A STUDY OF THE EFFECT OF THREE LINSEED OIL EMULSIONS ON SEEDLING EMERGENCE AND YIELD OF CERTAIN CROPS

By

RAYMOND E. CAMPBELL

Bachelor of Science

Oklahoma State University

Stillwater, Oklahoma

1963

Submitted to the faculty of the Graduate College
of the Oklahoma State University
in partial fulfillment of the requirements
for the degree of
MASTER OF SCIENCE
July, 1966

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Thesis Approved:

W. R. Kays
Thesis Adviser

J. A. Romshe

Dean of the Graduate College

ACKNOWLEDGMENTS

The author wishes to express his appreciation to all who assisted, advised, or otherwise aided in the completion of this research and thesis.

Indebtedness is especially expressed to Professor W. R. Kays, Head, Department of Horticulture, for his encouragement and cooperation during the entire study.

Special appreciation goes to all members of the Horticulture Department staff who graciously contributed their time and energies.

Acknowledgment is due Jack Marshall, Superintendent, Vegetable Research Station, and Charles Galeotti, Superintendent, Irrigation Research Station, for their assistance in setting up the experiment and collecting data.

Acknowledgment is also due the Northern Utilization and Research Division of the United States Department of Agriculture, Peoria, Illinois, for furnishing materials and funds for the research.

Sincere thanks and gratitude is expressed to my wife, Jo, for her encouragement, assistance and patience during this study.

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CHAPTER I

INTRODUCTION

The primary goal of any crop producer is to obtain a high quality saleable product as quickly and as economically as possible.

With the continuing increase in national population each year it is evident that the producer must also achieve greater yields on the same, or in many cases, less land area.

In the case of the vegetable producer, whose main farming operation is on a very intensive scale, these aims become even more significant. If the crop can be harvested even a few days earlier than that of his competitor, this may be the difference between profit and loss.

The importance of research in vegetable production was recognized as early as 1928 by research workers such as Jones and Rosa (7) who stated:

> Vegetable production will become increasingly important in the United States when compared to other fields of agriculture as the country becomes more densely populated. We are no longer able to increase production by merely expanding and occupying new areas of virgin soil. In the future, increased production will be obtained by the growing of crops more intensively, as is now being done in many of the European and Asiatic countries. The period of lethargy and passiveness regarding the problems of the vegetable industry is almost at its end. There is now becoming evident an increased activity in the various fields of research on vegetable crops.

It is apparent that this prediction is becoming a reality as vegetable growers are now looking for methods to produce seven tons of spinach per acre rather than the two tons produced ten years ago and three

thousand dozen bunches of onions per acre rather than one thousand dozen per acre.

Improvement, for the most part, has come through the adoption of better production practices. Soil and climatic factors have to be considered very carefully so the plant is provided an environment most conducive to optimum growth.

The rapid advancements that have recently been made in cultural techniques have allowed for substantially increased production. Further increase in production by the manipulation of environmental or genetic factors is needed.

Many attempts have been made to induce earliness and increase yields of crops by improving the chemical and physical condition of the soil.

Several of these attempts are represented as horticultural practices such as the use of concentrate fertilizer materials, improved cultivation methods, use of various mulching materials and erosion control practices. These practices have been highly successful and are of major benefit to the vegetable industry.

These experiments were designed to study the effect of three linseed oil-water emulsion sprays applied on the soil surface at different rates as an aid to increase soil stabilization, water penetration, seedling emergence, and yield of certain crops.

CHAPTER II

REVIEW OF LITERATURE

The time and method of planting seeds of a particular species will determine to a considerable extent the success or failure of the attendant crop. Adequate and proper preparation of the seed bed as well as environmental factors may have a most important effect upon seed germination, seedling emergence, and ultimate yield.

Cultivation of soil is a well established practice and the benefits are well known. There are many misconceptions as to the reasons for the benefits derived from this practice. Cultivation is an expensive and time consuming process. Practices which might be employed to decrease the need for this crop production practice should find a ready place in current agricultural practices.

Roberts and Bunch (11) point out that although the amount of rainfall cannot be increased, it can be utilized more effectively by providing increased water penetration in the soil.

One of the benefits claimed for cultivation is the increased water penetration and conservation of moisture due to the formation of a soil mulch. At one time the usual explanation of this was that the mulch decreased or stopped capillary flow and thus slowed water movement to the surface, since moisture would then be moved by diffusion. More recently, experimental data have shown that in semi-arid regions, drying of the surface after a rain or after irrigation is so rapid that forming a mulch

by cultivation is of little or no value (16). Cultivation may conserve moisture by reducing surface runoff.

Thompson and Kelly (16) stated that cultivation of the soil increases the absorption and retention of heat. Bouyoucos (4), on the other hand, found that uncultivated (but scraped) Michigan sandy-loam soil at depths of 3, 6, 7, and 20 inches averaged higher in temperatures than did cultivated soil.

Thompson and Kelly (16) reported that on a sandy-loam soil near Ithaca, New York, the temperature of the soil at depths of 3 and 5 inches was higher on scraped plots than on comparable cultivated plots. Thompson felt that the compactness of the uncultivated soil probably accounts for the higher temperature.

It was suggested by Bouyoucos (4) that the dry layer of loose soil forms imperfect connections with the subsoil and that not all of the heat energy which it receives from the sun is conducted downward, but rather that a large amount accumulates in the surface layer of the soil mulch and that some of the accumulated heat is radiated to the atmosphere.

Where earliness of a crop is important the first planting is made as early as soil and weather conditions become satisfactory (16). Under such conditions it may be feasible to supply a material that will contribute to an increase in soil temperature and/or allow for a more rapid entry of water into the soil.

Torfason and Nonnecke in 1954 (17) found that germination of sweet corn seed was seriously inhibited by low soil temperature, poor aeration, and by compacted soil.

In 1926 it was observed by Kotowski (8) that the speed of germination for several vegetable crop species increased as the soil

temperature increased. There also was a more rapid elongation of the hypocotyl.

Some of the more common reasons for poor plant stands, other than poor seed, are crusting of the soil prior to seedling emergence and cool temperatures. These may delay germination so that pathological organisms in the soil have time to damage or destroy the developing seedlings. Wiggans and Kays (19) suggested that it may be feasible to apply liquid stabilizer mulch materials to the soil surface to aid in the establishment of certain small seeded crops. The treatment materials appeared to aid emergence of the seedlings which ultimately resulted in a better plant stand with subsequent increased yields.

Herbicides were recommended to be used with the mulch material to control weeds. This was necessary due to the general plant growth increase caused by the mulches.

Thompson and Platenius (15) in 1931 showed that the use of a paper mulch resulted in increased yields of many crops and also aided in hastening maturity. Although the paper eliminated crusting and weeds in the covered area and also cut down on cultivation, this was largely offset by the cost of the paper and the labor required for applying it.

Recently, several types of synthetic and natural materials have been applied to the soil surface to aid in seedling emergence and yield. Among these materials, petroleum mulch appears to have many characteristics which may be of value in vegetable production.

Workers, in California, in 1963 and 1964 (13, 14) found that petroleum mulches and clear polyethylene films at band widths of six inches were effective in increasing soil temperature. During the daylight hours there was an increase in temperature at a depth of six inches and some

of this added heat was retained during the night. Increases in soil temperature with black polyethylene film mulch were found to be less than with either petroleum mulch or clear polyethylene film mulch during the day, but the black polyethylene treated plots retained more soil heat during the night.

In Arizona and California research (1) it was shown that when a specially formulated water emulsion of petroleum resins (termed "Encap" and manufactured by Armour Agriculture Chemicals) was applied to the soil there was an increase of 10 to 20 degrees in soil temperature over that of non-treated soil. There was, in addition, a noticeable increase in the water retention capacity of the soil along with protection of the seedbed from excessive packing and erosion by rain and wind.

Initial emergence of seedlings of corn, onion, beet, and summer squash was hastened with petroleum mulch applications and the initial stand was significantly greater than with non-mulched soils in all species except squash and corn (14).

At the same time, Takatori (14) observed a significant increase in early yield of corn, squash, and cucumber and in total yield of cantaloupe and squash.

The per cent increase in initial germination for all crops treated with the petroleum mulch may suggest that in addition to temperature increase, other environmental factors such as soil crusting, soil moisture, etc., that affect germination were favorably altered, according to Takatori (14).

Low rainfall and high evaporation rate at certain seasons of the year is rather common in much of the Southwest. High and rapid evaporation from a wet soil surface results in surface crusting and unfavorable

conditions for seed germination and emergence. Army and Hudspeth (2) showed that the microclimate of the seed zone can be favorably altered to hasten germination of certain grass plants by application of mulching materials that reduce erosion and crusting, but still allow for light penetration.

CHAPTER III

MATERIALS AND METHODS

Three linseed oil emulsions[1] were used to study their effect on seedling emergence and growth.

Each emulsion as received was a formulated mixture containing by volume, one-half linseed oil and one-half water. In addition an emulsifying agent had been added in order that the oil and water mixture formed a stable emulsion. At the time of application each emulsion was diluted with equal volumes of water so that the actual treatment material contained three-fourths water and one-fourth linseed oil.

Emulsion I was boiled linseed oil, experimental number: 6325-39-2. Emulsion II was a mixture of 70% boiled linseed oil and 30% bodied linseed oil, experimental number: 6779-49-1. Emulsion III contained 70% raw linseed oil and 30% bodied linseed oil, experimental number: 6779-50-1. All of the emulsion materials were supplied by the Northern Utilization and Research Laboratory of the USDA, Peoria, Illinois.

The tests were conducted at two locations in Oklahoma: The Vegetable Research Station, Bixby, Oklahoma, in the spring and fall of 1965; and the Irrigation Research Station, Lone Wolf, Oklahoma, in the spring of 1965. These locations were chosen so that a comparison could be made

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[1]Hereafter in this paper these emulsions will be referred to as emulsion I, emulsion II, and emulsion III.

between different soil types, soil topography, and under different rainfall and climatic conditions.

The crops under study at each location were carrot (variety, Royal Chantenay); leaf lettuce (variety, Grand Rapids H-8); spinach (Hybrid 424); bunching onion (variety, Crystal Wax); snapbean (variety, Top Crop); and soybean (variety, Hood). Mustard (variety, Florida Broadleaf) was substituted for carrots in the fall trials at Bixby. A uniform seed source for all tests was secured from a commercial seed dealer in Bixby.

Three emulsions at five rates of application plus non-treated check plots were used on each crop. Each treatment rate was replicated four times making a total of 450 individual plots. Each plot contained one row of crop and was ten feet long.

The treatment rates for each emulsion and on all crops were 6, 12, 25, 37, and 50 milliliters per square foot. Hereafter these treatments will be referred to as A, B, C, D, and E respectively with the check plots being designated by "Ck".

Due to a poor stand of carrots at the Vegetable Research Station in the spring trial, this crop was eliminated from the test. This was attributed to an unusually hard rain the night following seeding. In the fall trial at Bixby, mustard was substituted for carrots. Soybeans were eliminated from the tests at the Irrigation Research Station due to excessive infestations of puncture vine (Tribulus terrestris).

A. Research at the Vegetable Research Station, Bixby, Oklahoma

These studies were conducted at the Vegetable Research Station, Bixby, Oklahoma, in the spring and fall of 1965 on a Reinach silt loam soil.

Part A-1: This portion of the experiment was initiated on April 13, 1965. A suitable seedbed was prepared by cross discing the area to be planted, harrowing, leveling with a land float, followed by re-harrowing. A complete fertilizer (10-20-10) was applied in a band application at the rate of 300 pounds per acre prior to seeding. Onions at the rate of five pounds per acre, carrots at two pounds per acre, leaf lettuce at one pound per acre and spinach at twenty pounds per acre were seeded in 20 inch rows with an Allis Chalmers "G"-tractor equipped with two units of a plate type Planet Jr. planter.

A herbicide DCPA ("Dacthal") was applied as a pre-emergence application at the rate of six pounds active ingredient per acre.

The emulsions containing one fourth linseed oil and three fourths water were applied at the rate of 6, 12, 25, 37, and 50 milliliters per square foot in a twelve inch wide band directly over the row. The material was applied under approximately 40 pounds per square inch delivery pressure with a portable Hudson "Climax" sprayer equipped with a "Tee Jet" nozzle, number 6504.

As stated previously, a very hard rain fell the night following the application of the linseed oil emulsions to Part A-1. This probably contributed to excessive packing of the soil particles in addition to some erosion of the emulsion layer. As a result of this, a precise measurement of seedling emergence and moisture penetration was difficult to achieve. This, no doubt, contributed to a poor stand of carrots which led to their elimination from the test.

Throughout the season, the plots were irrigated as needed.

Part A-2: These tests were initiated on May 13, 1965. Crops under study were snapbeans and soybeans seeded at 45 pounds per acre.

Soil preparation, treatment rates, and method of application of the emulsion sprays were similar to those in the tests conducted under A-1 with the exception of space between rows being 40 rather than 20 inches.

Temperature readings were recorded on each treatment of the A-2 plots by means of a bulb type soil thermometer. These readings were taken at 1:00 p.m. on May 18 and 19 at the soil surface and at one inch below the surface.

Part A-3: These tests were initiated on September 25, 1965. Plots of lettuce, spinach, and onions were seeded at the same rate per acre as in Part A-1 while mustard was seeded at the rate of three pounds per acre. Soil preparation, treatment rates and method of application of materials were like those of previous tests.

Seedling counts were made in Part A-3 as an indication of emergence rate and total emergence. This was accomplished by counting the number of seedlings in three lineal feet of row located at random in each replicate. The counts were made 12 days following planting.

B. Research at the Irrigation Research Station, Lone Wolf, Oklahoma

These tests were conducted on an Enterprise very fine sandy loam soil at the Irrigation Research Station near Lone Wolf in Southwestern Oklahoma in the spring of 1965.

The area selected for the tests had been in alfalfa during the previous five years. It was plowed, disked, and harrowed in late March. A complete fertilizer (10-20-10) was applied in bands at the rate of 300 pounds per acre at planting time.

Part B-1: These tests were initiated on April 13, 1965. The rows were three and one-half feet apart. Each plot consisted of one crop row

and was ten feet long. Snapbeans, at the rate of 45 pounds per acre, lettuce at one pound per acre, onions at five pounds per acre, and spinach, at twenty pounds per acre were seeded and the plots treated with the three linseed oil emulsions. The procedure for treatment was the same as that previously described in Part A.

Because of the excessive foulness of weeds and grasses (namely puncture vine, Tribulus terristris) which occurred before the seeded crops emerged, it was necessary to spray the treated area in the row with gasoline as a contact herbicide. The rows were then treated with CEDC (Vegadex), a pre-emergence herbicide, at the rate of four pounds of active ingredient per acre to control grass and weeds. This treatment was not effective in controlling the weeds, but was rather phytotoxic to the germinating lettuce and carrots. These crops were re-planted at a later date (see Part B-2).

Part B-2: These tests were initiated May 1, 1965. Soybeans at 45 pounds per acre were planted and treated in the same way as in previous tests. At this time carrots and lettuce were also replanted and treated.

A spray treatment of DCPA (Dacthal) was applied at the rate of six pounds of active ingredient per acre. This was ineffective in the control of weeds and grasses. During the growing season it was necessary to spray the weeds with gasoline as a contact herbicide on two occasions. This was done on calm days and care was taken to avoid injury to the seeded crop.

There was a reasonably satisfactory stand of all seeded crops at the end of the test except soybeans. The gasoline was highly toxic to this crop so it was eliminated from the trials.

C. Water Penetration Studies

Water penetration studies were made at intervals throughout the test period in each treatment rate with the three emulsion materials and the check plots. This was accomplished by placing a metal cylinder at random locations on the surface of the plots. Five hundred milliliters of water was allowed to flow into the cylinder, and the time required for the water to soak into the soil was recorded. Due to the fact that soil moisture and soil compactness were extremely variable, this test was repeated in the Horticulture greenhouses at Oklahoma State University.

For this test, galvanized metal cylinders, eighteen inches tall with a six inch inside diameter, were used. One end of the cylinder was covered with very fine screen wire to hold the soil in the cylinder and still allow for drainage. The soil for these tests was obtained from the test area on the Vegetable Research Station. It was screened through a one-fourth inch mesh screen and packed uniformly in each cylinder to a depth of fourteen inches. This was accomplished by placing a one quart measure of dry soil in the cylinder at a time and tapping the outside of the cylinder with a hammer fifty times between each measure of soil until the cylinder was filled to the desired depth.

The soil surface was treated with each of the linseed oil emulsions at the rate of 6, 12, 25, 37, and 50 milliliters per square foot by means of an electric atomizer sprayer.

At 7, 21, and 42 days following treatment, 500 milliliters of water was applied to the surface of the soil in each cylinder and the time required for water absorption was recorded.

A sheet of moisture proof saran wrap was placed over the top of each cylinder between waterings to decrease evaporational loss and major soil shrinkage.

CHAPTER IV

EXPERIMENTAL RESULTS

Three linseed oil emulsion materials were applied as surface sprays at the rate of 6, 12, 25, 37, and 50 milliliters per square foot following the seeding of Royal Chantenay carrots, Grand Rapids H-8 lettuce, Hybrid 424 spinach, Crystal Wax onions, Florida Broadleaf mustard, Top Crop snapbeans, and Hood soybeans. The research was conducted at the Horticultural Research Stations at Bixby and Lone Wolf, Oklahoma.

Yield data were collected and analyzed for each crop. Additional data were collected concerning the effect of the treatments on soil temperature and on seedling emergence.

A test was conducted in the horticulture greenhouses at Oklahoma State University to study the rate of water penetration into the soil with each emulsion at each rate of application.

In some instances individual replicate yields appeared to be extremely high or extremely low and did not appear to be typical of the particular treatment involved. This was primarily attributed to excess wetting from leaking joints of the irrigation pipes.

These yields are marked with an asterisk (*) and are not included in the analysis.

A. The following is a report on the effect of three linseed oil emulsions and five rates of application on the yield of Grand Rapids H-8

lettuce, Hybrid 424 spinach, and Crystal Wax onions grown at the Vegetable Research Station, Bixby, Oklahoma, spring, 1965.

Because of a misunderstanding of the researcher, individual replicate yields of spinach and lettuce were not taken. This could lead to some misinterpretation of the data. The results are discussed, however, as they appear in Tables I and II.

Each crop was allowed to reach satisfactory market quality and size before harvest.

The data as shown in Figure 1 indicates a substantial difference in yield of leaf lettuce between the three linseed oil emulsions and between treatment rates. The highest yield for all treatments was 3.6 tons per acre from the B rate (12 milliliters per square foot) of Emulsion I, whereas the second highest yield was 3.3 tons per acre from the E rate (50 milliliters per square foot) of Emulsion II. The third highest yield was 3.2 tons per acre from the C rate (25 milliliters per square foot) of Emulsion III.

It appears that there are no consistent trends between yield and rate of treatments in Emulsions II and III; and in fact, the same situation may be the case in the Emulsion I treatments. The inconsistencies may be due to individual replicate yields not typical of the treatment and not taken into account when the data were collected.

Figure 2 shows the highest spinach yield of 3.5 tons per acre was obtained in the check plots of Emulsion I. The highest yield obtained with Emulsion II was 3.1 tons per acre with the E rate (50 milliliters per square foot) and 2.5 tons per acre was the highest yield obtained with Emulsion III. This was with the A rate (6 milliliters per square foot). As was pointed out in the previous paragraph, the inconsistency

between yield and rate of treatments and the very low yields in the Emulsion III treatments may not truly reflect the effect of the emulsions, but may be due to some very low yielding replicates that were not taken into account when the data were collected.

As shown in Figure 3, there was an increase in yield of dozen bunches of onions per acre as the treatment rate of Emulsion I increased, with the highest yield for this treatment being 778 dozen bunches with the E rate (50 milliliters per square foot) of the emulsion. The highest yield of all was 1,224 dozen bunches per acre obtained with the C rate (25 milliliters per square foot) of Emulsion II followed closely with 1,202 dozen bunches per acre obtained with the A rate (6 milliliters per square foot) of Emulsion III.

TABLE I

THE EFFECT OF THREE LINSEED OIL EMULSIONS AND FIVE RATES OF APPLICATION ON YIELD OF GRAND RAPIDS H-8 LETTUCE AT THE VEGETABLE RESEARCH STATION, SPRING, 1965[1]

	Treatment Rate[2]					
	Ck.	A	B	C	D	E
Emulsion I						
Total Lbs.	8.7	6.5	11.3	9.2	6.4	6.2
Tons/Acre	2.8	2.1	3.6	3.1	2.0	2.0
Emulsion II						
Total Lbs.	6.9	4.6	8.0	5.8	3.2	10.3
Tons/Acre	2.2	1.5	2.6	1.9	1.0	3.3
Emulsion III						
Total Lbs.	4.9	4.2	5.1	10.0	2.5	5.0
Tons/Acre	1.6	1.3	1.6	3.2	.81	1.6

[1]Planting date was April 13, 1965, and date of harvest was June 5, 1965.

