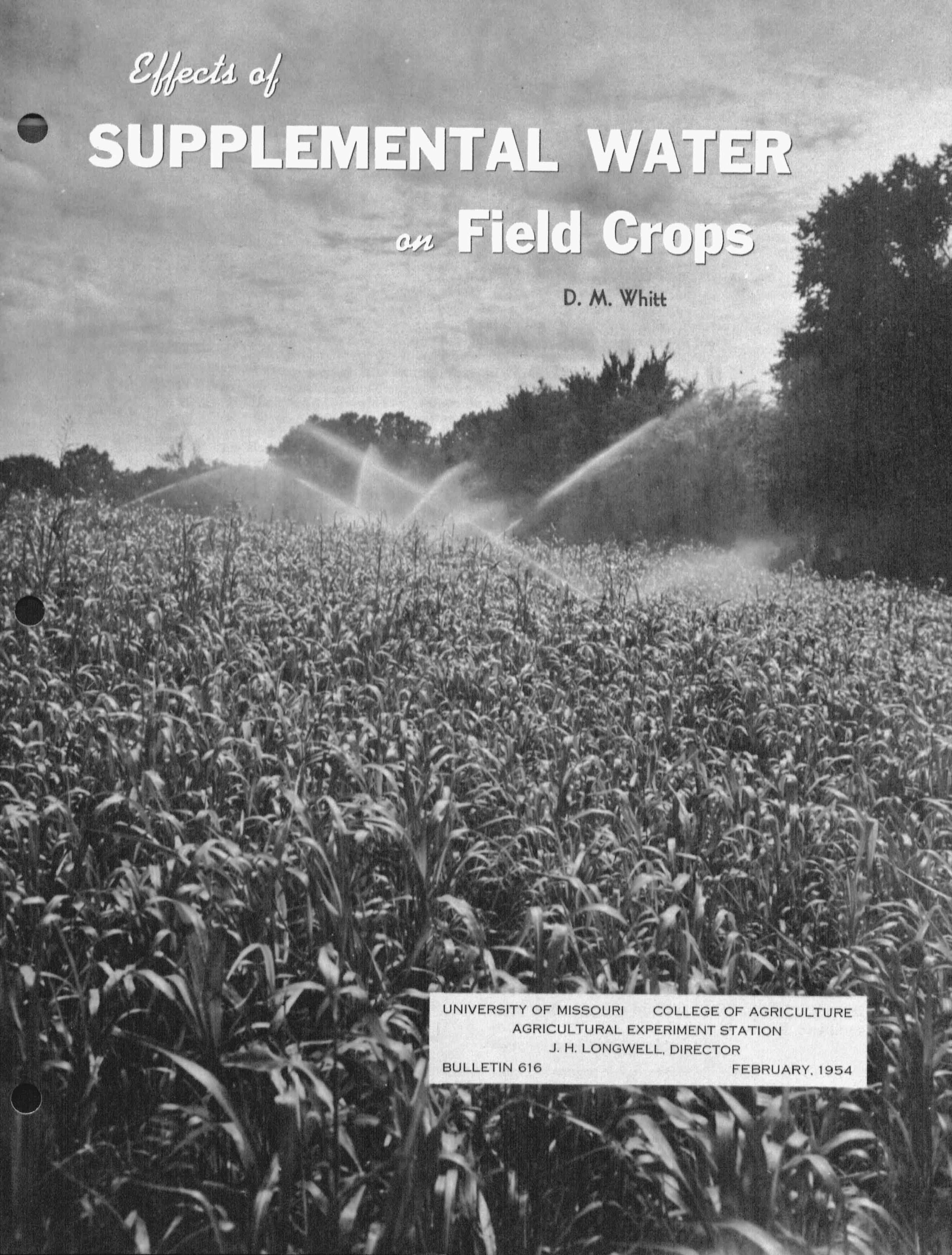
Effects of SUPPLEMENTAL WATER *on* Field Crops

D. M. Whitt



UNIVERSITY OF MISSOURI COLLEGE OF AGRICULTURE
AGRICULTURAL EXPERIMENT STATION
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SUMMARY

Corn yield at Campbell Field was raised from 34 bushels to 77 bushels per acre with three irrigations totaling 5.5 inches of water. Acre yield at McCredie Field was increased from 69 to 85 bushels of corn in one test and from 51 to 79 bushels in another comparison by one irrigation of approximately 2 inches.

