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**VEGETABLE ADAPTABILITY IN THE
WICHITA VALLEY**

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This bulletin reports 13 years work on the adaptability of vegetables to the soils and climate at the Wichita Valley Irrigated Experiment Station located near Iowa Park, Wichita County, Texas. The results are applicable specifically to the irrigated valley and generally to the region at large.

The bulletin is designed to place the results obtained before those interested in vegetable growing in the most usable form.

The first section of the publication deals with the relationships of temperature and vegetable crops. Low temperatures that injure the hardiest crops are discussed, as well as temperatures that injure those crops that are moderately hardy and those more tender. Growing periods for different crops are defined as limited by their ability to survive low temperatures and to grow, and produce good yields of marketable quality under the temperature conditions existing at harvest time.

The second section treats the effects of soils, in particular their physical properties, on the development of vegetable crops. A short discussion of soil reaction is also given.

In the final section varietal characteristics and behaviour under local conditions are given. Yield records for most of the common vegetables are shown. Any special problems affecting the growing of a crop are discussed in this last section.

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VEGETABLE ADAPTABILITY IN THE WICHITA VALLEY

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Ever since the experiment station at Iowa Park was established in 1926 work has been carried on leading toward an understanding of the factors which influence vegetable production in the Wichita Valley. It is the purpose of this publication to present the results that have been obtained between the beginning of the work and 1939. The two most important environmental characteristics of the Wichita Valley, climate and soil, will be carefully analyzed for their effects on vegetable adaptability. Further, a study of the kinds of vegetables and the varieties which are most suitable will be discussed and the results of this study presented.

Temperature Relations

Probably the most important climatic factor influencing gardening in the Wichita Valley is temperature. All crops depend more or less upon certain temperature relationships. Carrots, for instance, grow best with a temperature of 70° F. (8),¹ at higher temperatures root growth slows down remarkably. Beets produce roots faster between 50 to 60° than between 60 to 70° or between 70 to 80° (7). Hot weather produces long stems in cabbage which results in small heads of poor quality (3). Cool temperatures produce the finest spinach (6). In some parts of the state large fruited tomatoes will not set fruit during the summer most years because of high temperatures and low humidity (2), (5).

Ware (11) and Thompson (10) both discuss in some detail some of the various weather conditions and the way they affect vegetable crops. Crops are considered as cool weather crops and other crops. They point out the minimum and maximum temperature relationship in a general way. Much work has been done in Europe on many crops to determine the approximate temperatures which give the best results for growing different crops. These are reported by J. Becker (1).

It is interesting and important to note that while these various reports are useful they do not pretend to suggest that the results are absolute. In the Wichita Valley it has been found that there is no perfect agreement between results in the field and the reported work. In general, however, the agreement between the results in the Valley and those of others is quite close.

There are certain fairly well defined temperature limits which limit the production of many vegetable crops in the Wichita Valley. It is the purpose of this section to show what these limits are and when they are encountered.

¹Literature cited.

Vegetables vary considerably in their ability to endure high and low temperatures. Ten years of observation at the Iowa Park Station indicate certain temperatures as limiting. Twenty degrees, 25 degrees, 27 degrees and 32 degrees have been found to mark rather definitely the low temperatures some groups of vegetables can withstand. With regard to the upper limits of temperatures the average rather than the absolute maximum seems more important. Seventy degrees seems to be the maximum average for crops such as lettuce and mustard. Others like beets and carrots will grow well without becoming woody or coarse at temperatures up to 80 degrees. A few such as swiss chard and okra do not seem to be affected by the highest average temperatures at Iowa Park.

Spring planted vegetables

Vegetables planted in the spring are more influenced by temperature relationships than others since the spring season is often short. Table 1 gives the data with regard to temperature relations. This table is useful in conjunction with table 2 for determining varieties of vegetables for planting.

Table 1

Relation of seedling hardiness and plant heat tolerance to average length of spring growing season

Minimum temperature (°F.) seedlings can stand without serious damage	Average number of days available in which to mature crops, plants of which can grow well at average temperatures up to		
	70°	80°	85°
32	35	64	94
27	45	74	104
25	57	86	116
20	67	96	126

Note that the lower temperature seedlings can stand and the higher the temperature at which plants can grow the longer the growing season.

It must be remembered that the data presented in Table 1 are averages for the 10 years 1930 and 1939, inclusive. Some years even such cool-season crops as head lettuce may be grown. Annual variation is great and it is important to realize that what may appear to be a safe planting date may be either too early or too late. Some years slightly hardy cool season vegetables may have a season of 80 days, and in others the growing season may be only 45 days.

In the light of the figures presented in Table 1 it would seem that lettuce, a moderately hardy cool-season vegetable, usually withstanding temperatures as low as 25 degrees in the seedling stage, has as a rule 57 days in which to produce a crop of good quality. Thus it is apparent that only short season types may be grown profitably.

Beets, which are classed as hardy warm-season vegetables, have an average growing season of 96 days. Long season varieties of this vege-

table may thus be grown. It is also possible to make several successive planting of short season varieties and have crops of tender young beets ready for market from the middle of May to the middle of June. Some years, of course, the season may be prolonged; fortunately the season is seldom shorter.

English peas may be classed as hardy cool-season vegetables. As one would expect from the average available growing season of 67 days the early types and early mid-season types are most satisfactory.

Table 2
High average temperatures limiting the growing season of spring crops

Reasonably safe date of planting*	Crop	Limiting average high temperature	Starting about
March 2	Beets	Above 80° F.	June 9
March 2	Onions	Above 80°	June 9
March 2	Chard	None	
March 2	Kale	Above 70°	May 7
March 2	Kohl-rabi	Above 70°	May 7
March 2	Mustard	Above 70°	May 7
March 2	English peas	Above 70°	May 7
March 2	Radish	Above 70°	May 7
March 2	Spinach	Above 70°	May 7
March 2	Turnip	Above 70°	May 7
March 12	Lettuce	Above 70°	May 7
March 12	Carrots	Above 80°	June 9
March 12	Cabbage	Above 80°	June 9
March 24	Popcorn	See note ¹	
March 24	Sweetcorn	See note ¹	
April 5	Beans	Above 80°, note ²	June 9
April 5	Cucumbers	Above 85°, note ²	
April 5	Cantaloupe	None ³	
April 5	Eggplant	None ³	
April 5	Peppers	None ³	
April 5	Pumpkin	None	
April 5	Squash	None	

¹Hot winds during silking limit production.

²Several days of high temperature in succession.

³Seldom influenced by high temperature.

*These dates represent the earliest date on the average that these crops can be planted without undue chance of loss from cold.

Table 2 contains information concerning the limiting temperature factors of certain spring-planted vegetables in reference to harvest periods.

Here again it should be remembered that all dates in Table 2, both for planting and harvest, are averages for the past 10 years (1930-1939). There will be years when planting dates may be earlier and harvest dates later than those shown. Moreover, it is a part of the variety study to find vegetables which will extend the harvest dates beyond normal limits.

Figure 1 gives average temperatures of importance in vegetable growing. An average daily temperature of at least 45 degrees is necessary before any of the vegetables will make much growth.

Most of the hardier vegetables are injured by temperatures of 20° F. This temperature has occurred last for the spring season, as early as January 31 and as late as March 27 but the average date for the past

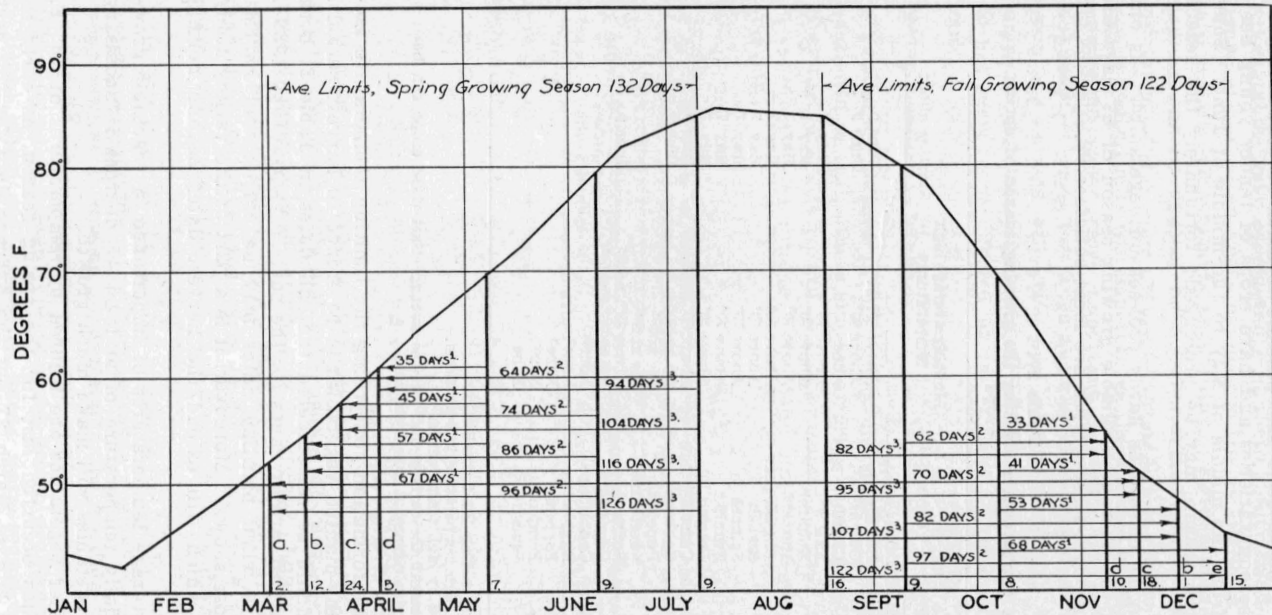


Figure 1. Growing Seasons as Affected by Temperature.