[2]See page 9 for explanation of symbols used for treatment rates.

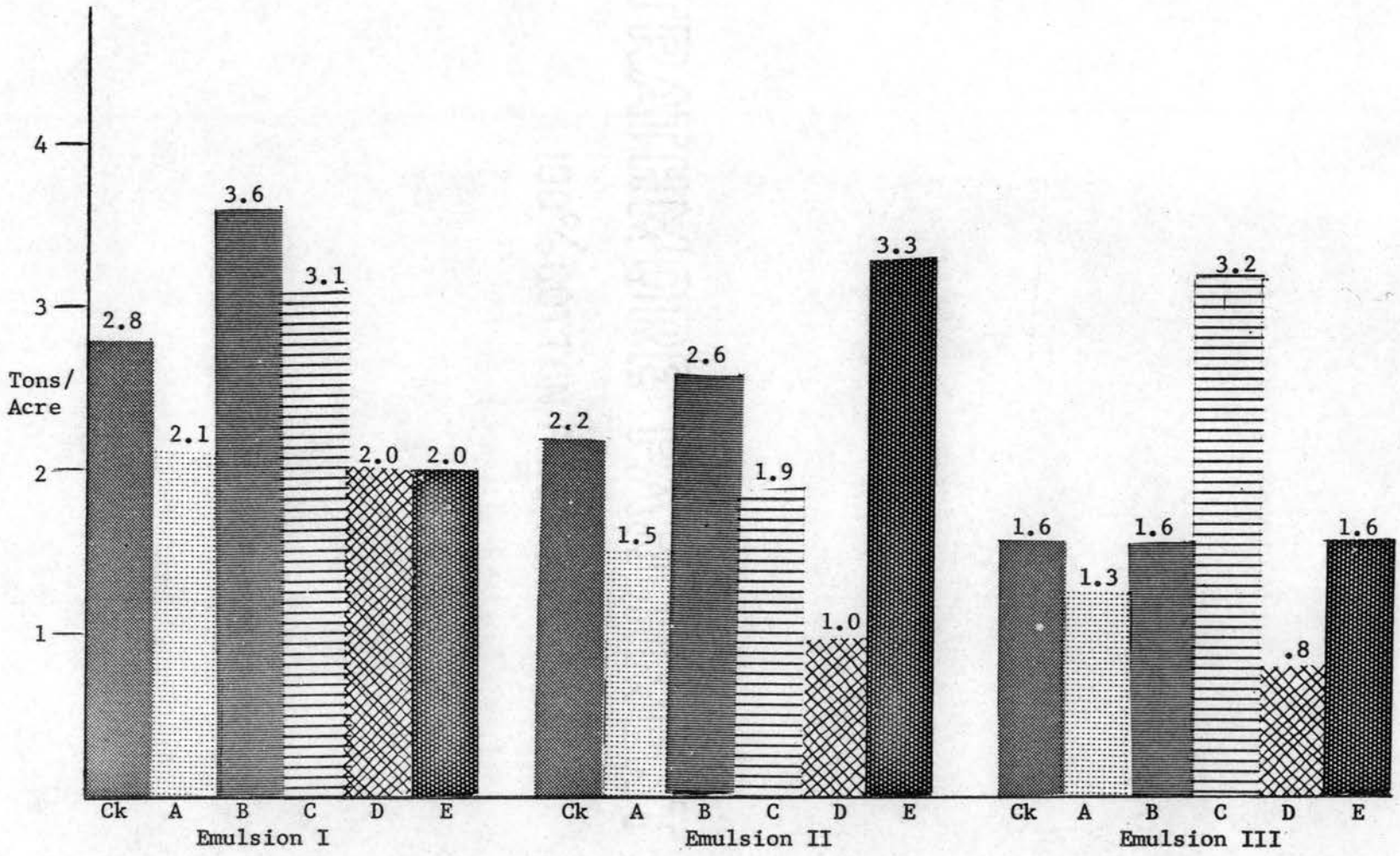

Figure 1. The Effect of Three Linseed Oil Emulsions and Five Rates of Application on Yield of Grand Rapids H-8 Lettuce at the Vegetable Research Station, Spring, 1965

TABLE II

THE EFFECT OF THREE LINSEED OIL EMULSIONS AND FIVE RATES OF APPLICATION ON YIELD OF HYBRID 424 SPINACH AT THE VEGETABLE RESEARCH STATION, SPRING, 1965[1]

	Treatment Rate					
	Ck.	A	B	C	D	E
Emulsion I						
Total Lbs.	10.9	6.0	7.2	10.0	5.3	6.7
Tons/Acre	3.5	1.9	2.3	3.2	1.7	2.1
Emulsion II						
Total Lbs.	5.5	3.5	9.2	7.7	7.5	9.5
Tons/Acre	1.79	1.1	3.0	2.5	2.4	3.1
Emulsion III						
Total Lbs.	5.1	7.8	4.3	3.9	1.5	4.5
Tons/Acre	1.6	2.5	1.4	1.2	.48	1.4

[1]Planting date was April 13, 1965, and date of harvest was June 5, 1965.

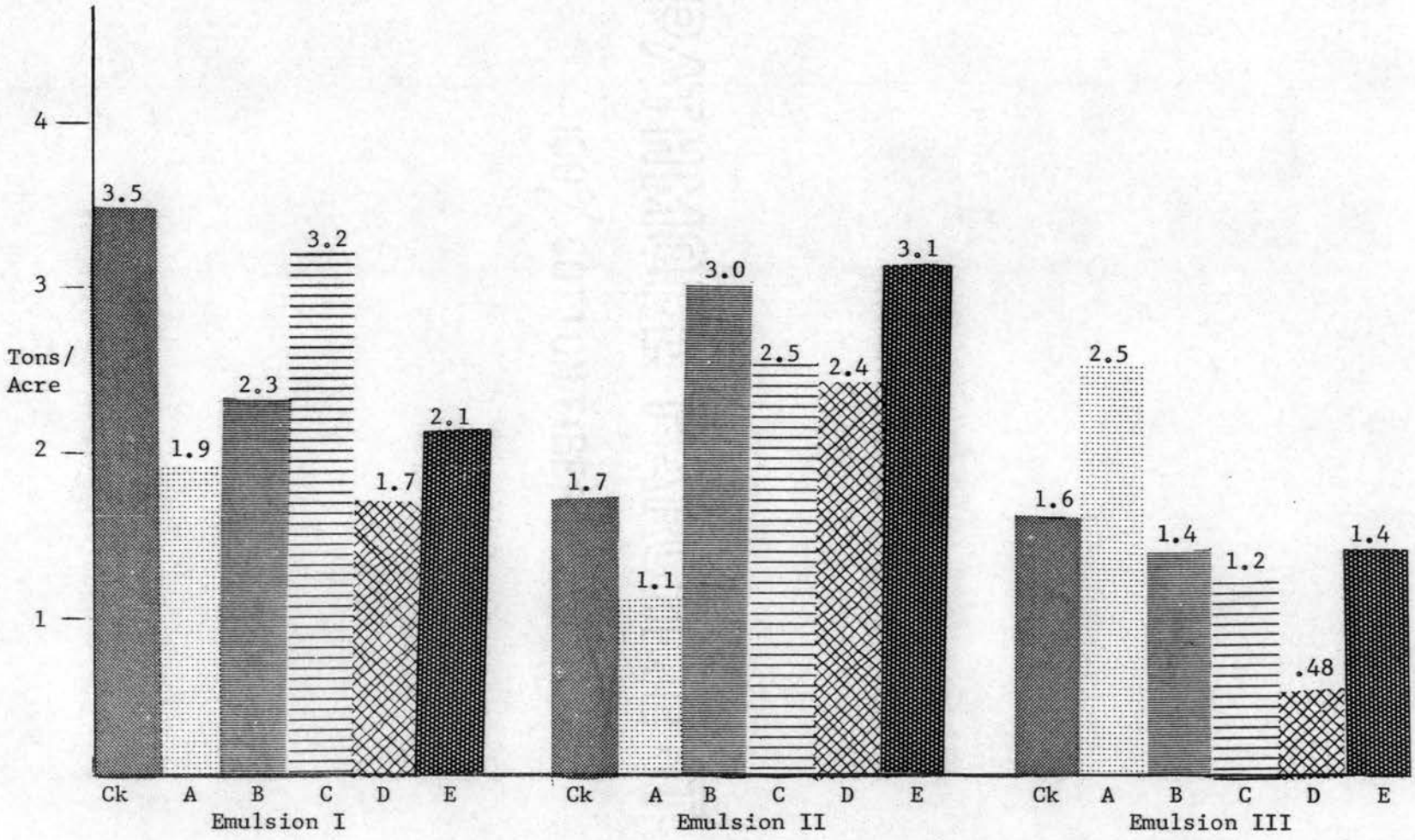

Figure 2. The Effect of Three Linseed Oil Emulsions and Five Rates of Application on Yield of Hybrid 424 Spinach Grown at the Vegetable Research Station, Spring, 1965

TABLE III

THE EFFECT OF THREE LINSEED OIL EMULSIONS AND FIVE RATES OF APPLICATION ON YIELD OF CRYSTAL WAX ONIONS GROWN AT THE VEGETABLE RESEARCH STATION, SPRING, 1965[1]

	Treatment Rate					
	Ck.	A	B	C	D	E
	Plant Stand	Plant Stand	Plant Stand	Plant Stand	Plant Stand	Plant Stand
Emulsion I						
Replicate 1	32	41	44	22	--	28
Replicate 2	13	24	--	*	19	*
Replicate 3	18	--	19	24	*	39
Replicate 4	*	24	20	--	26	--
Replicate 5	--	30	43	38	33	40
Average[2]	21	29.7	31.5	28	26	35.6
Dozen Bunches per Acre[3]	459	649	688	612	568	778
Emulsion II						
Replicate 1	41	37	39	*	--	33
Replicate 2	44	*	--	67	51	*
Replicate 3	*	--	*	55	30	59
Replicate 4	41	*	52	--	35	--
Replicate 5	--	44	36	46	*	40
Average	42	40.5	42.3	56	38.6	44
Dozen Bunches per Acre	922	874	924	1,224	844	962
Emulsion III						
Replicate 1	*	65	19	*	--	23
Replicate 2	40	*	--	*	17	*
Replicate 3	24	--	19	28	19	*
Replicate 4	28	*	*	--	14	--
Replicate 5	--	46	*	14	*	17
Average	30.6	55.5	19	21	16.6	20
Dozen Bunches per Acre	669	1,205	415	459	362	437

[1]Planting date was April 13 and date of harvest was June 21, 1965.

[2]Replicate yields expressed in plant number.

[3]Based on 10 onions per bunch.

*Indicates yields not typical of treatment.

--Indicates treatment not present in that replicate.

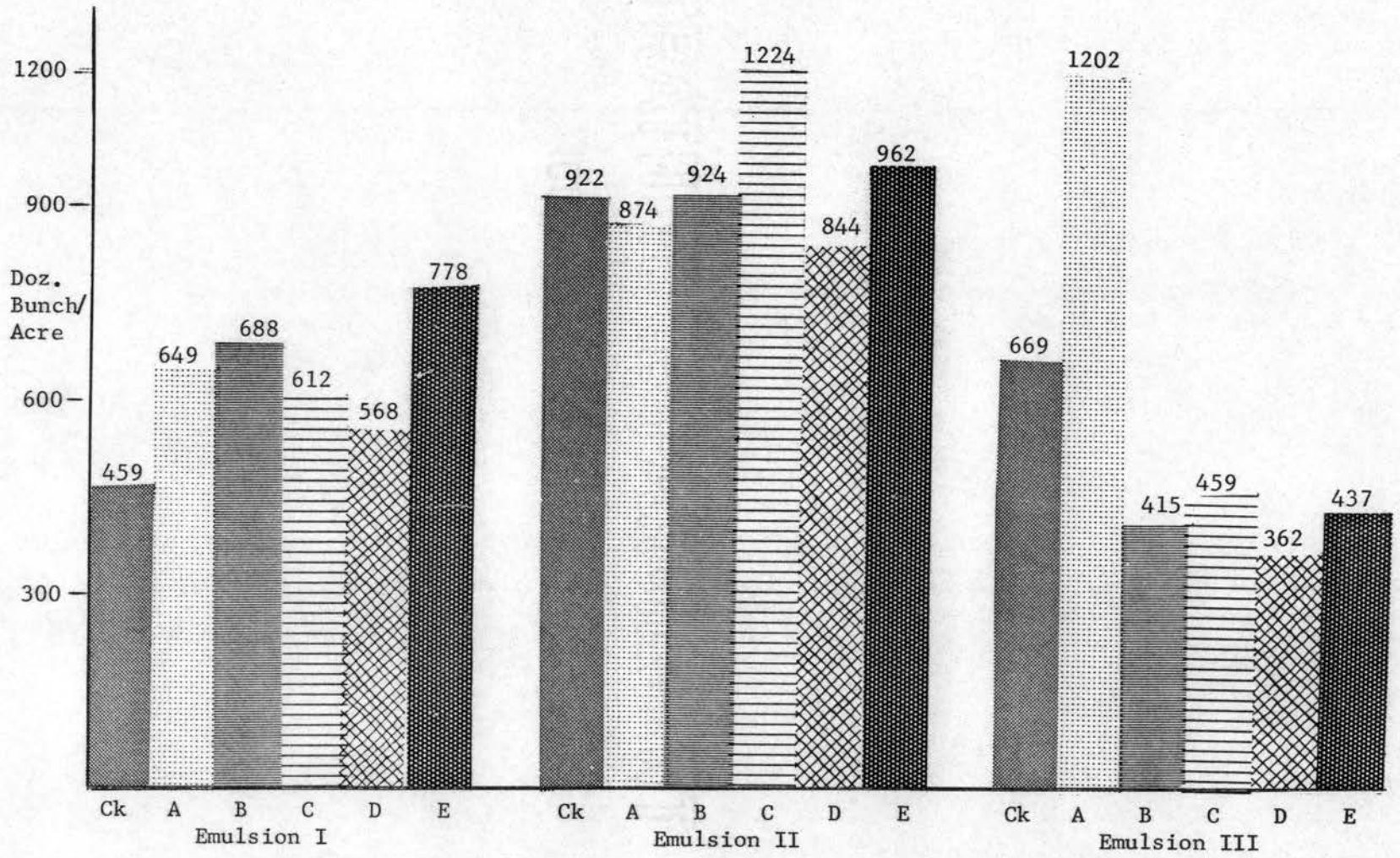

Figure 3. The Effect of Three Linseed Oil Emulsions and Five Rates of Application on Yield of Crystal Wax Onions Grown at the Vegetable Research Station, Spring, 1965

B. The following is a report of the effect of three linseed oil emulsions and five rates of application on soil temperature and on the yield of Top Crop snapbean and Hood soybean, grown at the Vegetable Research Station, Bixby, Oklahoma.

1. Soil Temperature

Temperatures were recorded between 1:00 and 2:00 p.m. at the soil surface and at one inch below the surface with a bulb type soil thermometer (Table IV).

Figures 4 and 4a show a comparison of these temperatures on May 18 and 19, 1965. It was observed that the temperature below the surface increased as the rate of application increased. Figure 4 shows the highest temperatures were recorded on May 18 on soil treated with 12, 25, 37, and 50 milliliters per square foot of Emulsion I; 25, 37, and 50 milliliters per square foot of Emulsion II; and 12, 25, and 37 milliliters per square foot of Emulsion III. As shown in Figure 4a, the highest temperature recorded on May 19 was on the 50 milliliters per square foot treatment of Emulsions I and III. Although the temperature of the soil treated at any of the treatment rates with Emulsion II was not higher than the surface temperature in that area, it did surpass the surface temperatures of the other two treatment areas.

TABLE IV

THE EFFECT OF THREE LINSEED OIL EMULSIONS AND FIVE RATES OF APPLICATION ON THE TEMPERATURE OF REINACH, FINE SILT LOAM SOIL AT THE VEGETABLE RESEARCH STATION MAY 18 AND 19, 1965

Temperatures (°F) at 1 p.m.

		Emulsion I		Emulsion II		Emulsion III		
		Surface	1 Inch Below Surface	Surface	1 Inch Below Surface	Surface	1 Inch Below Surface	Air Temp. at 1 p.m.[2]
May 18								
TREATMENT[1]	A	89°	88°	92°	91°	92°	91°	84°
RATE	B		90		92		92	
	C		90		93		92	
	D		90		93		92	
	E		90		93		91	
	Ck.		88		90		91	
May 19								
TREATMENT	A	88°	87°	91°	88°	88°	87°	77°
RATE	B		88		89		87	
	C		89		89		88	
	D		89		89		88	
	E		90		89		89	
	Ck.		87		87		87	

[1]See page 9 for explanation of symbols used in treatment rates.

[2]The air temperature at 1 p.m. was obtained from the United States Weather Reporting Station at the Vegetable Research Station, Bixby, Oklahoma.

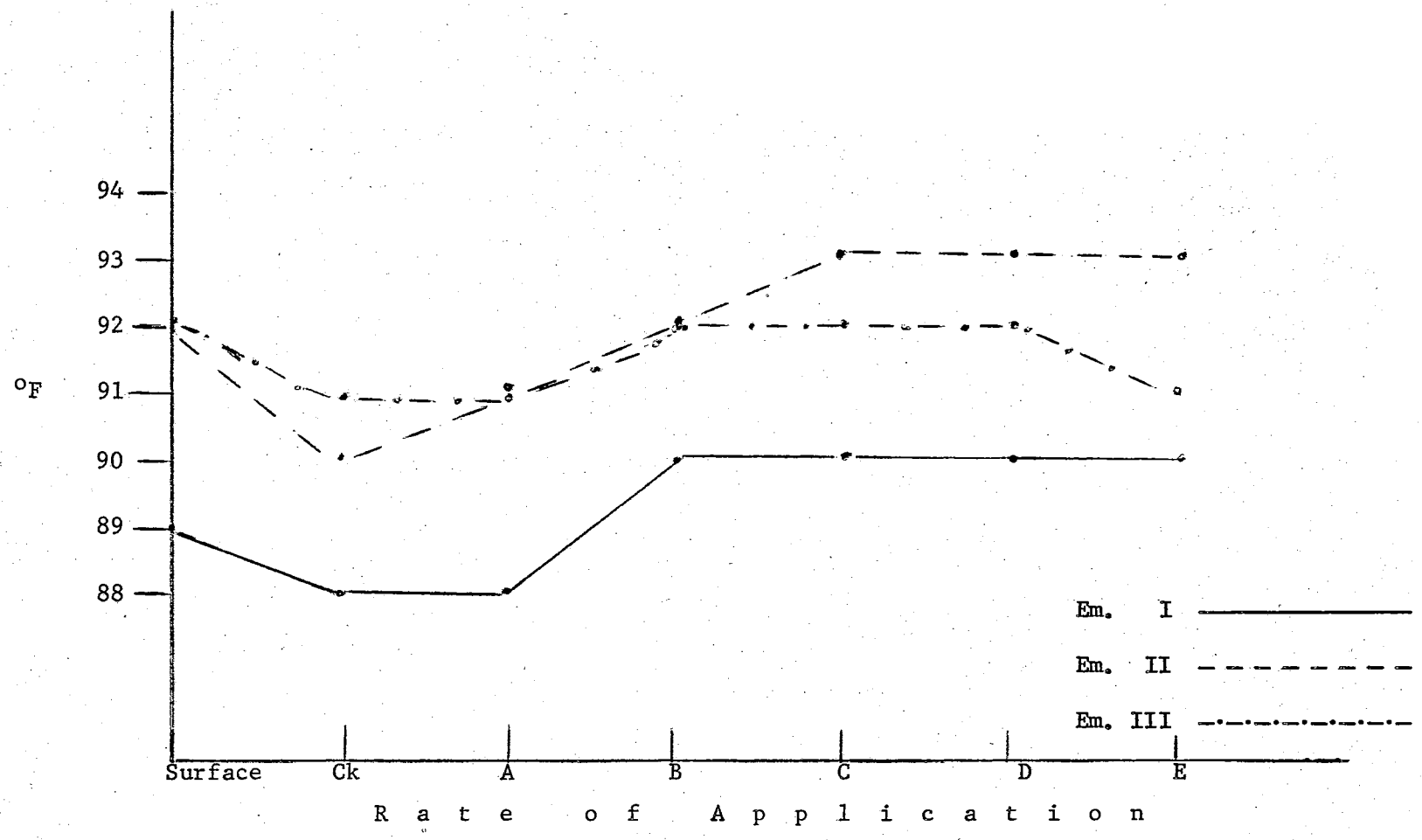

Figure 4. The Effect of Three Linseed Oil Emulsions and Five Rates of Application on Temperatures of Reinach Fine Silt Loam Soil at the Vegetable Research Station, May 18, 1965