Soybean yield at McCredie Field was raised from 17 bushels to 31 bushels per acre by one irrigation of 4.7 inches in late August. The beans from irrigated plots were 50 percent larger and their oil content was almost 11 percent higher, compared with beans from plots without extra water. Soybeans were damaged at Campbell Field by hot, dry winds in late July and August. Acre yield was only 10 bushels where 11 inches of water was applied, compared with 2 bushels without irrigation. Additional study is necessary to develop recommendations for irrigating soybeans.

Cotton yield was increased almost 1.5 bales per acre by 4 irrigations totaling 7.4 inches at Campbell Field. Staple length of the cotton was increased, and ginning percentage was decreased by irrigation. Extra water produced heavier bolls and a top crop which accounted for much of the yield difference.

Wheat, which grows in a more favorable part of the year from a water standpoint than the other crops under study, has not responded significantly to irrigation.

In addition to reporting 1953 work, this bulletin includes a summary of data covering the entire period of study, which began in 1948. The experimental plots are located in central Missouri near McCredie, Callaway County, and in southeast Missouri near Campbell, Dunklin County. Soil treatments were added to all plots according to soil tests so that plant nutrients would not be a limiting element in production.

Adapted seed with high yield and high quality breeding; plant nutrients in sufficient quantity; control of insects, diseases, and weeds; ample water; and good tillage and harvesting practices—all of these are necessary to obtain maximum yields of top quality crops with regularity.

Report on Department of Field Crops research project number 160, entitled "Cotton Research."

Effects of Supplemental Water on Field Crops[1]

D. M. Whitt[2]

INTRODUCTION

Dry weather during much of the growing season in 1953 focused attention on irrigation in most parts of Missouri. A survey by the Department of Field Crops showed that farmers in 67 counties of the State irrigated some kind of field crop during the year. Lower yields resulting from dry weather are observed easily in a year like 1953. But droughts of shorter duration have lowered yields at McCredie Field every year except 1951 since studies of irrigation were begun in 1948.

It is only natural that greater attention is given to water when there is too much or too little of it. But water must be looked upon as a major factor of production every year; one requiring as much attention as adapted seed; plant nutrients; control of insects, disease, and weeds; and good tillage and harvesting practices.

Studies of supplemental water were conducted at two locations in 1953. Corn, soybeans, and wheat were studied at the Midwest Claypan Experimental Field (McCredie Field) in Callaway county. Corn, cotton, and soybeans were under measurement at the University Horticultural Experimental Field (Campbell Field) in Dunklin County.

EXPERIMENTAL METHODS

Soil Description and Soil Treatments

McCredie Field. Soil on the McCredie Field is Mexico silt loam. A heavy, plastic clay layer underlies the surface soil at a depth of 12 to 14 inches. This soil was formerly referred to as Putnam silt loam, sloping phase, and is representative of about 5 million acres of claypan soils in the State. Results of tests made on surface soil samples from the plots when study began in 1948 are tabulated in Table 1.

TABLE 1 -- RESULTS OF SOIL TESTS McCREDIE FIELD PLOTS, 1948.

Horizon	Organic Matter	P_2O_5	K	Mg	Ca	Lime Requirement	pH
inches	%	lb.	lb.	lb.	lb.	lb.	
0 - 7	3.1	49	204	373	1370	5000	5.2

Basic soil treatments applied to the plots include 4 tons of lime, 1,000 pounds of rock phosphate, and 100 pounds of muriate of potash. Maintenance applications of potash are applied every 4 years in addition to that supplied in starter fertilizers. Each crop is planted with a starter fertilizer. Extra nitrogen is plowed down for corn. Wheat is topdressed with nitrogen in the early spring. Fertilizer applications made at planting time are given under the discussion for each crop.

