United States
Department of
Agriculture

Soil
Conservation
Service

Lexington
Kentucky

Kentucky Irrigation Guide

2003 Supplement to NEH PART 652
IRRIGATION GUIDE

CHAPTER 2 - SOILS

The soils of Kentucky are divided into sixteen irrigation groups. For planning purposes, each group has been assigned a maximum intake rate, available water holding capacity, and maximum design depth.

Intake Rate - The maximum intake rate of a soil is the rate at which it can absorb water without puddling or running off. Although this rate is not constant the above values are recommended for design.

Available Water Capacity - The water holding capacity of a soil is the amount of water it will hold after it has been drained by gravity. Part of this water is held by the soil particles and is not available to plants, the remaining is known as "available water". The amount of water applied at each irrigation should replenish the depleted available water in the crop rooting zone. Over application can result in loss of soil, fertilizer, and other solutes by surface runoff and or percolation.

Maximum Design Depth - This is the maximum soil depth used to determine irrigation water requirements. It is not necessarily the maximum root depth for any given plant. For most plants the concentration of absorbing roots is greatest in the upper part of the root zone (usually in the top foot) and near the base of the plant. When the root zone extraction depth (shown on Page 8) is less than the maximum design depth, it should be used for planning.

IRRIGATION GROUPS
(Soils of Kentucky)

IRRIGATION GROUP 1

Bruno
Crevasse
Flomaton
Lakin
Molena

IRRIGATION GROUP 2

Barbourville
Beulah
Bosket
Chavies
Combs
Grigsby
Hazleton
Kickapoo
Ochlockonee
Pope
Robinsville
Saffell
Sequatchie
Skidmore

IRRIGATION GROUP 3

Allegheny
Allen
Bodine
Brandon
Britwater
Clarksville
Clifty
Cranston
Ennis
Hayter
Holston
Humphreys
Jefferson
Negley
Nolichucky
Rigley
Riney
Rowdy
Sensabaugh
Staser
Tate
Wheeling

IRRIGATION GROUP 4

Adler
Armour
Ashton
Bewleyville
Cascilla
Chagrin
Chenault
Chenneby
Christian
Crider
Cuba
Cumberland
Cutshin
Dubbs
Elk
Etowah
Frankstown
Hackers
Hagerstown
Hamblen
Hammack
Haymond
Huntington
Iuka
Lexington
Lonewood
Maury
Memphis
Morganfield
Mountview
Nolin
Pembroke
Philo
Pickwick
Renox
Ryker
Sharon
Shelbyville
Shelocta
Sonora
Trimble
Vicksburg
Waynesboro
Wellston
Whitley

IRRIGATION GROUPS (Continued)

IRRIGATION GROUP 5

Arkabutla
Belknap
Collins
Commerce
Cotaco
Cruze
Dundee
Falaya
Henshaw
Licking
Lindside
Mantachie
Morehead
Newark
Steff
Stendal
Stokly
Uniontown
Whitwell
Wilbur

IRRIGATION GROUP 6

Baxter
Beasley
Bledsoe
Brashear
Braxton
Brookside
Caleast
Dewey
Donerail
Egam
Epley
Fleming
Frederick
Hampshire
Jessup
Loradale
Loudon
Lowell
Muse
Upshur
Vandalia
Vertrees
Wolftever
Woolper

IRRIGATION GROUP 7

Atkins
Bibb
Birds
Bonnie
Carpenter
Dekoven
Lanton
Melvin
Mhoon
Patton
Petrolia
Rosebloom
Wakeland
Waverly

IRRIGATION GROUP 8

Bedford
Captina
Cincinnati
Dickson
Gatton
Grenada
Lax
Loring
Mercer
Monongahela
Nicholson
Otwell
Providence
Rossmoyme
Sadler
Sango
Sciotoville
Tarklin
Tilsit
Zanesville

IRRIGATION GROUP 9

Alligator
Blago
Burgin
Cavode
Colbert
Dowellton
Dunning
Forestdale
Jacob
Karnak
Markland
McGary
Montgomery
Okaw
Purdy
Roellen
Sees
Sharkey
Tunica
Tupelo
Tygart
Wharton
Zipp

IRRIGATION GROUP 10

Avonburg
Calloway
Ginat
Guthrie
Henry
Johnsburg
Lawrence
Mullins
Robertsville
Taft
Tyler
Weinbach