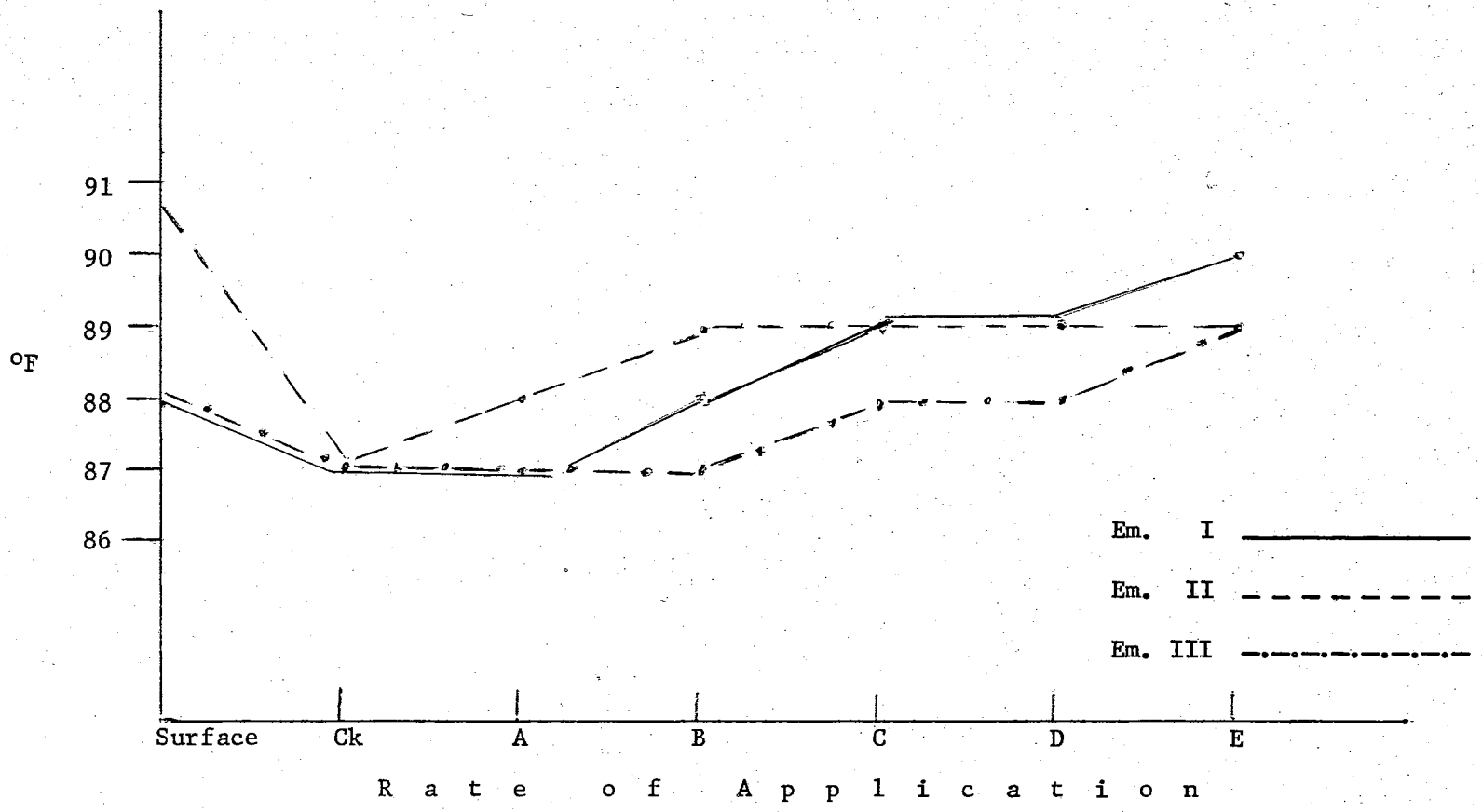

Figure 4a. The Effect of Three Linseed Oil Emulsions and Five Rates of Application on Temperatures of Reinach Fine Silt Loam Soil at the Vegetable Research Station, May 19, 1965

2. Yield of Snapbean and Soybean

Tables V and VI show the recorded yields of Top Crop snapbeans in tons per acre and Hood soybeans in bushels per acre when treated with the linseed oil emulsions. Figures 5 and 6 show these yields in a bar graph form.

The data represented in Figure 5 indicates an increase in yield of snapbeans as the treatment rate increases in Emulsion I with the highest yields (2.4 tons per acre) obtained with the D rate (37 milliliters per square foot) and E rate (50 milliliters per square foot) of application. With Emulsion II, the B rate (12 milliliters per square foot) of application resulted in a slight increase in yield over the check. The highest yield of all was 3.1 tons per acre obtained with the A rate (6 milliliters per square foot) of Emulsion III.

There appears to be very little, if any, effect on the yield of soybeans treated with any of the Emulsions as evidenced in Figure 6. The soybeans remained in the field 165 days from treatment to harvest. Any early benefits afforded by the linseed oil emulsions apparently had been overcome before harvest.

TABLE V

THE EFFECT OF THREE LINSEED OIL EMULSIONS AND FIVE RATES OF APPLICATION ON PLANT STAND AND YIELD OF TOP CROP SNAPBEANS AT THE VEGETABLE RESEARCH STATION, SPRING, 1965[1]

	Treatment Rate											
	Ck.		A		B		C		D		E	
	Plant Stand	Lbs.	Plant Stand	Lbs.	Plant Stand	Lbs.	Plant Stand	Lbs.	Plant Stand	Lbs.	Plant Stand	Lbs.
E. I												
Rep. 1	35	4.0	21	1.0	13	1.1	58	4.5	--	--	31	4.0
Rep. 2	20	2.6	32	3.8	--	--	32	1.5	28	2.5	36	2.0
Rep. 3	40	3.5	--	--	20	2.6	28	2.9	*	*	43	4.2
Rep. 4	33	1.6	42	4.5	40	5.0	--	--	24	4.0	--	--
Rep. 5	--	--	*	*	41	4.2	40	5.3	40	4.5	44	4.6
Avg.	32	2.9	31.6	3.1	28.5	3.2	39.5	3.5	30.6	3.6	38.5	3.7
T/A		1.9		2.0		2.1		2.3		2.4		2.4
E. II												
Rep. 1	30	5.0	40	4.2	38	2.1	44	4.3	--	--	33	3.8
Rep. 2	29	4.4	34	4.5	--	--	37	4.6	41	3.1	36	3.7
Rep. 3	28	2.0	--	--	30	2.1	27	4.5	29	3.0	33	1.4
Rep. 4	30	2.9	29	3.0	35	3.4	--	--	32	5.0	--	--
Rep. 5	--	--	30	4.4	29	6.0	25	2.1	38	3.0	29	4.9
Avg.	29.2	3.5	33.2	4.0	33	3.4	33.2	3.8	35	3.5	32.7	2.2
T/A		2.3		2.6		2.2		2.5		2.3		2.3
E. III												
Rep. 1	31	4.8	31	6.3	27	3.5	30	1.9	--	--	39	5.1
Rep. 2	34	5.2	32	4.5	--	--	*	*	31	3.5	30	2.5
Rep. 3	36	2.5	--	--	28	3.0	34	3.8	37	4.2	47	4.8
Rep. 4	26	2.0	33	3.8	*	*	--	--	27	3.8	--	--
Rep. 5	--	--	*	*	32	2.0	22	2.4	32	1.5	19	1.2
Avg.	31.7	3.6	32	4.8	29	2.8	28.6	2.7	31.7	3.2	33.7	2.2
T/A		2.3		3.1		1.9		1.7		2.1		2.2

[1]Planting date was May 13, 1965, and date of harvest was June 30, 1965.

*Indicates yields not typical of treatment.

--Indicates treatment not present in that replicate.

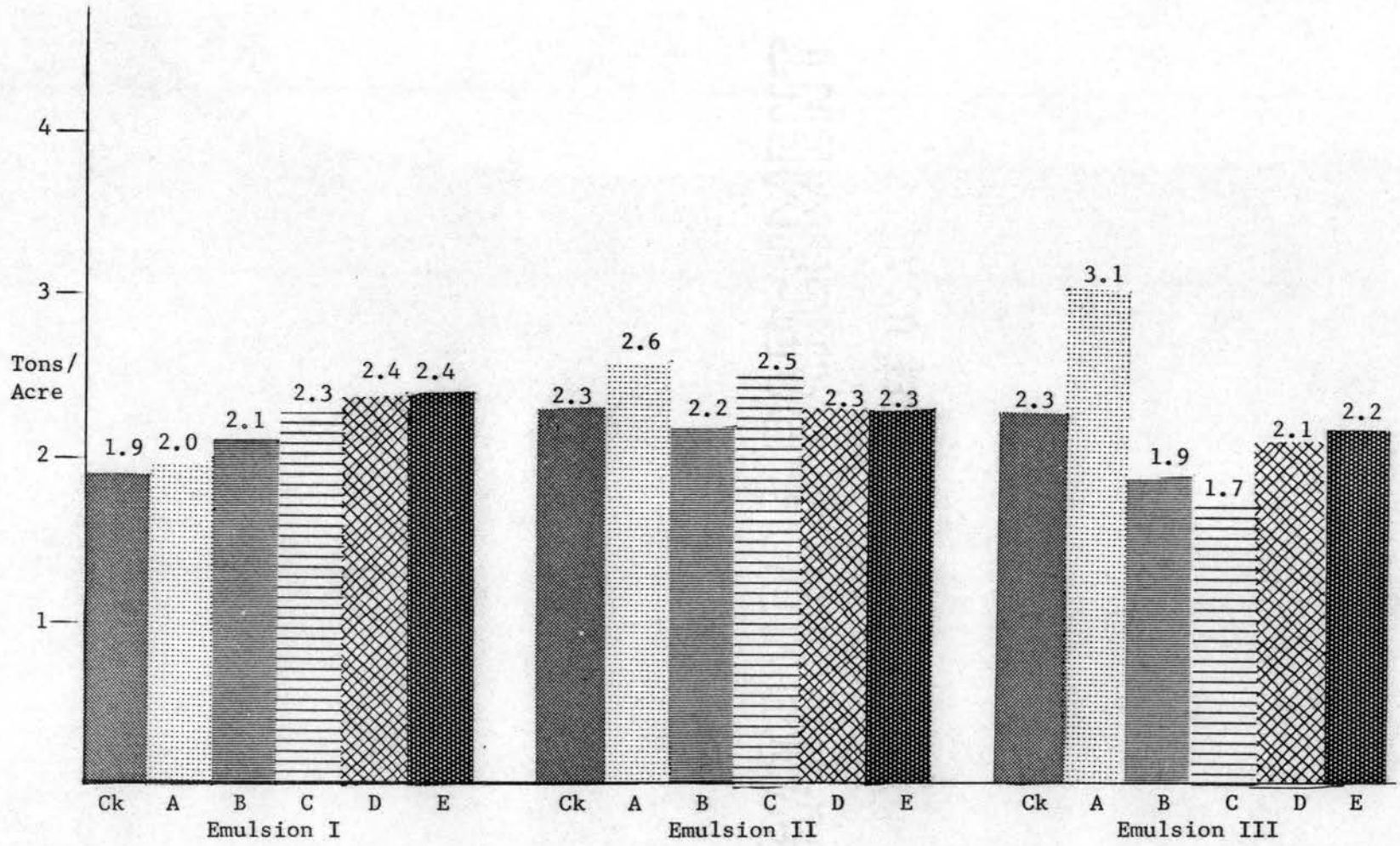

Figure 5. The Effect of Three Linseed Oil Emulsions and Five Rates of Application on Yield of Top Crop Snapbeans at the Vegetable Research Station, Spring, 1965.

TABLE VI

THE EFFECT OF THREE LINSEED OIL EMULSIONS AND FIVE RATES OF APPLICATION ON PLANT STAND AND YIELD OF HOOD SOYBEANS AT THE VEGETABLE RESEARCH STATION, 1965[1]

	Ck.		Treatment Rate A		B		C		D		E	
	Plant Stand	Lbs.	Plant Stand	Lbs.	Plant Stand	Lbs.	Plant Stand	Lbs.	Plant Stand	Lbs.	Plant Stand	Lbs.
E. I												
Rep. 1	55	2.16	54	2.09	53	2.07	38	1.82	--	--	43	2.1
Rep. 2	57	2.05	39	1.93	--	--	35	1.84	51	1.77	62	1.79
Rep. 3	56	1.96	--	--	30	2.1	44	2.05	34	1.81	52	1.86
Rep. 4	53	2.07	32	1.73	38	1.85	--	--	50	1.95	--	--
Rep. 5	54	1.79	30	1.58	33	1.80	61	1.96	33	1.84	60	1.93
Avg.	55	210	38.7	1.8	38.5	1.9	44.5	1.9	42	1.8	54.2	1.9
Bu/A		43.8		39.8		42.5		41.8		40.1		41.8
E. II												
Rep. 1	27	1.79	56	1.52	39	1.72	29	1.60	--	--	49	1.76
Rep. 2	41	1.75	48	1.75	--	--	30	1.38	34	1.65	36	1.67
Rep. 3	33	1.85	--	--	48	1.95	42	1.84	41	1.98	30	1.82
Rep. 4	46	1.71	32	1.83	33	1.68	--	--	45	1.82	--	--
Rep. 5	27	2.12	28	1.66	36	2.16	54	2.13	28	1.81	54	1.73
Avg.	34.8	1.8	41	1.6	39	1.8	38.7	1.7	37	1.8	42.2	1.7
Bu/A		40.1		36.8		40.9		37.9		39.4		37.9
E. III												
Rep. 1	34	1.81	46	1.64	32	1.62	36	1.41	--	--	41	1.49
Rep. 2	49	1.46	45	1.48	--	--	26	1.49	35	1.26	61	1.66
Rep. 3	50	1.54	--	--	54	1.58	60	1.36	26	1.48	54	1.43
Rep. 4	47	1.79	44	1.72	43	1.48	--	--	42	1.42	--	--
Rep. 5	50	1.43	33	1.40	33	1.94	42	1.83	47	1.70	38	1.60
Avg.	46	1.6	42	1.5	40.5	1.6	41	1.5	37.5	1.4	48.5	1.5
Bu/A		35.0		34.0		36.6		33.1		31.8		33.5

[1]Planting date was May 13, 1965, and date of harvest was October 26, 1965.

--Indicates treatment not present in that replicate.

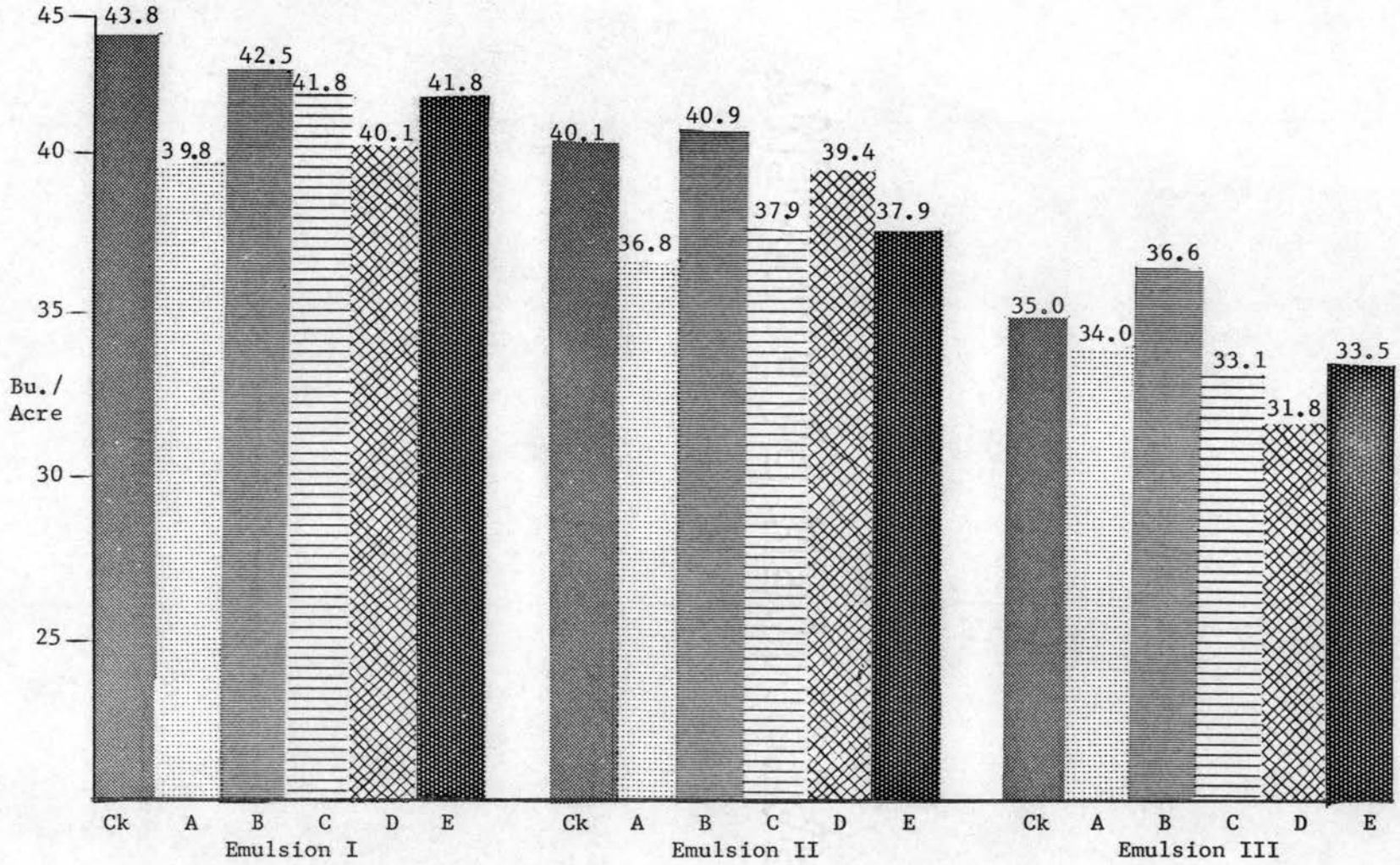

Figure 6. The Effect of Three Linseed Oil Emulsions and Five Rates of Application on Yield of Hood Soybeans at the Vegetable Research Station, 1965

C. The following is a report on the effect of three linseed oil emulsions and five rates of application on seedling emergence and yield of Grand Rapids H-8 lettuce, Florida Broadleaf mustard, Hybrid 424 spinach, and Crystal Wax onions at the Vegetable Research Station, Bixby, Oklahoma, Fall, 1965.

1. Seedling Emergence of Lettuce, Mustard, Spinach and Onions

A count was made of the number of seedlings which had emerged 12 days following planting in three lineal feet of row located at random in each replicate. The individual replicate data are given in Tables VII, VIII, IX, and X. Figures 7, 8, 9, and 10 show bar graph comparisons of data regarding emergence rates of the four crops treated with the three emulsion materials and five rates of application.

Figure 7 indicates that 50 milliliters per square foot of Emulsion I, 12 milliliters per square foot of Emulsion II, and 6 and 25 milliliters per square foot of Emulsion III was most conducive in hastening emergence of leaf lettuce.

In Figure 8 it is shown that an increase of 3.3 mustard plants in three lineal feet was obtained by the application of six milliliters per square foot of Emulsion II when compared with the check plots. An increase of 2.6 plants in three lineal feet was obtained with 25 milliliters per square foot of Emulsion III when compared with the check plots.

Figure 9 indicates an increase was obtained in spinach emergence with the use of 25 milliliters per square foot of Emulsion I and 37 milliliters per square foot of Emulsions II and III.

Fifty milliliters per square foot of Emulsions I and III were of greatest benefit in the emergence of onion seedlings as shown in Figure 10.

