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## EC1278 Strawberry Culture

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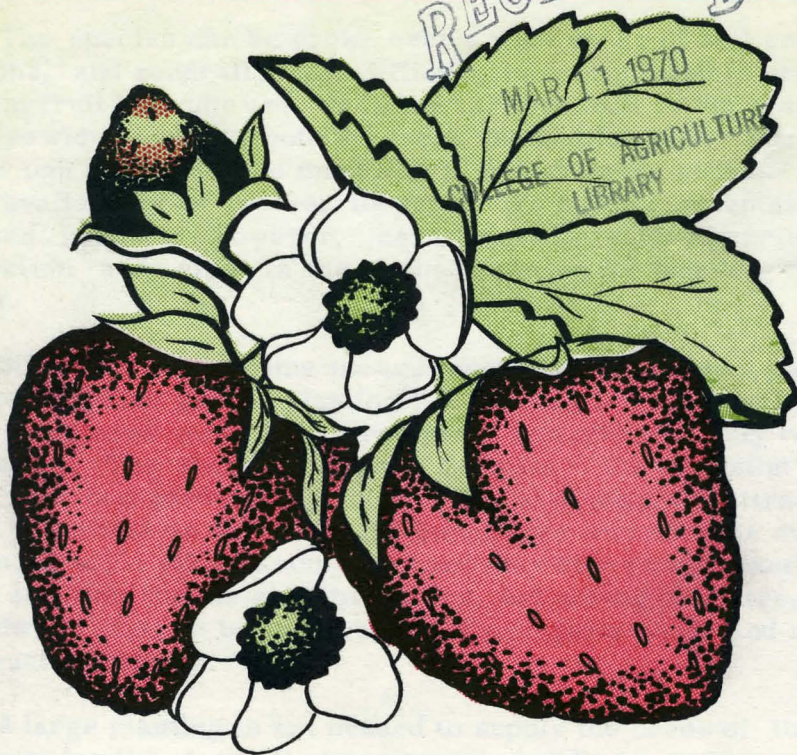
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# Strawberry

## CULTURE



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# Strawberries in Nebraska

C. C. Wiggans\*

The strawberry is the most widely grown fruit in Nebraska. It thrives in all parts of the state where there is adequate moisture and its popularity as a crop for the home garden is very high. Commercially, its annual crop value is exceeded regularly only by that of apples, grapes and cherries and in certain years by that of peaches and pears. State production, even in the most favorable seasons, however, is far below market demand. Therefore, where irrigation and a suitable labor supply are available the establishment of commercial strawberry plantings should receive consideration by those interested in fruit production.

The species can be grown over a wide range of soil conditions, and generally little difficulty is encountered in producing fruit for home use. It is the earliest fruit to ripen and enjoys wide popularity both for fresh use and for jam. Fresh fruit use has increased markedly in recent years because of the availability of freezer lockers. To have an acceptable frozen product, however, care must be used in variety selection and also in the methods chosen for handling the fruit.

Strawberries for home use are generally considered a part of the vegetable garden planting. A planting is rarely left on the same area more than three years and often for only two seasons. The short crop cycle permits the inclusion of this fruit in a garden crop rotation and also makes it attractive to tenants as well as to the land owner who tills his own farm. A newly planted home orchard may serve as an excellent location for the strawberry bed, but among older trees yields are likely to be low because of excessive shade and inadequate moisture.

A large planting is not needed to supply the needs of the average family. A small area properly handled may be more fruitful than a large neglected planting. Commercial possibilities with the crop are indicated by the fact that in a

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variety test conducted some years ago at Lincoln, the average annual yield without irrigation for the ten top June-bearing varieties was over 250 24-quart crates per acre. Recent reports from the Iowa Experiment Station indicate that ever-bearing varieties under good conditions may even double this yield.

Aside from the fact that this fruit has an attractive appearance and a delicious flavor, the strawberry has an added dietetic value because of the high ascorbic acid content of many varieties.