Spring Season

Reasonably safe planting date for a, hardy; b, semi-hardy; c, slightly hardy; and d, tender vegetables. (Average last dates when temperatures of a, 20°; b, 25°; c, 27°; d, 32° occur.)

Length of growing season for crop which can grow at temperatures up to 1, 70°; 2, 80°; 3, 85° F.

Fall Season

Safe planting date for crops seedlings of which can withstand average temperatures of 3, 85° 2, 80°; 1, 70° F. Length of season is limited by average date temperature first falls below d, 32° for tender crops, c, 27° for slightly hardy crops, b, 25° for semi-hardy, and by e, a daily average temperature of 45° for all crops, except those surviving the winter.

10 years, 1930 to 1939, has been March 2. This date is a reasonably safe planting date for the hardiest vegetables. The tenderest vegetables are injured or killed by temperature of 32°. Some years this temperature may occur last as early as March 20 and some years as late as April 13 but the average date for the period was April 5.

The very great variation of dates on which a critical minimum temperature may last fall, and the short cool season with a rapid onset of hot weather makes spring gardening a hazardous occupation unless every precaution is taken to minimize the dangers by the use of varieties and kinds of vegetables which will meet the weather conditions to which they may be exposed.

Fall planted vegetables

Fall vegetables should be planted as early as possible. Some such as turnips, beets, mustard, and chard may be planted as early as August 15. Seed of these germinate well and quickly at the temperatures then prevalent except under extremely unfavorable conditions. Temperatures above 100° are sometimes fatal to young seedlings of these plants. As a rule it is possible to obtain good stands. With some other vegetables, however, high temperatures will prevent emergence and it is necessary to delay planting until more moderate weather begins. Maximum temperatures of 100° may be expected as late as October 6, but on the average September 8 is the last date they occur.

In the case of carrots, kale and collards it is usually not possible to obtain stands in the fields before September 15 because of the effect on soils of high average temperatures and low humidity occurring up to that date. Spinach for the same reasons will not germinate well before the average daily temperature falls below 70° so that the average planting date is about October 8.

Figure 1 includes the average dates on which the critical temperatures occur which influence fall planted vegetables. The average temperature of 80° is reached September 9, 70° is reached October 8, and the first fall frost may be expected by November 10. Lows of 27° may be expected by November 18, and 25° by December 1.

Table 3 shows the reasonably safe dates of planting for fall vegetables as influenced by temperature.

Table 3
Planting dates of fall vegetables as influenced by temperature

Crops	Date of Planting	Limiting temperature factor
Beets	Aug. 15-Sept. 15	Several successive days with temperature of 100°
Carrots	Sept. 9-Sept. 15	Average temperatures above 80°
Chard	Aug. 15-Sept. 15	Several successive days with temperature of 100°
Kale	Sept. 9-Oct. 1	Average temperature above 80°
Kohl-rabi	Sept. 9-Oct. 1	Average temperature above 80°
Lettuce	Sept. 9-Oct. 1	Average temperature above 80°
Mustard	Aug. 15-Oct. 15	No apparent restriction
Onions	Aug. 15-Oct. 15	No apparent restriction
Radishes	Aug. 15-Oct. 1	Plant before average temperature falls below 70°
Spinach	Oct. 8-Nov. 1	Average temperature above 70°
Turnips	Aug. 15-Oct. 15	No apparent restriction

With regard to production it is only necessary to add to the information presented in Table 3 that when these crops are planted at the proper time with due regard to length of growing season and seasonal temperature variations they may be expected to make good quality produce.

Table 4 shows the time usually available for the production of vegetables in the fall based on seedling ability to withstand high temperatures and plant ability to survive low ones. It also shows rather closely the average period available for the production of vegetables of various degrees of hardiness in the fall.

Table 4
Relation of seedling resistance to high temperatures and of plant resistance to low temperature to average length of fall growing season

Average number of days available in which to mature crops, seedlings of which can survive average temperatures of			Minimum temperature (°F.) mature plants can stand without serious damage
85°	80°	70°	
87	62	33	32
95	70	41	27
107	82	53	25
122	97	68	20

Note that the higher temperature seedlings can stand and the lower temperature growing or mature plants can stand the longer the season.

There are some important exceptions. Spinach for example, may be expected to live through any winter and produce a good crop of early spring spinach. The severity of the winter, however, greatly modifies the date at which the crop will mature. If the late fall and early winter seasons are mild spinach can be harvested in late December and January. If the winter is severe, harvest may be delayed until March or April.

Onions are also winter hardy. They show marked response to winter severity. After mild winters there is very little bolting and seedling onions may be reset for the production of mature bulbs. After a severe winter bolting will be extensive.

Other Vegetables

Although planted in spring or fall, some vegetables cannot be classed with those groups because they mature their crops during the summer or carry over the summer and mature in the fall. Likewise some fall planted crops are carried over until spring. Certain temperature relationships are apparently operative in these cases as well.

The tomato is representative of a group of plants which are spring planted but which mature their crop during the cooler fall weather. Most commercial tomatoes, as it appears from observation here and elsewhere (2, 5), shed their flowers when average daily temperatures rise above 80°, that is, beginning about June 10. The safe planting

date averages April 5, thus allowing about 64 days for growth and the setting of fruit before hot weather begins. Sometimes in fortunate early plantings a small crop of fruit may be harvested during this short spring growing period. As a rule however, this period is too short, and no crop will be set until after the middle of September which allows about 55 days in which to mature a crop of fruit. All too often one day of excessively hot weather at the beginning of the period will prevent the available blossoms from setting. As a result, the actual time in which to mature a fall crop is probably no more than 30 days.

Fall planted spinach is a crop which is usually carried over until spring. This crop has been discussed with the fall crops.

Table 5 is developed in an attempt to bring all of the data on temperature generally applicable together and apply it to specific crops. The crops chosen for this table are those which are useful in the Wichita Valley. They are, with a few exceptions such as cabbage, those which respond best to the climate of the region. The kinds and varieties ap-

Table 5

Average length of growing season for most valuable spring and fall crops

Crop and Variety	Average length of growing season, planting to harvest, days		
	Spring	Fall	Required by crop
Beans, snap: Burpee's Stringless Green Pod.....	64	-----	52- 60
Pinto.....	75	-----	60- 80
Beets: Detroit Dark Red.....	96	122	84-100
Crosby's Egyptian.....	96	122	80- 90
Cabbage: Golden Acre.....	74	-----	67- 80
Carrots: Chantenay Red Cored.....	74	-----	85-100
Chinese Cabbage: Pe Tsai.....	57	-----	65- 80
Collards: Georgia White.....	57	82	60- 90
Cucumbers: Straight 8.....	96	-----	60- 70
Endive: Broad Leaved Batavian.....	67	53	50- 90
Kale: Dwarf Green Curled.....	67	122	85- 90
Kohl-rabi: Early White Vienna.....	67	122	90-100
Lettuce: Black Seeded Simpson.....	67	68	65- 80
Mustard: Giant Southern Curled.....	67 ₁	122	40- 80
Onions: Prizetaker.....	96	97	100-130
English Peas: Premium Gem.....	86	-----	55- 65
Radishes: Scarlet Globe.....	67	122	30- 70
White Icicle.....	67	122	30- 70
Spinach: Bloomsdale Longstanding.....	67 ₁	*	55-
Turnips: Purple Top White Globe.....	67 ₁	122	70- 80

¹Mustard, spinach and turnips tend to bolt under the day length conditions current about the end of April, reducing this length of season to about 45-50 days.

*Spinach may be carried over winter when planted in the fall.

General note: In the spring most crops require 7 to 10 days for germination. Some crops planted in August require only 3 to 5 days if moisture conditions are satisfactory. The later crops are planted in the fall the more time required for germination, in general.

pear in column 1. In column 2 are given the number of days available in which to produce a good crop in the spring. Column 3 contains the same data for the fall. Column 4 contains the number of days which each crop requires for the production of a good root, number of fruits, or plant.