TABLE VII

THE EFFECT OF THREE LINSEED OIL EMULSIONS AND FIVE RATES OF APPLICATION ON SEEDLING EMERGENCE OF GRAND RAPIDS H-8 LETTUCE 12 DAYS FOLLOWING PLANTING AT THE VEGETABLE RESEARCH STATION, Fall, 1965[1]

	Treatment Rate					
	Ck. Plant Count	A Plant Count	B Plant Count	C Plant Count	D Plant Count	E Plant Count
Emulsion I						
Replicate 1	18	8	11	13	--	37
Replicate 2	*	14	--	*	13	21
Replicate 3	20	--	*	21	15	*
Replicate 4	22	11	21	--	*	--
Replicate 5	--	*	*	14	7	12
Total	60	33	32	48	35	70
Average	20.0	11.0	16	16	11.6	23.3
Emulsion II						
Replicate 1	11	10	16	8	--	*
Replicate 2	*	9	--	7	*	7
Replicate 3	9	--	18	*	6	*
Replicate 4	*	8	12	--	9	--
Replicate 5	--	*	*	19	11	*
Total	20	27	46	34	26	7
Average	10	9	15.3	11.3	8.6	7
Emulsion III						
Replicate 1	13	*	7	14	--	10
Replicate 2	*	15	--	*	8	9
Replicate 3	8	--	8	13	*	*
Replicate 4	8	12	14	--	9	--
Replicate 5	--	*	8	*	12	*
Total	29	27	37	27	29	19
Average	9.6	13.5	9.2	13.5	9.6	9.5

[1]Date planted was September 25, 1965, and date counted was October 7, 1965.

*Indicates figures not typical of treatment.

--Indicates treatment not present in that replicate.

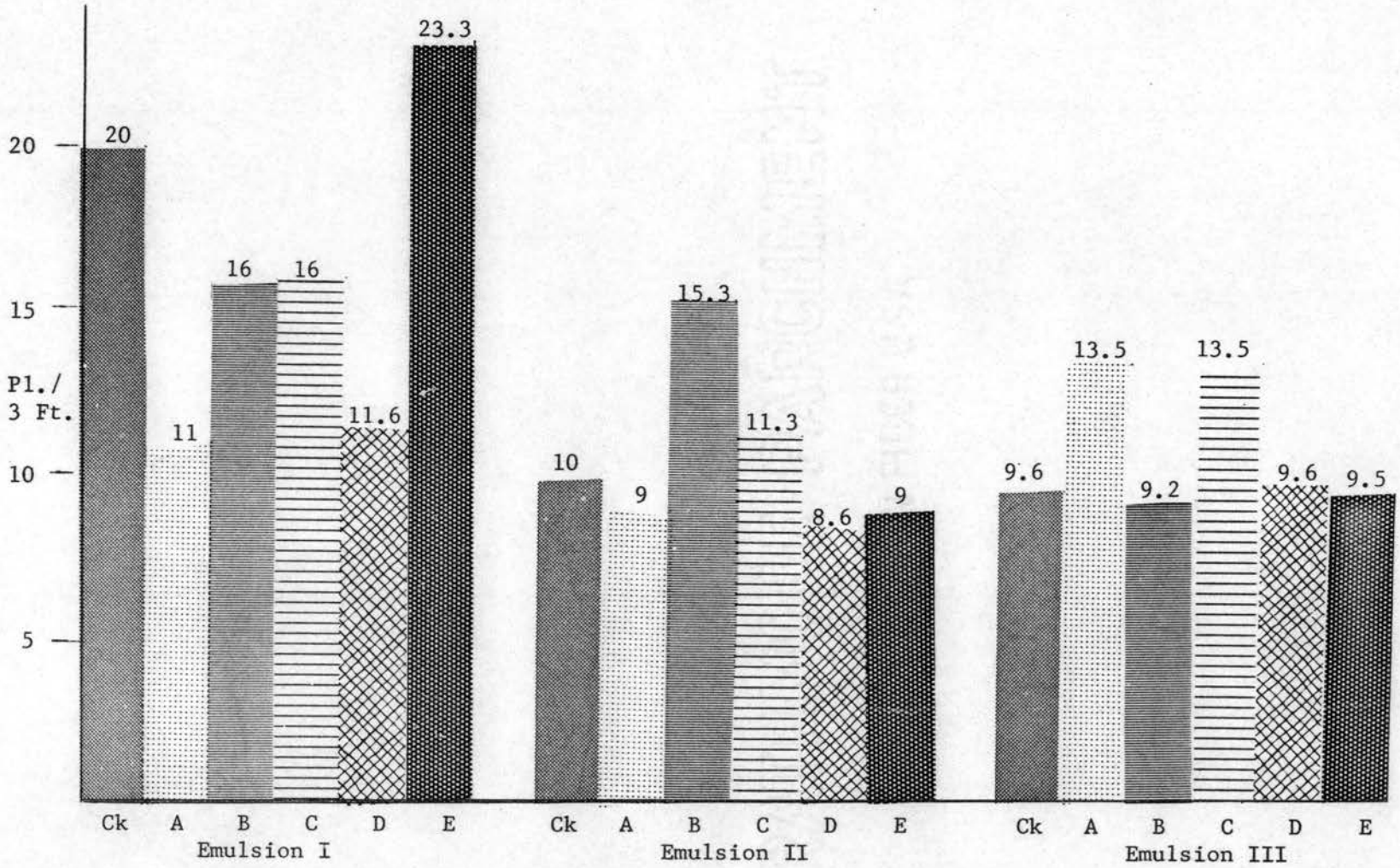

Figure 7. The Effect of Three Linseed Oil Emulsions and Five Rates of Application on Seedling Emergence of Grand Rapids H-8 Leaf Lettuce 12 Days Following Planting at the Vegetable Research Station, Fall, 1965

TABLE VIII

THE EFFECT OF THREE LINSEED OIL EMULSIONS AND FIVE RATES OF APPLICATION ON SEEDLING EMERGENCE OF FLORIDA BROADLEAF MUSTARD 12 DAYS FOLLOWING PLANTING AT THE VEGETABLE RESEARCH STATION, FALL, 1965[1]

	Treatment Rate					
	Ck. Plant Count	A Plant Count	B Plant Count	C Plant Count	D Plant Count	E Plant Count
Emulsion I						
Replicate 1	34	28	18	20	--	31
Replicate 2	*	19	--	*	13	*
Replicate 3	21	--	29	31	19	25
Replicate 4	17	17	21	--	18	--
Replicate 5	--	22	25	21	24	18
Total	72	87	91	72	74	74
Average	24.0	21.5	23.2	24.0	18.5	24.6
Emulsion II						
Replicate 1	17	20	15	21	--	19
Replicate 2	14	22	--	12	16	20
Replicate 3	21	--	16	11	12	14
Replicate 4	17	20	18	--	22	--
Replicate 5	--	21	12	16	18	15
Total	69	83	61	60	68	68
Average	17.2	20.7	15.2	15.0	17.0	17.0
Emulsion III						
Replicate 1	25	24	16	25	--	5
Replicate 2	16	22	--	*	17	26
Replicate 3	25	--	16	20	*	17
Replicate 4	22	21	15	--	15	--
Replicate 5	--	19	15	29	21	17
Total	88	86	62	74	53	65
Average	22	21.5	15.5	24.6	17.6	16.2

[1]Date planted was September 25, 1965, and date counted was October 7, 1965.

*Indicates figures not typical of treatment.

--Indicates treatment not present in that replicate.

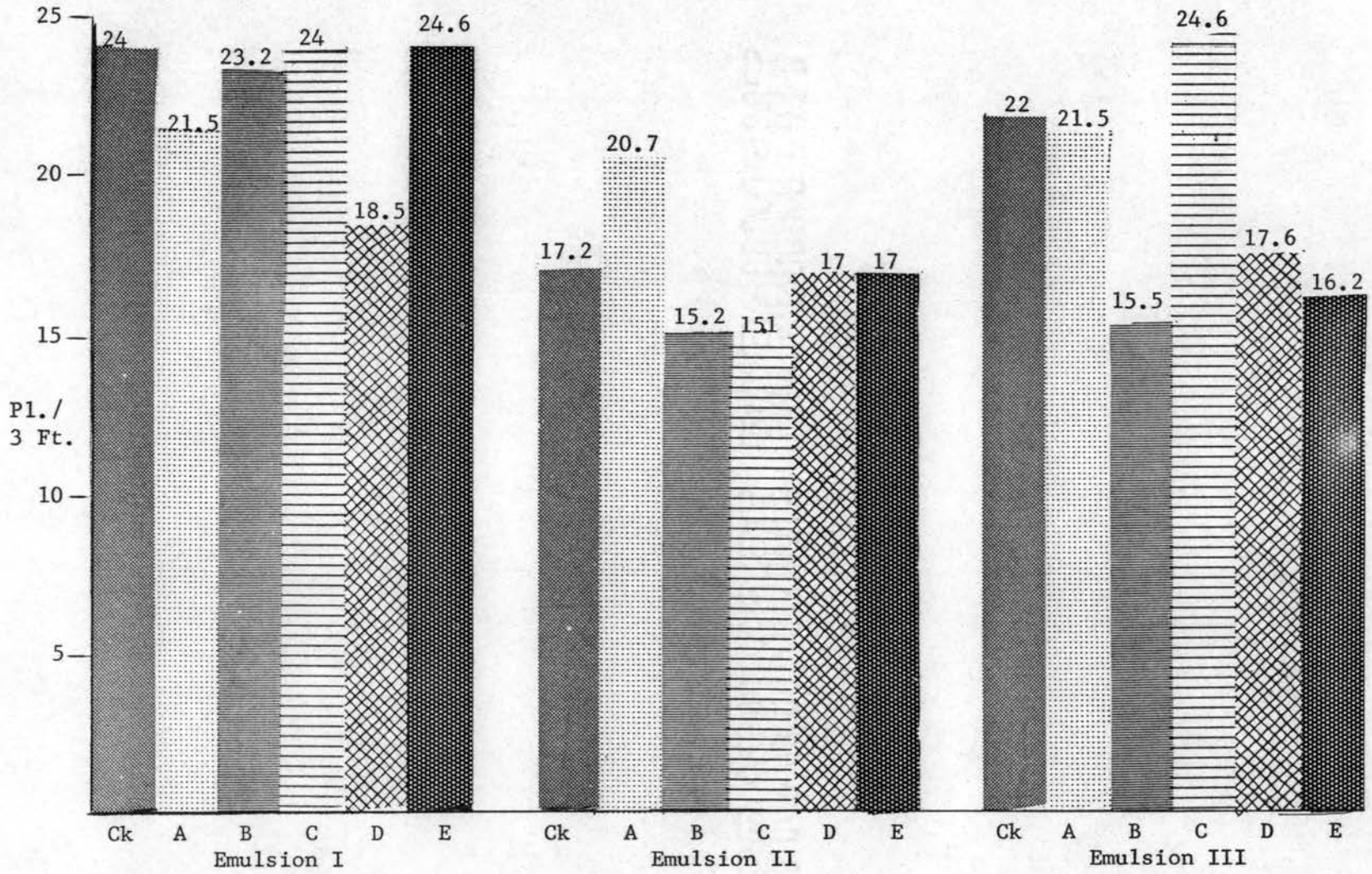

Figure 8. The Effect of Three Linseed Oil Emulsions and Five Rates of Application on Seedling Emergence of Florida Broadleaf Mustard 12 Days Following Planting at the Vegetable Research Station, Fall, 1965

TABLE IX

THE EFFECT OF THREE LINSEED OIL EMULSIONS AND FIVE RATES OF APPLICATION ON SEEDLING EMERGENCE OF HYBRID 424 SPINACH 12 DAYS FOLLOWING PLANTING AT THE VEGETABLE RESEARCH STATION, FALL, 1965[1]

	Treatment Rate					
	Ck. Plant Count	A Plant Count	B Plant Count	C Plant Count	D Plant Count	E Plant Count
Emulsion I						
Replicate 1	12	9	19	20	--	20
Replicate 2	10	11	--	*	13	*
Replicate 3	20	--	*	21	15	*
Replicate 4	*	*	9	--	*	--
Replicate 5	--	10	*	*	*	15
Total	42	30	28	41	28	35
Average	14.0	10	14	20.5	14	17.5
Emulsion II						
Replicate 1	7	10	10	11	--	6
Replicate 2	5	*	--	7	16	9
Replicate 3	7	--	7	11	*	*
Replicate 4	5	*	9	--	12	--
Replicate 5	--	5	*	6	9	9
Total	24	19	26	35	37	24
Average	6	4.7	8.6	8.7	12.3	8
Emulsion III						
Replicate 1	8	5	11	11	--	*
Replicate 2	12	9	--	9	*	8
Replicate 3	11	--	14	12	19	*
Replicate 4	6	10	7	--	8	--
Replicate 5	--	8	*	8	8	8
Total	37	32	32	40	35	16
Average	9.2	8	10.6	10	11.6	8.0

[1]Date planted was September 25, 1965, and date counted was October 7, 1965.

*Indicates figures not typical of treatment.

--Indicates treatment not present in that replicate.

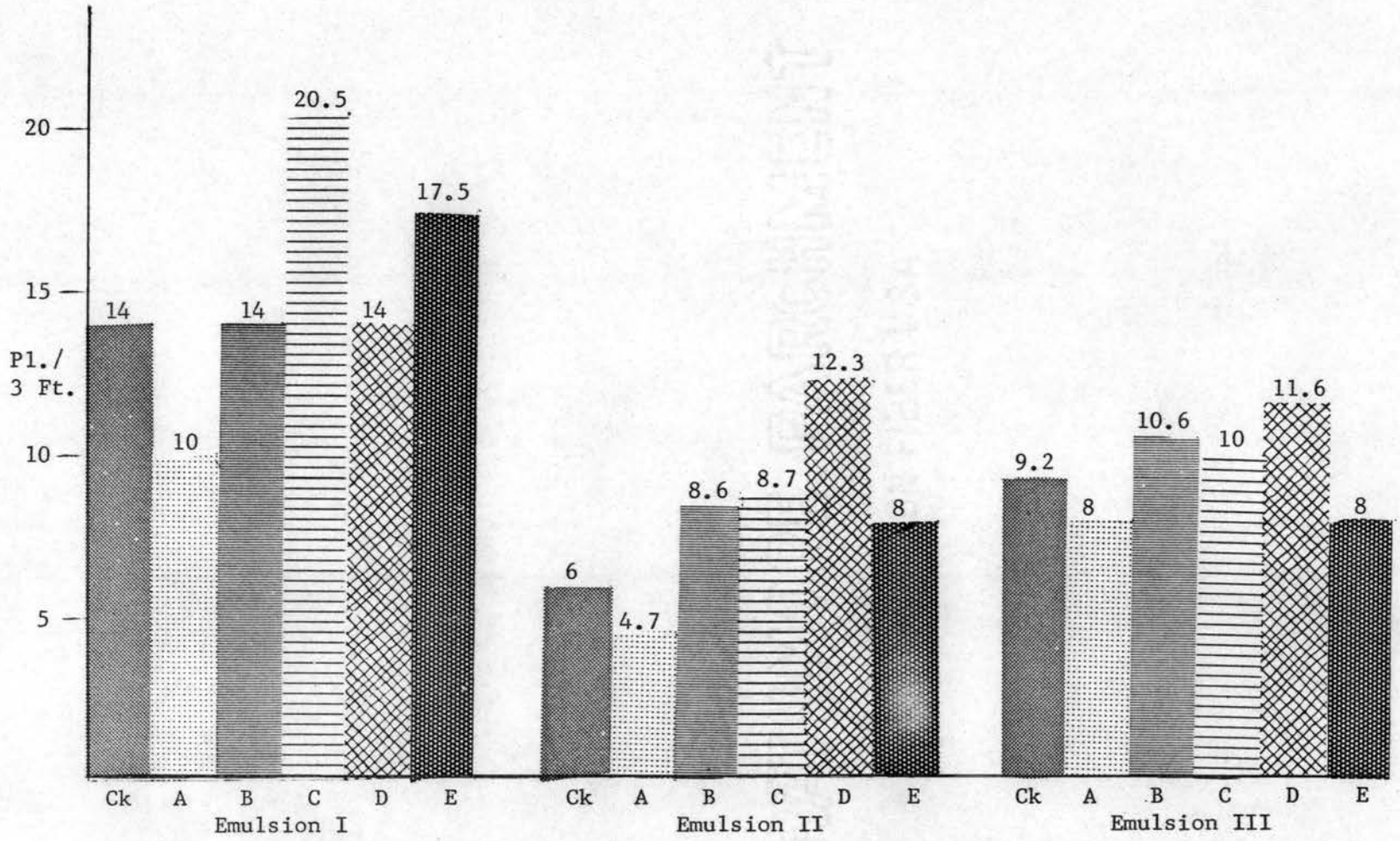

Figure 9. The Effect of Three Linseed Oil Emulsions and Five Rates of Application on Seedling Emergence of Hybrid 424 Spinach 12 Days Following Planting at the Vegetable Research Station, Fall, 1965

TABLE X

THE EFFECT OF THREE LINSEED OIL EMULSIONS AND FIVE RATES OF APPLICATION ON SEEDLING EMERGENCE OF CRYSTAL WAX ONIONS 12 DAYS FOLLOWING PLANTING AT THE VEGETABLE RESEARCH STATION, FALL, 1965[1]

	Treatment Rate					
	Ck. Plant Count	A Plant Count	B Plant Count	C Plant Count	D Plant Count	E Plant Count
Emulsion I						
Replicate 1	34	22	23	28	--	31
Replicate 2	22	25	--	17	28	25
Replicate 3	27	--	21	22	24	32
Replicate 4	30	18	23	--	22	--
Replicate 5	--	28	19	28	18	30
Total	113	93	86	95	92	118
Average	27.5	23.2	21.5	23.7	23.0	29.5
Emulsion II						
Replicate 1	28	24	28	14	--	34
Replicate 2	27	35	--	10	15	21
Replicate 3	23	--	15	21	*	*
Replicate 4	*	19	30	--	26	--
Replicate 5	--	23	*	13	19	16
Total	78	101	73	58	60	71
Average	26	25.2	24.3	14.5	20	23.6
Emulsion III						
Replicate 1	31	28	20	28	--	*
Replicate 2	27	27	--	14	*	40
Replicate 3	25	--	24	22	27	34
Replicate 4	29	22	28	--	28	--
Replicate 5	--	30	31	29	25	19
Total	112	107	93	93	80	93
Average	28.0	26.7	23.2	23.2	26.6	31

[1]Date planted was September 25, 1965, and date counted was October 7, 1965.

*Indicates figures not typical of treatment.

--Indicates treatment not present in that replicate.

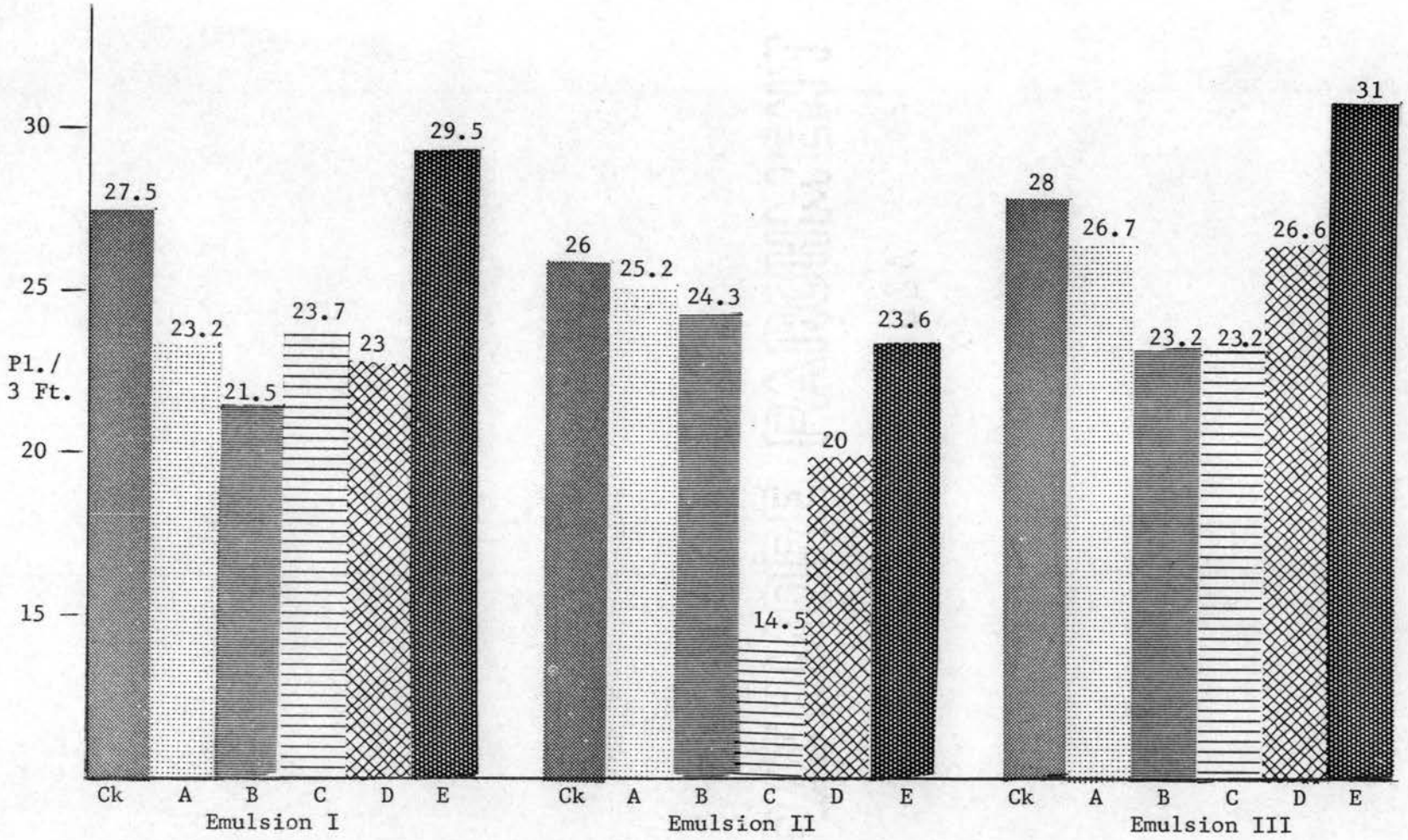

Figure 10. The Effect of Three Linseed Oil Emulsions and Five Rates of Application on Seedling Emergence of Crystal Wax Onions 12 Days Following Planting at the Vegetable Research Station, Fall, 1965

2. Yield of Lettuce, Mustard, Spinach, and Onion

The average yields of lettuce, mustard, spinach, and onions grown at the Vegetable Research Station in the fall tests are shown in Tables XI, XII, XIII, and XIV. Figures 11, 12, 13, and 14 show comparative relationships of these yields with the different treatment rates.