Campbell Field. Soil on the Campbell Field is Lintonia fine sandy loam. As is true with many delta soils in Southeast Missouri, the soil is highly variable in texture within short spaces. Sandy loam soil can be found the full depth of a soil auger on some plots, while adjacent plots may have materially heavier soil at a depth of 2 feet. Damage to young seedlings by blowing sand is experienced on this soil in seasons of high wind and the effects of drought are more severe than on heavier soils of the delta area.

Results of tests made on samples from the plots at the beginning of study are tabulated in Table 2.

TABLE 2 -- RESULTS OF SOIL TESTS CAMPBELL FIELD PLOTS, 1953.

Horizon	Organic Matter	P_2O_5	K	Mg	Ca	Lime Requirement	pH
inches	%	lb.	lb.	lb.	lb.	lb.	
0 - 6	0.8	171	238	45	1500	4100	5.4
6 - 12	.4	67	171	59	1600	3800	5.7
12 - 24	.3	57	147	79	1500	3400	5.8

Soil Moisture Determinations; Irrigation Schedules

Soil moisture blocks were placed at 0.5-, 1-, 2-, and 3-foot depths under three irrigated plots and three unirrigated plots of each crop at the Campbell Field. Wire leads on the blocks could be attached to a moisture meter to read the available water at each depth. The meter is calibrated to read directly the percentage of available moisture in the soil. It does not measure total water content but only that portion of the soil moisture which is available to the plants. Readings were secured twice weekly.

[1]Missouri Agricultural Experiment Station and United States Department of Agriculture cooperating.

[2]Research associate, Department of Field Crops, University of Missouri; and soil conservationist, Soil and Water Conservation Research Branch, Agricultural Research Service, U. S. D. A. Acknowledgment is made to Dr. W. C. Etheridge, chairman of the Department of Field Crops, for his advice, encouragement, and supplies for these studies. This department was the first to promote irrigation of field crops in Missouri and has urged systematic research on the subject for many years.

Corn. Studies at the Nebraska Station show the needs of corn for water throughout the season. The soil should be adequately supplied with water at planting time. Afterward, the plant needs water most when it is laid-by, when it is tasseling, and when it is silking. The Nebraska studies show that irrigating after silking doesn't help much in increasing yield and that irrigations after the milk stage are worthless. The irrigation schedule for corn at Campbell Field was as follows.

Plots

A. No irrigation.
B. Irrigate same as C through June.
C. Irrigate when laid-by and at early tasseling if block at 1 foot is down to 50 percent available water or less. Irrigate at late silking if block at 2 feet is down to 50 percent available moisture or less.

Treatment designated "*B*" was included to insure a full stand of the crop for comparative purposes.

Moisture blocks were not installed under the corn at McCredie. A single irrigation was made at late silking-early filling, when inspection of plants and soil indicated moisture shortage.

Soybeans and Cotton. Soybeans and cotton at the Campbell Field were irrigated on the same schedule as follows:

Plots

A. No irrigation.
B. Irrigate same as *C* through June.
C. Irrigate when moisture block at 1 foot drops to 40 percent available water through July. Irrigate when block at 2 or 3 feet drops to 40 percent available water in August. Stop irrigation August 31.

Moisture blocks were not installed under soybeans at McCredie. A single irrigation was made during pod filling in August, when inspection of plants and soil indicated moisture shortage.

Wheat. Only 0.27 inch of rain fell in the fall of 1952 between September 1 and November 8. A single irrigation of 1.5 inches was applied on October 22.

Irrigation Methods

Irrigations at the Campbell Field were made with a portable sprinkler system and the water was pumped from a deep well. Furrow irrigations for corn and soybeans and sprinkler irrigations for wheat were used at the McCredie Field with water from a 16-acre lake.

All water treatments at Campbell Field were in randomized blocks with four replicates. The results reported from McCredie Field are averages of triplicate plots in soybeans, duplicate plots in rotation corn, six samples at random from single plots in continuous corn, and four samples at random from single plots in wheat.

EXPERIMENTAL RESULTS

Precipitation and Temperatures in 1953

In general, the amount and distribution of rainfall was more favorable to crop production at the McCredie Field than at the Campbell Field in 1953. Low rainfall at Campbell in June was accompanied by high temperatures, with 27 days registering 90 degrees or higher and 10 days having a maximum temperature of 100 degrees or more. Precipitation and temperature data for the year are tabulated in Table 3. Rainfall of less than 0.25 inch in any one day is omitted from the daily amounts but is included in monthly totals. These small amounts of rainfall are of little importance in supplying the needs of growing plants unless they come almost daily.