IRRIGATION GROUP 11

Berks
Culleoka
Dekalb
Garmon
Lily
Linker
Ramsey
Steinsburg

IRRIGATION GROUP 12

Berea
Boonsboro
Braassfield
Clymer
Frondorf
Gilpin
Hartsells
Muskingum
Wernock
Westmoreland

IRRIGATION GROUP 13

Ashwood
Caneyville
Donahue
Faywood
Frederick
Fredonia
Heitt
Leneberg
McAfee
Needmore
Otway
Rockcastle
Salvisa
Sequoia
Talbott
Trappist

IRRIGATION GROUP 14

Eden
Hollywood
Latham
Rarden
Shrouts

IRRIGATION GROUP 15

Colyer
Corydon
Cynthiana
Dandridge
Fairmount
Litz
Montevallo
Opequon
Weikert

IRRIGATION GROUP 16

Bethesda
Fairpoint
Morristown

TABLE 1

IRRIGATION GROUP	DEEP SOILS > 40"	Maximum Intake rate inches per hour	Available Water holding capacity inches per foot depth	Maximum Design depth feet
1	Deep excessively drained sandy soils with rapid to very rapid permeability. Lakin, Creuasse, etc.	3.0	0.75	3.0
2	Deep well drained coarse loamy soils with moderately rapid permeability. Barbourville, Kickapoo, Pope, etc.	2.3	1.25	3.0
3	Deep well drained fine loamy soils with moderate to moderately rapid permeability. Allegheny, Clifty, Riney, etc.	1.5	1.75	3.0
4	Deep well drained fine silty or coarse silty soils with moderate permeability. Ashton, Crider, Memphis, etc.	1.0	2.5	3.0
5	Deep moderately well drained to somewhat poorly drained fine silty or coarse silty soils with moderate permeability. Belknap, Falaya Newark, etc.	1.0	2.5	3.0
6	Deep well drained clayey soils with moderately slow permeability. Baxter, Lowell, Muse, etc.	0.6	2.0	3.0
7	Deep poorly to very poorly drained silty soils with moderate to moderately slow permeability. Bonnie, Melvin, Waverly, etc.	0.6	2.5	3.0
8	Deep moderately well drained silty soils with fragipans. Permeability is slow or very slow. Grenada, Monongahela, Tilsit, etc.	0.6	2.4* 1.0**	3.0

*Above Fragipan
**Below Fragipan

TABLE 1 (Continued)

IRRIGATION GROUP	DEEP SOILS > 40" (Con't)	Maximum Intake rate inches per hour	Available Water holding capacity inches per foot depth	Maximum Design depth (feet)
9	Deep somewhat poorly to very poorly drained clayey soils with slow to very slow permeability. Alligator, Dunning, Karnak, etc.	0.3	1.75	3.0
10	Deep somewhat poorly and poorly drained silty soils with fragipans. Permeability is slow or very slow. Calloway, Henry, Lawrence, Tyler, etc.	0.3	2.4* 1.0**	3.0
	MODERATELY DEEP SOILS 20" - 40"			
11	Moderately deep well drained sandy or channery soils with moderately rapid permeability. Berks, Dekalb, Garmon, etc.	2.3	1.0	2.5
12	Moderately deep well drained silty soils with moderate permeability. Boonsboro, Gilpin, Frondorf, etc.	1.5	1.5	2.5
13	Moderately deep well drained clayey soils with moderately slow to slow permeability. Caneyville, Faywood, Fredonia, etc.	0.6	1.8	2.5
14	Moderately deep moderate to moderately well drained clayey soils with slow or very slow permeability. Eden, Latham, Shrouts, etc.	0.3	1.4	2.5

*Above Fragipan
**Below Fragipan

IRRIGATION GROUP	SHALLOW SOILS > 20"	Maximum Intake rate inches per hour	Available Water holding capacity inches per foot depth	Maximum Design Depth (feet)
15	Shallow loamy to clayey soil with moderate to moderately slow permeability. Colyer, Cynthiana, Fairmount, etc.	0.3	1.5	1.5
	MINE SPOIL			
16	Deep well drained mixed material from surface mining. The fine earth and coarse fragment content is variable. Permeability is moderately slow. Bethesda, Fairpoint, etc.	0.3	1.0	1.5-3.0

CHAPTER 3 - CROPS
(Crop requirement chart)