The number of days shown in column 4 is variable as shown by the two numbers used. For example radishes planted early in the fall may require only 30 days to make marketable roots. Those planted in the middle of September may require 45 to 60 days. In the spring it may take 40 to 60 days for radishes to make good roots. This is dependent partly on the planting date and partly on the weather.

Special weather conditions

Two forms of extreme weather conditions often cause disruption of the otherwise nearly perfect correlation between temperature and crop relationships as they have been discussed. The first of these is the "norther." A norther is a period of low temperature coming suddenly during an average or somewhat above average temperature period. It will often slow growth for several days even after warm growing weather has returned. This is particularly true in the spring. Fall northers are usually not as serious.

The second of these special conditions is the hot wind. These are high velocity, hot, dry winds usually from the southwest. They occur occasionally from March to October and are most frequent during the later part of June, and in July and August. Crops most seriously affected are tomatoes and corn. Corn planted early enough so that silking and pollination are completed before the hot winds occur will make good crops most years. Tomatoes however, unless they are hot weather hardy like the small fruited varieties, always become impotent.

If a hot wind does catch corn in silk, the silk is killed and kernel fertilization does not take place. As a result ears are formed with irregular rows of scattered kernels. Cucumbers are also injured by the hot wind. Cucumbers produce necked, pointed, or bulbous ended fruits after a period of hot wind indicating imperfect seed fertilization.

The Effects of Soils

Two soil factors influence the choice of varieties and kinds of vegetables for gardening in the Wichita Valley. These are soil texture and soil reaction or the degree of acidity. The first of these is particularly important with reference to root crops. Most of the valley has tight soils. They bake and crust deeply on drying. They puddle easily and after heavy rains it is nearly impossible to work them without damage to small plants or to the bulbous roots of root crops. As a result soft rooted crops are sometimes misshapen. For this reason firm rooted varieties are preferable. Beets illustrate this very well. Detroit Dark Red is a firm rooted variety and produces about 80 per cent marketable roots. Crosby Special Light Egyptian beet makes a much softer root and, for this reason, is only about 20 per cent marketable.

Soil reaction is of considerable importance. The varieties and kinds of vegetables that grow best on soils of relatively high pH, soils which are definitely on the alkaline side, should be chosen. Table 6 gives the

kinds of vegetables that grow best at different ranges of soil reaction. Some of the kinds shown are starred. These are kinds that have been found to grow well on Wichita Valley Soils although elsewhere they have shown a preference for soils of lower pH.

Table 6
Soil reaction preference of certain vegetables:

pH 5.0-6.0	pH 6.0-7.5	pH 7.5-8.3 ²
Carrot	Cabbage	Asparagus
Corn	Cucumber*	Beet
Pepper*	Eggplant*	Lettuce
Pumpkin	Muskmelon*	Onion
Squash	Radish	Peas, English
Tomato	Rape	Peas, Field
Turnip*		Spinach

¹Morgan (9). Information on such physical-chemical relationships as acidity (pH) and the growth of plants on soils is not always applicable to all areas, because other factors such as humidity and temperature often modify the effect of pH on plants.

²The range of Wichita Valley soils.

*These plants have been found to grow well on Wichita Valley soils.

There are vegetables which are considered to prefer a pH lower than that of the Valley soils but seems to possess considerable ability to make plants although they do not make much fruit. The apparent cause of failure does not seem to be high pH, but rather some other limiting factor such as temperature. For example tomatoes grow rapidly and produce many flowers at high temperatures, but fail to set fruit. Yet when the temperature falls to an average of 80 degrees, and with increased humidity, tomatoes will set fruit. However pH or soil reaction does undoubtedly influence the growth of plants to a large extent and it is necessary to choose varieties least affected by the soil reaction of the area under test.

Adaptability

A number of factors affecting adaptability have just been discussed. In order for a crop to be adapted it must not only meet the conditions of climate and soils from the standpoint of plant vigor, it must also make good yields of marketable produce. An adaptable variety, thus, is one that grows well, produces good crops of high quality, and is constant in its production habits.

In the variety adaptability trials every possible precaution was taken to avoid biased conclusions. The general procedure in determining adaptability at this station has been based on replicated plantings in randomized blocks to minimize the effects of soil variation so that an accurate record of crop behaviour could be made. Conclusions have never been based on the behaviour of a crop in a single year although the yields re-

corded in the bulletin sometimes are. As a rule at least three years' records have been studied before any conclusion was drawn.

A list of the kinds of vegetables tried and the varieties considered most suitable, together with the number of years the kind of vegetable has been grown appears in Table 7.

Table 7
Vegetables grown in variety trials

Kind of vegetable	No. of years grown	No. of varieties tried	Variety considered best on the basis of trial
Artichoke, Jerusalem.....	1	1	
Asparagus.....	10	1	
Beans, lima.....	4	6	Henderson's Bush
Beans, snap.....	9	24	Burpee's Stringless Green Pod
Beets.....	8	11	Pinto
Cabbage.....	5	36	Detroit Dark Red
Cantaloupe.....	10	33	Crosby's Egyptian
Carrots.....	8	12	Golden Acre
Chard.....	7	3	Superfecto; Seed Breeder's
Collards.....	4	4	Hale's Best No. 36
Corn, pop.....	1	1	Chantenay Red Cored
Corn, sweet.....	5	10	Lucullus
Cucumbers.....	8	30	Georgia
Eggplant.....	5	5	Honey June
Kale.....	5	5	Straight 8
Kohl-Rabi.....	4	2	Black Beauty
Leeks.....	3	1	Dwarf Green Curled
Lettuce.....	6	14	Early White Vienna
Mustard.....	7	6	Black Seeded Simpson
Okra.....	5	5	Southern Giant Curled
Onions.....	6	19	White Velvet
English Peas.....	8	20	Prizetaker
Field Peas.....	3	3	Premium Gem
Parsnips.....	3	2	Black Eye
Peppers.....	6	10	Hollow Crown or Guernsey
Potato.....	6	2	California Wonder
Pumpkin.....	6	10	Tabasco
Radish.....	8	14	Irish Cobbler
Spinach.....	7	10	Striped Cushaw
Squash.....	6	21	Scarlet Globe; White Icicle
Tomatoes.....	9	41	Bloomsdale Longstanding
Turnips.....	7	16	Yellow Summer Crookneck
Watermelons.....	5	13	Porter
			Purple Top White Globe
			Stone Mountain



Figure 2. **Harvesting Asparagus.** Eighty-eight bunches were harvested from this one-acre field the day this picture was taken. As a rule this acre of asparagus will gross \$150.00 dollars a year.

Vegetables Best Adapted

Stem and Leaf Crops

Asparagus offers the best possibilities of any vegetable for commercial development in the Wichita Valley. It is well adapted to both soil and climate. There have been no serious disease or insect troubles for the crop up to this time.

The average yield of asparagus on unfertilized Miller silty clay loam a common soil type in the Valley, has been 1,485 pounds of marketable tips per acre. When the soil was treated with 20 tons of barnyard manure per acre per year the yield was increased to 2,124 pounds of tips. These yields are averages for the first 7 cropping years of the asparagus field.

The variety used was Mary Washington. The tips are of medium thickness, and grow to good length rapidly (Figure 2). The upper portions are dark green, and the tips are tightly scaled. It is a mid-season variety.

Spinach is the most valuable and most successful winter greens crop. Weather conditions in the valley are such that the date of maturity is variable (Figure 3). In a few years, perhaps 2 out of 10, the crop may be killed by cold weather.

One disease, the insect-borne "curly top" or "spinach yellows," is sometimes serious. There appears to be no adequate control for this at present.



Figure 3. Spinach field planted Oct. 10, 1940. Spinach was harvested from this field from Jan. 1, 1941 to March 23, 1941.

Soil is quite a problem because most of the valley soils run together when wet, often preventing seed from emerging, and spinach does not seem to germinate well in puddled soils. The crop must be planted late to avoid the high soil temperatures common until late in the season. Plantings made in October usually grow off well, and most winters the crop will be ready to harvest the last of December or the first part of January.

Of the varieties tested Bloomsdale Longstanding Savoy is the best from all standpoints. It is the variety which receives the greatest market attention. It is of high quality, strongly savoyed and has great attractiveness. The plants when ready to harvest are small, with well bunched, dark green leaves.

Table 8
Yields of spinach (pounds per acre*)

Variety	Fall				1939		Average
	1931	1933	1934	1935	Spring	Fall	
Bloomsdale Longstanding -----	8490	11020	7590	5450	-----	-----	8138
King of Denmark -----	-----	7680	-----	-----	-----	-----	7680
Prickly Winter -----	-----	8370	-----	-----	-----	-----	8370
Perpetual -----	-----	-----	-----	-----	-----	639	639
Summer Savoy -----	-----	-----	-----	-----	6265	2363	4312

*Spinach weighs 20 lbs. per bushel.

