millet 1.7 lbs N/Bu

Nitrogen Recommendation

N lbs/A = (yield * N req.)

lbs of NO_3-N in 24”

Legume credit

Manure credit

Irrigation water credit

Iowa Pre-sidedress Nitrate Test

- N recommendation, lbs of N/A = (25 – soil nitrate (ppm)) * 8
- In this case, take a 0-12 inch sample at the 4 to 5 leaf stage of corn growth

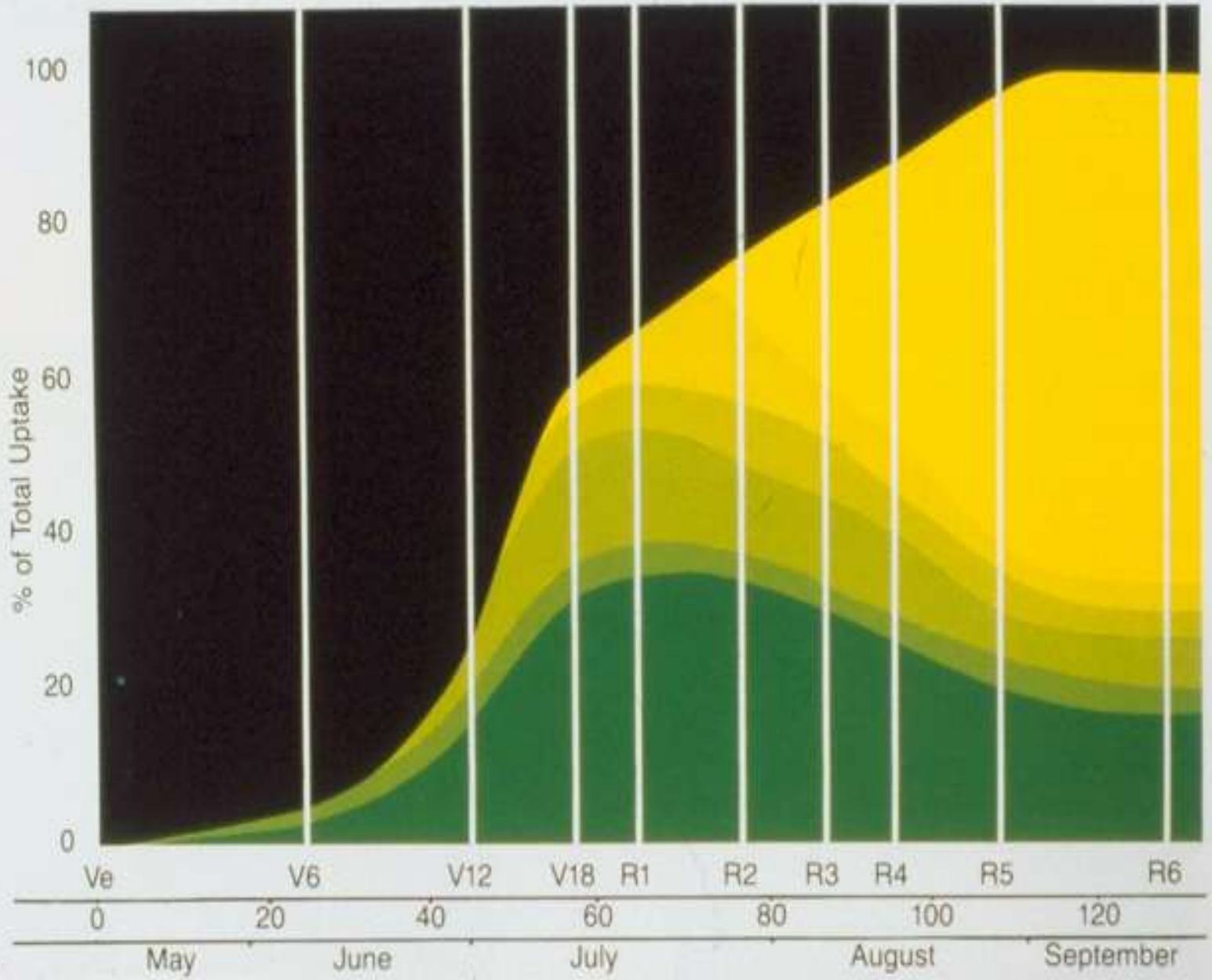
Suggested N Credits for Legume Crops

	% Stand	lb. N/A
Alfalfa	100%	100
	50%	50
	less than 50%	none
Sweet Clover		80
Red Clover		50
Soybeans		40-60

