

PLASTICULTURE GUIDE

Junebearing & Everbearing Strawberry Production with Dormant Plants



NOURSE

The Best Berry Plants Since 1932

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About Nourse Farms, Inc.

NOURSE FARMS of Whately, Massachusetts is located in the Connecticut River Valley of Western Massachusetts, home to some of the country's best soil for nursery production.

OUR MISSION is to supply top quality, disease-free productive berry plants of proven varieties.

OUR STAFF at Nourse Farms is a group of dedicated, knowledgeable individuals who are here to fulfill our mission and provide you, our customer, with the best possible information, service and plants.

- Established in 1932. Over 85 years of experience servicing professional growers and home gardeners.
- Progressive tissue-culture propagation program to maintain variety integrity and clean mother-plant stock.
- In-house laboratory and professional staff to support comprehensive virus indexing, ELISA, and PCR testing, and best-practices propagation programs.
- Field-grown nursery plants are raised using best management practices including methyl bromide soil fumigation, modern sprayer technology for insect and disease control, and solid set irrigation installed with best digging practices to maintain plant quality.
- Cooperation with numerous university agricultural extension services and research stations.
- Extensive on-going field trial programs for plant varieties and growing practices.
- Plasticulture methods used throughout our 10-acre strawberry fruiting operation.

Plasticulture Overview

The early development of plasticulture strawberry production in the eastern United States was led by Dr. Barclay Poling in North Carolina. Dr. Poling developed growing techniques that were effective for both reducing crop losses and increasing growers' ability to meet marketplace demand for fruit.

Early plasticulture methods developed around planting "plugs" (small green plants growing in plastic trays) under black plastic mulch. Growers saw notable success and many growers throughout the mid-Atlantic and Southeastern states began experimenting with plasticulture production. Today thousands of growers throughout the country grow small-fruit and other produce using plasticulture methods.

In recent years plasticulture production has evolved dramatically through experimentation, field trials, and working relationships between commercial growers, nurseries and experimental stations. Today, dormant bare-root berry plants have become an alternative for many growers. The great majority of berry growers we work with at Nourse Farms are planting bare root dormant plants, especially in zones 4-6.

For today's grower, the term 'plasticulture' refers to planting and growing techniques that may, or may not, involve the use of any plastic material. The old idea that plasticulture production must mean plastic mulch has changed. For example, for a progressive strawberry grower, 'plasticulture' production begins with raised beds of dual-row strawberries planted to stand with drip tape irrigation. Plastic mulch is an option. There is no single best method for all growers.

The following outline offers some insight into the successful elements of plasticulture production at Nourse Farms, the leading berry plant nursery east of the Rocky Mountains. Nourse Farms planted its first acre of plasticulture berries in 1994, today plasticulture techniques are used on all our fruit production acreage.

Key Benefits of Plasticulture

- SUPERIOR WEED CONTROL
- REDUCED LOSS OF SOIL MOISTURE AND NUTRIENTS
- EFFICIENT AND CONVENIENT HARVESTING
- INCREASED FRUIT SIZE AND YIELD
- MORE MARKETABLE FRUIT
- LONGER POTENTIAL PICKING SEASON

Plasticulture Berry Production

The primary purpose and goal of plasticulture berry growing is to improve fruit production and harvesting efficiency.

The following outline introduces some of the key aspects of plasticulture small-fruit production at Nourse Farms. We planted our first acre of plasticulture berry plants in 1994. Today, all our berry acreage is grown using plasticulture methods – *with and without plastic*. We also manage on-going field trials and other experimentation for improving plant growth and fruit production using plasticulture methods.

Successful plasticulture berry farming means successful management of the key elements – mulch, drip irrigation, and spaced plantings. Every grower's "best practices" will be different. There is no one best way that will work for everyone. Consequently, we prescribe practices and varieties for each grower's goals.

Nourse Farms grows and sells dormant bare-root berry plants. Growers in southern states may find green plug plants are the preferred alternative. Growers in more northern states may have difficulty making plugs work as well as dormant plants.

We encourage farmers who use plasticulture techniques, or who want to learn more, to call us for a free consultation.

The Competitive Advantage of Planting Dormant Plants

Planting Flexibility, Reduced Costs, High Plant Quality

Plant when you are ready

Choose planting dates to achieve ideal plant growth and optimal yields for two growing seasons. Nourse Farms ships plants continuously from April through the end of July.

