March 2024

University of Kentucky | Martin-Gatton College of Agriculture, Food and Environment

Pike County Agriculture and Natural Resources

A message from your ANR agent:

As March comes in there are many items to get excited about, both with animals and with your garden (flowers & vegetables). This is the time of year we all become very optimistic.

One of the first things you need to do is a soil test. It does not make any difference why you are testing, whether it's gardening, lawn care, pasture, or even in a High Tunnel - you need to know what you have to work with. Pike County is quite a bit different than other counties in that parts of our land test traditional mountain soil and parts of the county test almost identical to the Bluegrass. You cannot tell by looking at it. You must run a soil test to know. I tell everyone if it looks different or you know it's been treated differently, bring in 2 samples and make sure to label them so you know which is which.

We now have several High Tunnels in our area, so included is some information on using them. We also included a sheet of references for you to look up and study as you get time.

Livestock need pasture and there are both good and detrimental things about forages in the spring. You need to plan a grazing system that works for you and keeps fresh forage for your livestock.

I have talked to so many people that want to start gardening this year and wanted to give you some options on seed starting and produce storage. This can be for the Farmers Market or for home use. My advice to you is to start smaller than you planned. See what works for your area and what does not. I have found that most beginners plant too much and become overwhelmed with the amount of work and produce. They get so far behind and then they give up. Try several items and then in the next few years, keep growing your garden and expanding as long as you feel comfortable.

I suggest you get a calendar and write down everything you do, what works and what doesn't. It will help you figure things out and is even better for planning next year - you can see exactly what and when you need to do things.

Good luck and time to get started,

Suzanne Stumbo
Pike County ANR Agent
606-432-2534 or sstum1@uky.edu

Inside this issue:

UK COOPERATIVE EXTENSION SERVICE
UNIVERSITY OF KENTUCKY — COLLEGE OF AGRICULTURE

Taking Soil Test Samples

W.O. Thom, G.J. Schwab, L.W. Murdock, and F.J. Sikora

The most important part of making fertilizer recommendations is collecting a good, representative soil sample. Soil test results and fertilizer recommendations are based solely on the few ounces of soil submitted to the laboratory for analysis. These few ounces can represent several million pounds of soil in the field. If this sample does not reflect actual soil conditions, the results can be misleading and lead to costly over- or under-fertilization. It is necessary to make sure that the soil sample sent to the laboratory accurately represents the area sampled.

Sample Timing

Soil samples can be collected through much of the year, although fall (September to December) or spring (February to April) are the best times. Fall sampling will often result in a faster return of results and recommendations. Fall sampling will also allow the grower time to have the fertilizer applied well before planting the next crop. However, fall sampling results in lower pH and soil test K levels when conditions are dry. In either case, a field should always be sampled the same time of the year in order to make historical comparisons.

Most fields should be sampled every three to four years. High-value crops, such as tobacco, commercial horticultural crops, alfalfa, red clover, and corn silage, should be sampled annually so that plant nutrient levels can be monitored more closely. Application of manure can change soil test phosphorus, potassium, and zinc levels dramatically, so sampling manured fields each year is also recommended.

Tools You Need

A soil probe, auger, garden trowel, or a spade and knife are all the tools you need to take the individual cores that will make up the "field" sample (Figure 1). You will also need a clean, dry, plastic bucket to collect and mix the sample cores. Be sure not to use galvanized or rubber buckets because they will contaminate the sample with zinc. Soil sample boxes or bags and information forms for submitting samples are available at all county Extension offices.

Collecting Field Crop Samples

An individual sample should represent no more than 20 acres except when soils, past management, and cropping history are quite uniform. The most representative sample can be obtained from a large field by sampling smaller areas on the basis of soil type, cropping history, erosion, or past management practices (Figure 2). For example, a portion of a field may have a history of manure application or tobacco production while the other part does not. Phosphorus and potassium levels will likely be higher in these areas, causing the rest of the field to be under-fertilized if the field is sampled as one

Figure 1. A soil probe, auger, or spade and knife should be used in sampling soils. The spade sample must be trimmed as shown.

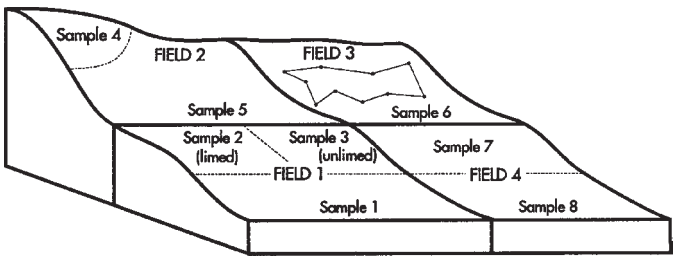

Figure 2. This shows how four fields might require the analysis of one to three composite samples for determining fertility needs. Each composite must contain 10 or more cores, as shown for Sample 6 in Field 3.

unit. It is much better to collect separate samples from these areas because their nutrient requirements are likely quite different from the rest of the field.