Nitrogen Recommendation

- An Example
- Corn after Soybeans
- 200 bu/A X 1.2 = 240 lbs of N required
- Subtract the following
- Soil nitrate = 30 lbs of N
- Past soybeans = 40 lbs of N
- Amount of N to apply = 170 lbs of N/A

Nitrogen—Corn



Timing N Application

N Rate	Method	Corn Yield
Control		81
120	Water	125
120	1/2 PP 1/2 Water	129
120	1/2 SD 1/2 Water	133
120	PP	119
120	SD	124

SAL, NE

Valentine Fine Sand

Soybean N Uptake

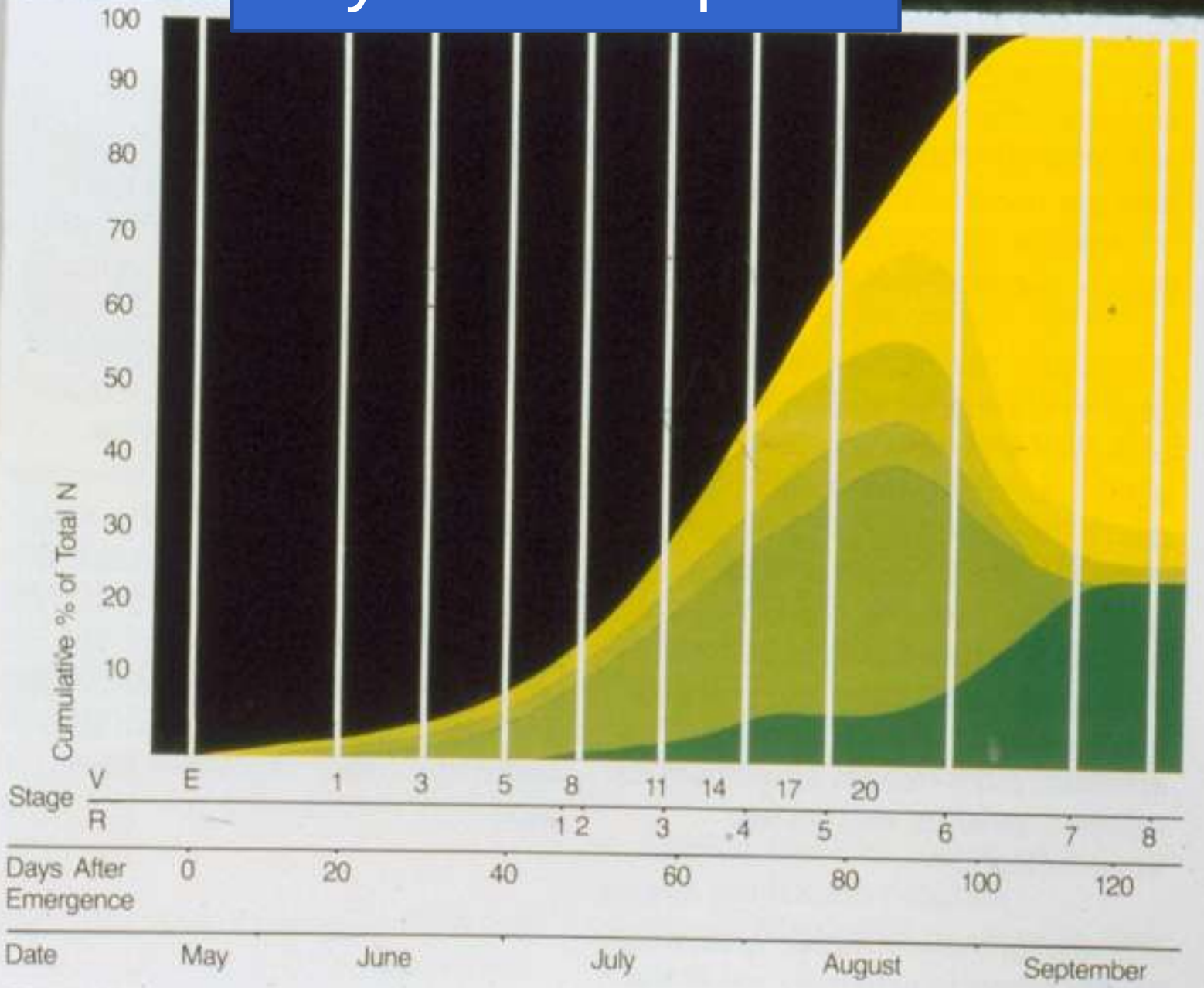


Fig. 39. Nitrogen

Low Soil Test Ratings (Less Than)