The highest yield of lettuce was 5.1 tons per acre obtained with the E rate (50 milliliters per square foot) of Emulsion I. The greatest yield obtained in the Emulsion II treatments was 4.2 tons per acre with the B rate (12 milliliters per square foot) of application and in the Emulsion III test the highest yield obtained was 4.7 tons per acre with the A rate (6 milliliters per square foot) of application. These data are graphically shown in Figure 11.

Figure 12 indicates the greatest increases in yields of mustard was obtained with the E rate (50 milliliters per square foot) of Emulsion I and with the C rate (25 milliliters per square foot) of Emulsions II and III.

Figure 13 shows the average yields of spinach in bar graph form. Application rates A (6 milliliters per square foot), B (12 milliliters per square foot), and C (25 milliliters per square foot) of Emulsion I and treatment rate A (6 milliliters per square foot) of Emulsion II indicate a slight increase in yield. The highest yield obtained was 6.2 tons per acre with the C rate (25 milliliters per square foot) of Emulsion III. However, the high yield obtained in the check plots and the A rate of application of Emulsion III and the very low yield obtained with the B rate of application, discredits the validity of any assumption made that the C rate of application of Emulsion III was most conducive in providing increased spinach yields.

The yields expressed in Figure 14 indicate the E rate of application of Emulsion I and the C rate of application of Emulsion II produced the highest onion yields for these two emulsions. The highest yield of all however, was 1591 dozen bunches per acre produced on the check plots of the Emulsion III tests. None of the treated plots in Emulsion III produced higher yields than this.

TABLE XI

THE EFFECT OF THREE LINSEED OIL EMULSIONS AND FIVE RATES OF APPLICATION ON PLANT STAND AND YIELD OF GRAND RAPIDS H-8 LETTUCE AT THE VEGETABLE RESEARCH STATION, FALL, 1965[1]

	Treatment Rate											
	Ck.		A		B		C		D		E	
	Plant Stand	Lbs.	Plant Stand	Lbs.	Plant Stand	Lbs.	Plant Stand	Lbs.	Plant Stand	Lbs.	Plant Stand	Lbs.
E. I												
Rep. 1	*	*	13	1.7	13	1.1	17	1.6	--	--	60	4.8
Rep. 2	24	2.3	27	2.2	--	--	*	*	*	*	21	2.9
Rep. 3	33	1.9	--	--	22	1.8	45	4.6	*	*	*	*
Rep. 4	15	1.4	*	*	23	2.2	--	--	*	*	--	--
Rep. 5	--	--	9	1.8	*	*	33	3.9	*	*	38	4.1
Avg.	24	1.9	49	1.9	19.3	1.7	31.6	3.3	*	*	39.6	3.6
T/A		2.4		2.4		2.2		4.4		*		5.1
E. II												
Rep. 1	*	*	19	2.0	*	*	22	1.8	--	--	16	1.5
Rep. 2	20	2.1	37	4.0	--	--	*	*	*	*	18	1.6
Rep. 3	37	2.6	--	--	28	2.9	20	2.6	*	*	*	*
Rep. 4	*	*	*	*	39	3.6	--	--	*	*	--	--
Rep. 5	--	--	*	*	--	--	*	*	*	*	*	*
Avg.	28.5	2.3	28	3.0	33.5	3.2	21	2.2	*	*	17	1.5
T/A		3.0		3.9		4.2		2.8		*		2.0
E. III												
Rep. 1	28	2.9	*	*	22	2.6	10	1.0	--	--	*	*
Rep. 2	28	2.8	33	3.6	--	--	*	*	*	*	15	1.5
Rep. 3	16	1.3	--	--	*	*	22	2.0	*	*	*	*
Rep. 4	22	2.9	*	*	47	4.1	--	--	9	1.0	--	--
Rep. 5	--	--	*	*	*	*	8	0.9	22	2.3	*	*
Avg.	23.5	2.4	33	3.6	34.5	3.3	20	1.3	15.5	1.6	15	1.5
T/A		3.2		4.7		4.4		4.3		2.1		2.0

[1]Planting date was September 25, 1965, and date of harvest was December 10, 1965.

*Indicates yields not typical of treatments.

--Indicates treatment not present in that replicate.

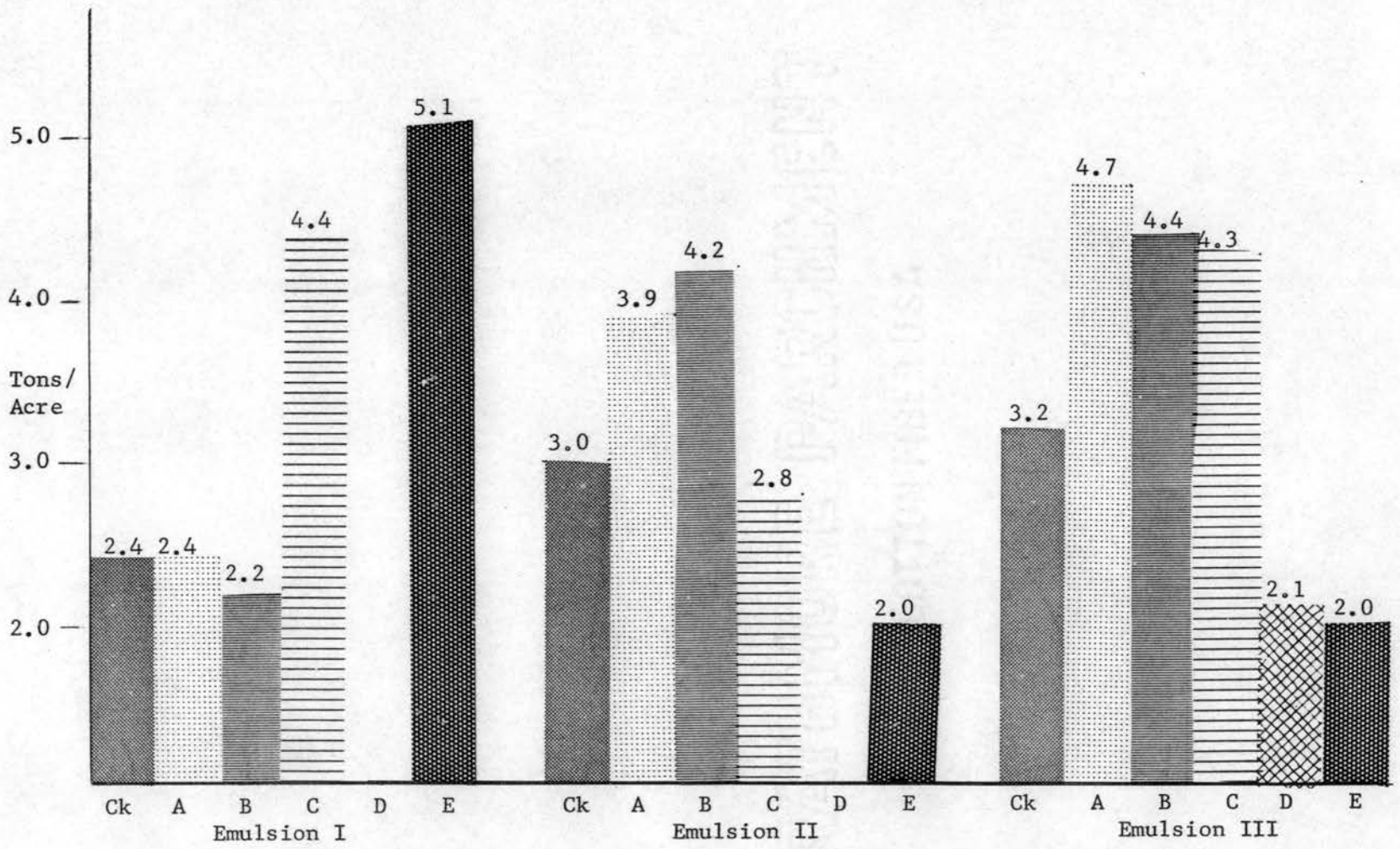

Figure 11. The Effect of Three Linseed Oil Emulsions and Five Rates of Application on Yield of Grand Rapids H-8 Lettuce at the Vegetable Research Station, Fall, 1965.

TABLE XII

THE EFFECT OF THREE LINSEED OIL EMULSIONS AND FIVE RATES OF APPLICATION ON PLANT STAND AND YIELD OF FLORIDA BROADLEAF MUSTARD AT THE VEGETABLE RESEARCH STATION, FALL, 1965[1]

	Treatment Rate											
	Ck.		A		B		C		D		E	
	Plant Stand	Lbs.	Plant Stand	Lbs.	Plant Stand	Lbs.	Plant Stand	Lbs.	Plant Stand	Lbs.	Plant Stand	Lbs.
E. I												
Rep. 1	*	*	33	4.0	14	2.0	50	7.6	--	--	65	8.7
Rep. 2	57	9.1	44	4.1	--	--	*	*	25	3.8	54	6.2
Rep. 3	45	3.4	--	--	56	9.5	34	4.6	*	*	34	5.7
Rep. 4	48	5.8	*	*	40	6.2	--	--	33	5.0	--	--
Rep. 5	36	3.0	*	*	*	*	37	5.6	54	8.0	38	5.9
Avg.	46.5	5.3	38.5	4.1	36.6	5.9	40.3	5.9	37.3	5.2	47.7	6.3
T/A		6.9		5.3		7.7		7.6		7.2		8.6
E. II												
Rep. 1	*	*	43	8.0	*	*	59	9.2	--	--	43	8.2
Rep. 2	37	2.6	40	4.5	--	--	*	*	*	*	40	7.1
Rep. 3	47	5.2	--	--	41	4.8	42	6.3	*	*	*	*
Rep. 4	25	1.0	38	3.6	38	5.2	--	--	48	8.0	--	--
Rep. 5	*	*	28	3.0	*	*	44	6.0	44	6.0	31	5.6
Avg.	36.3	2.9	37.2	4.7	39.5	5.0	48.3	7.2	46	6.0	31	5.6
T/A		3.8		6.2		6.5		9.3		9.1		9.1
E. III												
Rep. 1	36	4.0	25	4.8	38	6.1	32	4.9	--	--	*	*
Rep. 2	19	2.3	48	5.5	--	--	*	*	29	5.6	60	8.6
Rep. 3	51	4.3	--	--	*	*	55	7.4	*	*	35	6.0
Rep. 4	65	5.9	*	*	34	5.5	--	--	40	6.5	--	--
Rep. 5	*	*	44	3.5	*	*	59	9.7	41	5.6	30	50
Avg.	42.7	4.1	39	4.6	36	5.8	48.6	7.3	36.6	5.9	41.6	6.5
T/A		5.4		6.0		7.6		9.6		7.7		8.5

[1]Planting date was September 25, 1965, and date of harvest was November 16, 1965.

*Indicates yields not typical of treatment.

--Indicates treatment not present in that replicate.

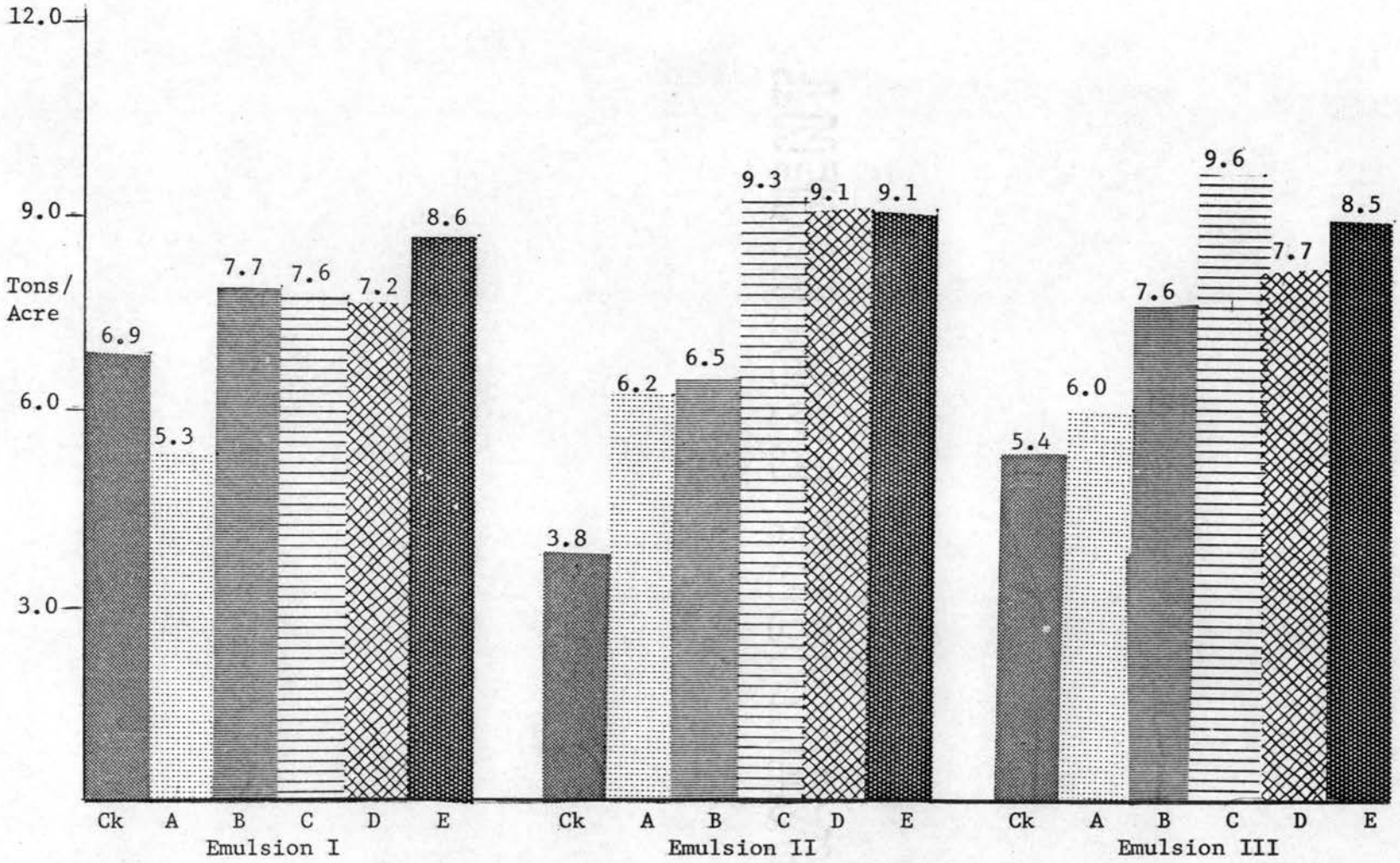

Figure 12. The Effect of Three Linseed Oil Emulsions and Five Rates of Application on Yield of Florida Broadleaf Mustard at the Vegetable Research Station, Fall, 1965

TABLE XIII

THE EFFECT OF THREE LINSEED OIL EMULSIONS AND FIVE RATES OF APPLICATION ON PLANT STAND AND YIELD OF HYBRID 424 SPINACH AT THE VEGETABLE RESEARCH STATION FALL, 1965[1]

	Treatment Rate											
	Ck.		A		B		C		D		E	
	Plant Stand	Lbs.	Plant Stand	Lbs.	Plant Stand	Lbs.	Plant Stand	Lbs.	Plant Stand	Lbs.	Plant Stand	Lbs.
E. I												
Rep. 1	21	2.5	26	3.5	36	4.0	40	4.4	--	--	39	3.6
Rep. 2	20	1.6	20	2.8	--	--	*	*	22	2.1	20	2.1
Rep. 3	24	2.7	--	--	32	3.2	24	2.9	*	*	32	3.5
Rep. 4	21	3.5	30	2.8	*	*	--	--	23	3.5	--	--
Rep. 5	36	5.1	36	5.3	23	3.8	28	3.5	25	3.2	20	3.0
Avg.	24.4	3.0	28	3.6	30.3	3.6	30.6	3.6	23.3	2.9	27.7	3.0
T/A		4.0		4.7		4.7		4.7		3.8		4.0
E. II												
Rep. 1	24	3.8	27	3.2	28	3.8	33	3.3	--	--	21	3.7
Rep. 2	32	4.2	30	3.2	--	--	21	2.1	22	2.5	29	2.9
Rep. 3	31	1.8	--	--	32	2.7	36	3.6	*	*	31	2.8
Rep. 4	29	2.4	43	3.7	32	1.9	--	--	48	4.2	--	--
Rep. 5	26	2.2	40	3.7	*	*	28	3.2	42	2.9	22	2.0
Avg.	28.4	2.8	35	3.4	30.6	2.8	29.5	3.0	37.3	3.2	25.2	2.8
T/A		3.7		4.5		3.7		4.0		4.1		3.7
E. III												
Rep. 1	21	3.3	41	2.8	35	2.4	36	3.8	--	--	*	*
Rep. 2	35	5.5	48	6.7	--	--	*	*	20	2.4	20	3.9
Rep. 3	33	4.4	--	--	*	*	35	5.2	23	3.3	17	1.9
Rep. 4	41	5.4	20	2.3	22	2.6	--	--	28	3.9	--	--
Rep. 5	*	*	39	6.3	17	2.6	37	5.4	24	3.4	19	3.3
Avg.	32.5	4.6	37	4.5	24.6	2.5	36.3	4.8	23.7	3.2	18.6	3.0
T/A		6.0		5.9		3.3		6.2		4.3		3.9

[1]Planting date was September 25, 1965, and date of harvest was December 10, 1965.

*Indicates yields not typical of treatment.

--Indicates treatment not present in that replicate.

