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# EC86-1244 Vegetable Producction in Nebraska

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# VEGETABLE PRODUCTION IN NEBRASKA

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# VEGETABLE PRODUCTION IN NEBRASKA

By R. E. Neild, R. B. O'Keefe, D. S. Nuland and J. O. Young[1]

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## SUMMARY

This bulletin presents a portion of results from investigations into the production, marketing and processing of vegetables in Nebraska. Information concerning climate, soil and water resources is presented and discussed. Also summarized are results from vegetable yield trials conducted at different locations in the state during the seven-year period 1960-66. The data were previously published in MP-18, "The Potential for Vegetable Production in Nebraska", University of Nebraska, 1967.


## INTRODUCTION

In developing its abundant water resources, Nebraska has become the largest irrigated region close to the metropolitan east. Extensive areas of productive soils and a climate similar to major vegetable production areas exist in the state.

With increasing mechanization, vegetable production depends less upon a large labor supply. Advancing agricultural and food technology, together with freight advantages resulting from Nebraska's central geographical location, plus the trend for establistment of regional centers for distributing various products have given Nebraska an opportunity to produce and market fresh and processed vegetable products.

Vegetable production on irrigated land in Nebraska can compete with other uses of that resource. Estimates of delivered prices of Nebraska-produced vegetables distributed to 16 major markets indicate that a competitive marketing potential exists with other producing regions.[2]

Vegetable research at the University of Nebraska concerns studies of the culture, processing, mechanization of production and marketing of vegetable crops with the objective of increasing production, quality and use of crops and products processed from them. Additional information and/or services pertaining to vegetable production in the state is available by contacting the Department of Horticulture, University of Nebraska, Lincoln, Nebraska 68583, or University of Nebraska, Panhandle Research and Extension Center, Scottsbluff, Nebraska.

## CLIMATE OF NEBRASKA IN RELATION TO VEGETABLE CROP PRODUCTION

### *CONSIDERATIONS OF CLIMATE*

Vegetables differ in climatic requirement and response to seasonal changes in climate. Each crop must be planted so growth and development correspond closely to the seasons most favorable for yield and quality.

Most vegetable crops are perishable and must undergo some preparation for preservation before storage or long distance transport. Processing is seasonal and facilities are located where crops are produced. The capacities and costs of harvesting, processing and storage facilities are related to season length and in turn to climate.

Yield and quality change rapidly during vegetable maturation so timing of harvest is critical. Plantings are scheduled and harvesting and processing operations are forecast on the basis of crop-climate relationships.

Analyses were, therefore, conducted and agroclimatic procedures were developed for evaluating the climatic resources of the state for vegetable crop production. These analyses contribute to economic studies of the costs of producing vegetable foods. They provide a basis for increased efficiency in research and development by permitting an allocation of capital and effort to crops and areas having the highest potential for success.

### *NEBRASKA'S CLIMATE*

Main factors influencing Nebraska's climate are its latitude, its central location in a large land mass, its position east of a high mountain system, its remoteness from the modifying influences of large bodies of water and its altitude.

The climate is distinctly continental and characterized by a wide temperature difference between winter and summer. Temperatures in January and July respectively, average 23.5 and 76.0 degrees F.

Lower average temperature, an increasing range in daily temperatures and a shorter growing season accompany the increase in elevation from about 1,000 feet in eastern Nebraska to 4,000 feet in the west.

Annual precipitation averages over 30 inches in eastern Nebraska and decreases to less than 16 inches in the west. About 80 percent of the precipitation falls as rain during the growing season (April to September).

Relative humidity averages 60 percent from April to October and is 70 percent the remainder of the year. Humidity decreases from east to west and is usually very low during periods of high temperature. Sunshine averages 63 percent of possible and ranges from 70 percent in July and August to 55 percent of possible in December and January.

Winds prevail from the northwest and west from January through April; a south or southeasterly direction from May to September and a southwest and westerly direction during the remainder of the year. Wind speeds are highest in the early spring and average 13.2 miles per hour in April. Wind speeds are lowest in the summer and average 10 miles per hour in July.

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[1] Professor, Horticulture; Professor, Horticulture; Assistant Professor, Horticulture; Professor Emeritus, Horticulture.

[2] A. L. Aspelin. 1963. An Analysis of the Potential for Establishment of a Vegetable Canning Industry in Nebraska. Agricultural Economics Report No. 30. Agri. Expt. Sta., University of Nebraska.

**Temperature** - The "growing season" in Nebraska, defined as the interval in days between the average dates of last spring and first fall 32 degree F. temperature, ranges from over 175 days in the east to less than 125 days in the west. However, plant species differ in cold tolerance and certain cool season crops may be successfully planted and harvested beyond the growing season temperature limits.

With a sequence of crops that vary in cold and heat tolerance, the growing season in Nebraska more realistically ranges from 200 to 235 days.

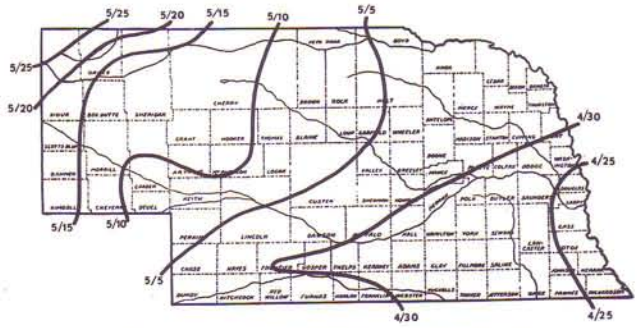



Figure 1a. Average date last spring 32° F.

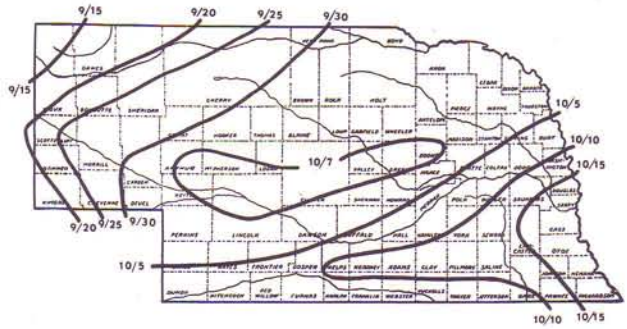



Figure 1b. Average date first fall 32° F.

Data based on long-time temperature records (Figures 1A to 1J) show comparisons of the relative lengths of Nebraska "growing seasons", the "earliness" of the growing season and the growing degree days (GDD) within the growing seasons for different regions in the state.

The average dates of the last spring and first fall 32 degree F. temperatures and consequent lengths of 32 degrees F. free season; the average seasonal accumulated growing degree days (GDD) above 40 degrees and 50 degrees F.; and the springtime occurrences of temperatures averaging 40,45,50,55, and 60 degrees F. are presented in Figure 1A through 1J.

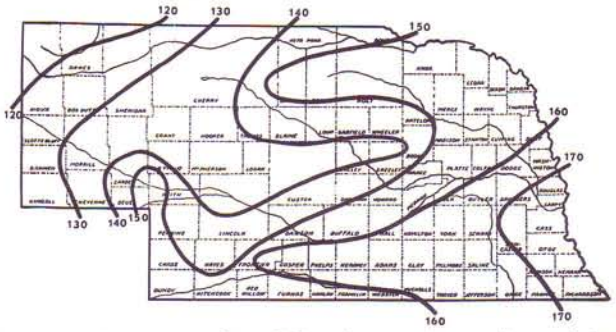



Figure 1c. Average number of days between last spring and first fall 32° F.


Figure 1d. Accumulated GDD above 40° F between average dates of last spring and first fall 32° F.

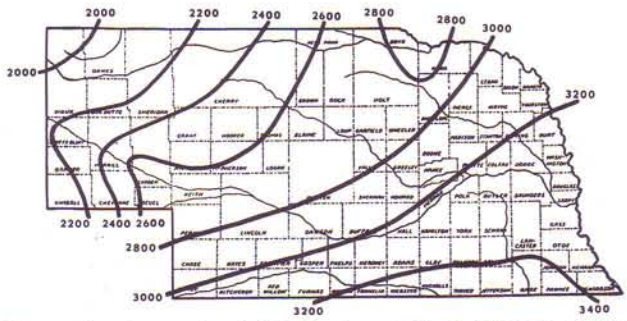



Figure 1e. Accumulated GDD above 50° F between average dates of last spring and first fall 32° F.

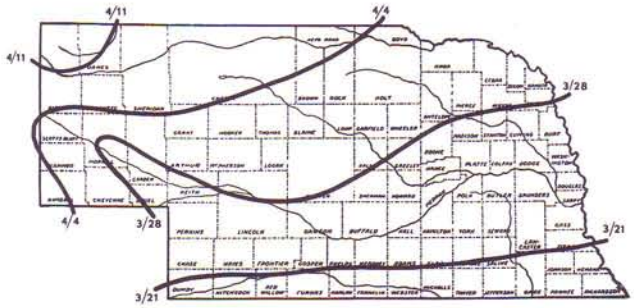



Figure 1f. First spring 40° F average daily temperature.

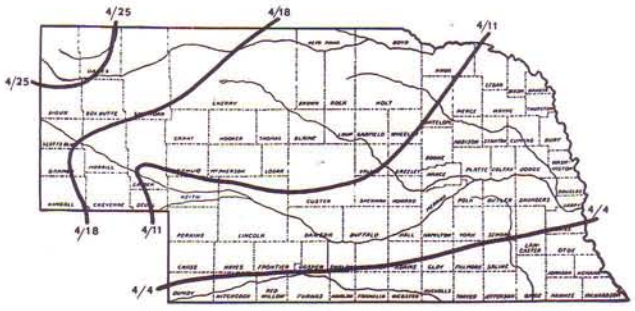



Figure 1g. First spring 45 F° average daily temperature.