Adaptability to weather conditions

Plasticulture with dormant-plant system is adaptable to a wide range of growing and weather conditions. If poor planting conditions exist, we can delay shipping until optimal conditions exist.

Reduced Plant Cost

Virus-indexed dormant plants from Nourse Farms generally cost about 50 % less than plug plants. Reduced shipping and handling costs are part of this saving.

Plant Integrity

Nurse plants are less likely to carry disease or insects due to our propagation system. Plants are shipped in a timely manner, arriving ready to plant and grow.

Key Elements of Plasticulture Production

Site Preparation

Prepare the growing site the same as you would for standard strawberry planting. Begin planning the year before planting. This includes soil and nematode sampling, cover crop decisions, and identification of any problem weeds and pests.

Optional fumigation, and nematicide, or insecticide applications through drip irrigation, can be performed prior to planting.

Pre-plant fertilizer - We add N, P, K, Zn, S, and Boron, and adjust pH.

Raised Bed vs. Flat Bed Culture

Either raised beds or traditional flat planting will support successful berry production. For best results, some level of raised beds is recommended.

Plants require a firm soil surface, and must be planted into plastic mulch that is tight to the bed.

Strawberry plants prefer raised beds. Raised beds promote superior drainage, weed control, and harvesting efficiencies.

Plasticulture systems are best supported by raised beds with a minimum height between 2" and 4". Optimal height is 8".

Equipment

Use your existing equipment as for vegetable plasticulture production.

Bed shaping, plastic mulch and drip tape are all laid mechanically.

Prior to planting, the plastic should be marked with the desired plant spacing. Bed width can vary between 4' and 6' with no distinct advantage offered by a specific width. Although 4' plastic is most common, 5' and 6' work well. We strongly recommend planted rows that are at least 12" apart.

The Benefits of Drip Irrigation

- **Timely delivery of water and nutrients.**
- **Reduced plant stress for increased fruit production.**
- **Better overall plant health and longevity.**

Drip irrigation allows a systematic approach to effective water management and timely fertilizer application throughout the growing season. Growers can truly maximize efficiencies and growth.

We regularly see the added benefit of evaporative cooling. Improved plant respiration means plants do not over-heat and shut down. Fruit quality is better and shelf life is extended. Watering timing depends on soil type.

From green fruit development, through harvest, we irrigate daily for 2-6 hours on well-drained soils, maintaining soil water capacity at 90 –100%.

We fertilize throughout the entire growing season, adding nutrients through the drip system at low rates of 1 to 3lbs of nitrogen per week per acre, along with micronutrients.

The Benefits of Black Plastic

Fewer weeds, better weed control, better runner control, better picking environment.

Weed Control

We encourage germinating and killing weeds before planting. We highly recommend laying plastic 30-40 days **before** planting. However, shorter intervals can also be successful. Herbicides are often used between rows, but care must be taken that these chemicals do not run off the plastic and concentrate in holes. Several herbicides are labeled for pre-emergence weed control 30 days prior to planting.

Runner Control

Plants cannot root on plastic. Runners will only root where the grower allows. The use of growth regulators should be considered to inhibit runner production. Research and strawberry physiology indicates runner initiation begins after flowers are produced. Experience dictates that monthly applications are better than one large dosage.

Clean Picking Surface

Fungi cannot survive on plastic.

Water moves away faster, so fruit is damaged less by downpours and excessively wet periods.

We recommend removing dead leaves in the spring. This will significantly reduce the potential for berry rot.

Management of Ripening Times & Season Extension

Plasticulture allows growers the advantages of more control and more flexibility for managing fruiting schedules.

If straw mulch is left on top of beds, covering the plastic mulch around the plants, plants will closely follow the growth and fruiting schedule of plants being grown with traditional methods. This is very important for mid and late season varieties whose berries are too soft to be on hot black plastic.

If straw is removed from the beds covered with plastic mulch in early spring, the black mulch will absorb and retain the sun's warmth. Plants will grow more quickly, and fruit ripening will be around 7 – 10 days earlier than traditionally grown plants of the same variety.