## Soils

Strawberries do best on a well drained, fairly light soil of medium fertility. Ordinary garden loam or land well suited for corn will generally be suitable for berry plantings. The soil should be well supplied with humus to aid in holding moisture. Excessive fertility, however, must be avoided since this tends to promote vine growth at the expense of fruit production. The numerous large leaves also shade the berries, resulting in soft fruits with a low ascorbic acid content. Sandy or gravelly soils ripen fruits somewhat earlier because of their greater absorption and retention of heat. These soils also present a greater frost hazard because they stimulate earlier blossom development.

If some hoed crop in which weeds have been well controlled immediately precedes the strawberry planting, fewer weeds will need to be removed from the strawberry bed. Sod land must be avoided until the white grubs have either matured or have been destroyed by cultural methods. Deep fall plowing is recommended to precede the spring planting. If left in the rough during the winter the soil will be more easily prepared for planting and also is likely to retain more of the winter precipitation. This practice likewise may destroy certain hibernating insects.

## Site

Strawberry blossoms open quite early and are therefore subject to the damaging effects of low temperatures in seasons



when late spring frosts occur. These blossoms are sometimes killed when tree fruit blooms are undamaged because of the lower temperatures near the ground. Since a slope permits the flow of the heavier cold air to a lower level it is advisable to use such a site if it is available. Locations at the base of a slope or on level low ground are undesirable also because of poorer soil drainage, but when lack of moisture is likely to be a factor they may sometimes be used successfully. Erosion may be a problem on slopes that are too steep.

A south or southeastern exposure will cause the berries to ripen somewhat earlier. However, since such an exposure hastens the blossom date there is an increased danger of frost damage. On the other hand, a northern exposure will avoid the frost danger to some extent by delaying the blooming date. The fruit also ripens later, but from the commercial point of view this is not undesirable since the midseason homegrown berries frequently bring a better price than the early homegrown ones.

Protection from seasonal winds holds winter snow in place and also decreases summer evaporation. A low hedge, a slatted fence, wide boards, or cornstalk bundles held upright against a wire are placed at right angles to the prevailing winds to serve this purpose.

Under some circumstances partial shade is useful in the production of high quality fruits. A location just north of a building or tall windbreak may offer advantages, but the ripening date will be later. Also the strawberries must be far enough away from other plants to eliminate most of the competition for soil moisture. A small planting can be shaded with muslin-covered frames. If the sides and ends of the area are solid, protection from birds is also assured.

## Planting

What to plant. Use only plants with light colored roots because these are the runners of last year. While the older plants, with the dark colored roots, will grow under good conditions the younger plants are more vigorous and are more

easily established. If the plants are from an adjacent bed they are ready for immediate planting, but plants from a nursery sometimes must be held for several days because of adverse weather conditions. In the latter case, unpack the stock to prevent heating and then heel it in by opening up the bundles and packing damp soil over the spread-out root mass. The plants may be held in this manner for several days.

When to plant. Spring planting is best in Nebraska. There is usually a better moisture supply in the spring and the plant has the full season to become established for the next year's crop. While summer- and fall-set plants can be made to survive, the plants seldom develop enough to produce an acceptable spring crop since there isn't time for the development of good crowns and vigorous runners.

How to plant. The outer leaves of the plant to be set should be removed and any long straggling roots shortened. The pruning is less important with very early-set plants which have developed only a small amount of leaf area, but if it is neglected for late-set plants the excessive evaporation from the extensive leaf area may cause the loss of many plants. If fall planting is followed, best results will come by using early runners which have been rooted in small flower pots sunk full length in the soil, or by lifting a mass of soil with the plant to be transplanted.

There are four essentials to successful transplanting: (1) The plant roots should never be allowed to dry out. (2) The plant should be set at the proper level (if the crown is covered with soil it will often rot, while if the roots are exposed they will dry out). (3) The roots will have better soil contact if they are spread out fanwise instead of being wadded into a compact bunch. (4) The soil should be pressed firmly around the roots. When the soil is either too dry or too wet it cannot be pressed around the roots properly.

A spade, hoe or dibble can be used in making the holes, which will be 12 to 20 inches apart in rows ranging from 1 to 4 feet apart. The spacing distance varies with the variety and the training system to be employed.