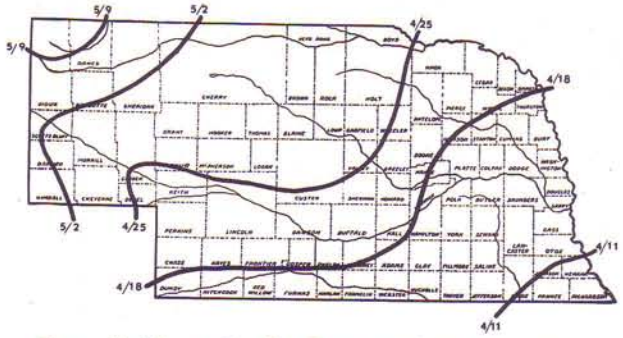



Figure 1h. First spring 50° F average daily temperature.

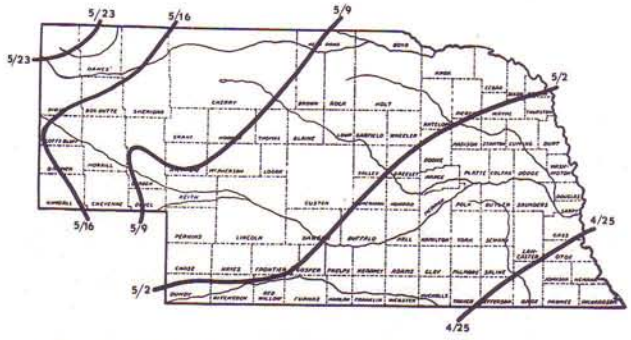



Figure 1i. First spring 55° F average daily temperature.

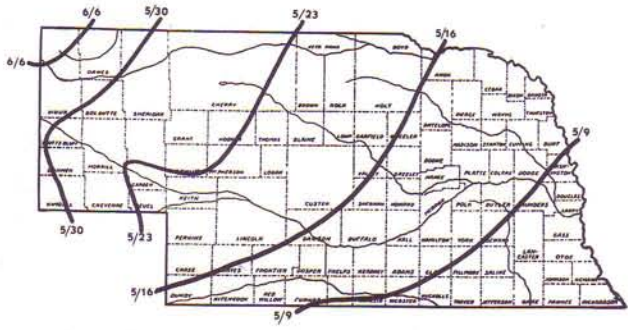



Figure 1j. First spring 60° F average daily temperature.

**Precipitation** - Annual and monthly precipitation normals for the "growing season" months of March through October are presented in Figure 2. The east to west pattern of decreasing precipitation may be seen in these data.

Early spring precipitation is generally light favoring the rapid completion of land preparation and the planting of cool season crops. Precipitation is highest in June. Summertime precipitation largely results from thunderstorm activity and varies from year to year. These rains may be frequent and well distributed in some years and infrequent and scattered in others.

Decreasing precipitation in fall enhances crop maturation and facilitates harvesting of certain crops.

**Hail** - The distribution of hailstorms as implied by crop insurance rates is shown in Figure 3. Hail frequency in the Great Plains seems to be associated with altitude and decreases from west to east across Nebraska. Hail is associated with thunderstorm activity and with minor exceptions, virtually all hailstorms occur from April through September. Hail is most frequent in June.

Hailstones generally fall in a path averaging 1-2 miles wide and from a few to 50 or more miles long. In Nebraska hail paths tend to run from southwest to northeast.

**Relative Humidity** - Relative humidity decreases from east to west across Nebraska. Annual midday relative humidity averages 60, 56, 52 and 48 percent respectively for Omaha, Grand Island, North Platte and Scottsbluff. Averages of monthly relative humidity and the hourly rate of decrease between morning and midday observations are presented in Table 1.

## GROWING AND HARVEST SEASONS IN NEBRASKA

A review of literature concerning crop-climate relationships of different vegetables and an analysis of climatic conditions and growing seasons in the principal producing areas in the United States were used to develop the time and temperature parameters presented in Table 2 for determining the growing seasons for vegetables in Nebraska. Applications of these parameters to climatological data from locations across the state appear in Table 3. The data show the effects of climate differences on the beginning of planting and harvest and the length of harvest period for different vegetable crops.

A detailed planting and harvest schedule involving sweet corn varieties and based on growing degree days at Kearney is presented in Table 4. Such schedules are not only useful in controlling harvest sequence and volume and quality of produce delivered but also are a basis for logistics such as allocation of seed and planting

dates to growers, arranging for harvest and delivery, procurement of packing supplies and scheduling seasonal labor.

The potential processing periods for a sequence of different vegetables at Kearney are presented in Figure 4. These crops provide a seasonal operation of 29 weeks. Nebraska now produces volumes of potatoes and dry beans which could be used to augment processing seasons to include full year packs.

Climatological summaries and detailed historic data in magnetic tape form are available for making growing season estimates throughout the state.

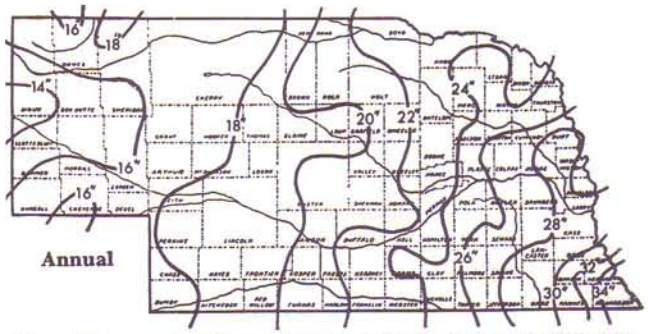
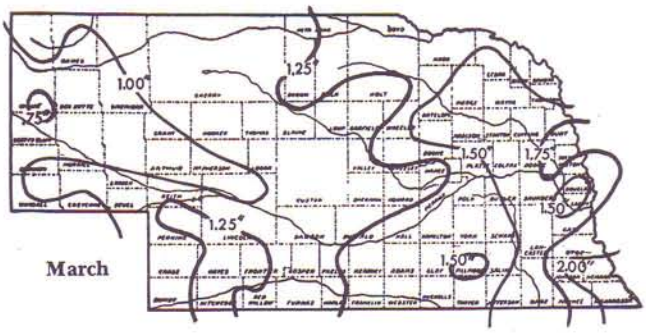
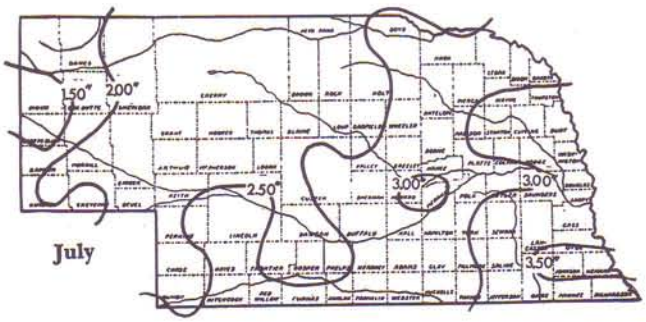
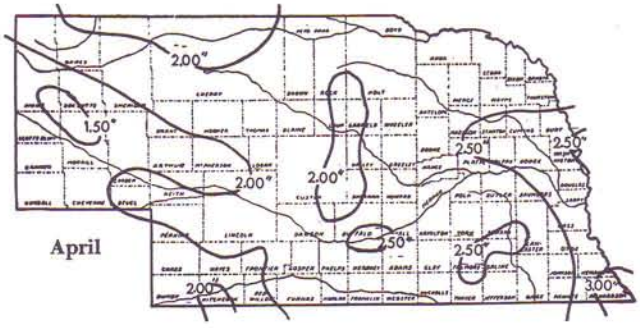
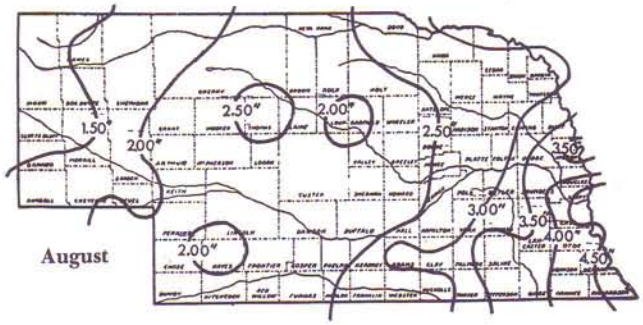


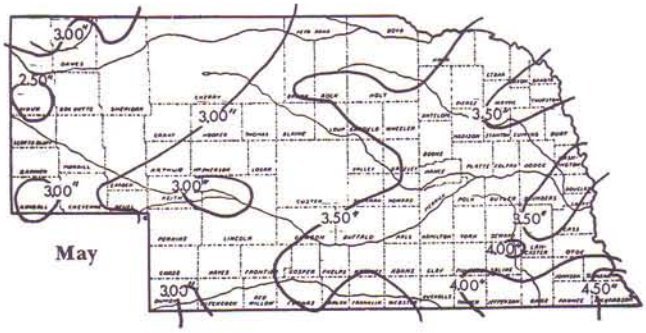

Figure 2. Annual and growing season precipitation in Nebraska. Source: Nebraska Precipitation, Its Patterns and Probabilities. Misc. Pub. 10, Nebraska Agric. Exp. Sta.