Leaving straw on the plastic mulch a few days longer will delay plant growth and fruiting. Your harvest season can be extended. Caution! Never leave straw mulch on plants as they begin to grow. This will damage the plants and reduce potential yields!

To summarize, we can say that with plasticulture the same variety of fruits can be harvested at three different times.

- **Normal Fruiting Schedule:** Leave straw through early spring to have same production schedule as bare ground. This is recommended for all growers that don't have frost protection.
- **Early Fruiting Schedule:** Remove straw in the early spring to allow early growth and fruiting. Adding row cover can add an additional 5-7 days to earlier fruiting. Damage from frost is also possible!
- **Late Fruiting Schedule:** Leave straw over plastic for an additional 3-5 days to promote slower growth and late fruiting. We only break the seal of the straw to allow plants to grow up through it. Mid to late season varieties tend to be softer and will perform better with some straw left in a strip next to the plants.

Summer Production with Day Neutral Varieties

Summer strawberry production is the fastest growing segment of our current strawberry plant business. The high demand for fresh locally grown berries could easily double over the next ten years.

Using the plasticulture method, summer strawberry production can be a reality in most areas north of the 38° parallel and higher elevations. Growers who sell directly to the consumer will not only add to their menu, they will add profits to their operation.

We have recommended that growers choose a minimum of two varieties to split weather related risks and have more regular harvests. Evie-2 have performed well for growers in warmer areas. Seascape performs best in cooler climates and cooler fall seasons. All varieties have the potential to deliver an early June crop the year after planting. The harvest during the summer in the second year isn't as consistent and berry size is smaller.

Day Neutral Varieties

Albion – Large fruit, very nice flavor, good disease resistance.

Evie-2 – More heat-tolerant day neutral variety.

Portola – Early, light colored fruit, will perform in warmer climates.

San Andreas – Light red berries with great flavor. The plant has heat and disease tolerance.

Seascape – Most popular day neutral variety for color and taste.

Mara des Bois – A specialty variety with intense strawberry flavor.

Recommended June-Bearing Varieties

Any variety that works for you using matted row methods should work as well, or better with plasticulture. Nourse Farms recommends the following varieties of strawberries for growers using plasticulture practices. Trials of several varieties are always recommended to see what works best in your specific conditions.

These varieties perform as well on straw as with plastic. Doing both will maximize the length of harvest on all varieties.

Galletta – Early season alternative to Sweet Charlie or Evangeline.

AC Wendy – Early season variety with a large sustained harvest.

Honeoye – Well established, high-yielding performer.

Yambu -Early midseason alternative to Honeoye.

L'Amour – Newer, up and coming variety.

Chandler – Traditional plasticulture variety. Very high yielding.

Darselect – Very high yield potential for mid and northern states.

Our favorite to split ripening times.

Jewel – Popular standard variety with high quality fruit.

Clancy – Vigorous, newer later-season variety.

We recommend the following varieties be planted on black plastic covered with straw during fruit production to delay harvest:

Mayflower – Late mid-season, firm, high quality berries. Performs well under difficult conditions.

Cabot – Largest berry we sell, great flavor, and lower runnering.

AC Valley Sunset – Late season alternative to Ovation.

Record – Very late fruiting, high yields.

Malwina – Latest in North America

Plasticulture Planting Goals

Plant Density per Acre and Fruit Production Goals

At Nourse Farms: 18,000 plants per acre produce an average of 15,000 – 16,000 pounds of fruit per acre in both the first and second years. Maximum yield potentials will vary by grower.

Development of 3-4 branch crowns by October 1st of the planting year are optimal. Our system will attain two harvest years with maximum yield potential and fruit size.

At Nourse Farms, we plant half our fruiting acreage every year.

Crown-Fruit Development Goals

Planting early leads to programmed **crown fruit harvests** after the normal June season, typically with 2-3,000lbs/acre potential yields, and harvests extended by two weeks. For this system, we recommend larger-crowned and larger-graded varieties. Water management is critical for early plant and crown-fruit development, also for harvesting quality fruit during hot weather. Black plastic or straw mulch may be required in areas where temperatures regularly exceed 95° fahrenheit.

The goal is to have fruit harvest around the time you would normally end your season, to compete in the market place. Crown fruit size during normal June-bearing periods is too small. We recommend planning for the harvest to start as other varieties are normally finished. Plants begin to fruit 55 days after planting.