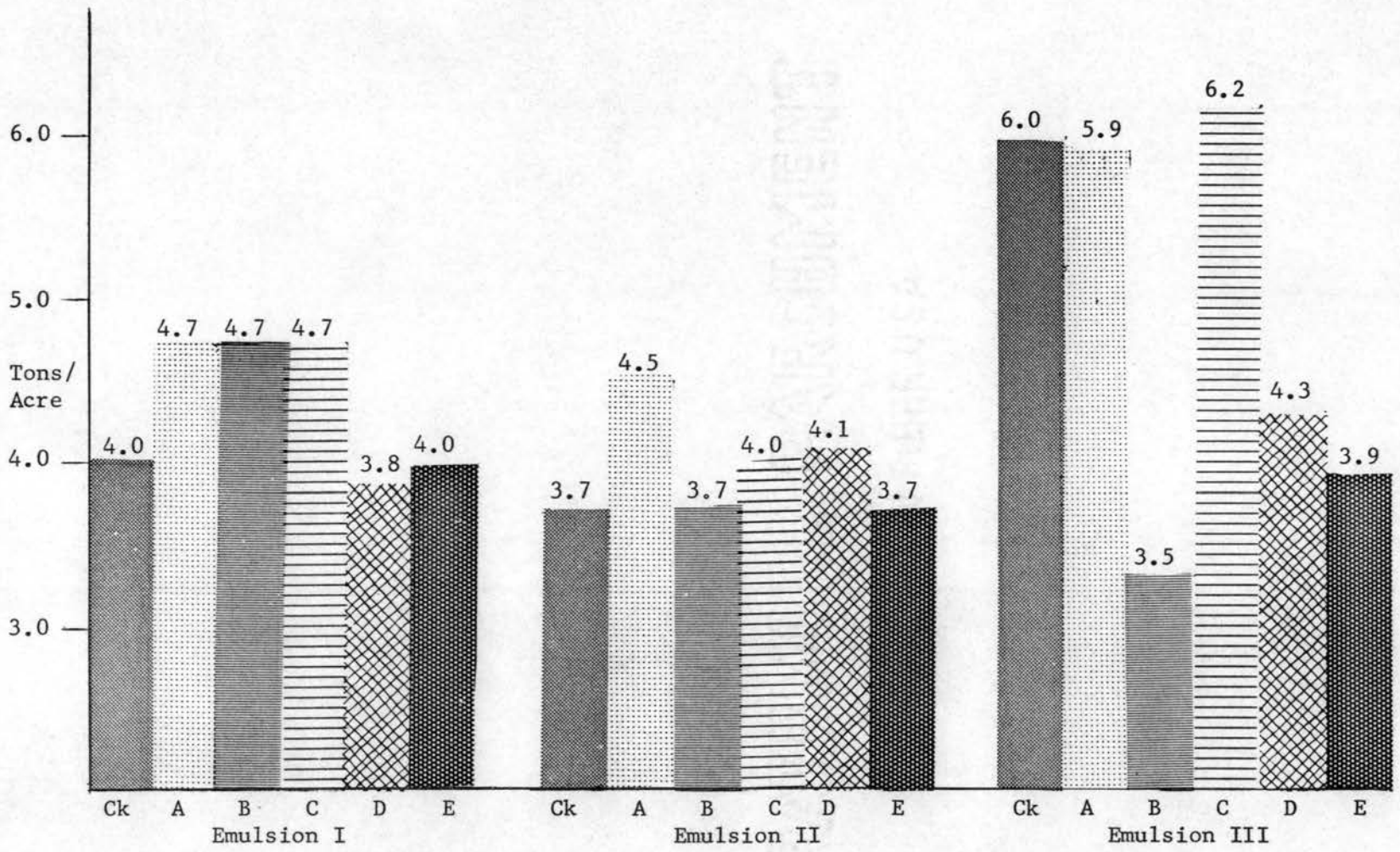

Figure 13. The Effect of Three Linseed Oil Emulsions and Five Rates of Application on Yield of Hybrid 424 Spinach at the Vegetable Research Station, Fall, 1965

TABLE XIV

THE EFFECT OF THREE LINSEED OIL EMULSIONS AND FIVE RATES OF APPLICATION ON PLANT STAND AND YIELD OF CRYSTAL WAX ONIONS AT THE VEGETABLE RESEARCH STATION, FALL, 1965[1]

	Treatment Rate					
	Ck. Plant Stand	A Plant Stand	B Plant Stand	C Plant Stand	D Plant Stand	E Plant Stand
Emulsion I						
Replicate 1	47	53	52	55	--	*
Replicate 2	*	50	--	*	64	61
Replicate 3	50	--	*	47	33	71
Replicate 4	58	*	56	--	38	--
Replicate 5	35	47	35	44	34	54
Average	47.5	50	47.6	48.6	42.2	62
Dozen Bunches per Acre	1,038	1,093	1,039	1,049	1,231	1,355
Emulsion II						
Replicate 1	46	56	46	*	--	
Replicate 2	74	65	--	*	26	69
Replicate 3	20	--	33	64	*	39
Replicate 4	59	44	52	--	52	*
Replicate 5	*	30	*	40	50	--
Average	49.7	48.7	43.6	52	42	24
Dozen Bunches per Acre	1,086	1,066	953	1,137	931	524
Emulsion III						
Replicate 1	73	52	48	73	--	*
Replicate 2	66	67	--	*	34	64
Replicate 3	74	--	33	52	67	89
Replicate 4	93	68	90	--	58	--
Replicate 5	58	84	42	86	71	52
Average	72.8	67.7	53.2	75	57.5	70.3
Dozen Bunches per Acre	1,591	1,481	1,164	1,230	1,257	1,153

[1]Planting date was September 25, 1965, and date of harvest was April 3, 1966.

*Indicates yields not typical of treatment.

--Indicates treatment not present in replicate.

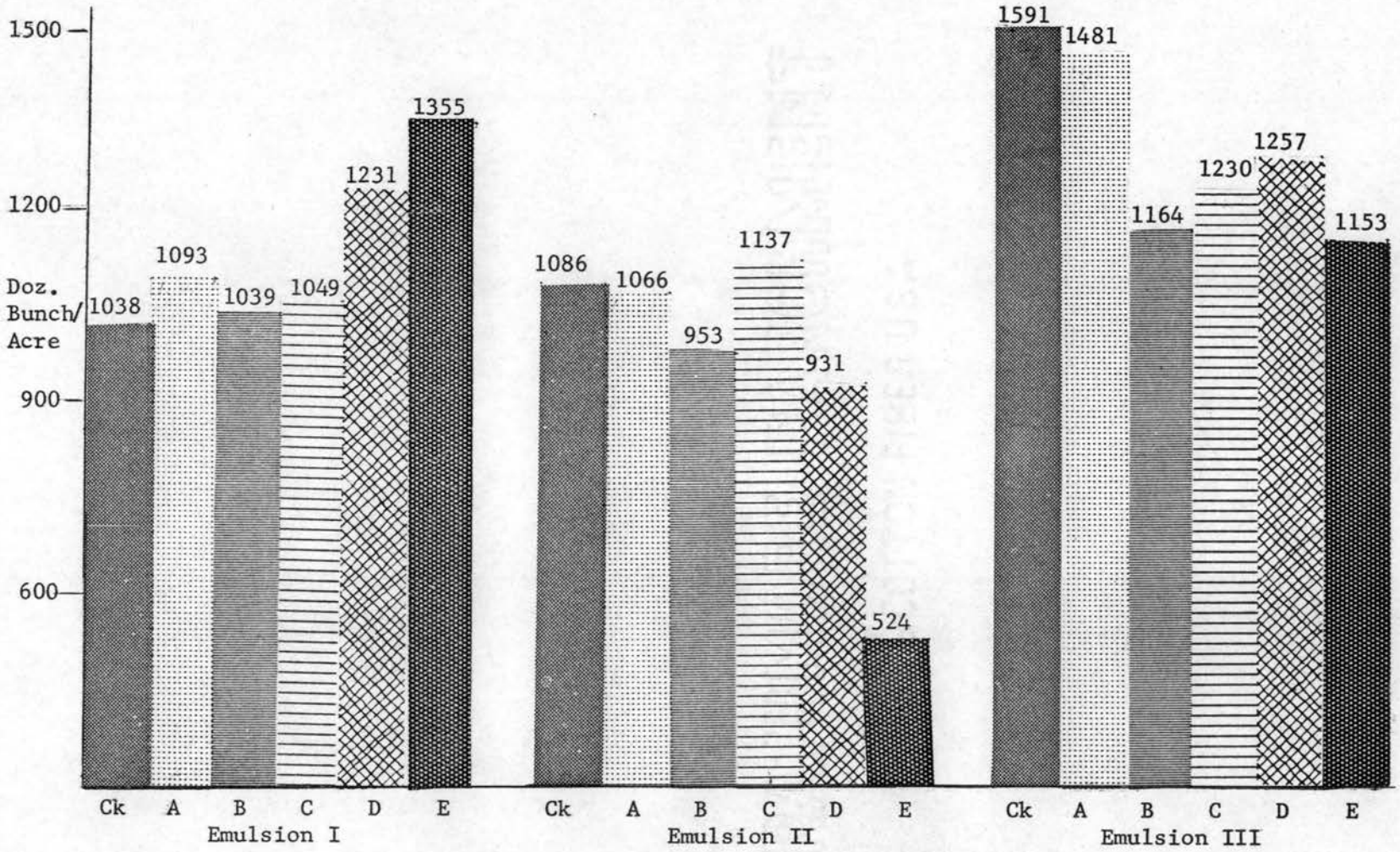

Figure 14. The Effect of Three Linseed Oil Emulsions and Five Rates of Application on Yield of Crystal Wax Onions at the Vegetable Research Station, Fall, 1965

D. The following is a report on the effect of three linseed oil emulsions and five rates of application on yields of Hybrid 424 spinach, Crystal Wax onions, Top Crop snapbeans, Grand Rapids H-8 lettuce, and Royal Chantenay carrots at the Irrigation Research Station, Lone Wolf, Oklahoma, Spring, 1965.

Tables XV, XVI, XVII, XVIII, and XIX show the yields of the five vegetable crops under study and Figures 15, 16, 17, 18, and 19 show, by means of bar graphs, comparative yields with the three emulsion materials and five treatment rates.

The snapbeans, lettuce and spinach made satisfactory yields but the lettuce and spinach were not harvested until bolting had occurred. The onions and carrots had not reached market size when harvested due to the difficulty encountered in controlling weeds in the plots.

All lettuce yields as represented in Figure 15 appeared to be relatively low. There was however a slight increase in yield obtained with the A rate (6 milliliters per square foot) of Emulsions I and II and with the E rate (50 milliliters per square foot) of Emulsion III.

Figure 16 shows the highest onion yield obtained was 321 dozen bunches per acre with the C rate (25 milliliters per square foot) of Emulsion I and the D rate (37 milliliters per square foot) of Emulsion II. This was followed by 259 dozen bunches per acre with the B rate (12 milliliters per square foot) and C rate (25 milliliters per square foot) of Emulsion III.

Snapbean yields are shown in Figure 17. All yields appear to be low, but a slight increase seems to be evident with 50 milliliters per square foot of Emulsions I and II and 12 milliliters per square foot of Emulsion III.

Yields of leaf lettuce and carrots are given in Figures 18 and 19. They, too, appear to be very low. The higher lettuce yields, however, were from plots treated with 6 milliliters per square foot of Emulsion I and 50 milliliters per square foot of Emulsions II and III. The highest carrot yield was 1.5 tons per acre obtained from plots treated with 12 milliliters per square foot of Emulsion III. Next in order was 1.3 tons per acre obtained with 25 milliliters per square foot of Emulsion I and 50 milliliters per square foot of Emulsion II.

Since the average yields were very low of all the crops at the Irrigation Research Station, it was difficult to determine if the increase in yield of the treated crops was actually due to the treatment variables imposed by the experiment.

TABLE XV

THE EFFECT OF THREE LINSEED OIL EMULSIONS AND FIVE RATES OF APPLICATION ON PLANT STAND AND YIELD OF HYBRID 424 SPINACH AT THE IRRIGATION RESEARCH STATION, SPRING, 1965[1]

	Treatment Rate											
	Ck.		A		B		C		D		E	
	Plant Stand	Lbs.	Plant Stand	Lbs.	Plant Stand	Lbs.	Plant Stand	Lbs.	Plant Stand	Lbs.	Plant Stand	Lbs.
E. I												
Rep. 1	12	0.5	9	1.2	12	0.9	6	0.4	--	--		
Rep. 2	17	1.5	14	1.6	--	--	8	0.6	13	1.1	14	1.0
Rep. 3	11	0.9	--	--	19	2.0	14	2.3	20	1.9	6	0.5
Rep. 4	9	0.9	19	2.0	8	1.0	--	--	5	0.4	*	*
Rep. 5	10	0.8	21	2.1	17	1.6	12	0.9	9	1.1	16	1.4
Avg.	12	.92	16	1.7	14	1.4	10	1.1	15	1.4	12	.96
T/A		.54		1.0		.84		.66		.66		.59
E. II												
Rep. 1	11	1.4	13	1.3	18	1.7	16	1.6	--	--	14	1.3
Rep. 2	17	1.9	27	2.2	--	--	18	1.4	11	1.3	17	1.9
Rep. 3	6	1.0	--	--	*	*	27	1.9	12	1.7	16	1.5
Rep. 4	9	1.1	15	1.4	9	1.4	--	--	10	1.4	--	--
Rep. 5	8	0.6	*	*	19	1.5	20	1.5	13	1.4	16	1.5
Avg.	10	1.2	18.3	1.6	15.3	1.5	20	1.5	13	1.4	16	1.5
T/A		.72		1.0		.95		.90		.84		.91
E. III												
Rep. 1	16	1.3	*	*	*	*	17	1.1	--	--	15	1.5
Rep. 2	6	0.5	12	1.0	--	--	12	0.8	*	*	12	1.2
Rep. 3	9	0.7	--	--	6	0.4	*	*	18	1.8	*	*
Rep. 4	6	0.5	4	0.4	11	1.0	--	--	15	1.5	--	--
Rep. 5	7	0.5	8	0.5	14	1.2	15	1.0	5	0.5	22	1.8
Avg.	9	.7	8	.63	10.3	.86	14.6	.96	12.8	7.2	16.3	1.5
T/A		.42		.39		.53		.59		.78		.93

[1]Planting date was April 13, 1965, and date of harvest was June 10, 1965.

*Indicates yields not typical of treatment.

--Indicates treatment not present in that replicate.

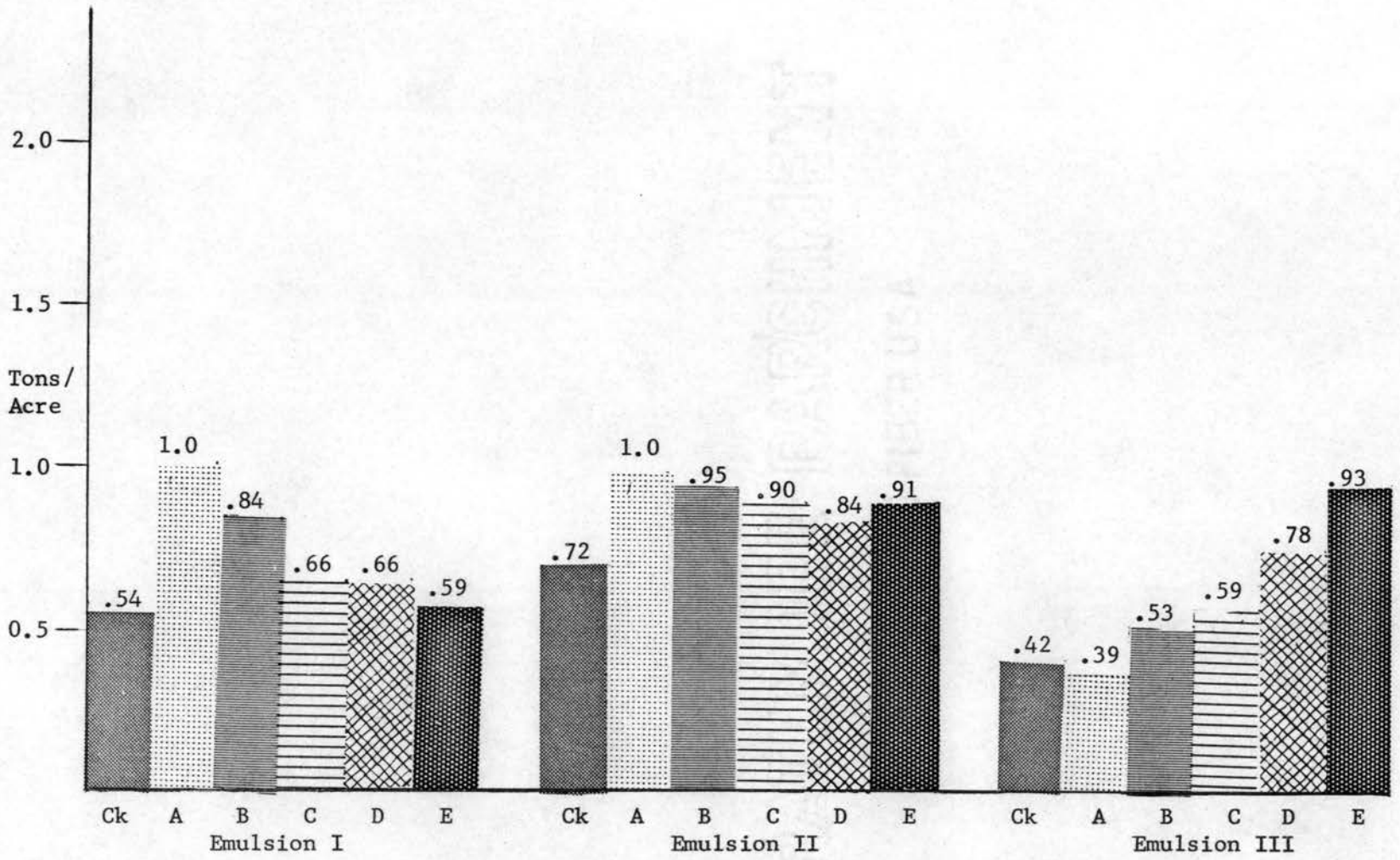

Figure 15. The Effect of Three Linseed Oil Emulsions and Five Rates of Application on Yield of Hybrid 424 Spinach at the Irrigation Research Station, Spring, 1965

TABLE XVI

THE EFFECT OF THREE LINSEED OIL EMULSIONS AND FIVE RATES OF APPLICATION ON PLANT STAND AND YIELD OF CRYSTAL WAX ONION AT THE IRRIGATION RESEARCH STATION, SPRING, 1965[1]

	Treatment Rate					
	Ck. Plant Stand	A Plant Stand	B Plant Stand	C Plant Stand	D Plant Stand	E Plant Stand
Emulsion I						
Replicate 1	21	28	27	10	--	*
Replicate 2	37	*	--	15	23	11
Replicate 3	12	--	21	68	9	17
Replicate 4	15	14	9	--	37	--
Replicate 5	*	*	*	*	13	22
Average	21.2	21	19	31	21	16.6
Dozen Bunches per Acre	219	217	197	321	217	165
Emulsion II						
Replicate 1	19	17	15	10	--	18
Replicate 2	11	26	--	21	45	*
Replicate 3	24	--	16	35	35	14
Replicate 4	15	17	39	--	16	--
Replicate 5	*	27	21	16	27	11
Average	17.2	22	23	21	31	14.3
Dozen Bunches per Acre	179	228	238	217	321	148
Emulsion III						
Replicate 1	15	37	19	32	--	15
Replicate 2	*	22	--	19	17	23
Replicate 3	34	--	41	*	20	21
Replicate 4	23	11	15	--	16	--
Replicate 5	10	23	26	24	15	20
Average	20.5	23	25	25	17	20
Dozen Bunches per Acre	207	238	259	259	176	207

[1]Planting date was April 13, 1965, and date of harvest was July 9, 1965.

*Indicates yields not typical of treatment.

--Indicates treatment not present in that replicate.