## Cultural Practices

Weed control. The strawberry bed should be kept free of weeds, particularly throughout the first season, in order to get good development of the runner plants which will be fruitful the following year. Several methods of weed control may be used. For small areas hoe and hand weeding will hold weeds in check and also keep the soil surface loose to facilitate rooting of the runners. Some hand placement of runners at this time will insure much better distribution of the new plants.

A second method of weed control involves the use of a herbicide. Very satisfactory results have been reported, without reduction in yields, by several workers through the use of Crag Herbicide 1, (sodium 2, 4 dichlorophenoxy ethyl sulfate) on the strawberry bed. Four pounds of this chemical dissolved in 50 to 100 gallons of water will cover an acre (2 level tablespoons in 1 gallon of water for a row 4 feet wide and 100 feet long). It is applied evenly to the soil in a weed-free patch about a month after the plants are set and may be repeated a month later. If weed seeds are brought to the surface by cultivation another weedicide application will be necessary. On old beds the chemical is used before bloom and after harvest, but never when blossoms or fruit are present.

A third scheme to control weeds is sometimes publicized. Young geese, 3 or 4 per acre, will destroy many of the grassy weeds if the weeds are not too large when the geese are turned into the field. The birds must be removed as soon as the berries begin to form to prevent crushing of the fruits.

Blossom removal. No June-bearing variety should be permitted to develop fruits during the summer following transplanting. Pinch off the blossom clusters as soon as they appear. Even though a few fruits might develop, they are likely to be very gritty because of their contact with the soil and will definitely hinder runner development.

In the case of the fall-bearing varieties, all blossoms are removed until late June. Later-formed blossoms will mature their fruits approximately a month later.



Training systems. The "matted row" system of training is generally used, but frequently the rows disappear and the whole area becomes matted. Runners are allowed to set promiscuously within a strip 18 to 24 inches wide where the row spacing is 3 1/2 to 4 feet. The narrower row is preferable since the finest fruits are usually found on its edges. If a narrow width is to be maintained, the distance between rows is adjusted proportionately. The cultivator maintains a clear space between rows. Rooting of the early runners is hastened if a node is covered with soil during the hoeing process. The early-rooted daughter plants are the most fruitful the next year and some growers permit only the first two on each runner to develop. It is worthwhile, too, to give these daughter plants plenty of room, and hence a spacing of 6 to 8 inches is suggested. Additional plants are held to a minimum by preventing the rooting of additional nodes. Flower buds formed in late summer are much more fruitful than those formed on the runner plants which become established in late September or later.

If the main objective is to produce fancy fruit, with perhaps a somewhat lower yield, then the "hill system" is recommended. In this case the initial spacing distance is lessened to 12 to 15 inches and the rows placed about the same distance apart. Provision should be made for paths at appropriate intervals by leaving an unplanted row. All runners are pulled off shortly after they begin to lengthen--a rather tedious task with those varieties which are heavy plant makers. Limiting plant development to the single plant results in the formation of a multiple crown, each part of which will form its share of fruits later on. Perhaps the best results from this system are obtained with the everbearing varieties, many of which normally form only a few runners.

Irrigation. Strawberries need a good supply of water, particularly during the period of fruit enlargement and then later as the runners and fruit buds for the next crop are developing. Dry periods, even of short duration, are very injurious. Roots usually extend only about 18 inches into the soil and hence, if growth of the plant is to be continuous, the moisture supply in the first 2 feet of soil must be kept at an adequate level. Newly set plants in a dry season are in special need of a water supply.



In the use of supplemental water, several points should be kept in mind. Overhead irrigation during the blossoming season is likely to cause malformed berries due to the washing away of pollen. Ditch irrigation often results in an uneven distribution of water unless special care is used in the row layout at the time the bed is established. Picking operations are facilitated if irrigation ditches are kept to alternate middles. A thorough soaking of the soil to a depth of 2 feet will usually supply enough moisture for at least one week. It is especially important that ample moisture be available during the ripening period to hold up berry size and assure heavy yields.

Mulching. Mulching serves three distinct purposes in the strawberry planting. First, it provides winter protection by slowing down water loss during the winter and also by preventing heaving due to alternate freezing and thawing of the surface soil. Second, a summer mulch between the rows conserves moisture and aids in keeping down weeds. Third, the berries are held away from the soil and, hence, are much cleaner at harvest time. A good mulch between the rows also provides a cushion for the pickers' knees.