Corn

Campbell Field. Corn, (US 523W) was planted April 23, with 333 pounds of 3-12-12 fertilizer per acre. It was side-dressed May 26 with 148 pounds of 33.5-0-0 and again June 4 with 332 pounds 33.5-0-0, making a total nitrogen application of 171 pounds per acre. The stand was thinned to approximately 18,000 stalks per acre on all irrigated plots and on one-half of the unirrigated plots. The remaining unirrigated plots were thinned to approximately 10,000 stalks per acre.

Moisture block readings showed a need for irrigation at all three times outlined in the schedule and irrigations were made as follows:

Plant stage and date	B Plots	C Plots
Laid-by, June 9	2.48 inches	2.48 inches
Tasseling, June 25	1.54	1.54
Late silk, July 7	—	1.50
Total	4.02	5.52

Yield data are summarized in Table 4. Highest yield, 76.9 bushels per acre, resulted when three irrigations, totaling 5.52 inches, were applied at laying-by, at tasseling, and at silking time. Omitting the irrigation at silking time resulted in a 16.2 bushel reduction to 60.7 bushels per acre. The acre yield without irrigation was 34.2 bushels. On plots without irrigation, reducing the stand from 18,500 to 10,500 stalks per acre gave a slightly higher yield but the difference was not statistically significant.

The average size of ears varied widely. Unirrigated corn had ears which weighed an average of 0.15 pound. Ears grown on plots receiving three irrigations averaged 0.30 pound, while those produced on plots without the irrigation at silking time averaged 0.26 pound each. There was not a significant difference in protein content of the corn from any of the plots.

Corn was damaged on all plots by corn borers and corn ear worms. Estimates of yield reduction made

TABLE 3 -- PRECIPITATION AND TEMPERATURE AT CAMPBELL AND McCREDIE IN 1953.

Month	Total Precipitation (inches)	Date and amount of effective rainfall	Daily Average maximum Temp. (°F)	Number of days 90°F or higher	Number of days 100°F or higher
		(Campbell Field)			
Jan.	3.06				
Feb.	2.58				
Mar.	8.18				
Apr.	3.58				
May	3.15	4: .34; 11: .42; 14: .33; 16: .69; 17: .52; 18: .43	80.2	7	0
June	.88	22: .38; 27: .50	96.2	27	10
July	2.62	3: .55; 8: .81; 16: .62; 20: .45	92.2	19	0
Aug.	.43	22: .28	92.9	22	3
Sept.	.03		87.0	12	2
		(McCredie Field)			
Jan.	1.42				
Feb.	1.01				
Mar.	3.60				
Apr.	2.95				
May	3.74	4-6: 1.35; 15-17: 1.21; 22: 1.04	75.1	5	0
June	3.50	6: .37; 13-14: 1.33; 25-26: 1.80	92.5	21	4
July	1.96	4: 1.58	92.7	22	6
Aug.	2.14	4: 1.93	91.9	19	4
Sept.	2.38	3-4: 1.88; 18: .50	89.3	14	5

Note: Rainfall of less than .25 inch in any one day is omitted from daily amounts but is included in monthly totals. These small amounts of rainfall are of little importance in supplying the needs of growing plants unless they occur almost daily.

TABLE 4 -- EFFECT OF IRRIGATION ON CORN YIELD, EAR WEIGHT, PROTEIN AND SHELLING PERCENTAGE, CAMPBELL FIELD, 1953.