Plasticulture Growing Methods

Pre-Planting Preparation

Option of using 4', 5', or 6' width plastic. Recommended thickness is greater than 1mil for two season harvests.

Lay plastic and drip lines 30 to 40 days before planting for maximum weed control. This allows weeds to germinate under the plastic and between rows - facilitating easier weed control by applying herbicide or mulch between rows.

Some Plasticulture Planting Method Basics

No one-step mechanical method has proved to be effective.

Some growers have attempted setting plants assisted by a water wheel planter with results varied to poor.

Water wheel planter does not work as well as hand planting.

Water wheel plungers can leave too large a hole, leading to poor root-soil contact and vulnerability to weeds becoming established.

Dormant plants should be hand-planted. Hand planting promotes proper hole size for good root-soil contact and fewer weeds. Plant mortality is kept to a minimum leading to better plant stands.

In the USA alone, over 40,000 acres of strawberries are planted by hand. We understand that planting by hand seems to take more time, however we believe it is time well spent. There will be fewer replants and fewer weeds to control.

***Now Available from Nourse Farms**– Plasticulture Tools that are designed to push dormant, bare-root strawberry plants through plastic; as well as a Plasticulture Starter Kit (includes both DVD's & two Plasticulture Tools) – See our catalog or website for complete details.

Plasticulture Planting Considerations

Row & Bed Configuration

Two rows on a bed, two drip lines per bed. Using only one drip line per bed will lower yield potentials. One drip line will also reduce plant establishment success! With all soil types, 2 drip lines per bed performs the best.

Planting-Bed Width

At Nourse Farms: Actual 72 in. bed with double plant row. All our equipment is set up for this width of bed. We recommend using a bed width that fits your equipment.

Plant Spacing

Most Strawberry Varieties: 10-14 inches.

Chandler & Day Neutrals: 12-16 inches.

More vigorous varieties need more room to grow.

Each row of plants has its' own drip line to maximize water and fertilizer application efficiencies.

4' plastic 12 – 16 inch staggered spacing

5' plastic 10 – 14 inch staggered spacing

6' plastic 10 – 14 inch staggered spacing

Air Drainage

We recommend rows greater than 12" apart for air drainage that supports disease control and maximum yield potentials (fruit size).

Planting Dates

Late April - Late July

At Nourse Farms, we plant the 4th week of June on bare ground.

Ideal planting dates will generally vary between late May and late July, depending on location and desired goals.

Planting too early develops too many branch crowns – desired number is 3 – 4 per plant.

Planting and Irrigation at Nourse Farms

We use a standard planter to set plants and drip lines at the same time on our bare-ground.

Overhead irrigation is used the first week of establishment, depending on soil type, to set plants immediately after planting. Mortality rates are much lower when it is hot and dry.

Drip irrigation is used throughout the growing season to maintain optimal water and nutrient levels. We like to say that the plant never lacks water or nutrients during its lifetime.

Post-Planting Considerations

Irrigation

We drip irrigate 2-3 times per week on our well drained soils, adding fertilizer once. We alternate 9% calcium nitrate with a balanced fertilizer that includes micronutrients. Usually one calcium application for every three balanced fertilizer applications. During berry harvest drip is used every day, during mid-day, if it doesn't rain.

Row Cover

Floating Row Cover is not needed in our system for plant growth in the establishment year. However, it can encourage early fruiting and support overall crop protection when applied in the spring.

Mulching and Winter Protection

Important for crown protection, especially in northern locations.

Nourse Farms uses normal straw and straw over plastic methods.

Straw mulch provides superior protection, especially in zones 3-6.

Combination of Row Cover and Black Plastic provides some protection and allows earlier harvesting. However, row cover may NOT be adequate for northern locations (zone 5 and north).

*Be advised that warm, late winter & spring temperatures will promote flowering too early for some growers. Unusually warm spring temperatures will initiate bud and flower development that could lead to crop losses or extensive frost protection.

We recommend that row covers not be applied before March or April, depending on the zone.

Herbicides

Herbicides should not need to be applied in the rows – helping to further maximize yield potentials. 2-4D is regularly used at renovation and in the fall after dormancy, if needed.

An important consideration is the use of a shielded sprayer to control weeds between rows. The use of contact herbicides will reduce herbicide pressure on plants.