Clean wheat straw has been the standard mulching material used in Nebraska, but with the increasing unavailability of this material, a substitute is often sought. Leaves pack too tightly and may cause plant loss because of wet conditions. Oat straw packs tightly, also. Cornstalks are somewhat coarse, but do not blow away as do lighter materials when used on exposed sites. Prairie hay tangles rather badly and is more trouble to use. Crushed or chopped corn cobs and sawdust have recently been tried with good success. The sawdust should be from materials which have not been creosoted and the corncobs should not be too finely divided because of the rapid decomposition of the small particles.

The strawberry plant remains active, but the rate of growth slows down as the temperature decreases. This brings about increased hardiness due to the increased reserves. A few frosty nights hasten the above development. The danger point for strawberry buds is about 20° F., hence the time for mulch application is after a few light freezes, but before the first sharp drop of soil temperature. If mulch is put on

too early, the accumulation of reserves is interfered with because of lessened light, and less hardy plants are the result. An undue delay in applying mulch usually results in a poorer crop the next season due to bud killing.

A combination of chemical weed control and the corncob or sawdust mulch seems to work out well during the first season, especially with everbearing varieties being grown under the hill system. Care must be taken to avoid covering the plant crown or leaves. The mulch will also tend to keep down further weed growth, but if weeds or grass push through it they must be taken out by hand. When those materials are used on a matted row, the runner nodes must be brought into contact with the soil if daughter plants are desired.

A straw mulch approximately 2 inches thick is usually adequate. It is most effective when used on the row, but the whole surface of the bed is generally covered. About 2 tons of straw are required per acre to give a 2-inch covering. A 1 1/2 to 2 inch covering of sawdust or corncobs will give ample protection.

Delaying the straw mulch removal in the spring until there is evidence of plant growth will delay the crop a bit, but lessens the danger of frost damage. The plant simply remains dormant longer because of the cooler conditions found under the mulch. If bleaching of the foliage is evident, remove the mulch at once. In the removal process some straw may need to be taken from the field, but in most cases, it is raked to the spaces between the rows. If some straw is left on the row, the plants force their way up through it to the light and then the thin straw cover keeps the fruit from direct soil contact.

## Fertilizers

Most Nebraska soils will produce a satisfactory crop of strawberries without the addition of commercial fertilizers. A soil deficient in nitrogen will be improved by turning under a generous application of manure or a heavy leguminous cover crop. These measures are of the greatest value if put into effect one year ahead of the strawberry planting. Phosphorus and potash are usually unnecessary. The use of a 10-20-0



fertilizer--20 pounds per 1000 square feet--is sometimes profitable. Beds mulched with corncobs or sawdust are more likely to need fertilizer applications.

Strawberry foliage frequently develops a yellowish, sickly appearance because of any one of several factors. There may be a deficiency of nitrogen or an overabundance of soil moisture, but the more usual cause is a lack of available iron to develop the normal green color in the leaves. The latter condition can be remedied by acidifying the soil to the point where the iron becomes soluble and thus available for the plant. Opening up a deep furrow, partially filling it with manure and adding 5 pounds of ferrous sulfate per 100 feet of length before refilling the furrow may be sufficient to correct this situation for plants set in rows between these furrows. Another possible remedy is to sprinkle the foliage with a weak solution (one teaspoonful per gallon of water) of the same material. It is wise to use these treatments experimentally until definite favorable results are in evidence. Such corrective measures are much more likely to be needed in the western half of the state than in other areas. There is much difference also between varieties as to the extent to which this chlorotic condition develops.

## Harvesting

The strawberry fruits increase enormously in size and sweetness during the last day or two of the ripening period. If intended for home use, they should be left on the plant until they are thoroughly ripened. When berries are to be held for several days or need to be shipped to market, somewhat earlier picking is necessary so that they will be in prime condition. Even here, however, they must be well colored but not mature enough to be soft. If the berries are soft, many of them are crushed and spoilage during transit is much greater.

Frequent picking gives a much more uniform product whether intended for home or market use. It should be done early in the day. Weather conditions may interfere with picking dates, but the best fruit is secured by picking at least three times weekly. Leaving the calyx and a short

piece of the stem attached to the fruit will lengthen its keeping period and improve its appearance.