CROP	Peak use rate inches per day	Seasonal use (inches per growing) season	Critical Periods for water requirements
Corn	0.30	24	Tasseling through silking
Pasture	0.30	30	After grazing
Potatoes	0.25	20	Blossom to harvest
Orchards	0.25	20	Fruit development
Soybeans	0.30	24	From bloom through seed forming
Truck Crops	0.20	22	Root, fruit or head development
Tomatoes	0.20	18	Fruit expansion
Tobacco	0.25	22	Knee high to full bloom

CROP	"D" inches
corn	36
soybeans	30
vegetables	21
pastures	36
tobacco	21

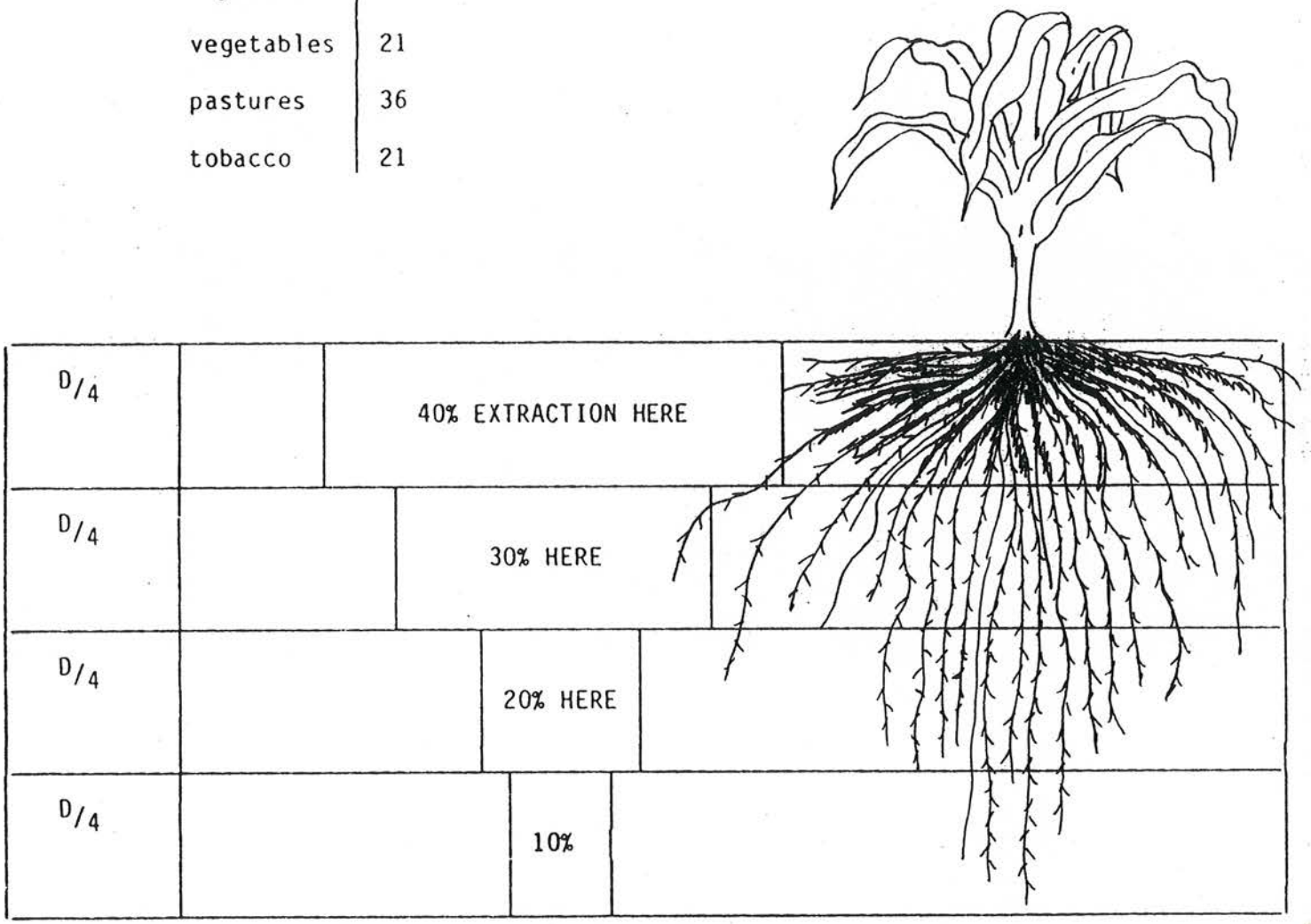
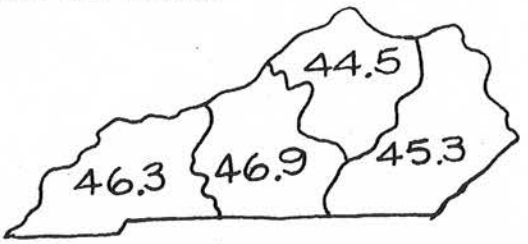


Figure 1 Average moisture-extraction pattern of plants growing in a soil without restrictive layers and with an adequate supply of available moisture throughout the root zone.