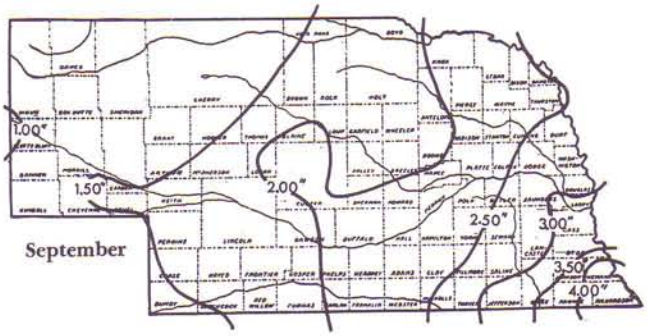


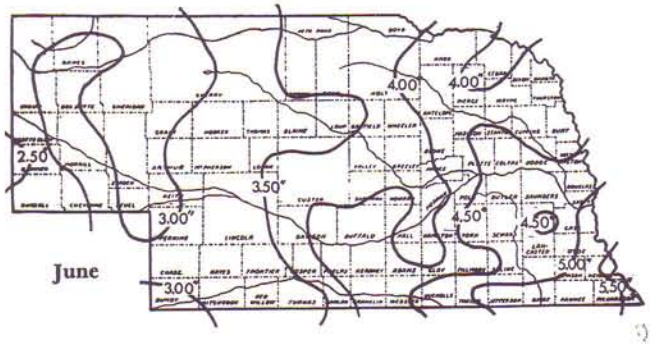



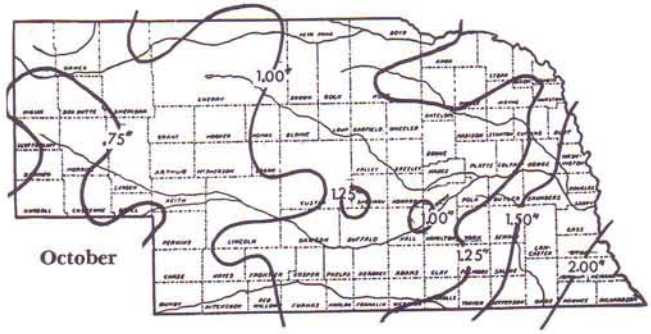



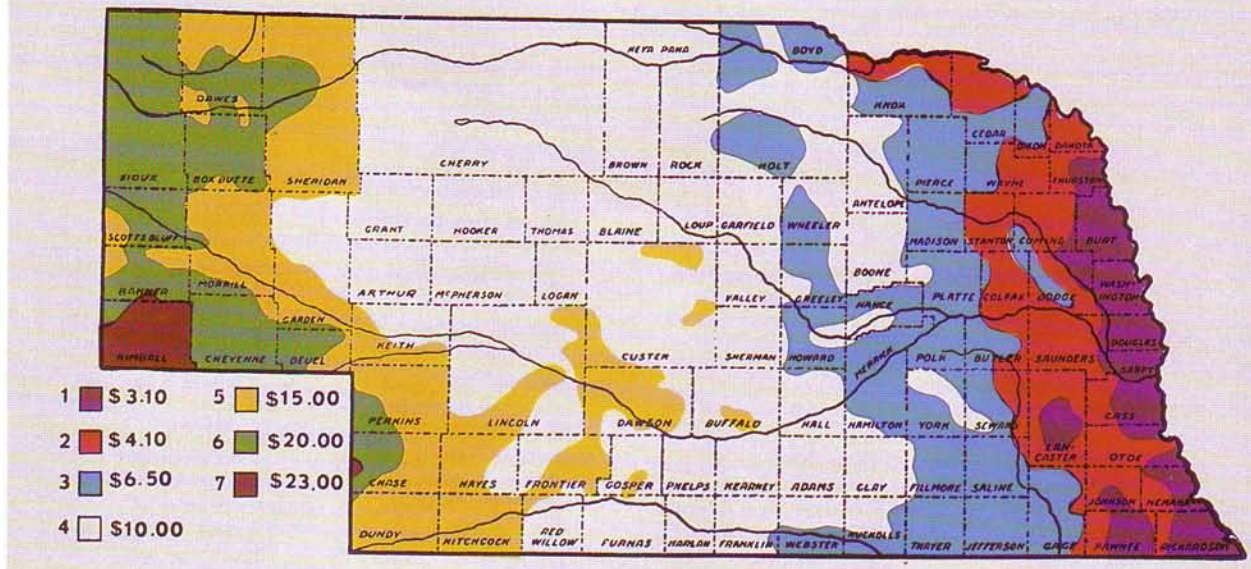



Figure 3. Hail in Nebraska as implied by insurance rates per $100. Source: Nebraska Agricultural Experiment Station Quarterly, Spring 1964.

Table 1. Average monthly relative humidity in Nebraska.

| Station | Time of day | J | F | M | A | M | J | J | A | S | O | N | D | Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Omaha (2)[a] | 6 a.m. | 76 | 78 | 78 | 78 | 76 | 80 | 82 | 85 | 89 | 79 | 82 | 82 | 80 |
| | Noon | 63 | 63 | 61 | 58 | 50 | 60 | 60 | 58 | 68 | 49 | 63 | 67 | 60 |
| | △[b] | 2.16 | 2.50 | 2.83 | 2.83 | 4.33 | 3.33 | 3.66 | 4.50 | 3.50 | 5.00 | 3.17 | 2.50 | 3.33 |
| Grand Island (4) | 6 a.m. | 78 | 79 | 81 | 76 | 82 | 85 | 86 | 87 | 93 | 83 | 82 | 79 | 82 |
| | Noon | 60 | 64 | 61 | 49 | 50 | 55 | 54 | 53 | 66 | 45 | 54 | 62 | 56 |
| | △ | 3.00 | 2.50 | 3.33 | 4.50 | 5.33 | 5.00 | 5.33 | 5.67 | 4.50 | 6.33 | 4.67 | 2.83 | 4.33 |
| North Platte (12) | 6 a.m. | 80 | 82 | 83 | 80 | 85 | 85 | 85 | 86 | 83 | 83 | 81 | 80 | 83 |
| | Noon | 62 | 60 | 58 | 47 | 52 | 52 | 49 | 49 | 46 | 44 | 53 | 58 | 52 |
| | △ | 3.00 | 3.66 | 4.17 | 5.55 | 5.55 | 5.55 | 6.00 | 6.17 | 6.17 | 6.50 | 4.66 | 3.67 | 5.17 |
| Scottsbluff (13) | 5 a.m. | 72 | 75 | 76 | 76 | 81 | 81 | 78 | 80 | 74 | 75 | 73 | 73 | 76 |
| | 11 a.m. | 55 | 53 | 51 | 43 | 46 | 45 | 45 | 47 | 43 | 42 | 49 | 56 | 48 |
| | △ | 2.83 | 3.67 | 4.16 | 5.55 | 5.83 | 6.00 | 5.55 | 5.55 | 5.17 | 5.50 | 4.00 | 2.83 | 4.67 |

[a] ( )—Indicates years of record for averages.
[b] △—Rate of decrease per hour between morning and midday.

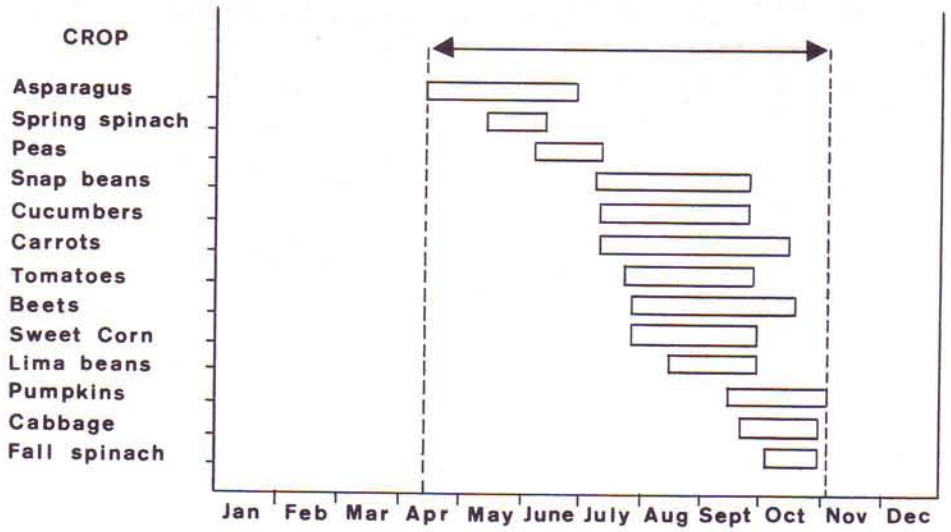



Figure 4. Potential processing periods for a sequence of vegetables at Kearney.

**Table 2. Temperature[a] and time parameters for defining the growing season for selected vegetables in Nebraska.**

| Crop | Earliest planting | Earliest harvest | Latest harvest | Latest planting |
|---|---|---|---|---|
| Spinach spring | Date of first normal occurrence of 38° F | 55 days from first planting | Date of first normal occurrence of 73° F | 40 days before latest harvest |
| Onions | Date of first normal occurrence of 41° F | 63 days after first normal occurrence of 70° F | Date of ≤50% probability of occurrence of 32° F minimum | 45 days before first normal occurrence of 70° F |
| Lettuce head | Date of first normal occurrence of 41° F | 70 days from first planting | Date of first normal occurrence of 75° F | 60 days before latest harvest |
| Peas | Date of first normal occurrence of 42° F | 1200 degree days from first planting[b] | 10 days after first normal occurrence of 75° F | 1550 degree days before latest harvest[b] |
| Cabbage spring (TP) | Date of first normal occurrence of 45° F | 62 days from first planting | Date of first normal occurrence of 75° F | 62 days before latest harvest |
| Carrots | Date of first normal occurrence of 46° F | 100 days from first planting | Date of ≤70% probability of occurrence of 32° F minimum | 100 days before first normal fall occurrence of 50° F |
| Beets | Date of first normal occurrence of 50° F | 100 days from first planting | Date of ≤80% probability of occurrence of 32° F minimum | 100 days before first normal fall occurrence of 50° F |
| Sweet corn | Date of first normal occurrence of 55° F | 1800 degree days from first planting[c] | Date of ≤20% probability of occurrence of 32° F minimum | 2000 degree days before latest harvest[c] |
| Snap beans | Date of first normal occurrence of 57° F | 1250 degree days from first planting[c] | Date of ≤20% probability of occurrence of 32° F minimum | 1250 degree days before latest harvest[c] |
| Tomatoes (TP) | Date of first normal occurrence of 57° F | 50 days from first normal daily minimum temperature of 54° F | Date of ≤20% probability of occurrence of 32° F minimum | 100 days before latest harvest |
| Cucumbers | Date of first normal occurrence of 60° F | 56 days from first planting | Date of ≤20% probability of occurrence of 32° F minimum | 90 days before latest harvest |
| Lima beans | Date of first normal occurrence of 63° F | 90 days from first planting | Date of ≤20% probability of occurrence of 32° F minimum | 80 days before latest harvest |
| Cabbage fall (TP) | 75 days before date of last normal occurrence of 70° F | 90 days from first planting | Date of ≤90% probability of occurrence of 32° F minimum | 100 days before first normal fall occurrence of 50° F |
| Spinach fall | Date of last normal occurrence of 75° F | 40 days from first planting | Date of ≤95% probability of occurrence of 32° F minimum | 50 days before latest harvest |

[a] Except where specifically stated, temperature parameters refer to mean daily air temperature.
[b] 40 degree base.
[c] 50 degree base.
(TP)—Transplanted crop.