• Phosphorus, P	12 ppm
• Potassium, K	80 ppm
• Sulfate, S	7 ppm
• Magnesium, Mg	20 ppm
• Zinc, Zn	0.50 ppm
• Manganese, Mn	1.5 ppm
• Copper, Cu	0.20 ppm
• Boron, B	0.25 ppm
• Chloride, Cl	4 ppm

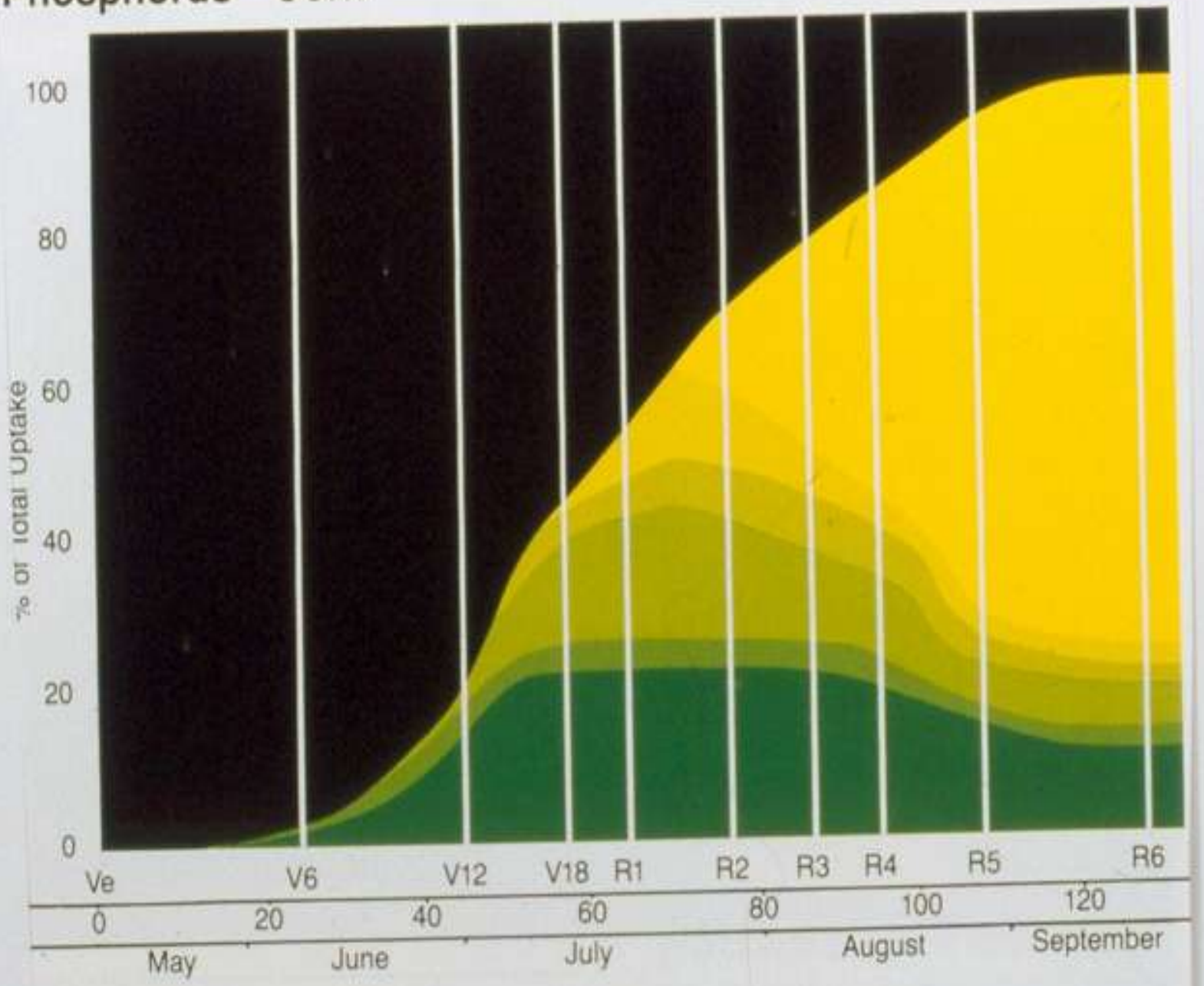
Phosphorus Soil Test
Mehlich P-3 or Bray P-1