CHAPTER 4 - WATER REQUIREMENTS

NORMAL PRECIPITATION

Kentucky can expect about forty-six inches of rainfall annually. The map below indicates that there is very little variation in the annual precipitation throughout the state.



Mean annual total precipitation (inches) by State Climatic Divisions.

Normal monthly total precipitation (inches) for Design in Kentucky.

January -	5	
February -	4	
March -	5	
April -	4	Normal Growing Season
May -	4	
June -	4.5	
July -	4	
August -	4	
September -	3	
October -	2	
November -	3.5	
December -	3.5	
	46.5	

The TR-21 computer program was used to determine annual and monthly irrigation requirements for normal and dry years for crops commonly grown in Kentucky. This is the amounts of water needed to bring the water holding capacity to "full" whenever it decreases to 50% or irrigation is started when it is half full. Kentucky soils were divided into three groups depending upon available water holding capacity.

Available Water Holding Capacity (inches per foot)	Irrigation Group
1.0 - 1.5	1, 2, 11, 12, 15, 16
1.6 - 2.0	3, 6, 9, 13
2.1 - 2.5	4, 5, 7, 9, 10

Annual Irrigation Requirements for Crops Grown in KY

Frequency	(normal) 50%			dry (4 of 5 yrs) 80%			dry (9 of 10 yrs) 90%		
Av1.W.H.C.	1.0-1.5	1.6-2.0	2.1-2.5	1.0-1.5	1.6-2.0	2.1-2.5	1.0-1.5	1.6-2.0	2.1-2.5
Crop									
Corn	12.91	10.87	9.41	14.93	13.07	11.68	15.70	13.91	12.55
Pasture	7.11	5.44	3.98	8.52	7.02	5.68	9.06	7.62	6.33
Potatoes	8.20	7.00	5.93	9.25	8.17	7.20	9.66	8.62	7.69
Orchards	7.20	5.25	3.83	9.05	7.27	5.92	9.76	8.04	6.71
Soybeans	10.22	8.58	7.14	11.60	10.12	8.80	12.13	10.71	9.43
Vegetables	6.19	5.40	4.72	6.92	6.21	5.58	7.20	6.51	5.91
Tobacco	9.43	8.06	7.09	10.55	9.32	8.43	10.98	9.80	8.95
Tomatoes	6.00	5.29	4.38	6.81	6.16	5.33	7.12	6.50	5.70

Monthly Irrigation Requirements for Crops in (1.0-1.5) Avl. WHC Range

50% Freq.

Crop	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Corn	0.00	0.00	0.00	0.00	0.38	1.65	4.45	4.71	1.71	0.00	0.00	0.00
Pasture	0.00	0.00	0.22	0.98	2.79	3.11	0.00	0.00	0.00	0.00	0.00	0.00
Potatoes	0.00	0.00	0.00	0.00	0.17	1.20	4.32	2.51	1.24	0.00	0.00	0.00
Orchards	0.00	0.00	0.00	0.00	0.92	1.83	2.66	1.79	0.00	0.00	0.00	0.00
Soybeans	0.00	0.00	0.00	0.00	0.04	0.47	2.30	4.91	2.51	0.00	0.00	0.00
Vegetables	0.00	0.00	0.00	0.00	0.00	0.44	3.44	2.32	0.00	0.00	0.00	0.00
Tobacco	0.00	0.00	0.00	0.00	0.12	0.95	4.44	3.92	0.00	0.00	0.00	0.00
Tomatoes	0.00	0.00	0.00	0.00	0.00	0.00	4.28	0.75	0.00	0.00	0.00	0.00

80% Freq.