Other varieties which have been fairly satisfactory are Burpee's Victoria, Prickly Winter, Juliana, and Summer Savoy. Prickly Winter is probably the second choice variety. The plants are rather large, extremely hardy, and grow rapidly. The leaves are broad, arrow shaped, smooth, thick, and a medium bright green in color. Juliana is a high quality type, better suited to home gardens than for commercial production. Yields are indicated in Table 8.

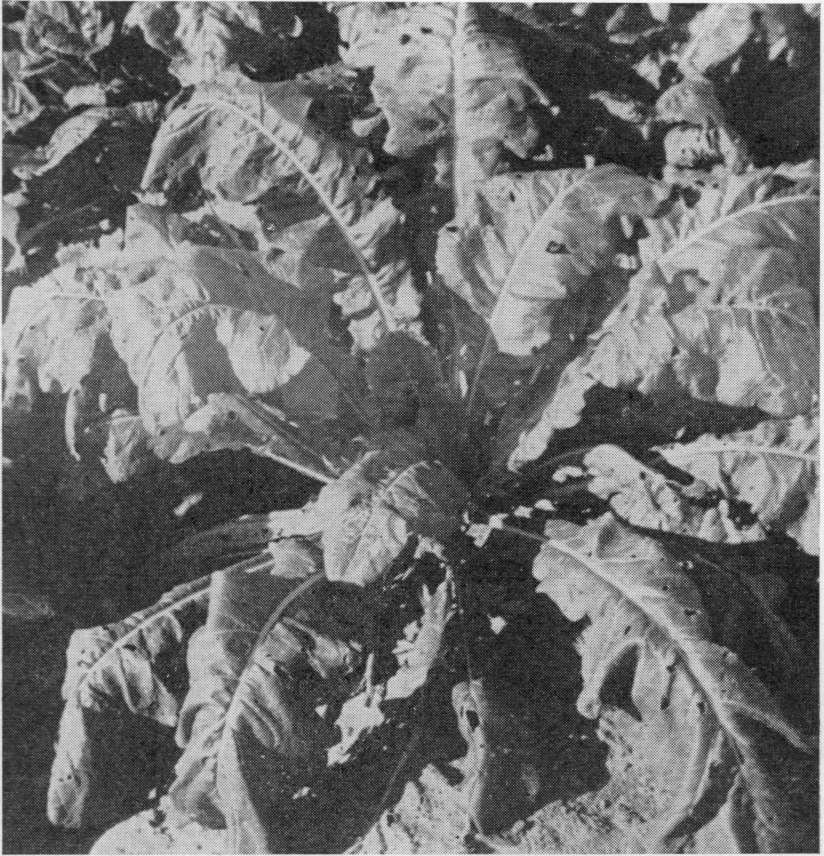


Figure 4. Tendergreen mustard. This variety is smooth leaved and of exceptionally high quality. It has a mild flavor.

Mustard is grown most successfully in the fall. The spring crop is difficult to grow, and, as a rule, of little value.

Climatic conditions in the spring are such that mustard quickly goes to seed, usually before producing a satisfactory crop of leaves. In the fall by the time the plants are ready to seed the crop is made. Soil conditions are satisfactory and large crops are the rule. The chief insect pests are the aphid and the flea beetle. The first of these causes little trouble until late in the season. The second is most active early in the fall and is sometimes so serious that entire stands may be killed. Dusting with rotenone or pyrethrum dusts can be used to control the flea beetle.

The four best varieties are Giant Southern Curled, Florida Broadleaf, Chinese Bok-Toi, and Tendergreen (Figure 4). Yields are given in

Table 9. Giant Southern Curled is a large plant carrying broad, deeply curled leaves. The quality is excellent, but the flavor is somewhat pungent. It is medium light green in color. Florida Broadleaf is a slightly crumpled, broad leaved, dark green mustard, which is rather slow to bolt. This variety is extremely pungent. Chinese Bok-Toi is a rather small, smooth leaved mustard with medium dark green leaves set off with thick white midribs and veins. The plant is compact, the flavor very mild. The leaves are crisp and edible uncooked. Tendergreen is a tall, upright growing, mild flavored mustard, sometimes known as "spinach mustard." The leaves are spatulate, narrow, smooth, and dark green in color.

Table 9
Yields of mustard (pounds per acre)

Variety	1934		1939		Average
	Spring		1st Fall sowing	2nd Fall sowing	
Giant Southern Curled.....	6655	5677	10436	13976	9186
Tendergreen	13332	10796	14930	20146	14801
Florida Broadleaf		12284	7023		9654
Chinese Bok-Toi		6803	14182	16519	12501

Ostrich Plume is a smaller edition of Giant Southern Curled. Smooth Leaved Chinese is similar in size and appearance to Florida Broadleaf, but is much milder in flavor. Neither yields very well.

Swiss chard is a member of the beet family grown exclusively for its leaves. It can stand exceptionally high temperatures, and with the help of irrigation, will produce successive crops of good quality greens all summer long. Soil conditions are good and little special care is required for the production of good crops.

There are no serious insect or disease troubles. Once in a while the blister beetle may cause some trouble but so far it has not been serious enough to require control.

Of the three varieties of swiss chard used the best is Lucullus (Figure 5). It ranks second in yield (Table 10) but the fine flavor, high quality and attractive appearance of the variety make it superior to either of the others. Lucullus is a tall, upright growing variety with light colored leaf



Figure 5. Lucullus is the best of the swiss chard varieties at Iowa Park.

midribs, and dark colored leaves. The leaves are broad, long, fleshy, and much crumpled or savoyed.

Large Ribbed Dark Green and Fordhook Giant are smooth-leaved varieties. The leaves are somewhat broadly arrow shaped. Both are of fair quality and yield well.

Table 10
Yields of Swiss chard (pounds per acre)

Variety	1931	1934	1939		Average	Percentage rating*
	Spring	Spring	Spring	Fall		
Lucullus -----	10400	4730	18467	19996	13398	100
Large Ribbed Dark Green -----			13620	21824	17722	92
Fordhook Giant -----			20117	18876	19496	120

*As compared with Lucullus.

Collards, Kale and Rape. These three vegetables are more easily grown as fall and early winter crops than as spring vegetables.

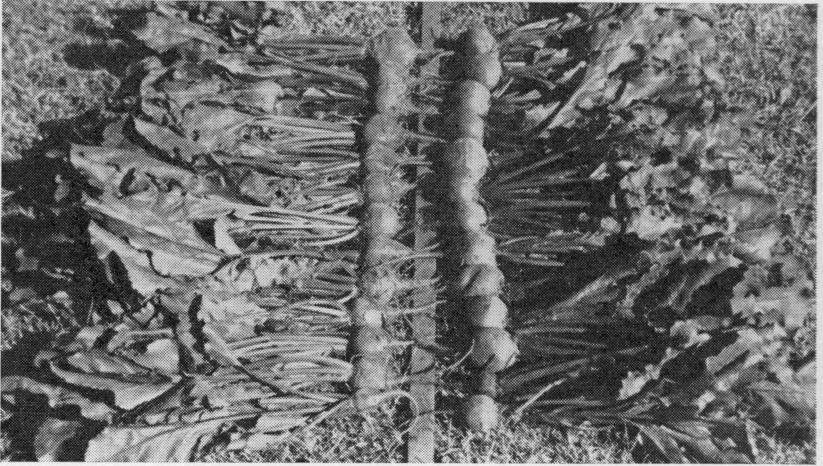
The only variety of Collards tried, Georgia White or Southern, is quite satisfactory and produces crops of from 4,000 to 10,000 pounds per acre. It is very hardy and will stand severe cold weather.

There are several varieties of several types of Kale available for use. Of these Dwarf Green Curled, Siberian and Tall Green Curled have grown well in the Wichita Valley. The average yield of Kale at the station is 7,499 pounds per acre. Kale germinates slowly and extreme care must be given plantings from seed selection to emergence to see that good stands are obtained. In individual plats yields as high as 14,000 pounds per acre have been made. A more friable soil than is available to the station is necessary for successful production.*

Georgia White or Southern Collards forms a rosette of tender leaves at the top of a plant 2 to 3 feet tall. Dwarf Green Curled Kale, Dwarf Blue Curled and Bloomsdale Dark Green Curled Kale are all similar. There are slight differences in color. These kales produce a low growing plant with the leaves branching out from a short stem or crown. The plants are very attractive in appearance. The tall sorts such as Siberian and Tall Green Curled are equally good, although slightly more coarse. The leaves are produced on a tall stem, and are rather widely separated. In both types the leaves are curled and plume-like, with some bloom.

There are no horticultural varieties of rape. Rape is usually a field crop often used for green manure or silage. It is an excellent substitute for collards and is more easily grown. With care in cooking it is a good green vegetable. The yield is high, sometimes as much as 15,000 to 20,000 pounds of greens per acre.