Soil test ppm P	Rating	% Sufficiency
0-5	Very Low	25-50
6-12	Low	45-80
13-25	Medium	70-95
26-50	High	90-100
51+	Very High	100

Phosphorus Recommendations

Soil test ppm P	Rating	lbs P_2O_5/A
0-5	Very Low	60-140
6-12	Low	35-75
13-25	Medium	20-45
26-50	High	0-30
51+	Very High	None

Phosphorus—Corn



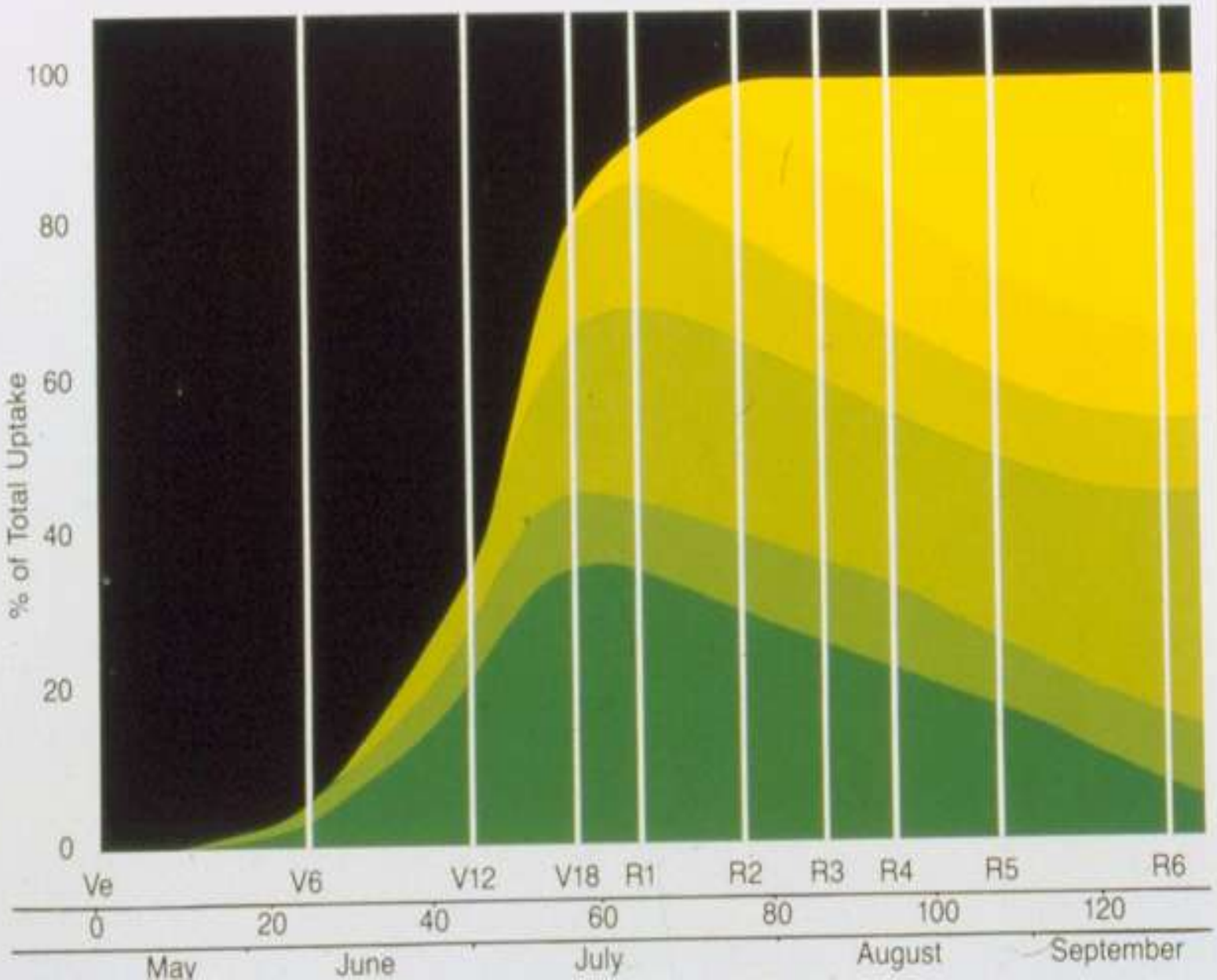
Potassium Soil Test, Ammonium Acetate Extractable