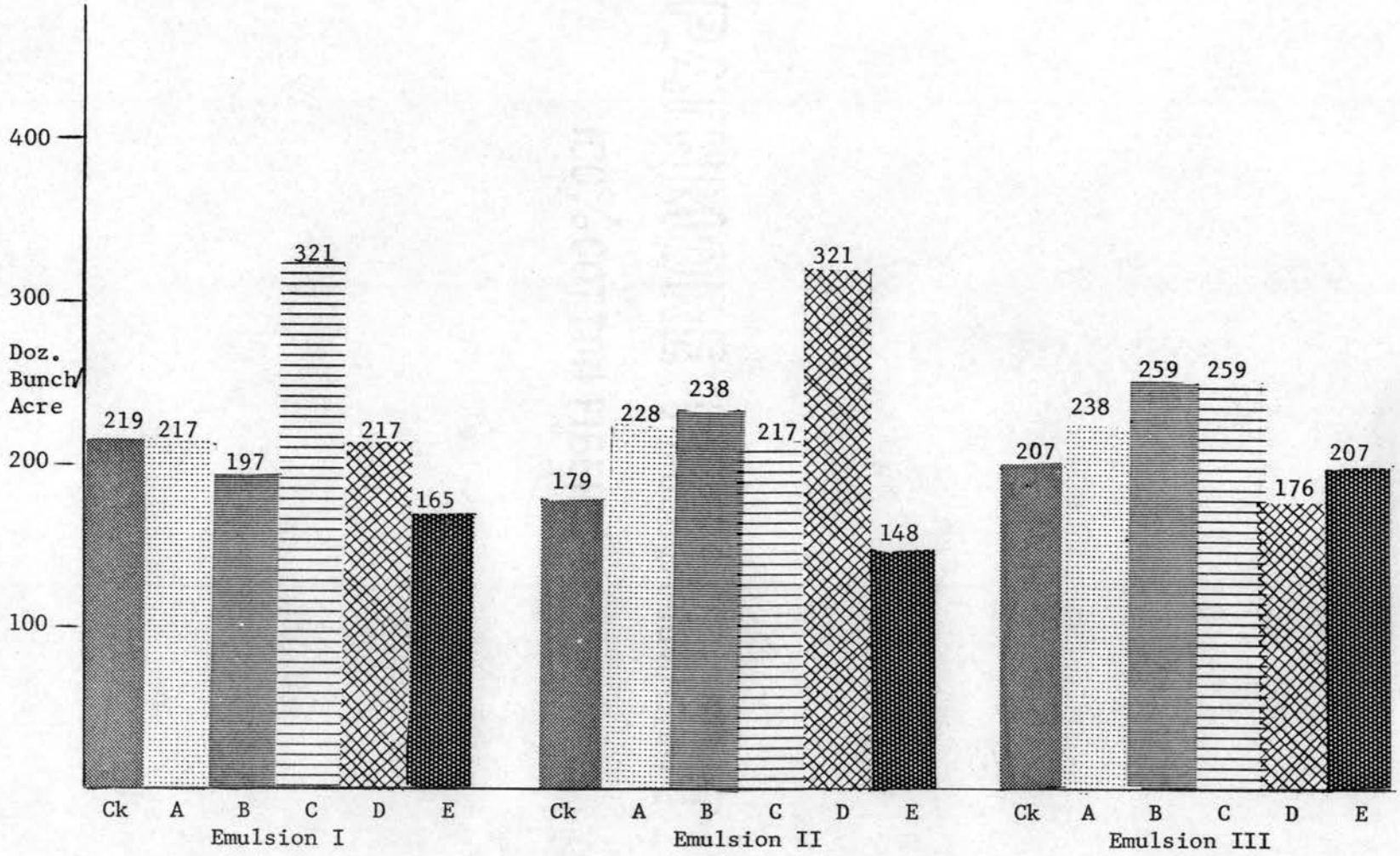

Figure 16. The Effect of Three Linseed Oil Emulsions and Five Rates of Application on the Yield of Crystal Wax Onions at the Irrigation Research Station, Spring, 1965

TABLE XVII

THE EFFECT OF THREE LINSEED OIL EMULSIONS AND FIVE RATES OF APPLICATION ON PLANT STAND AND YIELD OF TOP CROP SNAPBEANS AT THE IRRIGATION RESEARCH STATION, SPRING, 1965[1]

	Treatment Rate											
	Ck.		A		B		C		D		E	
	Plant Stand	Lbs.	Plant Stand	Lbs.	Plant Stand	Lbs.	Plant Stand	Lbs.	Plant Stand	Lbs.	Plant Stand	Lbs.
E. I												
Rep. 1	40	3.2	30	2.7	32	3.7	48	4.1	--	--	31	3.0
Rep. 2	23	2.2	27	2.5	--	--	24	2.2	21	2.6	39	3.8
Rep. 3	35	3.9	--	--	36	3.9	32	3.6	30	3.2	22	2.7
Rep. 4	24	3.0	12	2.0	34	2.7	--	--	21	2.5	--	--
Rep. 5	19	2.3	23	3.0	22	2.4	24	2.6	25	3.0	33	3.3
Avg.	28	2.9	23	2.6	31	3.2	32	3.1	24	2.8	31	3.2
T/A		1.7		1.5		1.9		1.8		1.6		1.9
E. II												
Rep. 1	41	3.4	20	2.6	32	3.9	31	3.2	--	--	39	3.5
Rep. 2	29	3.1	34	3.4	--	--	21	2.2	19	2.5	40	3.8
Rep. 3	37	3.2	--	--	20	2.0	26	2.6	26	2.6	26	2.3
Rep. 4	32	2.8	25	2.2	30	2.9	--	--	18	2.2	--	--
Rep. 5	20	2.2	27	3.1	13	1.9	30	3.3	35	3.2	28	2.6
Avg.	32	2.9	27	2.8	24	2.4	27	2.8	25	2.6	33	3.1
T/A		1.7		1.6		1.4		1.6		1.5		1.8
E. III												
Rep. 1	18	1.3	15	1.5	25	2.9	26	2.4	--	--	23	2.3
Rep. 2	23	2.5	23	2.3	--	--	20	1.1	32	3.2	17	2.0
Rep. 3	8	1.4	--	--	15	1.7	16	1.5	17	1.4	18	2.1
Rep. 4	15	1.6	11	1.0	9	1.6	--	--	27	2.8	--	--
Rep. 5	19	2.2	21	2.1	29	2.6	19	2.4	7	0.9	23	1.9
Avg.	17	1.8	70	6.9	78	8.8	81	7.4	83	8.3	81	8.3
T/A		1.0		1.0		1.3		1.1		1.2		1.2

[1]Planting date was April 13, 1965, and date of harvest was June 28, 1965.

--Indicates treatment not present in that replicate.

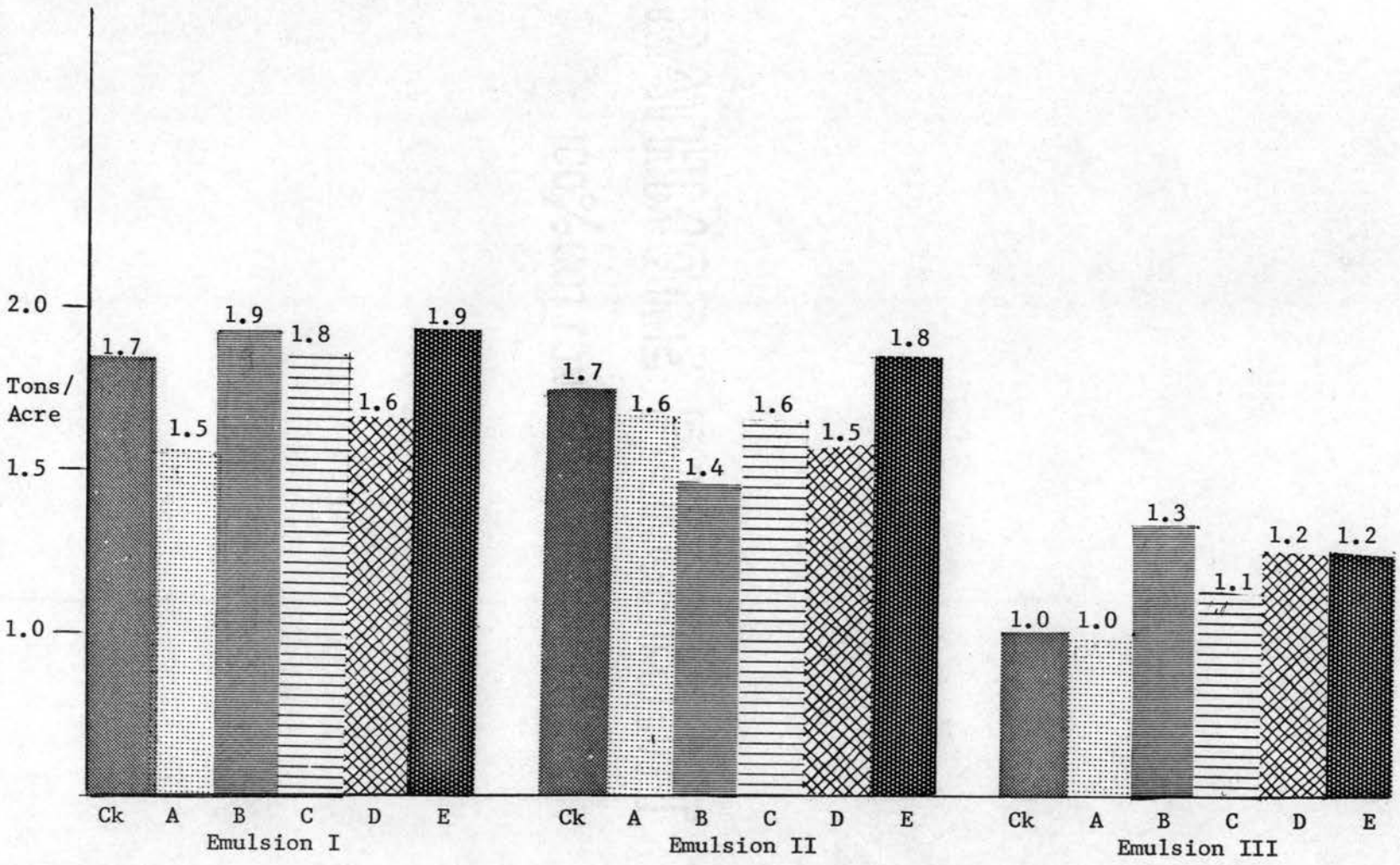

Figure 17. The Effect of Three Linseed Oil Emulsions and Five Rates of Application on Yield of Top Crop Snapbeans at the Irrigation Research Station, Spring, 1965

TABLE XVIII

THE EFFECT OF THREE LINSEED OIL EMULSIONS AND FIVE RATES OF APPLICATION ON PLANT STAND AND YIELD OF GRAND RAPIDS H-8 LETTUCE AT THE IRRIGATION RESEARCH STATION, SPRING, 1965[1]

	Ck.		Treatment Rate A		B		C		D		E	
	Plant Stand	Lbs.	Plant Stand	Lbs.	Plant Stand	Lbs.	Plant Stand	Lbs.	Plant Stand	Lbs.	Plant Stand	Lbs.
E. I												
Rep. 1	5	0.9	10	2.5	*	*	7	1.1	--	--	4	0.5
Rep. 2	*	*	14	3.0	--	--	*	*	*	*	*	*
Rep. 3	6	0.8	--	--	*	*	2	1.0	*	*	4	0.9
Rep. 4	*	*	*	*	*	*	--	--	4	1.6	--	--
Rep. 5	5	1.4	*	*	6	1.4	10	1.9	4	1.1	7	1.8
Avg.	5.3	1.0	12	2.7	6	1.4	6.3	1.3	4	1.3	5	1.0
T/A		.64		1.7		.87		.82		.83		.99
E. II												
Rep. 1	3	0.9	3	1.4	4	1.1	6	1.2	--	--	14	3.7
Rep. 2	*	*	9	3.8	--	--	7	1.2	10	1.9	7	1.5
Rep. 3	*	*	--	--	*	*	9	3.4	5	1.3	*	*
Rep. 4	3	1.0	6	1.7	3	0.8	--	--	6	2.8	--	--
Rep. 5	4	1.1	6	0.8	4	0.9	5	2.1	9	1.7	11	3.6
Avg.	3.3	1.0	6	1.9	3.6	.93	7	2.0	8	1.9	10.6	2.9
T/A		.62		1.1		.57		1.2		1.1		1.8
E. III												
Rep. 1	7	1.3	5	2.8	*	*	4	1.2	--	--	11	4.4
Rep. 2	10	2.3	7	2.4	--	--	6	1.3	*	*	*	*
Rep. 3	*	*	--	--	7	2.9	10	3.2	7	2.9	*	*
Rep. 4	5	1.3	7	2.1	*	*	--	--	8	1.5	--	--
Rep. 5	5	1.3	8	1.4	14	4.1	4	2.2	3	1.0	18	4.5
Avg.	6.7	1.5	7	2.2	10.5	3.5	6	1.9	6	1.8	14.5	4.4
T/A		1.2		1.3		2.1		1.2		1.1		2.7

[1]Planting date was May 1, 1965, and date of harvest was July 8, 1965.

*Indicates yields not typical of treatment.

--Indicates treatment not present in that replicate.

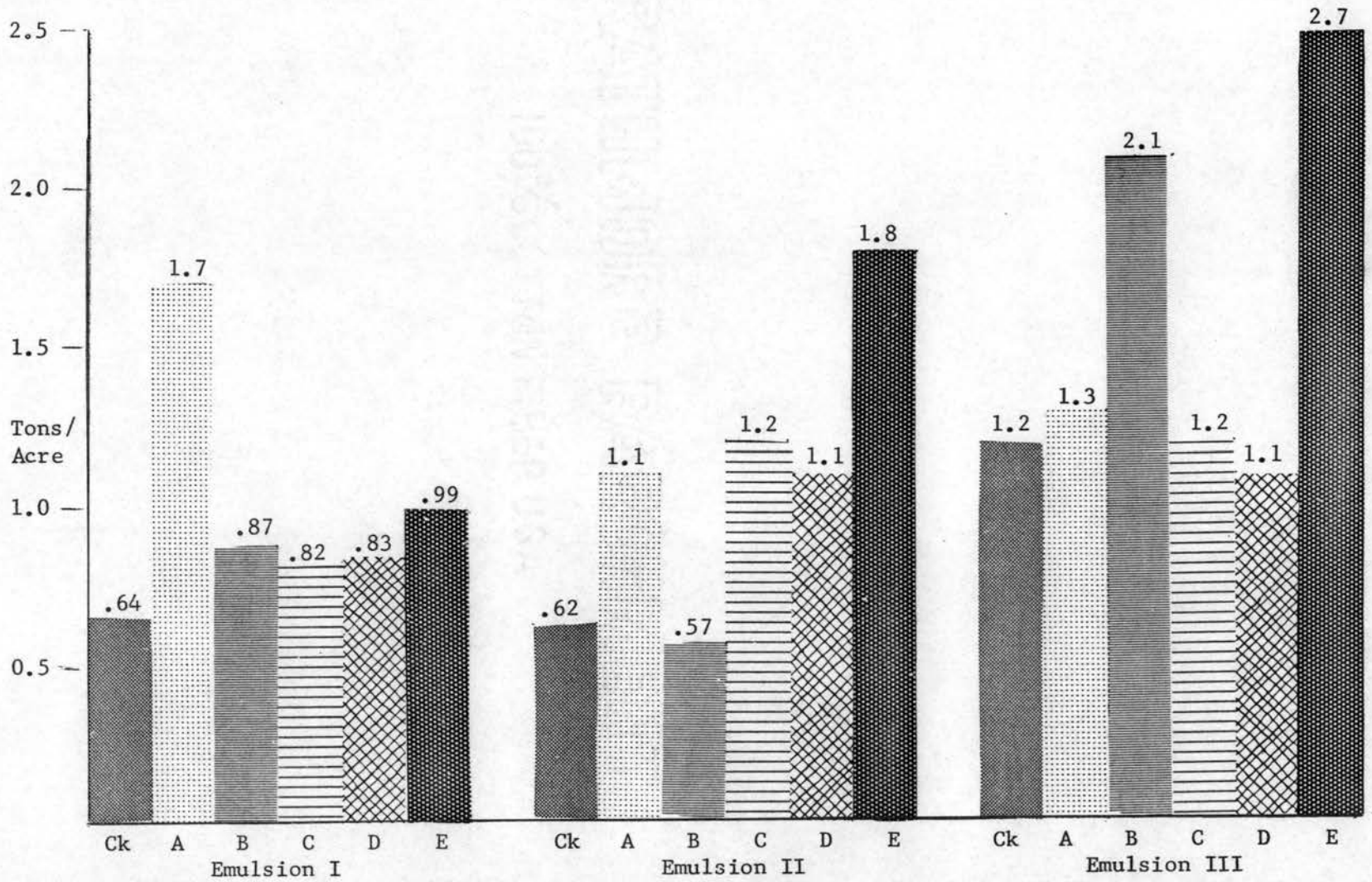

Figure 18. The Effect of Three Linseed Oil Emulsions and Five Rates of Application on Yield of Grand Rapids H-8 Lettuce at the Irrigation Research Station, Spring, 1965

TABLE XIX

THE EFFECT OF THREE LINSEED OIL EMULSIONS AND FIVE RATES OF APPLICATION ON PLANT STAND AND YIELD OF ROYAL CHANTENAY CARROTS AT THE IRRIGATION RESEARCH STATION, SPRING, 1965[1]

	Treatment Rate											
	Ck.		A		B		C		D		E	
	Plant Stand	Lbs.	Plant Stand	Lbs.	Plant Stand	Lbs.	Plant Stand	Lbs.	Plant Stand	Lbs.	Plant Stand	Lbs.
E. I												
Rep. 1	41	1.3	34	0.9	54	1.3	63	3.7	--	--	*	*
Rep. 2	39	0.8	40	1.8	--	--	*	*	41	1.9	71	2.2
Rep. 3	33	0.6	--	--	33	1.3	30	0.8	*	*	41	1.5
Rep. 4	35	1.0	*	*	*	*	--	--	*	*	--	--
Rep. 5	*	*	46	1.2	38	1.4	56	2.1	37	1.8	41	1.5
Avg.	37	0.9	40	1.3	41.6	1.3	49.6	2.2	39	1.8	51	1.7
T/A		.55		.80		.82		1.3		1.1		1.0
E. II												
Rep. 1	25	0.8	23	0.8	32	0.9	*	*	--	--	88	3.8
Rep. 2	17	0.7	*	*	--	--	*	*	36	1.2	*	*
Rep. 3	33	0.8	--	--	51	2.6	29	1.0	49	1.7	50	1.6
Rep. 4	*	*	38	1.0	*	*	--	--	57	2.2	--	--
Rep. 5	40	1.3	48	1.2	27	0.8	56	1.9	43	1.5	28	1.4
Avg.	28.7	0.9	35.6	1.0	36.6	1.4	42.5	1.4	46.2	1.6	55.3	3.2
T/A		.55		.62		.87		.87		.99		1.3
E. III												
Rep. 1	41	1.1	34	1.4	44	1.4	55	1.3	--	--	38	1.1
Rep. 2	*	*	*	*	--	--	57	1.9	*	*	39	0.7
Rep. 3	42	1.5	--	--	75	3.1	--	--	45	1.5	35	1.2
Rep. 4	*	*	49	1.6	93	3.1	*	*	58	1.5	--	--
Rep. 5	59	2.1	19	0.3	*	*	43	1.3	34	0.8	*	*
Avg.	47.3	1.9	34	1.1	70.6	2.5	51.6	1.5	45.6	1.2	37.3	1.0
T/A		1.1		.68		1.5		.93		.74		.62

[1]Planting date was May 1, 1965 and date of harvest was July 9, 1965.

*Indicates yields not typical of treatment.

--Indicates treatment not present in that replicate.

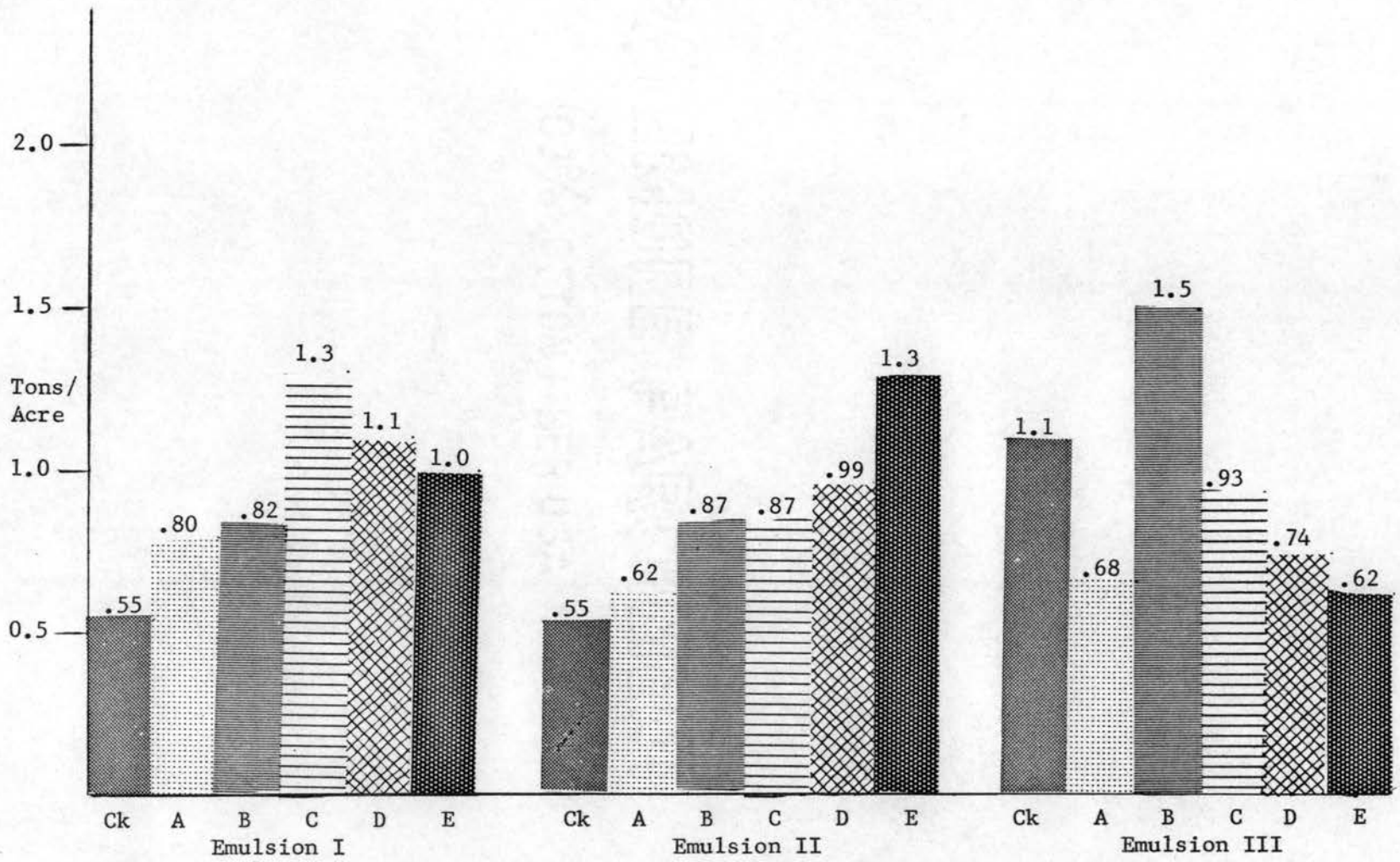

Figure 19. The Effect of Three Linseed Oil Emulsions and Five Rates of Application on Yield of Royal Chantenay Carrots at the Irrigation Research Station, Spring, 1965

E. The following is a report on the effect of three linseed oil emulsions and five rates of application on water penetration into a Reinach fine silt loam soil. The results reported herein were obtained in greenhouse tests at Oklahoma State University.