*Such soil is available in some parts of the Valley.



Detroit Dark Red

Early Wonder

Figure 6. A comparison of Detroit Dark Red and Early Wonder Beets. Note the exceptional smoothness of Early Wonder.

Root Crops

Beets. Twelve varieties of beets have been tried during the past 10 years. Of these several are of sufficiently high quality to make them commercially valuable. The two best are Detroit Dark Red (Figure 6) and Crosby's Egyptian. Valuable local market and home garden sorts are Early Red Chief, Edmund's Early, or Early Blood Turnip, and Early Wonder. The others can be well grown but their types are not as well suited to soils and market. Yield data are presented in Table 11.

The only insect to cause much damage to beets is a species of blister beetle. At times this insect is very serious, although it may be controlled readily with arsenate sprays. Cotton root-rot is the most serious disease. Early beets and fall beets are not much affected by the disease. Late spring beets are sometimes seriously damaged.

Burpee's Extra Early, Burpee's Red Ball, Ohio Canner and Good for All are similar to Detroit Dark Red. Of these only Burpee's Extra Early, was as good as Detroit Dark Red. Extra Early is an excellent spring variety and grows well in the fall. Detroit Dark Red is a medium sized beet with medium sized tops. The leaves are dark green, tinged with red. Roots are globular, smooth, but somewhat russetted, quite uniform in size and have a small tap root. The outside skin color of the roots is ox-blood red, the flesh is very dark red, with indistinct zoning. It is a fine quality beet with sufficient root firmness to produce good roots in fairly tight soils.

Crosby's Egyptian is equally good. It is somewhat earlier than Detroit Dark Red. The roots are a flattened globe in shape with a small tap root. The skin color is dark red, and the flesh color is a purplish

red with slight zoning. The tops are medium green in color and are rather strongly tinged with red. It is an excellent beet for either market or home use.

Early Wonder (Boston Crosby or Nutting's Gem) (7) is an excellent beet which tends to be somewhat large. The color is good and the beet cans well. Early Red Chief is another variety very similar to Early Wonder, and equally good.

Edmund's Early Blood Turnip is a fine variety of the Blood type. It produces nicely rounded, smooth skinned beets of excellent quality. Early Eclipse yields well and might be preferred by some gardeners.

Table 11
Yield of beets (pounds per acre)

Variety	1931	1932	1933	1934	1935	1939		Ave.	Percentage Rating*
						Spring	Fall		
Crosby's Egyptian.....	12908	16556						14732	108
Detroit Dark Red*.....	10599	16606	11459	15686	14388	11434	11236	13071	100
Edward's									
Early Blood Turnip.....	14933				14501	9982	12727	13036	109
Early Wonder.....	10138					10164		10151	92
Improved Blood.....		19057		15400				17228	106
Early Eclipse.....		21888						21888	131
Ohio Canner.....			9625					9625	84
Extra Early.....			14967					14967	131
Red Chief.....						10890	5830	8360	63

*Percentage rating calculated on basis of yields of Detroit Dark Red.

Radishes. This fine salad root crop can be grown both in the spring and fall. Unfortunately the soil texture in the Wichita Valley is generally so poor that many unmarketable roots are formed. Only one pest has proved serious enough to reduce stands. The flea beetle is sometimes bad in the fall. A fair measure of control is given by the use of rotenone and pyrethrum dusts.

Yields vary from 4,000 to 13,000 bunches per acre depending largely on the stand the grower can obtain and maintain, and the type of soil on which the crop is grown. If the soil is as tight as Yaholo loamy very fine sand the number of market grade radishes will be much less than on such soils as Wichita sandy loam.

The outstanding radish in tests at the experiment station has been Scarlet Globe. This radish has a small, brilliantly scarlet, globe-shaped root with white flesh. The quality is excellent and the flavor pleasing. It is by all means the best of the radishes tried. White Icicle is a long white radish with rather slender roots 5 to 6 inches long. White Icicle is the best of the long rooted spring radishes. The fact that it is a long type is against it because in most Valley soils the roots are difficult to pull without breaking. Moreover the roots are often much twisted and flattened. The best of the winter radishes is Black Spanish. It has a

large root, rather turnip-shaped, with a black skin color and a brilliantly white flesh. The flavor is good and the quality excellent.

Comet, Early Scarlet Button, Early Scarlet Globe, Glowing Ball, Early Scarlet White Tipped, Early Scarlet Short Topped, and Rapid Red have no advantage over Scarlet Globe, although a few such as Early Scarlet Button, and Early Scarlet Short Topped are slightly earlier. These are somewhat more difficult to grow and the extra earliness is not great enough to offset this disadvantage.

French Breakfast is a long white type but it is not superior to the more easily grown White Icicle under Wichita Valley conditions.

Celestial is a good quality white skinned winter radish.

Of the long rooted scarlet varieties Early Long Scarlet, or Long Scarlet Short Top will grow well. These, like the long white short season varieties are often twisted and flattened because of the tight soil.

Turnips rank next to beets as a commercially productive root crop for the Wichita Valley (Table 12). The fall season is by far the best. Turnips require a rather cool season for best results because they bolt readily in hot weather. In the fall by the time turnips have grown large enough to begin bolting the season is sufficiently cool for the plants to continue vegetative growth.

Insect pests are, at times, destructive. Aphides are most serious in the spring and late fall. They are active even in January and February, a time when control is most difficult to effect. In warm weather nicotine sulfate dust is effective, in cold weather sprays are necessary. Flea beetles are often destructive in the fall, particularly when the plants are small. Nicotrol spray, a trade product, is fairly effective as a control measure. The third dangerous insect is the cut worm. The most serious damage from this insect occurs in the spring. Poison baits will help to control the pest.

The best short season turnip for the Valley is Extra Early White Milan. This turnip has a small, compact top. It is strap leaved. The roots are small, flattish and angular. The flesh is firm, white and tends to become somewhat bitter unless harvested early or planted late. When harvested at the right stage the quality is excellent. Purple Top White Globe is a rather long season variety of excellent quality. The tops are large, erect, dark green and cut-leaved. The large roots are globe to top shaped, very smooth with the upper part purple, and the lower part a creamy white. The flesh is white, sweet, crisp and juicy. The Shogoin or Japanese Foliage variety is valuable both for root and leaf. It grows about 20 inches tall with a compact, dense, strap-leaved top. The leaves are nearly smooth and the flavor is mild. The roots are globular, of good size and excellent quality. The flesh and skin are white. The roots are very mild in flavor and are tender fleshed.

Table 12
Yield of turnips (pounds per acre)

Variety	1933	1934	1939	Average	Percentage Rating*
Purple Top White Globe*-----	21518	4682	17337	14496	100
Amber Globe-----	13026	3131	-----	8078	62
Extra Early White Milan-----	-----	-----	13660	13660	79
Golden Ball-----	-----	4921	-----	4921	106
Shogoin-----	-----	-----	21283	21283	123
White Egg-----	16308	5211	-----	10760	82
White Flat Dutch-----	-----	4053	-----	4053	88

*All varieties compared with Purple Top White Globe.

The Cowhorn turnip does not have as good quality as many others and should be used only when immature. Snow Ball is an excellent early variety but it is not equal to Extra Early White Milan. Purple Top Milan is similar to the white variety. Purple Top Strap Leaf is another good variety. Purple Top Yellow Aberdeen is an excellent yellow fleshed variety. Seven Tops is a good leaf variety of turnip and is very popular. It lacks the quality of Shogoin, but being better known, and cut-leaved, has a distinct marketing advantage.

Fruit Crops

Eggplant is a fruit vegetable that could be used for commercial planting. Hot weather does not bother it much and yields have been good.

The chief difficulty in the production of eggplant as with other transplanted crops is that of getting stands. Once a stand is established there is little difficulty in producing a good crop of fruit. Three rather serious pests sometimes cause damage but with proper care this can be largely prevented. The first of these is Phomopsis rot. This is controlled best by controlling the insects making it possible for the rot to start by injuring the skin of the fruit. The lace bug and flea beetle are the most serious insects but they may be controlled with careful dusting. Pyrethrum, rotenone and fluosilicate dusts are best.

Black Beauty is the best of the varieties tried. The plant is about 2 feet tall, semi-spreading, compact and much branched. The leaves are large and offer good protection against sun. The fruit is obovate in shape carrying an intense blue-back color on the skin. This variety has yielded at the rate of 18,632 pounds per acre. New York Spineless is another excellent variety. The fruit is somewhat larger than that of Black Beauty, it is broadly oval in shape, smooth and rich purple in color. The yield of this variety is about 20,000 pounds per acre.

New York Market and New York Purple are similar in type and fruit to Black Beauty, but neither is equal to it in yield or attractiveness. Florida Highbush is an excellent variety for the home garden.