Soil Test ppm K	Rating	% Sufficiency
0-40	Very Low	20-50
41-80	Low	45-80
81-120	Medium	70-95
121-200	High	90-100
201+	Very High	100

Potassium Recommendations

Soil Test ppm K	Rating	lbs K2O
0-40	Very Low	90-200
41-80	Low	50-120
81-120	Medium	25-60
121-200	High	0-35
201+	Very High	None

Potassium—Corn



Soybean K Uptake

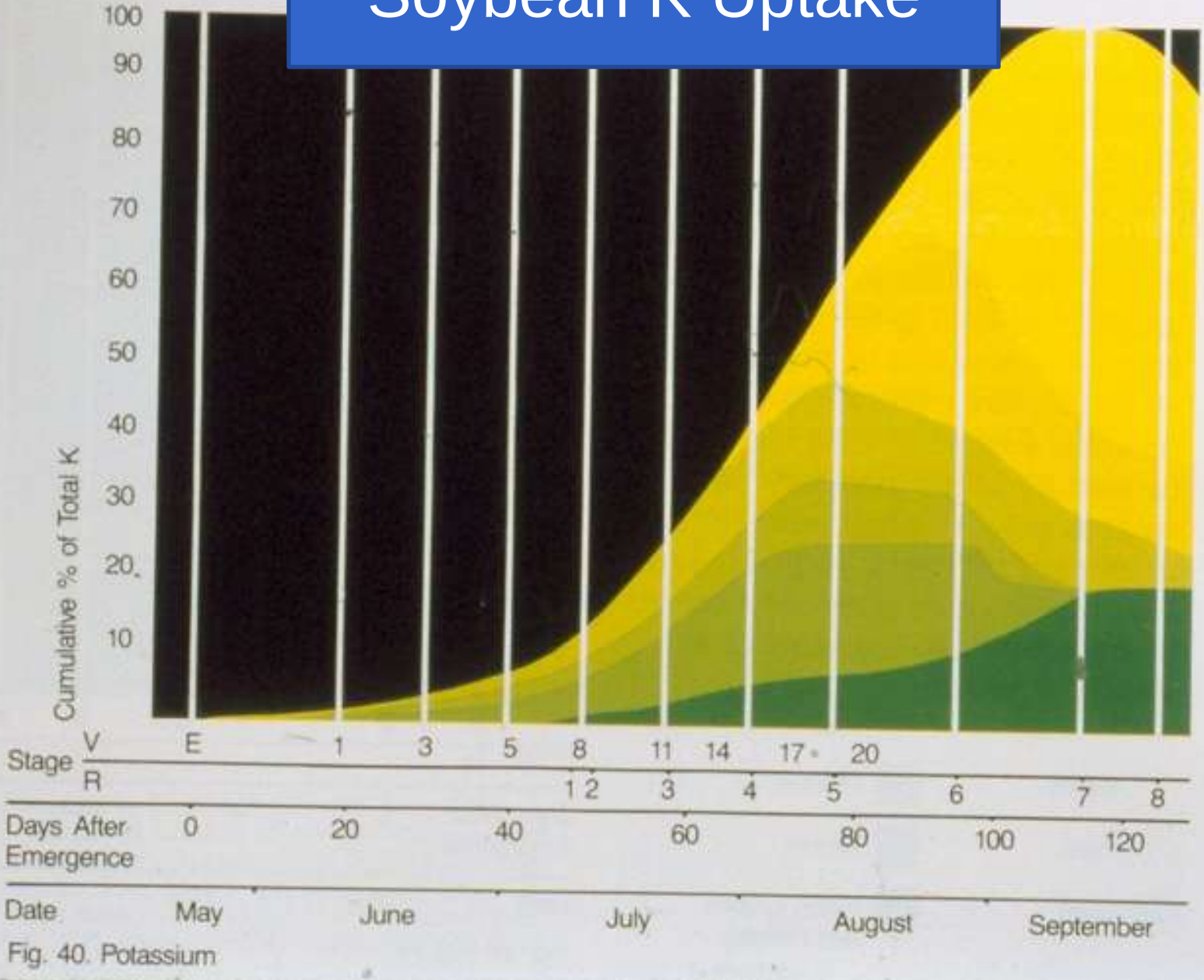


Fig. 40. Potassium

Sulfur Soil Test, Ca-P Extractable

Soil Test ppm S	Rating
0-4	Very Low
5-7	Low
8-11	Medium
12-15	High
16+	Very High

Sulfur Requirement

Crop	Yield Unit	LBS of S
Corn	Bushel	0.18-0.26
Soybean	Bushel	0.20-0.29
Wheat	Bushel	0.28-0.35
Alfalfa	Ton	4.7 – 6.3
Grass	Ton	2.2 – 3.6

Sulfur Recommendation Example

Wheat 80 bu/A Yield Goal

Sulfur Requirement is .28 to .35 lb S/bu

Total S Required is 22 to 28 lbs/A

Sulfate Soil Test is 8 ppm S

8 ppm X .3 X 8 inches = 19 lbs S/A

Recommendation is 3 to 9 lbs S/A

Sulfur Recommendation Example

Corn 200 bu/A Yield Goal

Sulfur Requirement is .18 to .26 lb S/bu

Total S Required is 36 to 52 lbs/A

Sulfate Soil Test is 8 ppm S

8 X 2.4 = 19 lbs S/A

Recommendation is 17 to 33 lbs S/A

Zinc Soil Test, DTPA Extractable

Soil Test ppm Zn	Rating
0-0.25	Very Low
0.26-0.50	Low
0.51-.75	Medium
0.76-1.00	High
1.01+	Very High

Zinc Recommendations

Soil Test ppm Zn	Corrective Rate lb Zn/A
0-0.25	3-12
0.26-0.50	1-7
0.51-.75	0-6
0.76-1.00	0-3
1.01+	None

*Annual rate: Divide Corrective Rate by 6.

In Furrow Fertilizer

Crop	Pounds N + K2O 30 “ rows	7 “ rows
• Corn	8	32
• Milo	4	16
