A LOOK AT OUR IRRIGATION PRACTICES

Mel A. Hagood
Extension Irrigation and Water Use Specialist
Irrigation Experiment Station, Prosser, Washington

Yield and quality variations in crops due to moisture differences have always been more difficult to determine than have differences due to fertility, variety and insect and disease control. This is partly due to the inadequate methods of determining moisture conditions and labor involved in using the methods which have proven to be effective. Crops are seeded once and usually fertilizers are applied only once in the crop life, therefore extra care is usually taken to do a proper job at that time. Often the philosophy concerning irrigation is that a better job will be done on the next irrigation to make up for a poor irrigation this time. With many vegetable crops, especially potatoes, the damage may have been done without being obvious.

Irrigation practices throughout Washington State are generally very poor. Much of this is due to an abundant supply of water and the lack of information on the economic results when too much or too little water is used in crop production.

Irrigation Frequency

The end product of a good irrigation is to get the proper amount of water into the soil at the proper time. Many farmers realize that lack of soil moisture at certain stages of growth of a crop may seriously affect either the yield or quality, consequently frequent irrigations are the rule. Frequent irrigations do not necessarily maintain adequate soil moisture and in some cases infrequent irrigations may create conditions which will increase intake rates and in the long run allow more water to enter the soil.

A common method of irrigating potatoes and most other row crops is to start water in one furrow, skip several, start another, and at each change the water is either moved to the adjacent furrow or to the second furrow over. This rotation is usually followed throughout the season. Sprinkler systems are usually used in somewhat the same manner - with a set sequence of so many hours of irrigation for a certain interval between irrigations. These rotation systems are usually set for either a 12 or 24 hour period of irrigation. The problem with this method is approximately the same amount of water is applied throughout the season regardless of the rate which plants use or need the water.

Length of Run

Another practice in common use is to use long irrigation furrows to reduce machinery and irrigation labor costs. Some studies at Washington State University have been made regarding relative costs for these operations in relation to length of run which will be available soon. Another

study under way is for determining yield differences due to various lengths of irrigation furrows. The following table shows differences on one experiment yield due to insufficient water throughout the season which may happen when long runs are used. Last fall some of our agents began a study to find what differences, if any, do occur when runs become excessively long.

Yields of Irrigated Sweet Corn in Irrigation Efficiency Tests*

Plot designation	Treatment	Total Water Applied (Acre inches)	Marketable Yield (Tons/acre)
A Lower end of field	25% of D	4	3.33
B	50% of D	8	3.38
C	75% of D	12	3.75
D Middle of field	100% of D	16	4.09
E	150% of D	24	4.97
F Upper end of field	200% of D	32	5.23

* Irrigating Annual Crops, John R. Davis and Mel A. Hagood, Calif. Agriculture, Aug. 1961.

Undoubtedly there are differences in yields or quality in potatoes due to different moisture treatments which can be attributed to runs which are too long. These differences can occur due to excessive water at the upper end or insufficient water at the lower end and in some cases it is possible to have reductions in yields both at the upper and lower ends.

Length of Set

Another common practice of irrigators is to change water on a set schedule of every twelve or twenty-four hours. This may result in over-application of water either in the soil, in light soils, or off the end of the field in heavy soils.

Some typical problems and	possible solutions.
Excessive water application	Lengthen interval between irrigations Reduce time of flow per furrow Reduce length of furrow Adjust flow from large to small after water reaches the end of the furrow Change irrigation method to sprinkling or in some cases border irrigation may work.
Insufficient water application	Let water run longer in furrows Irrigate at more frequent intervals Improve soils' ability to absorb water Change irrigation method--to sprinklers or cross slope irrigation.

Since space limits a detailed explanation of how to determine frequency of irrigation, application rates and techniques to solve the problems listed above, the following discussion deals with only one phase which should be of value to those who follow a regular sequence of irrigation regardless of time of year or soil moisture conditions. Although scheduling irrigations by this method may encourage poor irrigation practices, the method is discussed to show how a certain sequence can be changed without causing too much of a problem. The following table shows how to set up a sequence when alternate furrows are to be irrigated.