Okra is a fruit vegetable, but the immature pods or fruits are used rather than the mature fruit. The pods are picked when they are from

one to two inches in length. Yields of okra are good and both the climate and soils of the Wichita Valley are excellent for the production of the crop. There are no serious insect pests or diseases.

The best varieties tried are Dwarf Stalked Long Pod and Perkins Mammoth Long Pod. White Velvet is a shy bearer but is preferred by the markets. It is probably the best of the three in quality. Dwarf Stalked Long Pod produces a plant from 2 to 3 feet tall. It is compact and much branched. The pods when ready to pick measure $1\frac{1}{2}$ inches in length and $\frac{1}{2}$ -inch in diameter at the shoulder. Perkins Mammoth Long Pod makes a much taller plant, growing to a height of five feet or more. It is well branched and heavily leaved. The pods at picking stage are from 1 to $2\frac{1}{2}$ inches long, tapered from $\frac{3}{4}$ -inch at the shoulder to a point. They are lighter green than those of the Dwarf Stalked variety and more fleshy. White Velvet produces almost round pods tapering gradually toward the point. They are about the size of the pods of Perkins Mammoth but more slender. The quality is excellent.

Peppers. One of the best fruit vegetables is the pepper. Although much of the fruit must be discarded because of poor shape a large proportion of the fruit is marketable, and all except that injured by disease, insects, or sunscald may be used for drying, brining or canning.

The chief trouble with the pepper is sunscald. It is especially serious for varieties which have few leaves. Very few insect pests damage the pepper. The relative freedom of the crop from diseases and insects makes it fairly easy to grow once the plants are established in the field.

The climate is, in general, satisfactory. However the dry air and warm days of spring often make it difficult to get good stands. During the summer conditions are excellent. The dry air and warm days tend to mature the fruit evenly.

From the standpoint of yield Ruby King is the outstanding sweet pepper (Table 13). Long Red Cayenne yields the best of the "hot" type. California Wonder carries the best quality.

California Wonder is a medium sized upright plant. With the long season of the Wichita Valley it becomes somewhat spreading but not drooping in habit. The plants are productive throughout the fruiting season. The fruits are 4 to 5 inches long, 3 to 4 inches in diameter at the shoulder and usually but not always squarish in shape. They may be somewhat tapered toward the tip. The fruit is borne upright on short pedicles. The flesh is thick, tender, mild flavored and sweet. The skin is smooth and deep glossy green in color. At maturity the fruit is crimson.

Ruby King makes a taller more vigorous plant than California Wonder. The fruit is 5 to 6 inches long, strongly tapered toward the tip and about 3 inches in diameter at the shoulder. It is generally three-lobed. Ruby King has a deep glossy green skin that turns ruby red when the fruit is mature. The flesh is medium thick, mild in flavor and has very good quality.

Harris Early Giant, Burpee's Sunnybrook and Pimiento have been grown satisfactorily in trials. These are useful in the home garden. Some of them are more susceptible to sunscald than Ruby King or California Wonder.

Table 13
Yields of peppers (pounds per acre)

Variety	1932	1933	Average	Percentage Rating*
Sweet varieties:				
Chinese Giant* -----	10890	21987	16438	100
California Wonder -----	6662	27390	16526	101
Ruby King -----	13702	23156	18429	112
Sunnybrook -----	6453	22592	14522	88
Hot varieties:				
Long Red Cayenne* -----	5899	5372	5636	100
Red Chili -----	5046	5212	5129	91
Tabasco -----	963	4229	2506	46
Tabasco (station strain) -----		4245	4245	74

*Percentage rating for sweet peppers calculated against Chinese Giant; for hot peppers against Long Red Cayenne.

Long Red Cayenne, a "hot" pepper, is a vigorous, rather large plant growing to 2 feet or more in height, and spreading out 10 to 12 inches. It is extremely productive. The fruits are 4 to 5 inches long and $\frac{1}{2}$ to $\frac{3}{4}$ -inch in diameter at the shoulder, tapering to a point. The fruit is thin, twisted, with thin flesh and an extremely pungent flavor. The skin, glossy green when immature, turns carmine. Hungarian Yellow Wax is another excellent "hot" pepper. The plants are about 15 inches tall, with 8 to 12 inches of spread. They are resistant to heat and produce excellent crops. The fruits are 5 to 6 inches long and 1 to $1\frac{1}{2}$ inches in diameter at the shoulder, tapering toward the tip. The flesh is thick, and is rather mild for the type. The skin is waxy yellow when immature, but is carmine when fully ripe.

Other good hot peppers are Anaheim and Tabasco.

Vine Crops

Cantaloupe or Muskmelon. Next to asparagus this is probably the most satisfactory commercial vegetable. It is acceptable when prepared in many ways. It may be used as a breakfast fruit, as a between meals dish, as a salad, or as dessert. When well grown, cantaloupe will compete on even terms with any other fruit or salad vegetable for these purposes.

Soil conditions are excellent and the climate, so severe for most crops during the summer, is well suited to cantaloupe production (Figure 8). The high temperatures and dry atmosphere occurring during the ripening period tend to keep diseases in check. The water required can be supplied by irrigation. As a result of this, fruit of very high quality can be produced.

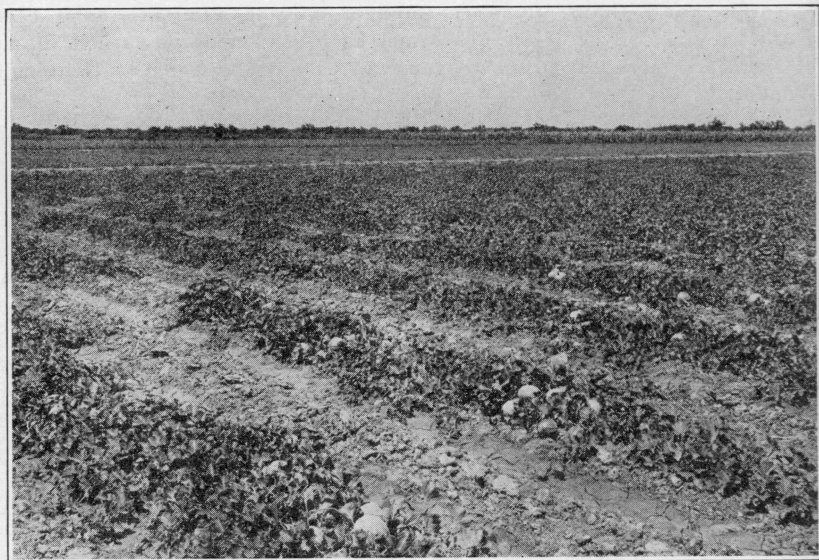


Figure 7. A cantaloupe field in the Wichita Valley. Note the large size and fine form of the melons. This vigorous vine growth is typical of melons of Yahola loamy very fine sand.

Diseases serious to cantaloupes in most areas are generally unimportant in the Valley. The aphid is the only insect causing much damage. It may be controlled by dusting with nicotine sulfate. As a rule the removal of infested vines is all that is needed to keep the aphid damage down. Rotation of crop land is also helpful.

Cantaloupe yields are somewhat low but quite high enough to offer a real opportunity for the commercial grower. Yields on various station soils vary from an average of 27.4 crates per acre on Miller silty clay loam to 196.8 crates per acre (45 melons per crate) on Yahola loamy very fine sand following a leguminous crop (Table 14).

Table 14
Yield of cantaloupe on different soil types¹

Soil	Yield, crates per acre ²
Miller Silty Clay Loam.....	33.6
Miller Loam	51.0
Yahola Fine Sandy Loam.....	46.8
Yahola Loamy Very Fine Sand.....	79.6
Yahola Loamy Very Fine Sand (legume cover crop).....	124.0

¹These are average yields of at least 25 varieties.

²45 melons per crate.

The lighter valley soils are superior as melon soils, to the heavier silt or clay soils. The best soil on the station is Yahola loamy very fine sand.

No variety has been grown every year during the past ten years. For this reason varieties of the Hale's Best type were chosen to provide a comparable basis. Six varieties in this group have been grown, Hale's Best, Hale's Best No. 36, Hale's Best No. 112, New Early Hale's Best, Nine-thirty-six, and Seed Breeder's.

Since 1931 only 10 varieties have equalled or bettered the yield record of the Hale's Best strains (see Table 15, percentage rating). These, in order of yield are Seed Breeder's, Hale's Best No. 36, Mildew Resistant No. 50, Honey Rock, Michigan No. 331279, Rocky Ford, Hale's Best No. 112, Edward's Perfecto, Hale's Best, and Extra Early Hackensack. It is noticeable that of the 10 leaders four are Hale's Best types, and one, Mildew Resistant No. 50, is similar to Hale's Best in type. One of the 10 leaders is Edward's Perfecto, a Perfecto type. All of the ten varieties, with the exception of Michigan No. 331279 and Extra Early Hackensack are good commercial types for the Valley.