Plots	Irrigation	Stalks per acre	Ears per acre	Yield per acre	Ear weight average	Shelling percentage	Protein
	inches			bushels	pound	%	%
A[1]	None	10,500	10,000	40.0	.26	77.8	11.2
A	None	18,500	14,300	34.2	.15	77.7	11.1
B	4.02	17,900	15,900	60.7	.26	79.3	10.7
C	5.52	18,200	17,800	76.9	.30	79.3	10.1
L.S.D. 1%*				52.2	.21	4.9	2.1
L.S.D. 5%*				36.4	.14	3.5	1.4

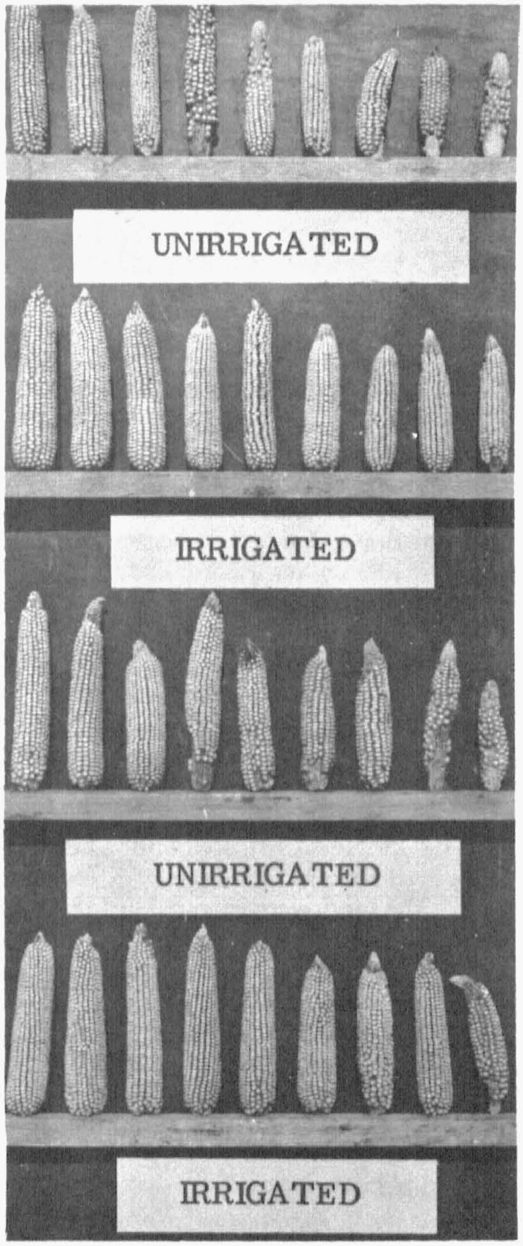
*The values entered opposite these terms show the difference required for statistical significance at the 1 percent and 5 percent levels, respectively.

TABLE 5 -- EFFECT OF IRRIGATION ON CORN YIELD, EAR WEIGHT, PROTEIN, AND SHELLING PERCENTAGE OF CORN GROWN ANNUALLY, McCREDIE FIELD, 1953.

Plots	Irrigation	Stalks per acre	Ears per acre	Yield per acre	Ear weight average	Shelling percentage	Protein
	inches			bushels	pound	%	%
A	None	14,400	12,400	68.6	.38	78.7	10.8
C	2.00	13,200	12,400	84.6	.47	80.0	10.6
L.S.D. 1%				14.6	.09		.6
L.S.D. 5%				10.3	.06		.5

TABLE 6 -- EFFECT OF IRRIGATION ON CORN YIELD, EAR WEIGHT, PROTEIN, AND SHELLING PERCENTAGE OF CORN GROWN IN ROTATION, McCREDIE FIELD, 1953.

Plots	Irrigation	Stalks per acre	Ears per acre	Yield per acre	Ear weight average	Shelling percentage	Protein
	inches			bushels	pound	%	%
A	None	16,400	11,600	51.3	.30	74.3	11.9
C	1.83	16,100	12,500	79.0	.43	79.5	11.3
L.S.D. 1%				13.5	.07	3.7	.4
L.S.D. 5%				9.5	.05	2.6	.3



Adequate plant nutrients and ample water are required for high yields of good quality corn. At the McCredie Field in 1953, average weight of ears was .43 pound under irrigation and .30 pound without extra water.

by the University survey entomologist were 10.5 percent for irrigated plots and 8.25 percent where no water was applied. Corn on the experimental plots was the only corn in an extensive acreage farmed largely in cotton, soybeans, and horticultural crops.