**Table 3. Beginning of planting and harvest seasons and length of harvest season at different locations in Nebraska.**

| Crop | First planting | | | | First harvest | | | | Harvest season days | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Omaha | Grrand Island | North Platte | Scottsbluff | Omaha | Grrand Island | North Platte | Scottsbluff | Omaha | Grrand Island | North Platte | Scottsbluff |
| Spring spinach | 3/15 | 3/16 | 3/21 | 3/27 | 5/9 | 5/10 | 5/15 | 5/21 | 36 | 38 | 43 | 42 |
| Onion | 3/22 | 3/24 | 3/28 | 4/4 | 8/7 | 8/11 | 8/19 | 8/24 | 73 | 58 | 45 | 34 |
| Peas | 3/24 | 3/26 | 3/30 | 4/6 | 6/3 | 6/6 | 6/13 | 6/20 | 28 | 27 | 30 | 30 |
| Carrots | 4/1 | 4/3 | 4/7 | 4/14 | 7/10 | 7/12 | 7/16 | 7/23 | 106 | 94 | 85 | 72 |
| Beets | 4/8 | 4/11 | 4/17 | 4/22 | 7/17 | 7/20 | 7/26 | 8/1 | 103 | 89 | 78 | 66 |
| Sweet corn | 4/21 | 4/24 | 5/3 | 5/9 | 7/23 | 7/26 | 8/6 | 8/15 | 82 | 68 | 52 | 37 |
| Snap beans | 4/27 | 4/30 | 5/9 | 5/17 | 7/5 | 7/9 | 7/18 | 7/25 | 97 | 82 | 68 | 55 |
| Tomatoes | 4/27 | 4/30 | 5/9 | 5/17 | 7/10 | 7/21 | 7/28 | 8/8 | 92 | 70 | 58 | 41 |
| Cucumbers | 5/6 | 5/10 | 5/18 | 5/29 | 7/1 | 7/5 | 7/13 | 7/24 | 127 | 113 | 100 | 83 |
| Lima beans | 5/15 | 5/20 | 5/27 | 6/6 | 8/13 | 8/18 | 8/25 | 9/4 | 58 | 42 | 30 | 14 |
| Fall cabbage | 6/25 | 6/25 | 6/17 | 6/16 | 9/23 | 9/23 | 9/15 | 9/14 | 40 | 29 | 32 | 27 |
| Fall spinach | 8/23 | 8/24 | 8/13 | 8/7 | 10/2 | 10/3 | 9/22 | 9/16 | 34 | 23 | 29 | 29 |

Table 4. Hypothetical schedule for field and processing operations involved in producing approximately 350,000 cases of sweet corn at Kearney.

| Planting date | Elapsed G.G.D. | Harvest date | Acres | Tons/Acre | Tons | Cases | Plant processing hours |
|---|---|---|---|---|---|---|---|
| *Early variety* | | | | | | | |
| 5/3 | | 8/5 | 20 | 6.8 | 136 | 4,760 | 8 |
| 5/7 | 26 | 8/6 | 20 | 6.8 | 136 | 4,760 | 8 |
| 5/11 | 26 | 8/7 | 20 | 6.8 | 136 | 4,760 | 8 |
| 5/14 | 26 | 8/8 | 30 | 7.0 | 210 | 7,350 | 12 |
| 5/17 | 26 | 8/9 | 30 | 7.0 | 210 | 7,350 | 12 |
| 5/19 | 26 | 8/10 | 30 | 7.2 | 216 | 7,560 | 13 |
| 5/21 | 26 | 8/11 | 30 | 7.2 | 216 | 7,560 | 13 |
| 5/23 | 25 | 8/12 | 40 | 7.4 | 296 | 10,360 | 17 |
| *Main season variety* | | | | | | | |
| 5/3 | 25 | 8/13 | 40 | 7.6 | 304 | 10,640 | 18 |
| 5/7 | 25 | 8/14 | 40 | 7.6 | 304 | 10,640 | 18 |
| 5/11 | 25 | 8/15 | 40 | 7.8 | 312 | 10,920 | 18 |
| 5/14 | 25 | 8/16 | 40 | 7.8 | 312 | 10,920 | 18 |
| 5/16 | 24 | 8/17 | 40 | 7.8 | 312 | 10,920 | 18 |
| 5/18 | 24 | 8/18 | 40 | 8.0 | 320 | 11,200 | 19 |
| 5/20 | 24 | 8/19 | 40 | 8.0 | 320 | 11,200 | 19 |
| 5/22 | 24 | 8/20 | 40 | 8.0 | 320 | 11,200 | 19 |
| 5/24 | 24 | 8/21 | 40 | 8.0 | 320 | 11,200 | 19 |
| 5/26 | 23 | 8/22 | 40 | 8.0 | 320 | 11,200 | 19 |
| 5/28 | 23 | 8/23 | 40 | 8.0 | 320 | 11,200 | 19 |
| 5/29 | 23 | 8/24 | 40 | 8.0 | 320 | 11,200 | 19 |
| 5/31 | 23 | 8/25 | 40 | 7.8 | 312 | 10,920 | 18 |
| 6/1 | 22 | 8/26 | 40 | 7.8 | 312 | 10,920 | 18 |
| 6/2 | 22 | 8/27 | 40 | 7.8 | 312 | 10,920 | 18 |
| 6/4 | 22 | 8/28 | 40 | 7.8 | 312 | 10,920 | 18 |
| 6/5 | 22 | 8/29 | 40 | 7.6 | 304 | 10,640 | 18 |
| 6/6 | 21 | 8/30 | 40 | 7.6 | 304 | 10,640 | 18 |
| 6/7 | 21 | 8/31 | 40 | 7.4 | 296 | 10,300 | 18 |
| 6/8 | 21 | 9/1 | 40 | 7.4 | 296 | 10,300 | 17 |
| 6/9 | 21 | 9/2 | 40 | 7.2 | 288 | 10,080 | 17 |
| 6/10 | 20 | 9/3 | 40 | 7.2 | 288 | 10,080 | 17 |
| 6/12 | 20 | 9/4 | 40 | 7.0 | 280 | 9,800 | 16 |
| 6/13 | 20 | 9/5 | 40 | 7.0 | 280 | 9,800 | 16 |
| 6/14 | 19 | 9/6 | 40 | 6.8 | 272 | 9,520 | 16 |
| 6/15 | 19 | 9/7 | 40 | 6.8 | 272 | 9,520 | 16 |
| 6/16 | 19 | 9/8 | 40 | 6.6 | 264 | 9,240 | 15 |
| 6/17 | 18 | 9/9 | 40 | 6.6 | 264 | 9,240 | 15 |

Assumptions:
Growing degree days:
Early variety 1875.
Main season variety 2085.

Yield in tons per acre:
Varies with variety and planting date as per schedule.
Cases per ton:
35.
Processing capacity:
600 cases per hour.

## SOILS IN NEBRASKA IN RELATION TO VEGETABLE CROP PRODUCTION

### *Considerations of Soils*

Vegetables are commercially grown on soils varying from the mineral sands in the winter vegetable area in southern Florida to the highly organic soils in the northern lake states.

Yield and the vegetable production costs are closely related to soil productivity. However, labor availability, market proximity and climatic conditions permitting early "off season" harvests result in soil productivity being given secondary consideration in certain regions.

The higher price commanded by fresh vegetables enables successful production on soils that would be considered marginal for vegetables grown for processing.

In general, soils best suited for growing vegetables are well drained, medium textured soils with a relatively high moisture-holding capacity and a uniform depth of 36 inches or more for root growth and development. They are sufficiently high in organic matter to prevent soil crusting during seedling emergence and are free of stones which interfere with planting and harvesting.

When irrigation is available, lighter-textured soils may be more desirable since they warm up earlier in the spring and are less inclined to hamper harvest operations during rainy weather. Vegetable soils should be inherently fertile and free of undesirable salts or other adverse chemical conditions.

Soil uniformity is important in growing vegetables for processing: crop growth and development are more uniform, enabling efficient field and processing operations which can be scheduled and forecast more closely.

### *Rating of Nebraska Soils*

Slope and erosion conditions differ among soil series groups and the ground water distribution for irrigation varies across Nebraska. Therefore, the ratings developed for Nebraska soils assume adequate irrigation water slope conditions for commercial vegetable production.