In general there are two groups of cantaloupes which have been satisfactory. These are the Hale's Best and Perfecto groups. From the standpoint of yield alone the Hale's Best strains outyielded the Perfecto strains by about 24 crates per acre per year. The highest yielding strain of Hale's Best, Seed Breeder's outyielded the highest yielding strain of Perfecto, Edwards', by 30 crates per acre. The lowest yielding Hale's Best, New Early Hale's Best, outyielded the lowest yielding Perfecto, Perfected Perfecto by 17 crates per acre, per year.

Table 15
Yield of cantaloupe (crates per acre)

Variety	1931	1933	1934	1935	1936	1937	1938	1939	Aver.	Percentage rating*
Banana		78							78	65
Bender's Surprise		66							66	55
Burrell's Gem	174	106	37						105	68
Edward's Perfecto					76	79			78	103
Emerald Gem		97							97	81
Extra Early Hackensack			76		82	86			81	100
Globo de Oro							98		98	92
Golden Champlain			53		38	57			49	65
Golden Honey				49		2			26	43
Golden Marvel				34					34	55
Hale's Best	257	120	89	62					132	100
Hale's Best No. 36						73		106	98	120
Hale's Best No. 112					87	77		94	86	103
Hearts of Gold	192	99	44	41		13			78	67
Hearts of Gold No. 2				41					41	66
Honey Ball		163				4			84	94
Honey Rock				73		54			64	107
Imperial Sunset					38	1			20	26
Improved Perfecto				62		46	73		60	79
Michigan No. 331279				65					65	105
Mildew Resistant No. 45							66	112	89	86
Mildew Resistant No. 50				55	76	84	142		89	112
Mildew Resistant No. 50-15					93	54			74	97
New Early Hale's Best					99	27			63	83
New Ideal				35	83	56			58	82
Nicholson's Perfecto						43			43	73
Nine-thirty-six							92	86	89	86
Osage							90		90	84
Perfecto Perfecto						40			40	68
Persian							0		0	0
Reuter's Improved Perfecto						50			50	85
Reuter's Wonder						45			45	77
Rocky Ford	248					79			164	104
Seed Breeder's							164	98	132	130
Superfecto	113	79	52				82	100	85	63
Tip Top							60		60	56
Weaver Special					68	16			42	55
Woodside Winner					77	44			60	79
Hale's Best Strains*	257	120	89	62	93	59	107	99	111	100

*Percentage ratings are based on the yields of the Hale's Best strains in comparable years.

From the standpoint of quality both groups are nearly equal. Either, correctly packed, is satisfactory for shipping. On the local markets neither type meets any discrimination because of shape or color or netting. Netting in both groups is heavy and suturing is nearly eliminated in both. Sizes may be determined by the strain or variety chosen and each will provide good crops.

There is still a third group made up of a number of varieties with different general characteristics, but all having resistance to powdery mildew in common. The melons are all good commercial types and have much the appearance of Hale's Best or Perfecto. Three excellent varieties are Mildew Resistant No. 45, No. 50, and No. 50-15. The best under Wichita Valley conditions seems to be No. 50.

Although every effort has been made to remove personal and experimental bias from the data it is realized that not all could be eliminated.

It is believed, nevertheless, that the grower may expect results comparable to those reported here.

Four of the foremost varieties have been chosen as the best varieties to grow in the Wichita Valley. Two of these are representative of the Hale's Best type, one of the Perfecto type, and the last from the Mildew Resistant group. In addition to these, two other varieties will be discussed because of their merit and apparent value to the local market.

Seed Breeder's is the highest yielding of all cantaloupes tried. The variety produces a good crop of medium sized melons of good shipping quality, but too small to please the local market. The fruit is well netted and nearly sutureless. The vines are vigorous, large and provide good shade for the fruit. The quality of the fruit is excellent, the shape slightly oval, with thick flesh, salmon yellow in color and with a small cavity. The flesh color carries through to the rind.

Hale's Best No. 36 tends to produce a large proportion of large melons. As a shipping melon it is probably inferior to Seed Breeder's but it is superior for the trucking and local markets.

The vines are large, vigorous, and provide good shade for the fruit. The fruit is medium to large in size, solidly netted and almost without sutures. It is not as early as Seed Breeder's but nearly so. The quality is excellent, shape slightly oval, flesh salmon yellow; never, or almost never green at the rind when fully mature. The cavity is larger than that of Seed Breeder's, but not excessively large.

Superfecto has a rather uneven yield record, but its quality and good size recommend it above other varieties in the Perfecto group. The vine growth is very heavy, vigorous and dense. The fruit matures later than either of the Hale's Best varieties discussed. The fruit is large, nearly spherical, with well netted rind. Flesh orange, thick, and when ripe edible nearly to the rind. The cavity is small, but larger than that of the Hale's Best varieties.

Mildew Resistant No. 50 yields well. Its quality is excellent, and the flesh thick, juicy, but slightly coarse. The rind is well netted but shows somewhat deeper sutures than Hale's Best or Superfecto. The shape is nearly spherical. The cavity is relatively large for melons of its type.

Globo de Oro is a smooth skinned melon with much to recommend it. The fruit is large, with an extremely small cavity. Flesh orange yellow, very thick, crisp in texture, and rather aromatic. This variety should find a market among discriminating buyers.

Osage is a very large melon of pleasing quality, adaptable to the local market. The flesh is orange, rather thin, and the cavity very large. However the quality is exceptionally good and the large size of the fruit and attractive color should make the melon worth planting.

A number of the varieties listed in the study of cantaloupes are so outdated by the newer varieties that there is little point in discussing

them. Among these are Banana, Bender's Surprise, Burrell's Gem, Heart's of Gold, Honey Ball, and Honey Rock, as well as Rocky Ford, all good melons, but the newer varieties are so much better that the older varieties can no longer be recommended.

Golden Champlain, Golden Honey, Golden Marvel, Extra Early Hackensack, New Ideal, Reuter's Wonder, Tip Top, Weaver's Special and Woodside Winner are all fine home garden sorts. Only two varieties proved of no value. Imperial Sunset made very few fruits and Persian requires a long, cooler season than that afforded by the climate of the Wichita Valley.

Cucumbers are a successful crop under Valley conditions. The only serious drawback is high summer temperatures which tend to shorten the harvesting season.

Aphis is the most troublesome pest of the cucumber. Other insects which cause some trouble are the striped cucumber beetle and the squash bug. Aphis may be controlled with nicotine sulfate dust. While the season is relatively short, good crops are usually made.

Straight 8 is an exceptionally high quality slicing cucumber. Although it is somewhat erratic in yield it is probably the best variety for slicing. The fruit is from 7 to 8 inches long and about 2 inches in diameter. The skin is dark green with white spines. The fruit is straight, cylindrical and blunt ended. Of the pickling types National Pickling seems to be best. The fruit grows to 6 inches in length, and 1½ inches in diameter when full sized. The spines are numerous, the fruit dark green in color, tapering somewhat from stem to apex, but is well developed throughout its length.

Always Green, A & C Special, Black Diamond (Stays Green), Davis Perfect, Earliest of All, Early Frame, Landreth's New Hybrid, Lemon, Longfellow, and Woodruff's Hybrid are all fine slicing varieties. In general there is little choice except as the grower may have a preference. The high yielding variety is Always Green (Table 16). The only serious fault of Always Green is that the fruit is rather sharply tapered.

Boston Pickle, Chicago Pickling, Jersey Pickle, Landreth's Extra Early White Spine, Short Prolific and Snow's Prolific are excellent pickling varieties. In general, however, they do not carry the quality of National Pickling.

Table 16
Yield of cucumbers (pounds per acre)

Variety	1936	1937	1938	1939	Average	Percentage rating*
Straight 8.....	8293	7290	5886	603	5518	100
Early Fortune.....	8333	8209	4209	1419	5555	100
Average.....	8338	7750	5048	1011	5536	100
Always Green.....		12155	6036		9096	142
A & C Special.....		8134			8134	105
Black Diamond.....	7777		6432	2677	5629	117
Boston Pickle.....			2767		2767	55
Chicago Pickling.....	6049				6049	73
Davis Perfect.....	8141		2595	567	3738	78
Earliest of All.....		10065	5117	1664	5615	122
Early Frame.....	13399	7301			10350	129
Jersey Pickle.....		8669	4121	1595	4795	104
Klondike.....	6851				6851	82
Landreth's Extra Early White Spine.....	6773	7865			7319	63
Landreth's New Hybrid.....	7315	4822			6068	73

*Percentage rating calculated against average of Straight 8 and Early Fortune.

More Vegetables for Home Gardens

Some of the vegetables placed in this section are of great importance in other regions as commercial crops. Certain factors peculiar, at least at present, to the Wichita Valley make them of doubtful value to the commercial operator, but they are distinctly valuable in home gardens, and to a limited extent in local market gardens.