• Sunflowers	4	16
• Beans	0	6
• Wheat	8	32

The Best Combination:

Banding and broadcasting fertilizer P to build soil fertility levels and to optimize long-term yield potential and profits

An Example of Nutrient Recommendations, 80 Bu Wheat

	Soil Test Value ppm	Nutrient Recommendations
Nitrate, NO3-N	5	140 lbs N/A
Phosphorus, P	21	40 lbs P2O5
Potassium, K	250	0 lbs K2O
Sulfur, S	12	9 lbs S
Zinc, Zn	0.44	0 lbs Zn

An Example of Nutrient Recommendations for 130 Bu Corn

	Soil Test Value ppm	Nutrient Recommendations
Nitrate, NO3-N	5	120 lbs N/A
Phosphorus, P	21	25 lbs P2O5
Potassium, K	250	0 lbs K2O
Sulfur, S	8	9 lbs S
Zinc, Zn	0.44	6 lbs Zn

Nutrient Recommendations Assuming Low Soil Tests

Nutrient		Calculation for Amount/A
• Nitrogen	N	Removal times 1.2
• Phosphorus	P2O5	Crop Removal Rate
• Potassium	K2O	“
• Sulfur	S	“
• Zinc	Zn	“

Nutrient Recommendations Assuming Low Soil Tests

Nutrient		Wheat, 80 bu/A	
		Removal	Recommended
• Nitrogen	N	96	115
• Phosphorus	P2O5	42	42
• Potassium	K2O	21	21
• Sulfur	S	10	10
• Zinc	Zn	0.2	0.2

Nutrient Recommendations Assuming Low Soil Tests

Nutrient		Corn, 200 bu/A Removal	Recommended
• Nitrogen	N	150	180
• Phosphorus	P2O5	66	66
• Potassium	K2O	46	46
• Sulfur	S	18	18
• Zinc	Zn	0.2	0.2

Nutrient Recommendations Assuming Low Soil Tests

Nutrient		Soybeans 60 bu/A Removal	Recommended
• Nitrogen	N	216	0
• Phosphorus	P2O5	46	46
• Potassium	K2O	72	72
• Sulfur	S	11	1
• Zinc	Zn	0.18	0.18

Thank You

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