McCredie Field. Corn grown in rotation and corn grown continuously have been under irrigation study at McCredie since 1948. This year US 13 hybrid corn was planted on all plots May 12 with 340 pounds of 3-12-12 fertilizer. A poor stand was obtained on the rotation plots. They were replanted June 1 with 285 pounds of 3-12-12 per acre. Ammonium nitrate and 96 pounds per acre of 0-0-60 were applied ahead of corn on all plots. Total nitrogen application was 152 pounds per acre on the rotation plots and 173 pounds on the continuous corn plots.

Corn at this location was fairly well supplied with moisture in June and early July. It was not until late silking that soil moisture became critical. An irrigation of 1.83 inches was applied to the rotation plots July 28 and 2.00 inches was applied to continuous corn July 29. As seen in Tables 5 and 6, yields were increased substantially by this single irrigation. The quality of ear corn also was higher under irrigation as indicated by ear weights and shelling percentage. Protein content of shelled corn was slightly higher on unirrigated than on irrigated plots.

In contrast with former years, corn in the McCredie plots was irrigated only when the soil moisture level appeared critical in 1953. From 1948 through 1952, the plots were irrigated in July and August on a schedule attempting to supply approximately 2 inches of water every two weeks from rainfall and irrigation. Rainfall in 1951 was adequate and well distributed and no plots were irrigated that year.

Corn in rotation during this period, 1948-1952, averaged 85.4 bushels per acre annually without irrigation, compared with 110.2 bushels under supplemental irrigation. An average of 3.50 inches of water was applied each year.

Corn on the continuous corn plots yielded 84.9 bushels per acre annually without irrigation and 108 bushels with an average of 3.66 inches of extra water. These averages are based on three years of data and are not comparable with those from the rotation corn plots which cover a four-year period. Corn on the continuous plots was not irrigated in 1948 when a 1.20-inch rain occurred during the night after the rotation plots were irrigated. The continuous plots had been scheduled for irrigation the next day.

Soybeans

Campbell Field. Ogden soybeans were planted June 1 in 38-inch rows with 271 pounds per acre of 3-12-12 fertilizer. An uneven stand was secured on all plots because the surface two to three inches of this sandy soil was too dry to germinate the seed. A 1-inch irrigation was made June 13 to hasten germination. A good stand resulted on the plots which received this irrigation, but the stand was extremely spotted on the unirrigated plots.

Moisture block readings showed a need for water five times in July and August according to the schedule. Irrigations were made as follows:

Date	B Plots	C Plots
June 13	1.02 inches	1.02 inches
July 17	—	1.83
30	—	2.05
Aug. 12	—	2.00
22	—	2.05
29	—	2.05
Total	1.02	11.00

All beans were damaged by hot, dry winds in late July and August and yields were low on all plots, as seen in Table 7. Beans, which were given a single irrigation June 13 to germinate them produced 2.1 bushels per acre. Unirrigated soybeans yielded 3.5 bushels per acre. There is the suggestion here that irrigations in the early part of the season are of no

A 2-inch irrigation at late silking increased corn yield from 69 bushels (left cage) to 85 bushels per acre (right cage) at the McCredie Field in 1953. Moisture was adequate earlier in the year.

Fifty percent more soybeans were required to weigh a pound from the unirrigated plots (right) than from the irrigated plots (left) at the McCredie Field in 1953.

value in producing beans unless adequate water is available later. This single irrigation produced a better stand and more forage per acre than rainfall alone. In so doing, however, soil moisture was depleted at the time of pod setting and filling. This resulted in depressing the yield below that secured without irrigation.

TABLE 7 -- EFFECT OF IRRIGATION ON SOYBEAN YIELD, CAMPBELL FIELD, 1953.

Plots	Irrigation	Yield per acre
	inches	bushels
A	None	3.5
B	1.02	2.1
C	11.00	9.8
L.S.D. 1%		4.6
L.S.D. 5%		3.2

Irrigation was stopped the last of August to avoid delaying maturity, but inspection of the beans and checks on available soil moisture in mid-September showed definite water need. There were numerous pods with small, immature beans that would have developed if water had been supplied.