The standard strawberry container is either the quart or pint box. These may be of wooden veneer or paper construction and for market purposes are never used more than once. Surplus clean fruit can usually be disposed of to good advantage if it is not overripe, and if the mis-shapen berries are graded out.

## Renewal

Renewal is the process of preparing the strawberry bed for a second or even third crop. The first crop borne is usually the best because of greater plant vigor. In matted rows the plants are also less crowded. Later crops dwindle in both total yield and berry size unless proper care is given the bed immediately after harvesting. It is doubtful if it ever pays to renew the June-bearing bed more than twice, while more than a single renewal of the everbearers is seldom attempted. This means that the planting should be extended each year if annual production is expected.

At renewal time for the June varieties the objective is to eliminate the surplus plants. A very large number of runner plants may have developed from the mother plant which was originally spaced perhaps  $1\frac{1}{2} \times 3\frac{1}{2}$  feet. These are not so vigorous, however, and will be less prolific in runner production for the next season. The row must be thinned out but enough plants must remain to produce a good row for the following year.

The bed may first be mowed and the foliage and straw mulch raked off and perhaps burned as a disease control measure. Burning off the field is a questionable practice unless the soil is damp, the surface mulch dry, and the wind blowing rather briskly.

After the mulch is out of the way, one side of the row may be plowed out or the plants in the row thinned out with a hoe. Perhaps at least 50 per cent of the plants should be removed, but the amount of thinning needed will depend upon



the stand, seasonal conditions and variety. In large fields where the plow is used to remove some of the plants, a harrow may be used crosswise to level the ridges and give some cultivation to the remaining plants.

After the mulch is removed the rows are kept under cultivation for weed control and also to provide conditions suitable for runner growth. As cold weather approaches the winter mulch should be applied again.

Later renewals follow the pattern already described. Each succeeding season, however, finds weaker plants because of decreasing soil fertility and less efficient cultivation.

When the hill system is used, renewal as directed above cannot be used since only the originally set plants are present. In such a case, keep all runners pulled off and continue the single-plant type of growth. Seldom is such a bed held for longer than the second fruiting season.

## Everbearing Strawberries

In recent years and with the introduction of improved varieties, the everbearing type of strawberry has become more popular. In these varieties the plant has the ability to form fruit buds regardless of the day length and hence produces berries not only in June, but also throughout the late summer and fall.

In general they require care similar to that for June-bearing sorts, but there are a number of significant variations.

1. Everbearing varieties give very favorable results when grown by the hill system. Many are poor plant makers anyway and if runner plants are permitted to develop, they will do so at the expense of fruitfulness. Matted rows are usually much less fruitful.

2. Mulching material (corn cobs or sawdust), is applied a month or so after the plants are set.

3. After late June, the blossom clusters are allowed to develop. Ripe fruit begins to appear about August 1 and continues to be available until hard freezes occur.

4. Pickings at any one time will be much lighter than with the June bearers, but the season's yield may be as good as that from the other type.

5. A winter mulch of coarse clean straw or cornstalk is applied after the berries can no longer ripen, but it is completely removed in early spring.

6. The corncob or sawdust mulch may need additional material after removal of the winter mulch.

7. A June crop is generally followed by the usual fall production. The second year's total crop may equal the first season's fall crop, according to 1951-52 results reported by the Iowa Experiment Station for tests made near Council Bluffs, Iowa.

Everbearers will usually be considered as a home fruit crop, but under good climatic and soil conditions may also prove to be a profitable commercial venture. In the Iowa tests yields slightly under one pint per plant were obtained for each of the two fruiting seasons. It should be remembered, however, that such high yields can be expected only if soil drainage and fertility are satisfactory and temperature ranges and moisture conditions are favorable. Cost of production will be considerably higher than for the varieties which ripen their total crop within a three- or four-week period.

## Insects & Diseases

Fortunately few insects or diseases are of sufficient importance in Nebraska to warrant control measures. Damage from heat and drouth are much more prevalent and may sometimes be mistakenly attributed to diseases or insects. Leaf spot, white grubs and leaf rollers are more frequently found than other pests, but on occasion, others such as crown borer and mildew may be present.