If a few years of yield maps are available, these can help identify areas of the field that should be sampled separately.

Soil sampling can also be used to "troubleshoot" areas of the field that are visually different or are consistently low yielding when compared to the rest of the field. Take a sample both from the poor growing area and adjacent areas of good growth. Keep good records indicating where each sample was taken.

Collect at least 10 soil cores for small areas and up to 30 cores for larger fields. Take the soil cores randomly throughout the sampling area and place them in the bucket. **Do not sample:**

- back furrows or dead furrows,
- old fencerows,
- areas used for manure or hay storage and livestock feeding, and
- areas where lime has been piled in the past.

Grid Soil Sampling

With new advances in agriculture and the availability of global positioning satellites, it is now possible to divide a field into smaller units or grid cells that can be sampled individually. Soil test results from each grid can be used to prepare nutrient availability maps of fields. Variable-rate fertilizer and lime applications are then based on these maps. Grid soil sampling and prescription fertilizer maps may result in more accurate recommendations and may lead to greater efficiency in fertilizer use.

Currently the industry standard grid size is 2.5 acres, but Kentucky research shows that variability within areas as small as one acre can be as great as the variability within the entire field. Because soil variability is so high, it is important to treat each grid cell as a field. At least 10 random samples should be collected across the entire grid cell, rather than a few cores from the center of the grid (Figure 3). Grid sampling can be a good way to identify old field boundaries or parts of fields that have had different management in the past if they are unknown to the current producer. This intensive sampling is costly, and limited Kentucky research has not shown a predictable economic benefit when it is compared to the current recommended method of sampling according to soil type, past history, or past management zones.

Sampling after Banded Fertilizer Applications

Care must be taken when sampling no-till fields that have had fertilizer applied in bands rather than broadcast. Phosphorus, potassium, and zinc are immobile in the soil and remain in the concentrated band for several years after application. If these bands are completely avoided during sampling, soil test results will be lower than "actual," leading to over-fertilization. If bands are included too often, soil test results will be higher than "actual," causing an underestimation of fertilizer needs for the crop.

When the location of the bands is known, it is best to sample in the band one time for every 20 cores taken. If the location of the band is unknown, it is best to take pairs of random samples. The first core is completely random, and the second core is taken one-half the band spacing distance in a direction perpendicular to the band direction. For example, if banded fertilizer was applied on 30-inch spacing, the first core would be randomly selected, and the second sample would be taken 15 inches away (perpendicular to the direction of the band). This process would be repeated at least 10 times in a small field and up to 30 times in a larger field. The more cores that are collected, the more closely the sample will represent "actual" field conditions.

Collecting Lawn or Garden Samples

Sample gardens, lawns, and landscaped areas separately. Collect cores randomly from each area. The area to sample for trees includes the soil below the width of the tree. For shrubs, flower beds, and gardens, sample just the soil where the plants are growing. You should sample problem areas and areas with shrubs, trees, or flower beds separately from other turf or lawn areas. **Do not sample:**

- compost areas,
- under the drip-line of trees, and
- close to driveways or streets.

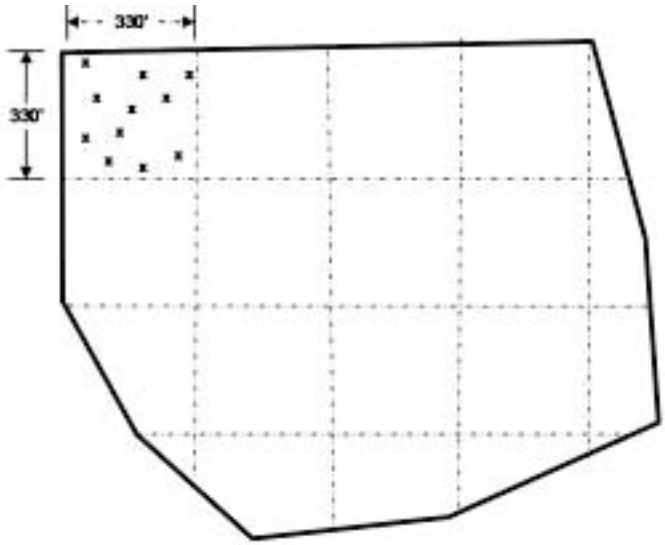

Figure 3. A field can be divided into 2.5-acre grid cells, as shown in the diagram above. Each cell should be treated as an individual field, and approximately 10 random cores should be taken from each cell.