The soil association map (Figure 5) shows the distribution and ratings of major soil series in Nebraska. Soil associations shown on this map are named according to the two principal soils within each area.

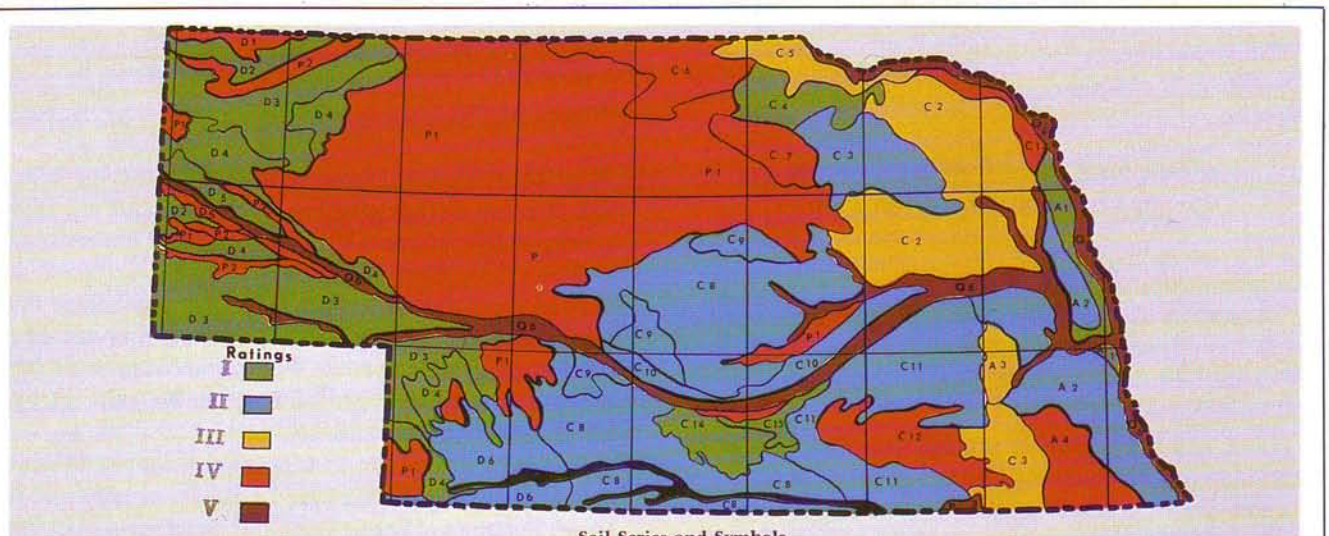
Ratings of these soils for vegetable production follow the soil series names in the legend and are also listed on the map.

It should be noted, however, that other, less extensive soils occur within each area and may have ratings for vegetable production different from those listed for the principal soils. For example, the Loup River valleys in the Sandhills grassland region contain desirable soils for vegetables.

Comparison of Figure 5 and the water resource map Figure 6 shows that extensive excellent vegetable soils and abundant ground water for irrigation are located in south-central and east-central Nebraska, northwestern Nebraska and within major river valleys. Published detailed soil surveys for individual counties in Nebraska are available by writing the Conservation and Survey Division, Institute of Agriculture and Natural Resources, University of Nebraska, Lincoln, 68583.

**Table 5. Limiting factors used in rating Nebraska soils for vegetable production (rating of a given soil is based primarily on its most limiting factor).**

| Rating | Depth of root zone | Drainage class | Texture of surface layer | Fertility and chemical condition | Size of uniform soil areas |
|---|---|---|---|---|---|
| I<br>Very desirable | Deep<br>36″ + | Well drained | Silt loam<br>Loam<br>Sandy loam | Very fertile,<br>no adverse<br>chemical<br>conditions | >30 acres |
| II<br>Desirable | Moderately<br>deep 20–36″ | Moderately<br>well drained | Silt loam<br>Loam<br>Sandy loam | Fertile, easily<br>correctable<br>adverse<br>chemical<br>conditions | 10–30 acres |
| III<br>Satisfactory | Shallow<br>10–20″ | Moderately<br>well drained | Silty clay loam | Fertile, adverse<br>chemical<br>conditions difficult<br>to correct | 5–10 acres |
| IV<br>Unsuitable | Very shallow | Excessively drained<br>Poorly drained<br>Very poorly<br>drained | Sand<br>Loamy sand<br>Sandy clay loam<br>Clay loam<br>Sandy clay<br>Silty clay<br>Clay | Low fertility,<br>adverse chemical<br>conditions<br>extremely<br>difficult<br>to correct | <5 acres |
| Mixed V | Very desirable to unsuitable | | | | |




**Soil Series and Symbols**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| A 1 | Marshall-Monona | C 5 | Moody-Boyd | C 13 | Crete-Wymore | D 5 | Mitchell-Tripp |
| A 2 | Sharpsburg-Marshall | C 6 | Holt-Valentine | C 14 | Holdrege-Hastings | D 6 | Keith-Colby |
| A 3 | Sharpsburg-Shelby | C 7 | Loup-Valentine | C 15 | Kenesaw-Holdrege | P 1 | Valentine-Dunday |
| A 4 | Wymore-Pawnee | C 8 | Holdrege-Colby | D 1 | Pierre-Lismas | P 2 | Rough broken land |
| C 1 | Crofton-Nora | C 9 | Colby-Holdrege | D 2 | Bridgeport-Keith | P 3 | Lancaster-Hedville |
| C 2 | Moody-Crofton | C 10 | Hall-Wood River | D 3 | Keith-Rosebud | Q 6 | Bottomland, sandy to clayey |
| C 3 | Thurman-Valentine | C 11 | Hastings-Crete | D 4 | Anselmo-Keith | | |
| C 4 | Thurman-O'Neill | C 12 | Crete-Fillmore | | | | |

Figure 5. Ratings of major soils series for vegetable production.

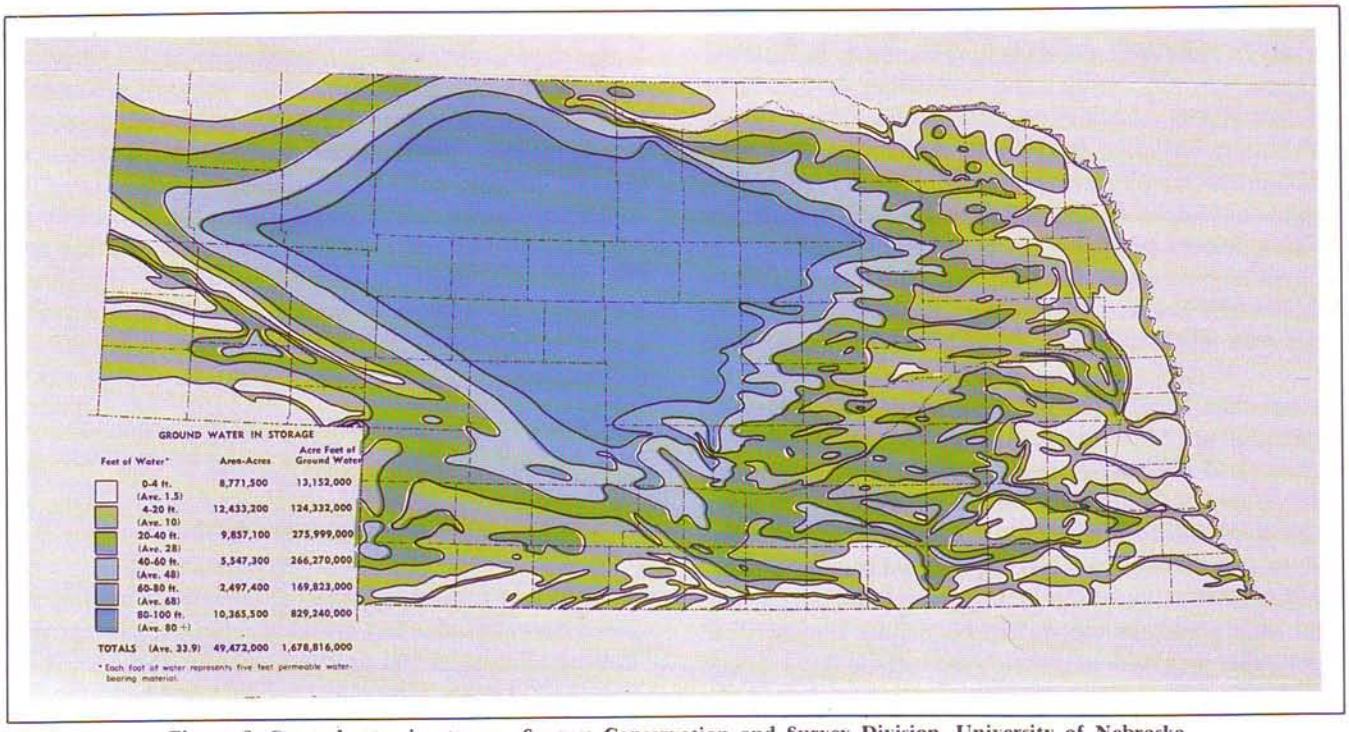



**Figure 6. Groundwater in storage. Source: Conservation and Survey Division, University of Nebraska.**

## NEBRASKA'S WATER RESOURCES IN RELATION TO VEGETABLE CROP PRODUCTION

With growing population, rising per capita consumption of water and the developing water shortages in the United States, it is inevitable that Nebraska's abundant water resources will play an increasingly important role in the future growth and economic development of the state and nation.

Irrigation controls an essential variable in crop production. It assures the availability of adequate soil moisture for good seed germination and enables the timely applications of water at critical stages of crop development that are basic in achieving high yields of quality vegetables.

Consistent annual yields and uniform seasonal harvests are of particular importance in producing and processing perishable crops. Nebraska's ample and well developed water resources are an important feature of its potential for producing vegetable crops.