ALTERNATE ROW IRRIGATION ROTATION

FURROW NUMBER

SET NO.	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	*					4 5		6 7	4	8 9	5	10 11	6	4	7	5	4 8		9	6	5 10
2																					
3		4																			
4		5 6																			
5	4	7 8																			
6	5	9 10																			
7	6	4 11																			
8	7																				
9	4 8																				
10	9																				
11	5 10	4																			
12	11																				

SET NO.	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
1	4 7	11		4 6	8		9	7	4	5	6 10	4 8	11		5 7	6 9				10

Many irrigators prefer to move siphon tubes to every other furrow at each change of irrigation set. This alternate row method provides water to at least one side of a crop row or bed in approximately one half the interval compared to moving the siphons one furrow at each set.

This plan shows what furrows should receive water for a particular rotation for the most satisfactory interval between irrigations.

Where * appears, all rotations will have water in this furrow.

Set furrows where the rotation wanted appears under thr furrow number.

Start a new sequence when the rotation wanted appears under furrow 0 or 1.

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SET NO.	FURROW NUMBER																																												
	0	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	33	34	35	36	37	38	39	40				
	*					4		6	4	8	5	10	6	4	7	5	4		9	6	5	4	11		4	8		9	7	4	5	6	4	11			5	6							10		
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Rotation changes and what it does to the irrigation interval

When moving one furrow per set:

From an odd number of days between intervals to another odd day interval: an even to odd and an odd to even, a + (b - 1) will be the longest interval between irrigations on any furrow. Where: a equals the first rotation sequence interval and b equals the desired rotation interval

Example: when changing from a 3 to a 5 day sequence
3 + (5 - 1) = 7 days. This will be the longest period which any furrow will go without water.

Some furrows will receive water in a shorter period than the new interval, some the same interval, and others as long as a + (b - 1), the ratio will be:

1 furrow will receive water the next day or 1 - 1
2 furrows will receive water the 2nd day or 2 - 2
3 furrows will receive water the 3rd day or 3 - 3
etc. 3 - 4
3 - 5
2 - 6
1 - 7 (a + b - 1)

when changing from a to 2a:
one half of the furrows will go a days between irrigations and the other one half will be irrigated at a 2a interval

when changing from a 5 day interval to a 10 day interval, out of 10 furrows, 5 will be irrigated withing 5 days and the other 5 will get water within 10 days.

When following an alternate row sequence

The maximum number of days between irrigations of any furrow will still be a + (b - 1) regardless of whether you are going from an odd sequence to another odd, an odd to an even, or an even to an odd,

The ratio of the number of days between intervals is similar to every row irrigation but with minor differences. Examples:

when going from a 5 to a 7 day interval the ratio will be:

1 - 1
2 - 2
3 - 3
4 - 4
4 - 5
5 - 5
6 - 7
4 - 8
3 - 9
2 - 10
1 - 11 (a + b - 1)

when going from a 5 to an 8 day interval:

1	-	1	
2	-	2	
3	-	3	
5	-	4	
4	-	5	
5	-	6	
5	-	7	
6	-	8	
3	-	9	
3	-	10	
2	-	11	
1	-	12	a + (b - 1)

when going from an even to odd reduced interval example: 8 to 5, the ratio will be:

2	-	2	
3	-	3	
0	-	4	
5	-	5	
6	-	6	
0	-	7	
17	-	8	
0	-	9	
3	-	10	
2	-	11	
2	-	12	a + (b - 1)

when changing from an alternate row even sequence to another lower even sequence, example: from 8 to 4

4	-	2	
0	-	3	
8	-	4	
0	-	5	
6	-	6	
0	-	7	
8	-	8	
2	-	9	
4	-	10	(a + b - 2)

By following an alternate furrow system changes can be made to increase or decrease the irrigation frequency at will since water will be applied at least to one side of the furrow or bed in approximately one half the time of the longer sequence