In some areas methods have been worked out whereby it is possible to transplant cabbage and similar crops to the fields in mid-summer. Here it has not been possible to do so. A combination of low humidity, high wind movement, and consequently high evaporation has made it impossible, even with the use of irrigation water which the plants cannot readily use at that season, to obtain stands with transplanted plants. That any vegetable should appear in this section does not mean that it is forever relegated to the small garden, for it is always possible that at some time new methods of production may be devised to circumvent the conditions which at present prevent the crop from being a commercial success. New varieties may be discovered or developed that will be well adapted to the climatic conditions which are so effective in preventing the more extensive use of these crops at present.

Leaf Crops

Cabbage requires a long cool season for best results. It is fairly hardy and can be planted as early as March 7 about half of the time. When this can be done a good crop of the vegetable can be obtained. It is difficult and often impossible to maintain stands in the fall because the temperatures usual at the time of planting are frequently high, humidity low, and wind movement brisk. Because of these climatic factors cabbage is, at present, of doubtful commercial value.

All of the desirable cabbage varieties mature early. Early Jersey Wakefield and Golden Acre require about 64 days to head and Copenhagen Market 70 days. Later cabbage is seldom satisfactory.

Lettuce is included under vegetables for home gardens because of the limited market for leaf lettuce. Head lettuce has never proved satisfactory at the Station, although some of the growers report occasional success. Leaf lettuce will always make a good crop and may sometimes be grown as a fall crop. High soil temperatures in the fall sometimes destroy seedlings as they emerge. The early varieties of leaf lettuce are best. Black Seeded Simpson, Early Curled Simpson, and Grand Rapids are good.

Root Crops

Carrots are very sensitive to hot weather. If carrots have reached market size by the time hot weather begins most varieties are satisfactory. After hot weather starts very few varieties will increase much in root weight. Satisfactory spring carrot crops may be raised about 2 years in 5. In the fall the problem of getting stands sufficiently early to mature crops is somewhat troublesome. Carrot seedlings, like lettuce, are tender and scald off badly if the crop is planted early most years. In occasional mild winters carrots may be grown as a winter crop.

Of the varieties tried the most satisfactory appear to be Chantenay Red Cored, which matures in 70 days, Danver's Half Long, maturing in 75 days, and Nantes which requires 68 days for the roots to reach market size.

Parsnips require an extremely long growing season. Once in three years a good crop can be grown. It is best to plant late in June and harvest the mature roots in the fall. Some years the summer heat so stunts the plants that good roots do not form.

Of the two varieties tried Hollow Crown or Guernsey was best. The variety requires 130 days to produce satisfactory roots under good growing conditions.

Onions. None of the borderline crops comes as near being successful as the onion. There seem to be several factors that, combined, prevent the crop from being successful. In some years not all factors are operative and the crop does well.

Onions are usually planted in seedling rows the later part of August or early in September. These are transplanted to production rows the following spring. In years with severe winter weather a large proportion of the plants bolt the following spring, so destroying much of the spring crop. After such years it is best to buy plants which have not been exposed to severe winter weather.

After onions have been set in the field, preferably by the first of March, the period available for maturing sound bulbs is sometimes short, and the onions cease to grow and do not bulb properly.

The third factor adversely affecting onion production is the water supply for irrigation in the valley. Onions do not seem to respond

favorably to the water and often appear to be suffering from drouth even though the ground is still wet from irrigation.

Variety investigation has not completely solved the problem of onion production. The results of the investigation are given here.

- a. Varieties which bolt least following cold winters:
 1. Prizetaker
 2. Red Weathersfield
- b. Varieties least severely affected by hot weather:
 1. Prizetaker
 2. Red Weathersfield
 3. Denia
- c. Varieties best able to utilize irrigation water:
 1. Prizetaker
 2. Red Weathersfield
 3. Italian Red Bottle

It must not be considered from this listing that these varieties are entirely satisfactory. They are only the best of all of the varieties tried.

Yields per acre when all conditions for onion production are favorable run as high as 18,000 pounds of market sized dry onions per acre, which is equivalent to 360 50-lb. bags per acre.

Irish Potatoes. Only two varieties of Irish potatoes have been given trial. Neither of them makes yields large enough, nor do they produce tubers big enough for market. Irish Cobbler may be useful for the local market. It yields on the average about 90 bushels of small potatoes per acre. Bliss Triumph yields about half as many smaller, less marketable tubers.

Fruit Crops

Beans, snap. Once in 3 years it is possible to grow a good crop of snap beans. Once in 8 years an excellent crop can be made. This crop is one which tends to shed its flowers and stop growth during hot weather. The early varieties are best. Burpee's Stringless Green Pod, Dwarf Horticultural and Golden Wax may be used. Pinto, a shell bean, is a fair substitute and usually fruits well. It seldom makes good shell beans, however.

Beans, Lima. As a rule hot weather begins before lima beans are ready to set fruit. If, however, the crop can be carried over until fall a fair crop is produced. The best varieties are those with early fruiting dates. Henderson's Bush Lima and Fordhook Bush Lima have given good results.

English Peas. A fair crop of some varieties of peas may be produced every year provided powdery mildew does not kill the plants before the first peas are ready to harvest. In the years with a long spring growing season the crop will exceed 2,000 pounds of green peas per acre.

The best varieties seem to be Gradus which ripens in 70 days, Premium Gem, ripening at the same time, and Bliss Everbearing which requires 80 days. Bliss Everbearing is the best of the three. Of the edible pod peas Dwarf Grey Sugar is good.

Sweet Corn and Popcorn. Sweet corn and popcorn are not, generally, good producers. The climatic factor chiefly influencing the production of corn is the hot winds. These are more apt to occur in June and early July. If corn can be planted early enough, or if early varieties are planted the danger of damage from this weather factor can be largely eliminated and fair to good crops of both sweet corn and popcorn can be grown. While neither sweet corn nor popcorn can be considered sure crops they can always be grown in home gardens with real satisfaction to the gardener.

Of the varieties of sweet corn tried, Honey June, a production of the Texas Agricultural Experiment Station has been best. Every year tried it has produced a crop. Only one variety of popcorn, Japanese Hulless has been tried.

Squash and Pumpkins. Summer squash should be included in all home gardens and might be used in limited plantings for market. For commercial production, however, summer squash would be a hazardous crop. The fruiting season is very short because squash bugs usually kill the vines shortly after fruiting starts.

The best varieties are Early Yellow Bush, Giant Summer Crookneck, Yellow Summer Crookneck and Early White Bush scallop.

Winter or fall squash and pumpkins seldom make crops because of the damage caused by the squash bugs. In home gardens with adequate attention to the removal of the bugs they are very satisfactory.

Watermelons have been grown in the Wichita Valley on favored soils for a number of years. There is relatively little soil which is satisfactory for watermelon production. On other soils the crop may be grown once in a number of years when weather conditions are best for the crop.

Tomatoes. The small fruited varieties can be recommended for production in the Wichita Valley, especially in home gardens. Of these the Porter has proved best.

Miscellaneous Crops

The following miscellaneous crops have been tried out a number of times. They may all be grown during seasons when the weather conditions are favorable. The best varieties, so far as they are known, are listed.

Table 17

Miscellaneous crops and suggested varieties

Crop	Variety
Broccoli	Calabrese
Brussels Sprouts	
Cauliflower	Snowball
Celery	Golden Self-Blanching
Chervil	
Chicory	
Chinese Cabbage	Pe Tsai
Corn Salad	
Cress	
Endive	Broad Leaved Batavian
Parsley	
Salsify	
Large fruited tomatoes	{ Pritchard June Pink Chalk's Early Jewell McGee

SUMMARY AND CONCLUSIONS

Some types of vegetables are well adapted both to the climate and soils of the Wichita Valley. Wherever possible it is preferable to choose varieties that meet the climatic conditions of the valley. Soils somewhat restrict the choice of kinds of vegetables. In nearly all cases however, vegetables of all kinds have been found which can be used at least in the home garden. In general, the soils are satisfactory for leaf and fruit crops adapted to the valley from the standpoint of climate. In almost all cases some varieties of root crops have been found that do well.

The best kinds of vegetables are asparagus, beets, cantaloupe or muskmelon, eggplant, mustard, peppers, okra, spinach, cucumbers and turnips. Other good kinds are collards, kale, rape, swiss chard and radishes.

There is a considerable number of crops which can be grown well in the home garden beside the ones listed in the previous paragraph. Among these are cabbage, leaf lettuce, carrots, parsnips, onions, white potatoes, beans, sweet corn, English peas, and squash. The small fruited tomatoes are very satisfactory as well.

Although usually somewhat difficult to grow there are occasions when all of the following list of vegetables may be produced. These vegetables are broccoli, brussels sprouts, cauliflower, celery, chervil, chicory, Chinese cabbage, corn salad, cress, endive parsley, salsify, head lettuce, and the large fruited tomatoes.

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