Following the drought of the 1930's, Nebraska has experienced a tremendous growth in irrigation. Irrigated land increased from 282,000 acres in 1930 to 7,900,000 acres in 1984. About 15 percent of the acreage is ditch irrigated and 85 percent from wells. Underground reservoirs contain an estimated 1.7 billion acre feet of water.

Irrigation has a very significant effect on crop production in Nebraska. As would be expected, yields are higher and production and quality more certain when rainfall is supplemented with irrigation.

For example, statistical analysis of field corn yields in Nebraska, 1980-1984, showed irrigated yields to average 120.9 bushels compared with 69.3 bushels per acre on unirrigated land.

Coefficients of yield variability measuring yield uncertainty showed unirrigated corn yields to vary 23.5 percent of average as compared to only 9.9 percent when the crop was irrigated. The cost of irrigation water in Nebraska is very favorable for vegetable crop production. Depending on water source, location and system used for applying water, energy costs range from $7 to $30 per acre foot.

Minimal commercial and industrial water rates of the twelve large geographically dispersed cities in Nebraska average $.48 per 1,000 gallons.

**Table 6. Estimated per acre costs for production of selected irrigated crops in Nebraska in 1985.**

| | CORN | DRY BEANS | POTATO | ONION | CARROT |
|---|---|---|---|---|---|
| Yield/acre | 140 bu. | 20 cwt. | 265 cwt. | 800 bags | 24 ton |
| Price/unit | 2.55 | 19.00 | 4.85 | 4.25 | 105.20 |
| EXPENSES* | | | | | |
| Seed bed & cultivation | 37.83 | 44.00 | 25.08 | 53.85 | 68.66 |
| Seed and seeding | 37.12 | 29.19 | 275.78 | 220.73 | 148.87 |
| Fertilizer/ application | 38.13 | 15.69 | 82.87 | 45.00 | 47.70 |
| Pesticides/ application | 29.78 | 23.33 | 63.50 | 77.81 | 64.00 |
| Fuel,repairs,etc. | 40.11 | 45.03 | 68.67 | 49.35 | 53.50 |
| Water | 18.53 | 18.92 | 50.70** | 18.92 | 18.92 |
| Labor | 33.92 | 41.97 | 35.77 | 133.80 | 19.50 |
| Harvest | 36.23 | 46.52 | 61.51 | 143.54 | 360.00** |
| Totals | 271.64 | 264.65 | 663.88 | 743.00 | 781.06 |

* Data derived from "Estimated crop production costs",James C. Robb, Panhandle Research and Extension Center, University of Nebraska and from average costs reported by growers of the vegetable crops. Costs do not include land, management, interest, etc. costs and will vary depending upon area in the state and kind of irrigation system.

** Potato costs are for center pivot operations. Carrot costs include hand harvest costs; similar costs apply to hand harvesting of onions.

Maps showing developed irrigation areas and water regions in Nebraska are present in Figure 6. Additional information concerning water resources is found in *Ground Water Atlas of Nebraska* by the Conservation and Survey Division, Institute of Agriculture and Natural Resources, University of Nebraska, Lincoln, Nebraska, 68583. More detailed data for specific counties and regions are available.

## VEGETABLE PRODUCTION, PROCESSING AND MARKETING IN NEBRASKA

Approximately $220 million of fresh and processed vegetables are imported into Nebraska each year. An estimated 65 percent of these crops and products could be produced within the state.

A survey was conducted in 1985 to determine the distribution and magnitude of vegetable production in Nebraska and the type of marketing sytems that were being used for the various crops. The results are summarized as follows:

| *PRODUCTION FOR* | *PERCENT OF GROWERS* |
|---|---|
| HOME GARDEN ONLY | 47.0 |
| HOME AND DIRECT MARKET | 4.6 |
| HOME AND WHOLESALE | 2.7 |
| HOME, DIRECT, WHOLESALE | 0.6 |
| DIRECT AND WHOLESALE | 5.8 |
| DIRECT MARKET ONLY | 9.6 |
| WHOLESALE MARKET ONLY | 5.6 |
| NON-GROWERS | 24.1 |

The survey questionnaire was sent to some 49,000 farm operators with the cooperation of the Department of Economic Development and the Nebraska Crop and Livestock Reporting Service, Nebraska Department of Agriculture. Over 3,200 returns were received. As indicated, 47 percent of the respondents grow vegetetables in the home garden only. Another 7.9 percent grew vegetables for home use plus direct and/or wholesale marketing. An additional 9.6 percent produced for the direct market only, 5.6 percent for the wholesale market only and 5.8 percent for direct and wholesale markets. Production is concentrated in 11 counties as shown in the survey.

Direct marketing involves the vegetable sales through urban or roadside stands, by "pick your own" operations or through local groceries. Wholesale operations sell vegetable produce in volume to produce distributors or to processing companies. Dry beans, potatoes, onions, sweetcorn, popcorn, melons, cucumbers and tomatoes are the crops produced by the largest numbers of direct and wholesale market producers.

Dry beans and potatoes (fresh and processing) have been produced and processed in Nebraska for many years. Onions are processed (frozen products) by three companies in the state. Frozen food dinners using potatoes, onions, carrots, peas, sweetcorn, cauliflower and broccoli are also processed. One company in Lincoln uses a large volume of Nebraska-produced potatoes. Fresh market produce distributors are located in Omaha, Lincoln and Grand Island.

Commodity associations include the Nebraska Potato Council, the Nebraska Onion Growers Association and the Nebraska Bean Growers Association. The direct marketing growers participate in annual conferences in Lincoln and Norfolk. Their mailing list includes 140 individuals.

## ESTABLISHED CROPS

Yield and production costs comparisons among irrigated corn and several vegetable crops are presented in Table 6. The price per unit indicated in Table 6 for the vegetable crops is for graded product and include grading and marketing costs which differ for each crop. Therefore, comparative net income comparisons vary for each production area and marketing season and are difficult to estimate. The yield price per unit and costs of production figures showed that high inputs of labor and financing are required for the vegetable crops but high net profits per acre are possible.

A large portion of the costs of growing vegetables is fixed on a per acre basis. With larger equipment investments associated with increasing mechanization in harvesting, harvest costs also tend to become fixed. Yield per acre and its relation to costs is essential in evaluating a region for its potential to produce vegetables for processing. Field trials were, therefore, conducted to obtain yield data for different vegetables and locations in the state during 1960-66. Locations of yield plots are shown in Figure 7.

Varieties, planting rates and cultural practices common to the principal producing areas in the United States were used at all locations and years. Fertilizer applications, based upon soil tests, were made when necessary to provide adequate soil fertility. Irrigation water was applied to maintain a healthy growing condition. Spray programs were used to protect against insects and diseases.

Harvests were made at maturities suitable for processing. To achieve these maturities, pretests were conducted on rapid maturing crops such as peas, snap beans and sweet corn. Yield data obtained for peas, snap beans, sweet corn, tomatoes and lima beans grown at eleven locations during 1960-66 are summarized in the tables to follow. Yield results are averages of a series of planting dates each year.

Planting and harvest periods for eastern, central, and western Nebraska are shown. For comparison purposes,

average yields from the principal producing areas in the United States are also presented. These data were summarized from reports of the Statistical Crop Reporting Service, USDA, 1960-66.

**Table 7. Maturity, seed size and yield for selected dry bean varieties within market classes in trials, 1980-85.**

| Variety and Class | Maturity | Seed Size | Total Yield |
|---|---|---|---|
| | days | #/lb. | lbs./Acre |
| *SMALL SEEDED CLASSES* | | | |
| NAVY | | | |
| *Fleetwood | 97 | 2475 | 2569 (3) 2/ |
| SMALL WHITE | | | |
| *Aurora | 96 | 3239 | 2323 (4) |
| BLACK | | | |
| *Midnight | 103 | 2456 | 2607 (4) |
| *MEDIUM SEEDED CLASS* | | | |
| GREAT NORTHERN | | | |
| *UI 59 | 86 1/ | 1439 | 2627 |
| Harris | 89 | 1348 | 2900 |
| Valley | 95 | 1339 | 3072 |
| Tara | 99 | 1269 | 3206 |
| PINTO | | | |
| *UI 114 | 86 1/ | 1254 | 2846 |
| NW 410 | 88 | 1417 | 2985 |
| NW 590 | 100 | 1434 | 3279 |
| PINK | | | |
| *Viva | 95 | 1876 | 2508 (5) |
| RED MEXICAN | | | |
| *UI 36 | 99 | 1393 | 2812 |
| *LARGE SEEDED CLASSES* | | | |
| WHITE KIDNEY | | | |
| *White Kidney | 102 | 974 | 1928 (3) |
| LIGHT RED KIDNEY | | | |
| *Red Kloud | 97 | 899 | 2279 (4) |
| DARK RED KIDNEY | | | |
| *Royal Red | 100 | 985 | 2181 (3) |

* Standard variety used to document yields.
1/ In general, yield increases with maturity.
2/ Number of years in trials if less than six years.

**Dry Beans** - Some 155,000 acres (2.6 million cwt.) of dry beans were produced in 1985. Great Northern and Pinto are the two main types grown but other types of beans including Red Kidney, Small White and California Pink beans have been grown since 1978. The crop is concentrated in the western Panhandle area. Nebraska ranked first in Great Northern beans production in the United States for many years. The value of the crop is $52 million. Two percent of the direct market growers and 35 percent of the wholesale market growers produced dry beans in 1984.

The results of variety trials with various types of beans are given in Table 7. These data show that dry beans of the types used for processing are successfully produced in Nebraska.