Strawberry leaf spot is identified by the small round spots or holes found in the leaves soon after the blooming period. A "rusty" appearance is produced if the infection is severe. Many leaves drop off, lessening the vigor of the plant. It may be held in check by spraying with Bordeaux mixture (4-6-50) when growth is beginning and again just before blossoming time. Removal and destruction of the old infected leaves at renewal time is helpful in the control of leaf rust. Some varieties are more resistant than others.

Slime mold grows only upon decaying organic matter, but it may sometimes smother adjacent strawberry plants with its slimy, frothy growth. It is more common in very wet seasons. Fortunately it disappears after a few days of hot, dry weather.

Mildew sometimes appears as a whitish, superficial covering of the leaf surface. Bordeaux mixture will hold down this infection in wet seasons when it may be of some consequence.

White grubs are larvae of the June bug or May beetle. They destroy the roots of the plant and often cause poor stands. Injury is largely avoided by cultivating the area, particularly if it has recently been in sod, for a year or two ahead of planting. Fall plowing is also of some value. A 5 per cent chlor-dane dust broadcast at the rate of 5 pounds per 1000 square feet before the plants are set, and worked or watered into the soil gives effective control and will grub-proof the area for several years. Lead arsenate used in a similar way also gives effective control.

Strawberry leaf rollers are small greenish worms easily controlled by stomach poisons, but the spray must be applied before rolling of the leaves begins. Arsenate of lead, 1 pound to 50 gallons of water, or other stomach poison may be combined with the leaf spot spray. If damage continues after the bloom period begins, dust thoroughly once a week with a 1 per cent rotenone dust. Rotenone leaves no harmful residue on the developing fruit.

## Varieties

Since commercial strawberry production began 150 years ago around the large cities along the eastern coast, perhaps 2000 varieties have been named and distributed by American nurserymen. Among these may be found sorts adapted to diverse kinds of soils and climatic conditions and to a great variety of uses--in fact a variety can be found to fit almost every need and location. Certain sorts are restricted in their adaptation and will thrive only in special environments, while others can be used under a great variety of conditions.

Of the great number of varieties, about 15 are grown extensively and a dozen or more others are of lesser significance. Varieties for the South not only endure the hot summers, and form fruit buds during the short days, but require little or no chilling before resuming growth. The long dry summers in areas in the Pacific Northwest permit the use of varieties susceptible to leaf spot because the disease doesn't develop under those conditions. Other sorts endure the long cold winters of the Midwest while still another group is adapted to the cool, humid conditions along the eastern coast.

The average grower will be interested in only a few varieties. A very early variety (furnishing fruits which usually are of poor quality), a midseason main crop variety and a later sort, unless climatic conditions make its yield disappointing, generally will supply the needs of the home gardener. An everbearing sort will provide late summer and fall fruit production. Choice of variety depends somewhat upon the grower's preference. Catalogue descriptions of the various varieties indicate seasons, general quality and adaptation for canning or locker storage.

Certain varieties produce very little fruit if planted alone since they require cross pollination to bring about fruitfulness. These are the so-called pistillate varieties which develop little or no viable pollen. Variety descriptions indicate whether a pollinizing variety needs to be planted every fourth or fifth row. These varieties should bloom at about the same time. Most commercial varieties require no cross pollination.



The Dunlap will probably give more satisfaction throughout Nebraska than any other variety. It has been a standard sort for the Midwest since about 1900, but in recent years other sorts have also been planted widely. Which one is best for a given condition can be determined finally only by comparative trials in a given location.

Midseason sorts are likely to be more dependable than the early or late ones. The early ones are often caught by frost and the later ones by heat and drouth. The following list is by no means exhaustive, but in it will undoubtedly be found one or more sorts which can be expected to do well in Nebraska. All of these are fruitful when planted alone.

June-bearing varieties	Everbearing varieties
Beaver	Gem
Blakemore	Mastodon
Dunlap	Red Rich
Fairfax	Streamliner
Premier	Superfection
Robinson	Wayzata
Sioux	

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This is a revision of Experiment Station Circular 11 bearing the same title and last revised in March, 1948.