McCredie Field. Soybean yield was almost doubled by one irrigation at the McCredie Field in 1953. Lincoln soybeans, in a 4-year rotation of corn-soybeans-wheat-meadow, were planted in 21-inch rows on May 21 with 195 pounds per acre of 0-20-20 starter fertilizer. A poor, uneven stand was secured and all plots were reworked and replanted June 5 with 228 pounds of 3-12-12 fertilizer.

A good stand resulted and growth and development were excellent. It was not until pod filling in mid-August that soil moisture became critical. A single irrigation of 4.70 inches was applied August 21. There was much leaf shedding on the unirrigated plots in late August and early September. Average acre yield from the irrigated plots was 30.6 bushels, compared with 16.6 bushels without supplemental water.

Irrigation also affected the size, quality, and composition of the beans. Fifty percent more beans were required to weigh a pound from the unirrigated plots than from the irrigated plots. The quality of the seed was slightly higher under irrigation.

From the processor's point of view, irrigation produced superior beans. There was not a significant difference in amount of protein, but the oil content was almost 11 percent higher in the beans which were irrigated. The percentage of acetone insolubles is a rough measure of the refiner's loss in refining the oil. The amount was more than three times as great in the unirrigated beans. Irrigation delayed maturity approximately 3 days. The yields and other data on soybeans are tabulated in Table 8.

Soybeans did not respond to irrigation at the McCredie Field in 1949 and 1950, when corn showed yield increases of more than 20 percent from irrigation.

Cotton yield was increased almost 1.5 bales per acre in 1953 by supplying ample water until September 1. Note the larger plant and greater number of bolls on the irrigated plant (right) at the time of first picking.

TABLE 8 -- EFFECT OF IRRIGATION ON YIELD, SIZE, QUALITY, AND COMPOSITION OF SOYBEANS, McCREDIE FIELD, 1953.[1]

Plots	Irrigation	Acre Yield	Quality Number	Beans per pound	Protein	Oil	Acetone Insolubles(3)
	inches	bushels	(2)	number	%	%	%
A	None	16.6	2.5	4493	40.1	20.3	1.39
C	4.70	30.6	2.1	2993	38.3	22.5	.45
L.S.D. 1%		4.2	0.5	419	3.6	1.0	1.20
L.S.D. 5%		2.5	.3	252	2.2	.6	.72

[1] All determinations except yield courtesy of J. L. Cartter, Director, U. S. Regional Soybean Laboratory, Urbana, Illinois.
[2] Quality of seed. Scale of rating 1 to 5, with 1 very good and 5 very poor.
[3] This is a rough measure of loss in refining the oil.

This substantiates many observations that soybeans are more drought resistant than corn. Workers at the Arkansas station have observed that soybeans appear to enter a resting period during dry weather. If the period is short, they resume development, damage is slight, and yields are not affected. Additional studies will be needed to develop irrigation recommendations for soybeans.

Cotton

Campbell Field. D. P. L.—Fox cotton was planted April 25 with 268 pounds per acre of 3-12-12 fertilizer. Two side dressings of nitrogen were made at cultivations as follows: May 25, 144 pounds of ammonium sulfate per acre; and June 4, 91 pounds of ammonium nitrate per acre. In all, the cotton received 69 pounds of actual nitrogen per acre.

Irrigation was not required in June; hence there were eight unirrigated plots and four irrigated plots under measurement. Irrigations were applied as follows:

Date	C Plots
July 7	1.44 inches
27	1.97
Aug. 10	1.97
15	2.05
Total	7.43

Yield data are tabulated in Table 9. The first picking was made September 9 when the irrigated cotton yielded 1,530 pounds of seed cotton per acre compared with 1,343 pounds without extra water. This was 95 percent of the crop on unirrigated plots but only 44 percent of the crop under irrigation. The second picking was made October 8. This completed harvest on unirrigated plots, with 71 pounds of seed cotton per acre being picked. Irrigated cotton yielded 1,805 pounds of seed cotton per acre from the second picking, which was 52 percent of the total season yield. Final picking was made October 20 when irrigated cotton picked-out 123 pounds of seed cotton per acre. Weather was ideal for harvest throughout the fall and early winter.

TABLE 9 -- EFFECT OF IRRIGATION ON COTTON YIELD, CAMPBELL FIELD, 1953.