Corn	0.00	0.00	0.00	0.00	0.68	2.07	4.90	5.17	5.17	2.11	0.00	0.00
Pasture	0.00	0.00	0.37	1.29	3.15	3.71	0.00	0.00	0.00	0.00	0.00	0.00
Potatoes	0.00	0.00	0.00	0.00	0.25	1.53	4.68	2.80	2.80	0.00	0.00	0.00
Orchards	0.00	0.00	0.00	0.00	1.28	2.25	3.06	2.46	2.46	0.00	0.00	0.00
Soybeans	0.00	0.00	0.00	0.00	0.07	0.74	2.64	5.31	2.84	0.00	0.00	0.00
Vegetables	0.00	0.00	0.00	0.00	0.00	0.57	3.74	2.61	0.00	0.00	0.00	0.00
Tobacco	0.00	0.00	0.00	0.00	0.17	1.28	4.80	4.30	0.00	0.00	0.00	0.00
Tomatoes	0.00	0.00	0.00	0.00	0.00	1.28	4.63	0.90	0.00	0.00	0.00	0.00

90% Freq.

Corn	0.00	0.00	0.00	0.00	0.80	2.23	5.07	5.34	2.26	0.00	0.00	0.00
Pasture	0.00	0.00	0.43	1.41	3.28	3.94	0.00	0.00	0.00	0.00	0.00	0.00
Potatoes	0.00	0.00	0.00	0.00	0.28	1.66	4.82	2.91	0.00	0.00	0.00	0.00
Orchards	0.00	0.00	0.00	0.00	1.42	2.42	3.21	2.72	0.00	0.00	0.00	0.00
Soybeans	0.00	0.00	0.00	0.00	0.08	0.84	2.77	5.47	2.96	0.00	0.00	0.00
Vegetables	0.00	0.00	0.00	0.00	0.00	0.62	3.85	2.73	0.00	0.00	0.00	0.00
Tobacco	0.00	0.00	0.00	0.00	0.19	1.40	4.94	4.44	0.00	0.00	0.00	0.00
Tomatoes	0.00	0.00	0.00	0.00	0.00	1.40	4.76	0.96	0.00	0.00	0.00	0.00

Monthly Irrigation Requirements for Crops in (1.6-2.0) Avl. WHC Range

50% Freq.

Crop	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Corn	0.00	0.00	0.00	0.00	0.22	1.41	4.20	4.45	0.59	0.00	0.00	0.00
Pasture	0.00	0.00	0.11	0.74	2.52	2.06	0.00	0.00	0.00	0.00	0.00	0.00
Potatoes	0.00	0.00	0.00	0.00	0.11	0.97	4.07	1.85	1.24	0.00	0.00	0.00
Orchards	0.00	0.00	0.00	0.00	0.72	1.59	2.43	0.51	0.00	0.00	0.00	0.00
Soybeans	0.00	0.00	0.00	0.00	0.02	0.26	2.04	4.60	1.66	0.00	0.00	0.00
Vegetables	0.00	0.00	0.00	0.00	0.00	0.36	3.23	1.81	0.00	0.00	0.00	0.00
Tobacco	0.00	0.00	0.00	0.00	0.07	0.70	4.15	3.13	0.00	0.00	0.00	0.00
Tomatoes	0.00	0.00	0.00	0.00	0.00	0.82	4.10	0.37	0.00	0.00	0.00	0.00

80% Freq.

Corn	0.00	0.00	0.00	0.00	0.54	1.87	4.69	4.95	1.02	0.00	0.00	0.00
Pasture	0.00	0.00	0.28	1.09	2.92	2.73	0.00	0.00	0.00	0.00	0.00	0.00
Potatoes	0.00	0.00	0.00	0.00	0.20	1.33	4.47	2.18	0.00	0.00	0.00	0.00
Orchards	0.00	0.00	0.00	0.00	1.11	2.05	2.87	1.24	0.00	0.00	0.00	0.00
Soybeans	0.00	0.00	0.00	0.00	0.05	0.56	2.42	5.05	2.03	0.00	0.00	0.00
Vegetables	0.00	0.00	0.00	0.00	0.00	0.50	3.57	2.14	0.00	0.00	0.00	0.00
Tobacco	0.00	0.00	0.00	0.00	0.14	1.07	4.56	3.55	0.00	0.00	0.00	0.00
Tomatoes	0.00	0.00	0.00	0.00	0.00	1.15	4.48	0.54	0.00	0.00	0.00	0.00

90% Freq.