As shown in Figures 20, 20a, and 20b, there was an increase in rate of water penetration as the rate of application of the emulsion material increased. This was more evident following the first watering cycle.

Treatment rates of 25, 37, and 50 milliliters of Emulsion I; 37 and 50 milliliters of Emulsion II; and 12, 25, 37, and 50 milliliters of Emulsion III allowed for more rapid water infiltration as shown in Table 20. The treatment rates were sufficiently heavy to provide a fixed film around the surface soil particles which was not affected to a great degree by the applied water. The soil in the check plots, on the other hand, moved and became aligned to the extent that the rate of infiltration was reduced.

TABLE XX

THE EFFECT OF THREE LINSEED OIL EMULSIONS AND FIVE RATES OF APPLICATION ON WATER PENETRATION IN A REINACH FINE SILT LOAM SOIL UNDER GREENHOUSE CONDITIONS

Time, in Minutes and Seconds Required, for 500 ml. of Water To Be Absorbed Into a 28.3 Square Inch Area of Soil

	Treatment Rate											
	Ck.		A		B		C		D		E	
Emulsion I												
7 Days After Treatment	6m	11s	5m	6s	4m	41s	3m	19s	3m	53s	2m	39s
21 Days After Treatment	13m	7s	9m	53s	10m	28s	5m	46s	4m	0s	4m	30s
42 Days After Treatment	25m	30s	23m	0s	23m	0s	14m	0s	10m	15s	7m	30s
Emulsion II												
7 Days After Treatment	5m	51s	4m	3s	5m	0s	5m	0s	3m	0s	4m	3s
21 Days After Treatment	16m	16s	10m	23s	3m	0s	2m	48s	1m	55s	2m	26s
42 Days After Treatment	23m	0s	9m	0s	4m	0s	7m	30s	4m	45s	4m	0s
Emulsion III												
7 Days After Treatment	5m	2s	5m	30s	4m	52s	4m	45s	4m	37s	4m	45s
21 Days After Treatment	11m	32s	12m	35s	5m	31s	5m	23s	0m	54s*	0m	33s*
42 Days After Treatment	27m	30s	9m	0s	13m	0s	6m	30s	4m	0s	5m	15s

*Although it was not detected, it was assumed that the fast infiltration rates 21 days after treatment with Emulsion II at the D and E rates of application was due in part to a portion of the applied water escaping between the soil column and the inside of the cylinder.

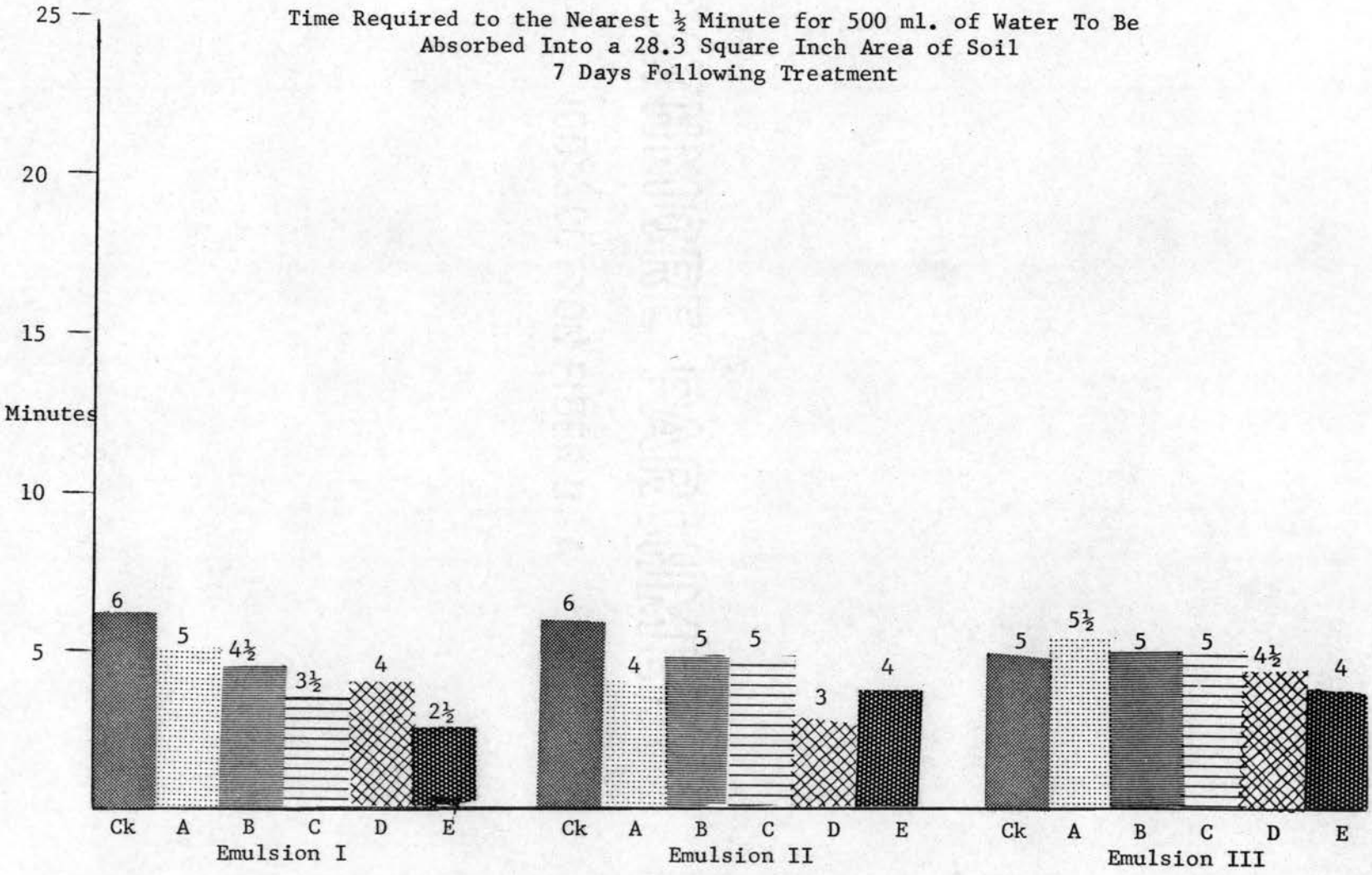

Figure 20. The Effect of Three Linseed Oil Emulsions and Five Rates of Application on Water Penetration Into a Reinach Fine Silt Loam Soil

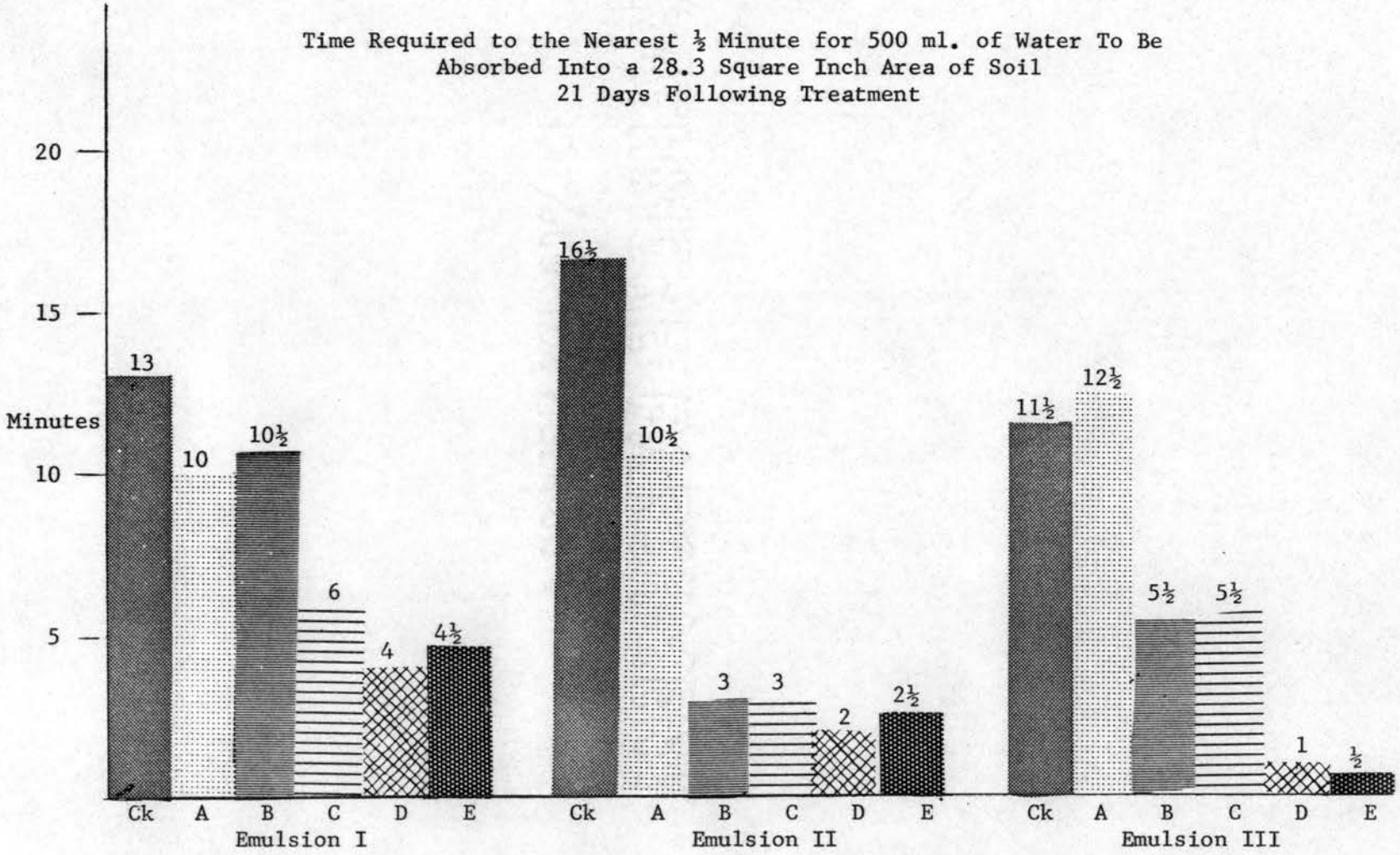

Figure 20a. The Effect of Three Linseed Oil Emulsions and Five Rates of Application on Water Penetration Into a Reinach Fine Silt Loam Soil

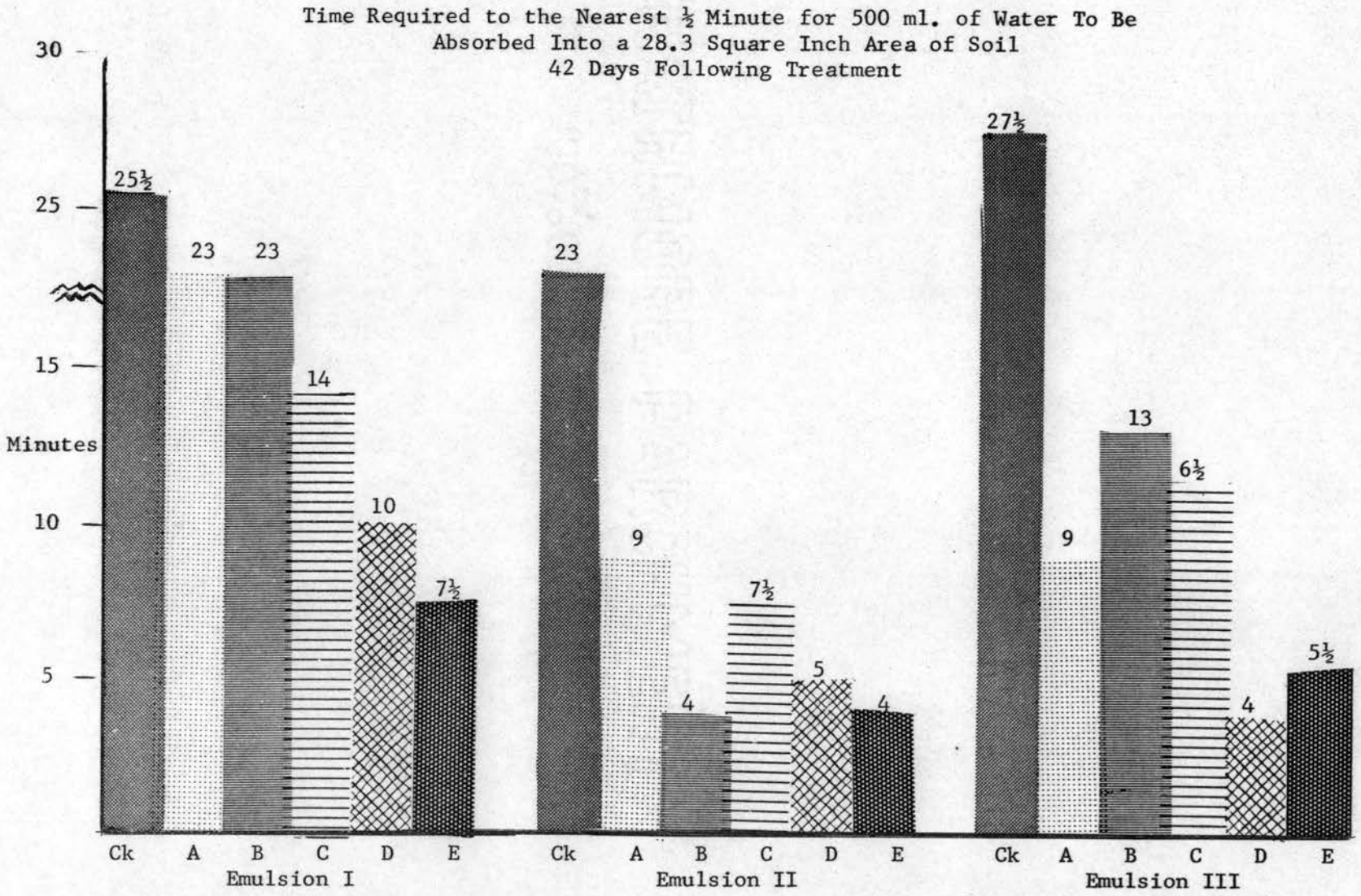

Figure 20b. The Effect of Three Linseed Oil Emulsions and Five Rates of Application on Water Penetration Into a Reinach Fine Silt Loam Soil

CHAPTER V

DISCUSSION AND CONCLUSIONS

Plant growth is dependent upon many factors. Among these are proper temperature, available water, adequate nutrient supply, and a well aerated medium.

The purpose of this study was to determine the effect of three linseed oil-water emulsion surface spray materials at five rates of application on soil temperature, water penetration, seedling emergence, and yield of certain crops.

The application of each linseed oil emulsion to the soil resulted in increased temperatures one inch below the surface. Soils in the check plots and in some cases treatment rates for six and twelve milliliters per square foot were found to have lower temperatures one inch below the surface than was recorded on the surface, whereas at the higher treatment rates soil temperature one inch below the surface approached or exceeded soil surface temperature. This was probably due to the fact that some degree of crusting had occurred on the check plots and the lower treatment rate plots, whereas plots with a higher treatment rate remained quite friable. These loose soil particles provided better protection against heat loss than did the compacted soil. This is shown in Figures 4 and 4a.

The data in Table XX and Figures 20, 20a, and 20b show that as the rate of application of each emulsion increased, the rate of water

infiltration into the soil also increased. The underlying cause of this was the fact that as the rate of application of the treatment materials became higher there was less realignment of the surface soil particles, thus more rapid water penetration into the soil.

In nearly all instances there was an increase in seedling emergence of lettuce, onions, spinach, and mustard upon application of the emulsions at a particular treatment rate. Exceptions to this was mustard when treated with Emulsion I and onions when treated with Emulsion II. This evidence would lend support to previous work which indicated that application of similar materials to the soil surface prevented surface crusting to act as an aid in seedling emergence (6, 14).

An increase in yield was obtained in almost all of the test crops treated with each emulsion. The exceptions to this was spinach and soybean plots treated in the spring at the Vegetable Research Station with Emulsion I and snapbeans at the Irrigation Research Station treated with Emulsions I and II.

Spinach and onions treated with Emulsion III in the fall at the Vegetable Research Station and onions, snapbeans, and carrots treated with Emulsion III at the Irrigation Research Station also failed to produce higher yields than did the check plots.

The data for soybean yield presented in Table VI suggests that the emulsions were not as effective in producing increased yields of long term crops such as this.

There appears to be an optimum treatment rate of the emulsion materials for the crops with a leveling off or decrease in yield after this rate has been reached.

It would be unwise to recommend these materials for use on crops based upon these tests alone. There certainly appears to be need for further investigation of the possibilities of the emulsions.

The use of these materials without satisfactory herbicidal treatments or other means of weed control other than cultivation is not recommended.

CHAPTER VI

SUMMARY

1. The application of linseed oil-water emulsion materials to the soil as surface spray applications resulted in an increase in soil temperatures one inch below the surface when compared to non-treated plots.

2. Linseed oil emulsions acted as a soil stabilizing material to aid in more rapid water infiltration.

3. In all tests, except mustard and onions when treated with Emulsion III, there were increases in seedling emergence of lettuce, onions, spinach, and mustard. This apparently was due to the emulsion materials preventing realignment of the surface soil particles.

4. Increases in yield of mustard, lettuce, spinach, onions, carrots, and snapbeans was obtained when the soil was treated with the emulsions.

5. Fast growing and early maturing crops such as lettuce and mustard were benefitted more by the treatments than were long term crops such as soybeans.

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VITA

Raymond E. Campbell

Candidate for the Degree of

Master of Science

Thesis: A STUDY OF THE EFFECT OF THREE LINSEED OIL EMULSIONS ON SEEDLING EMERGENCE AND YIELD OF CERTAIN CROPS

Major Field: Horticulture

Biographical:

Personal Data: Born in Ranger, Texas, January 4, 1941, the son of James J. and Ethel I. Campbell.

Education: Attended grade school and high school in Idabel, Oklahoma; graduated from Idabel Gray High School in 1959; attended Eastern A. and M. College, Wilburton, Oklahoma from 1959-1961; received the Bachelor of Science degree from Oklahoma State University with a major in Animal Husbandry, in May, 1963; completed requirements for the Master of Science degree in Horticulture in July, 1966.

Professional Experience: Assistant County Extension Agent at large, Coal County, Oklahoma, June, 1963, to September, 1964. Served 1965-1966 school year as graduate assistant in teaching in Oklahoma State University Horticulture Department, Stillwater, Oklahoma.

Organizations and Honors: Oklahoma State University Horticulture Club, Oklahoma State University Deans' Honor Roll, Recipient of Tulsa Garden Club Student Scholarship Grants in 1964 and 1965.