Plots	Irrigation	Yield of Seed Cotton per Acre: Sept. 9	Oct. 8	Oct. 20	Total
	inches	pounds	pounds	pounds	pounds
A	None	1343	71	0	1414
C	7.43	1530	1805	123	3458
L.S.D. 1%					514

Cotton reacts to conditions of moisture stress by shedding leaves, flowers, squares, and bolls. Some evidence of this is given in results of boll counts up until the time of first picking. The same average number of bolls, 30 per plant, was produced with and without irrigation. Of this number, an average of 11.7 bolls were shed by each irrigated plant, compared with an average of 20.0 shed by the unirrigated plants. Irrigated cotton produced and matured many additional bolls after this date, but few new bolls developed on the unirrigated plots after the first picking.

TABLE 10 -- EFFECT OF IRRIGATION ON COTTON BOLL PRODUCTION, BOLL DROPPING, AND BOLL WEIGHT AT TIME OF FIRST PICKING, SEPTEMBER 9, CAMPBELL FIELD, 1953.

Irrigation	Plants per acre	Bolls per plant	Bolls dropped per plant prior to Sept. 9	Bolls required per pound of seed cotton
inches				
None	16,200	9.7	20.0	112*
7.43	15,100	17.5	11.7	70

*This value appears large, but the data have been rechecked and the value confirmed. This cotton was grown on a very sandy soil in an unusually dry season which accounts for the low boll weight.

Irrigated cotton produced 60 percent heavier bolls at the first picking than unirrigated cotton. Seventy bolls were required to make a pound of seed cotton under irrigation, compared with 112 bolls where no water was applied. Tests on samples of seed cotton showed longer staple length and lower percentage of lint in the irrigated cotton than in that not receiving supplemental water. These data are summarized in Tables 10 and 11.

TABLE 11 -- EFFECT OF IRRIGATION ON PERCENTAGE OF LINT AND STAPLE LENGTH OF COTTON, CAMPBELL FIELD, 1953.

Irrigation	Percentage of lint*: Sept. 9	Oct. 8	Oct. 20	Weighted Average	Staple Length: Sept. 9	Oct. 8
inches	%	%	%	%	1/32 inch	1/32 inch
None	39.0	37.8	----	38.9	31.4	30.0
7.43	38.4	34.6	37.5	36.5	32.5	31.8
L.S.D. 1%	1.2	2.4		.9	2.2	1.0
L.S.D. 5%	0.8	1.7		.6	1.5	0.7

*Percentage of lint on unirrigated cotton was higher than that on irrigated cotton as a result of the much smaller seed on the unirrigated plots.

Wheat

McCredie Field. Wheat is grown in a rotation of corn-soybeans-wheat-meadow on the irrigation study plots. Vigo wheat was drilled September 26, 1952, with 175 pounds of 0-20-20 and 75 pounds of 33.5-0-0 per acre. Only 0.62 inch of rain fell between September 1 and November 17. A 1.5-inch irrigation was applied on one wheat plot October 22. A week later, irrigated wheat was sprouted but not through the surface. Unirrigated wheat had not germinated.

Observation on November 28 showed a good stand of wheat 2 to 3 inches tall on the irrigated plot, compared with a thin stand ¼ to 1 inch tall on the unirrigated plot. By April 30, 1953, there was practically no difference in growth and density of wheat on the two plots, and there was an excellent stand of young grass which was seeded with the wheat on both plots.

Acre yield without irrigation was 51.6 bushels, compared with 53.9 bushels with the single irrigation. This yield difference of 2.3 bushels per acre is not significant at the 5 percent level. A yield of 51.6 bushels is the highest ever recorded on these plots with or without irrigation until this year.

Wheat was irrigated in the fall of 1950 when no rain fell between October 7 and November 7. Yield was increased from 22.8 bushels to 26.0 bushels per acre by a 1.95-inch irrigation applied October 25. Grasses were seeded with wheat and were well established on the irrigated plot in the fall of 1950. Reseeding was necessary on the unirrigated plot the following spring, when legumes were seeded on both plots. The grass continued superior on the irrigated plot and yields the following year were 1.63 tons per acre where water was applied, compared with 0.9 ton where the wheat and grass seeding had not been irrigated.