Corn	0.00	0.00	0.00	0.00	0.66	2.04	4.87	5.14	1.18	0.00	0.00	0.00
Pasture	0.00	0.00	0.34	1.23	3.07	2.98	0.00	0.00	0.00	0.00	0.00	0.00
Potatoes	0.00	0.00	0.00	0.00	0.23	1.47	4.62	2.30	0.00	0.00	0.00	0.00
Orchards	0.00	0.00	0.00	0.00	1.26	2.23	3.03	1.52	0.00	0.00	0.00	0.00
Soybeans	0.00	0.00	0.00	0.00	0.06	0.68	2.57	5.23	2.17	0.00	0.00	0.00
Vegetables	0.00	0.00	0.00	0.00	0.00	0.55	3.69	2.27	0.00	0.00	0.00	0.00
Tobacco	0.00	0.00	0.00	0.00	0.16	1.21	4.72	3.71	0.00	0.00	0.00	0.00
Tomatoes	0.00	0.00	0.00	0.00	0.00	1.28	4.62	0.60	0.00	0.00	0.00	0.00

Monthly Irrigation Requirements for Crops in (2.1-2.5) Avl. WHC Range

50% Freq.

Crop	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Corn	0.00	0.00	0.00	0.00	0.15	1.31	4.10	3.85	0.00	0.00	0.00	0.00
Pasture	0.00	0.00	0.03	0.57	2.33	1.04	0.00	0.00	0.00	0.00	0.00	0.00
Potatoes	0.00	0.00	0.00	0.00	0.00	0.07	0.77	3.86	1.24	0.00	0.00	0.00
Orchards	0.00	0.00	0.00	0.00	0.64	1.49	1.70	0.00	0.00	0.00	0.00	0.00
Soybeans	0.00	0.00	0.00	0.00	0.01	0.11	1.86	4.38	0.79	0.00	0.00	0.00
Vegetables	0.00	0.00	0.00	0.00	0.00	0.29	3.07	1.36	0.00	0.00	0.00	0.00
Tobacco	0.00	0.00	0.00	0.00	0.05	0.53	3.97	2.54	0.00	0.00	0.00	0.00
Tomatoes	0.00	0.00	0.00	0.00	0.00	0.63	3.75	0.00	0.00	0.00	0.00	0.00

80% Freq.

Corn	0.00	0.00	0.00	0.00	0.48	1.79	4.60	4.81	0.00	0.00	0.00	0.00
Pasture	0.00	0.00	0.21	0.95	2,76	1.76	0.00	0.00	0.00	0.00	0.00	0.00
Potatoes	0.00	0.00	0.00	0.00	0.16	1.17	4.29	1.58	0.00	0.00	0.00	0.00
Orchards	0.00	0.00	0.00	0.00	1.04	1.97	2.79	0.11	0.00	0.00	0.00	0.00
Soybeans	0.00	0.00	0.00	0.00	0.04	0.44	2.27	4.87	1.18	0.00	0.00	0.00
Vegetables	0.00	0.00	0.00	0.00	0.00	0.44	3.43	1.71	0.00	0.00	0.00	0.00
Tobacco	0.00	0.00	0.00	0.00	0.11	0.93	4.41	2.99	0.00	0.00	0.00	0.00
Tomatoes	0.00	0.00	0.00	0.00	0.00	0.99	4.29	0.05	0.00	0.00	0.00	0.00

90% Freq.

Corn	0.00	0.00	0.00	0.00	0.61	1.97	4.79	5.06	0.11	0.00	0.00	0.00
Pasture	0.00	0.00	0.28	1.09	2.92	2.03	0.00	0.00	0.00	0.00	0.00	0.00
Potatoes	0.00	0.00	0.00	0.00	0.20	1.32	4.46	1.72	0.00	0.00	0.00	0.00
Orchards	0.00	0.00	0.00	0.00	1.20	2.15	2.96	0.40	0.00	0.00	0.00	0.00
Soybeans	0.00	0.00	0.00	0.00	0.05	2.43	5.06	1.33	0.00	0.00	0.00	0.00
Vegetables	0.00	0.00	0.00	0.00	0.00	0.50	3.57	1.85	0.00	0.00	0.00	0.00
Tobacco	0.00	0.00	0.00	0.00	0.14	1.08	4.57	3.16	0.00	0.00	0.00	0.00
Tomatoes	0.00	0.00	0.00	0.00	0.00	1.13	4.45	0.12	0.00	0.00	0.00	0.00