**Potatoes** - Approximately 12,000 acres (2.7 million cwt.) of potatoes were produced in 1984 with a value of $14.5 million. The crop is marketed for processing as chipping potatoes (60%), certified seed (28%) and for fresh table potatoes (12%). Acreage has increased by 47 percent since 1979 as new areas have come into production for the fresh market "count pack trade" and as the demand for chipping potatoes increased. Three modern warehouse and packing operations have been constructed to support the expansion. Nineteen percent of the direct market growers and 15 percent of the wholesale market growers produced potatoes in 1984.

Two seasonal crops are grown. The "late summer crop" is planted in eastern and central Nebraska in early April and harvested in July and August. The "fall storage crop" planted in western Nebraska in May is harvested in September and October. The production of processing potatoes developed in the state following the release of the chipping variety Haig by the University of Nebraska in 1960. The trends in the production and markets for potatoes are shown in the table below.

**Use of the Nebraska Potato Crop in Percentages**

| *Year* | *Processing* | *Seed* | *Fresh* |
|---|---|---|---|
| 1960 | 1 | 16 | 83 |
| 1972 | 65 | 22 | 13 |
| 1984 | 60 | 28 | 12 |

The yield and quality of potatoes produced in Nebraska are presented in Table 8. The data indicated that yields and quality of Nebraska grown potatoes are competitive with other producing states.

**Table 8. Yield and quality of Nebraska potatoes**

| Variety | Yield cwt./a. | Percent Over 2 1/4 in. | Specific Gravity |
|---|---|---|---|
| | 1974 Late Summer Crop | | |
| Kennebec | 156 | 49 | 1.061 |
| Haig | 207 | 52 | 1.070 |
| Norchip | 254 | 45 | 1.076 |
| | 1974 Fall Storage Crop | | |
| Kennebec | 410 | 96 | 1.086 |
| Haig | 385 | 94 | 1.087 |
| Norchip | 271 | 97 | 1.087 |
| Rus.Burbank | 300 | 90 | 1.092 |
| | 1985 Late Summmer Crop | | |
| Norgold | 574 | 86 | 1.080 |
| Norland | 539 | 91 | 1.068 |
| | 1985 Fall Storage Crop | | |
| Norgold | 381 | 84 | 1.083 |
| Norland | 299 | 92 | 1.076 |

* Yields obtained in replicated trials planted by the University Nebraska Potato Project.

**Onions** - Some 1,200 acres of onions were planted in 1984 representing an increase of 150 percent since 1978. Over 2,000 acres of onions were produced in Nebraska during the World War II years but production decreased to around 400 acres in 1970. Acreage has increased as growers have sought alternative crops to support their farming operations. Processing companies have encouraged the production of quality onions in volumes large enough to supply their needs. Onion production can be mechanized to reduce costs.

The yield and quality of Nebraska-produced onions are indicated in Table 9.

**Table 9. Yield and quality of direct seeded onions in Nebraska.**

| Variety | Yield* | Jumbo | Percent 4"-2" | < 2" | Sort-out |
|---|---|---|---|---|---|
| | 50# bags/a. | | | | |
| | Western Nebraska - 1983 | | | | |
| Vega | 1121 | 53 | 38 | 1 | 8 |
| Inca | 924 | 19 | 70 | 10 | 1 |
| Colo. 6 | 841 | 23 | 58 | 5 | 10 |
| Armada | 800 | 33 | 58 | 5 | 4 |
| Ringmaster | 765 | 6 | 84 | 2 | 8 |
| Brown Beauty | 370 | 0 | 74 | 16 | 10 |
| | Eastern Nebraska - 1985 | | | | |
| Vega | 894 | 9 | 82 | 2 | 7 |
| Inca | 873 | 7 | 84 | 3 | 7 |
| Armada | 775 | 6 | 84 | 2 | 8 |
| Brown Beauty | 714 | 0 | 80 | 2 | 18 |

* Yield obtained from replicated twin-row plots grown by the University of Nebraska with the cooperation of commercial growers. Commercial growers obtain yields of 550 to 1200 bags/a.

Nebraska-grown onions have received favorable market acceptance in competition with other producing states. The yields obtained range from 550 to 1,200 bags/acre and exceed the national average of 596 bags. The survey in 1985 indicated that 48 percent of the direct market growers and 9 percent of the wholesale market growers produced onions in 1984.

**Sweet Corn** - An estimated 2,000 acres of sweet corn were planted in 1984. The number one crop grown for direct marketing is sweet corn, produced by 48 percent of the growers. Nine percent of the wholesale market growers produce sweet corn. The crop can be schedule planted and produced to maximize the harvesting and marketing season using the growing degree day system.

Yields of 96 plantings of sweet corn during the 1960-66 period are summarized in Table 10. The highest yield of 9.83 tons was obtained at Scottsbluff in 1965. The average yield for the state was 6.89 tons. The data show that high and consistent yields are obtained at numerous locations in Nebraska.

**Vine Crops** - Vine crops including watermelon, squash, cucumber and muskmelon were grown on some 900 acres in 1984. Cucumbers are grown for the fresh market and for processing as pickles by eight percent of the direct market and by nine percent of the wholesale market producers. They are generally grown on very small areas (0.5 to 3 acres) as a family project in northeastern

**Table 10. Victory Golden sweet corn yield, 1960-66.**

| Region | Season | |
|---|---|---|
| | Planting | Harvest |
| East | 4/21–7/12 | 7/23–10/13 |
| Central | 5/3 –6/27 | 8/6– 9/27 |
| West | 5/9–6/24 | 8/15– 9/21 |

| Year | Location | Total yield T/A (in husk) |
|---|---|---|
| 1960 | Columbus I | 6.54 (4)[a] |
| | Columbus II | 5.45 (4) |
| | Wood River | 8.44 (3) |
| | Hastings | 8.57 (1) |
| | Lexington | 6.07 (3) |
| | Holdrege | 5.28 (3) |
| | McCook | 5.75 (4) |
| 1961 | Holdrege | 6.61 (5) |
| | McCook | 6.24 (6) |
| | Alliance | 8.15 (3) |
| 1962 | Wood River | 6.22 (6) |
| | McCook | 7.95 (6) |
| | Alliance | 5.31 (3) |
| 1963 | Lincoln | 5.32 (5) |
| | Wood River | 6.77 (7) |
| | Alliance | 8.16 (5) |
| 1964 | North Platte | 8.04 (3) |
| | Scottsbluff | 6.25 (3) |
| 1965 | Lincoln | 7.36 (3) |
| | North Platte | 8.88 (3) |
| | Scottsbluff | 9.83 (2) |
| 1966[b] | Lincoln | 4.75 (6) |
| | North Platte | 6.70 (4) |
| | Scottsbluff | 9.12 (4) |
| Average of all years, planting dates and locations | | 6.89 (96) |
| *U.S. regional average yields 1960–66:* | | |
| East | | 3.45 |
| Midwest | | 3.83 |
| West | | 5.52 |

[a] Number of planting dates at each location.
[b] Variety: Jubilee.

Nebraska counties for pickling companies. A few larger operations grow 5 to 100 acres that are mechanically harvested. The fresh market crop is also grown on small acreages.

The watermelons, squash and muskmelons are produced mostly for marketing through roadside stands or at farmer's markets in various communities. Watermelon and muskmelon are produced by 20 percent of direct market and 6 percent of wholesale market growers. Squash is grown by 12 percent of direct market and by 8 percent of wholesale market producers. Production of these crops is predominantly in the eastern third of the state.

**Carrots** - A small number of direct (3%) and wholesale (0.6%) market growers produced carrots for the fresh and processing markets in 1984 on some 100 acres. In 1985, carrots were grown in the Scottsbluff area for individual quick frozen processing. Carrot yields range from 23 to 29 tons depending upon carrot type and area of production in Nebraska. Yields and quality of western Nebraska carrots equal or exceed national averages.

**Tomatoes** - Direct market growers (12%) and wholesale market growers (6%) grew 16 and 32 acres respectively in 1984. Yields of tomatoes for variety trials at various

locations in 1960-66 are summarized in Table 11. The average yield for transplanted tomatoes over all varieties, locations and years was 25 tons. Yields for direct seeded and transplant single harvest crops of the determinant variety Fireball are given in Table 12. Yields of direct seeded tomatoes were higher than for transplants. Direct seeded crops averaged 16.5 tons of usable and 34.2 tons of total fruit per acre as compared to 14.2 tons and 28.3 tons of usable and total fruit per acre from transplanted tomatoes.

**Table 11. Yield of usable fruit (US #1 & #2) from two or more pickings of transplanted tomatoes, 1960-66.**

| Region | Season | |
|---|---|---|
| | Planting | Harvest |
| East | 4/27–7/2 | 7/10–10/10 |
| Central | 5/9 –6/16 | 7/21– 9/24 |
| West | 5/17–6/10 | 8/8 – 9/18 |

| Year | Location | Usable fruit–tons/acre | | | |
|---|---|---|---|---|---|
| | | Varieties | | | |
| | | H 1370 | KC 146 | Redtop | Roma |
| 1960 | Wood River | ..... | 11.7 | 16.9 | ..... |
| | Holdrege | ..... | 20.3 | 16.3 | ..... |
| | McCook | ..... | 9.1 | 22.8 | ..... |
| 1961 | Columbus | 18.5 | 18.4 | 20.2 | ..... |
| | McCook | 24.1 | 20.5 | 24.5 | ..... |
| 1962[1] | Wood River | 27.4 | 25.2 | 36.6 | 31.5 |
| | McCook | 33.8 | 48.5 | 53.3 | 43.5 |
| 1963[1] | Wood River | 10.1 | 12.2 | ..... | ..... |
| | McCook | 15.1 | 22.0 | ..... | ..... |
| 1964 | ..... | ..... | ..... | ..... | ..... |
| 1965 | Lincoln | 32.0 | 28.0 | ..... | 37.0 |
| 1966 | Lincoln | 29.5 | ..... | ..... | 24.9 |
| | Scottsbluff | 22.9 | ..... | ..... | 20.6 |
| Average for all locations and years | | 23.71 | 21.59 | 27.22 | 31.50 |
| Average for all years, locations and varieties | | | 25.08 | | |
| *U.S. regional average yield, 1960–66:* | | | | | |
| East | | | 14.76 | | |
| North Central | | | 15.41 | | |
| Mountain | | | 12.57 | | |
| West | | | 18.46 | | |

[1] Planting rate 10,890 plants per acre in 4-foot rows.