Runner Control and Removal

We work with growth regulators that inhibit runner (daughter-plant) production. In addition to superior fruiting, we have observed increased plant resistance to insects and disease, and better root development. Runners cannot set their roots through plastic mulch.

Removing early runners helps maximize crown production. Runner removal must be done by hand at least once monthly.

On bare ground we remove runners on plants with shallow-depth rototilling prior to manual removal. Chemical burning off of runners with a shielded sprayer is also effective. However, we highly recommend runner removal to reduce disease pressure during the entire season.

Post-Harvest Renovation

Beds should be renovated soon after harvest is complete.

If a weed problem exists, we apply 2-4 D (Formula 40) and then mow 3-4 days later.

We recommend frequent drip irrigation at this time. Do not allow soil to go below 75% water capacity.

We see clear benefits by completely removing water stress throughout the entire growing season and renovation period.

We recommend maintaining soil at 85-95% water capacity throughout the year.

Conclusions

The observed competitive advantages of plasticulture can be summarized as follows:

INCREASED YIELD – Average harvest efficiency can increase by 20% or more. Larger fruit, more fruit per plant, increased picking rate, and controlled timing of fruiting contribute to this increase.

DRAMATICALLY IMPROVED WEED CONTROL – Far fewer man-hours, much less herbicide expense, and much less herbicide damage.

HIGHER QUALITY FRUIT – Larger, sweeter, fruit, with less damage, is more attractive to buyers and PYO customers. Less stress at harvest leads to longer shelf life.

INCREASED SALES AND PROFITABILITY – We are experiencing consistent increases in sales of fruit every year. The demand for this high quality fruit is so great, we plan to increase acreage in coming years.

Links

Southeast Regional Strawberry Plasticulture Production Guide

<http://www.smallfruits.org/SmallFruitsRegGuide/Guides/2005culturalguidepart1bs1.pdf>

Hill System Plastic Mulched Strawberry Production Guide for Colder Areas http://www.smallfruits.org/Strawberries/production/ODell_text.PDF

An Introductory Guide to Strawberry Plasticulture

<http://www.agrireseau.qc.ca/petitsfruits/documents/quebec-poling.pdf>

Mid Atlantic Berry Guide (Pg. 57)

June-Bearers: Plasticulture Production

<http://pubs.cas.psu.edu/freepubs/MAberryGuide.htm>

	Recommended* Planting Dates	Harvest (Following Year)
Zone 4	June 1st – 15th	June – July
Zone 5	June 15th – 30th	May – June – July
Zone 6	July 1st – 15th	May – June
Zone 7	July 15th – 30th	April – May – June

*These are approximate recommendations.

Many growers plant earlier and later.

Contact us if you have any questions on your best planting date.

SETTING FRESH DUG, BARE-ROOT STRAWBERRY PLANTS WITH A HAND TOOL

[E. B. Poling, Extension Specialist (Small Fruits), NC Cooperative Extension Service]

1. Place the curved end of the tool near the base of the roots (Fig. 1)
2. Use the tool to “slide” the roots **straight down** into the hole (Figs. 2 & 3)
3. Don’t be too forceful as the edge of the tool can cut or damage the roots.
4. The roots must not be jammed-in or be “j-rooted” when set in the hole. This will cause the plant to grow poorly or die (Fig. 3).
5. Set the fresh dug deeply enough so that all of the roots are in contact with the soil beneath the plastic mulch, but not planted so deep that you have covered up the plants growing point (Fig. 4).
6. Close-ups of a hand tool for setting fresh dug, bare-root plants (Figs. 5 & 6). The handle is 4 inches and is wrapped in duct tape with foam cushioning beneath.



Fig 1. Curved end at base of roots



Fig 2. Slide the roots straight down



Fig. 3. Setting plant to correct depth



Fig 4. Don't cover the growing point



Fig. 5. The tool is 10.5" in length



Fig 6. Curved end comes in 1/2 inch

Planting Year



(Photo courtesy of Dave Pike)

Planting Year – Runner Removal



(Nourse Farms Photo)

Spring – Fruiting Year



(Nourse Farms Photo)

Fruiting Year



(Nourse Farms Photo)

Renovation Year



(Photo courtesy of Dave Pike)

Renovation Year



(Photo courtesy of Dave Pike)