## ADDITIONAL CROPS

**Peas** - Yields of Early Perfection peas grown at three locations in eastern, central and western Nebraska during 1960-66 are summarized in Table 13. The average yield of thirty plantings was 1.98 tons per acre. The highest yield of 2.37 tons per acre was obtained at North Platte in 1965. The lowest average yield, 1.52 tons per acre, was obtained at Lincoln in 1960.

Comparison of data at Alliance and Scottsbluff vs. Lincoln shows pea yields in western Nebraska tend to be higher than in the east. Yields for the latest planting dates tend to be low because of the high temperatures during crop maturation in late July.

**Table 12. Usable and total yield from a single harvest of transplanted and direct seeded tomatoes (variety Fireball), 1961-64.**

| Year | Location | Method for establishing tomato crop | | | |
|---|---|---|---|---|---|
| | | Transplanting | | Direct seeding | |
| | | Usable[a] | Total | Usable | Total |
| | | T/A | T/A | T/A | T/A |
| 1961 | Columbus | 17.1 (2)[b] | 23.2 | 19.2 (3) | 23.1 |
| | McCook | 14.7 (2) | 28.0 | 21.1 (4) | 35.6 |
| 1962[c] | Wood River | 18.8 (2) | ..... | 15.8 (6) | ..... |
| | McCook | 21.2 (2) | ..... | 20.6 (6) | ..... |
| 1963 | Wood River | 7.7 (2) | 23.4 | 11.0 (4) | 29.1 |
| | McCook | 10.2 (2) | 19.3 | 16.4 (4) | 32.5 |
| | Alliance | 9.3 (2) | 49.0 | 8.3 (4) | 41.6 |
| 1964 | Lincoln | 18.2 (1) | 27.8 | 10.8 (1) | 28.0 |
| | North Platte | 14.7 (1) | 32.1 | 23.9 (2) | 49.6 |
| | Scottsbluff | 9.0 (1) | 21.9 | ..... | ..... |
| Average for all years, planting dates and locations | | 14.10 (17) | 28.3 (13) | 16.50 (34) | 34.2 (22) |
| Average for all years, planting dates, locations and methods of planting | | | | 15.72 (51) | 31.98 (35) |

[a] Usable fruit includes only ripe fruit of U.S. grades classified as 1 and 2 for canning tomatoes.
[b] Number of planting dates at each location.
[c] Total yield not available for 1962 trials.

**Snap Beans** - Yields from single harvests of 115 plantings of snap beans grown during 1960-66 are summarized in Table 14.

The average yield of these plantings over all locations and years was 3.69 tons per acre.

The highest yield averaging 5.69 tons per acre for six plantings was obtained at Wood River in 1962.

The lowest yield, 2.23 tons per acre, was obtained from four plantings at Scottsbluff in 1964.

Yields from plantings harvested in later July and the first week in August were below the seasonal average.

**Lima Beans** - Yields of Fordhook and Thorogreen varieties of lima beans are summarized in Table 15. The average yield of 45 plantings involving both varieties at all locations and years was 2.21 tons per acre.

Yields from the Thorogreen variety averaged slightly higher than Fordhook but Fordhook yields were more consistent over the different locations and years. The highest yield for the Fordhook variety was 2.79 tons from four plantings at McCook in 1962. The highest yield for Thorogreen was 3.82 tons per acre at the Box Butte Experiment Station in 1961. Comparing data from different locations indicates lima bean yields tend to be higher in eastern and central Nebraska than in the west.

**Other Crops** - The cole crops (cabbage, cauliflower, broccoli), popcorn and peppers are produced for both direct and wholesale marketing. The percentages of producers who grew various crops in 1984 for commercial marketing are presented in Table 16.

**Table 13. Early Perfection pea yields 1960-66.**

| Region | Season | |
|---|---|---|
| | Planting | Harvest |
| East | 3/24–5/10 | 6/3 –7/1 |
| Central | 3/30–5/22 | 6/13–7/13 |
| West | 4/6 –5/28 | 6/20–7/20 |

| Year | Location | Green shelled peas T/A |
|---|---|---|
| 1960 | Lincoln | 1.52 (2)[a] |
| | Alliance | 2.14 (2) |
| 1961 | Lincoln | 2.22 (4) |
| | Alliance | 1.69 (4) |
| 1964 | Scottsbluff | 1.54 (3) |
| 1965 | Lincoln | 1.71 (3) |
| | North Platte | 2.37 (4) |
| | Scottsbluff | 2.11 (4) |
| 1966 | Lincoln | 1.95 (1) |
| | North Platte | 2.29 (3) |
| Average for all years, planting dates and locations | | 1.98(30) |
| *U.S. regional average yields for 1960, 61, 64, 65, 66:* | | |
| East | | 1.41 |
| Midwest | | 1.21 |
| West | | 1.26 |

[1] Plantings were not made in 1962 or 1963.
[2] Number of plantings at each location.

**Table 14. Tendercrop snap bean yields 1960-66.**

| Region | Season | |
|---|---|---|
| | Planting | Harvest |
| East | 4/27–8/6 | 7/7 –10/10 |
| Central | 5/9 –8/3 | 7/19– 9/24 |
| West | 5/17–7/21 | 7/25– 9/18 |

| Year | Location | Total yield T/A |
|---|---|---|
| 1960[a] | McCook | 2.48 (5)[b] |
| | Lexington | 2.25 (2) |
| | Holdrege | 2.73 (2) |
| | Hastings | 2.25 (3) |
| | Wood River | 1.69 (4) |
| | Columbus | 4.16 (3) |
| 1961 | Holdrege | 3.71 (7) |
| | McCook | 3.60 (6) |
| | Alliance | 4.28 (6) |
| 1962 | Wood River | 5.69 (6) |
| | McCook | 4.90 (6) |
| | Alliance | 3.90 (5) |
| 1963 | Wood River | 2.93 (8) |
| | McCook | 3.67 (7) |
| | Alliance | 4.58 (5) |
| 1964 | North Platte | 2.79 (4) |
| | Scottsbluff | 2.23 (4) |
| 1965[c] | Lincoln | 4.46 (7) |
| | North Platte | 4.77 (5) |
| | Scottsbluff | 3.82 (3) |
| 1966 | Lincoln | 4.15 (8) |
| | North Platte | 3.57 (5) |
| | Scottsbluff | 2.34 (4) |
| Average for all years, planting dates and locations | | 3.69 (115) |

[a] Multiple pickings were made in 1960 only. Yield values listed for this year are for the largest single picking.
[b] Number of planting dates at each location.
[c] Variety: White Seeded Tendercrop.

*U.S. regional average yields, 1960–66:*

| | *Bush beans* |
|---|---|
| East | 1.69 |
| Midwest | 1.85 |
| West | 2.54 |
| | *Pole beans* |
| West | 5.87 |

**Table 15. Fordhook and Thorogreen lima bean yields 1960-63.**

| Region | Season | |
|---|---|---|
| | Planting | Harvest |
| East | 5/15–7/22 | 8/13–10/10 |
| Central | 5/27–7/6 | 8/25– 9/24 |
| West | 6/6 –6/30 | 9/4 – 9/18 |

| Year | Location | Green lima beans shelled T/A | |
|---|---|---|---|
| | | Fordhook | Thorogreen |
| 1960 | Lincoln | 2.39 (1)[a] | 2.46 (1) |
| | Columbus | 1.82 (2) | 3.09 (2) |
| 1961 | McCook | 1.30 (3) | 2.23 (3) |
| | Alliance | 2.10 (1) | 3.82 (1) |
| 1962 | McCook | 2.79 (4) | 2.06 (4) |
| | Alliance | | .86 (3) |
| 1963 | Wood River | 2.45 (4) | 3.38 (4) |
| | Alliance | 1.74 (2) | .84 (2) |
| Average for all years planting dates and locations | | 2.15 (17) | 2.26 (20) |
| Average for varieties, years, planting dates and locations | | 2.21 (37) | |
| U.S. Regional average yields, 1960–66 | | | |
| East | | .84 | |
| Midwest | | 1.07 | |
| West | | 1.65 | |

[a] Number of plantings at each location.

Popcorn production has increased rapidly in recent years. The exact acreage of popcorn is not known; however, the acreage reported for the 1984 crop was 25,610 acres.

Cauliflower, broccoli, and peppers are used by frozen food processors in Nebraska but require a large amount of hand labor to harvest and prepare the raw product for processing.

Asparagus and sweet potatoes have been produced commercially in Nebraska for many years. Production has been concentrated in the eastern counties along the Missouri River valley. Asparagus yields have ranged from 1.5 to 3 tons per acre. Sweet potato yields of 10 to 15 tons/a. are produced.

**Table 16. Direct and wholesale market producers of various crops in Nebraska in 1984.**

| Crops | Percent of Producers | |
|---|---|---|
| | Direct | Wholesale |
| Dry Beans | 2 | 35 |
| Potatoes | 19 | 15 |
| Onions | 22 | 22 |
| Sweet Corn | 48 | 8 |
| Tomatoes | 12 | 6 |
| Popcorn | 7 | 23 |
| Green Beans | 6 | 2 |
| Peppers | 4 | <1 |
| Broccoli | 7 | <1 |
| Cauliflower | 4 | <1 |
| Asparagus | 7 | <1 |