Sample Depth

One commonly overlooked component of soil sampling is the depth of soil to be tested. Most plant nutrients accumulate at the soil surface. This nutrient stratification is a result of past broadcast fertilizer applications and decomposition of plant residue on the soil surface. Because there is a higher concentration of nutrients on the soil surface, soil test values usually go down as the sample depth is increased. To obtain accurate and consistent (between different years) results, samples must be taken to the following depths for these areas:

Tilled Areas—Take soil cores to the depth of the tillage operation (usually 6 to 8 inches).

Non- or Reduced-Tilled Areas—Take soil cores to a depth of 3 to 4 inches for pastures, no-till planting (where fertilizer or lime remains on the soil surface), and minimum-till planting (where fertilizer is incorporated only in the surface 1 to 2 inches).

Lawns and Turfgrasses—Collect soil cores to a depth of 3 to 4 inches.

Sample Preparation

After all cores for an individual sample are collected and placed in the bucket, crush the soil material and mix the sample thoroughly (Figure 4). Allow the sample to air dry in an open space free from contamination. **Do not dry the sample in an oven or at an abnormally high temperature.** When dry, fill the sample container with the soil (Figure 5).

Figure 4. Break up clods while a sample is moist, and spread out to air dry in a clean area.

Sampling and preparing the soil for submission is only half of the process. The other equally important part is filling out a sample information sheet so that the desired crop, tillage, and other information can be considered when making the fertilizer recommendation (Figure 5). The sample information sheet contains all the important information required to provide accurate lime and fertilizer recommendations. Sample information sheets for the University of Kentucky Soil Testing Laboratory can be found on the Web at <http://soils.rs.uky.edu/sample1.htm>. The types of forms available are the:

Figure 5. Thoroughly mix the air-dried sample, fill the sample bag or box, mark with your sample designation, fill out the information sheet, and take the sample to your county Extension office.

Each form asks for primary and alternative crops, as well as other background information. The amount of background information needed depends on the crop to be grown. Table 1 is provided as a guide to the background information needed for major agricultural crops (a) and home lawn and garden plants (b). Help on filling out the forms can be provided by your county Extension office.

It is very important to complete the pertinent sections of the sample information form. This will assure that you receive the most accurate fertilizer recommendations possible. Soil samples should be taken to your county Extension office; from there they will be sent to the UK Soil Testing Laboratory. Results and recommendations will be e-mailed to the county office usually within one to two weeks of submission.

Table 1. List of required crop information for accurate lime and fertilizer recommendations.

A. Agricultural Soil Sample Form

	Primary Crop			
Required Information	**Corn**	**Soybeans**	**Tobacco**	**Forages**
Previous crop	yes[1]	no[2]	yes	no
Primary management	yes	no	no	yes
Previous management	yes	no	no	no
Primary use	yes	no	no	yes
Previous use	no	no	no	no
What was there 2 years ago?	no	no	yes	no
Soil drainage	yes	no	yes	no

B. Home Lawn and Garden Soil Sample Form

	Primary Crop		
Required Information	**Vegetables & Fruits**	**Turfgrass**	**Landscape Plants**
Turfgrass location	no[2]	yes[1]	no
General information	no	yes	no

[1] Yes = Information is needed for accurate recommendations.

[2] No = Information is not needed for accurate recommendations.

Revised 12-2003

HO-56
STARTING PLANTS FROM SEED AT HOME
ISSUED: 6-81
REVISED:
J. W. Buxton, R. G. Anderson, M. L. Witt, and S. Bale

Germinating and growing vegetable and flower seeds until they are ready to be planted in the garden will save you money and give great satisfaction. Home germination of flower and vegetable seed may be necessary if you plan to plant a fall garden or in order to produce your favorite varieties of vegetables during the year.
A variety of systems can be used for starting transplants. These systems should provide an ideal environment for both seed germination and plant growth. They should also be dependable when seeding a variety of plants and give consistent results.

Steps in Seed Germination
1. Seed Selection and Storage.
It is best to start with new seed, so order only one year's supply. While some seed may be stored for several years with slight deterioration in quality, other seed may be viable for only one year.

2. Selection of Germination Medium.
The germination medium should be well drained and well aerated, relatively low in fertilizer or other toxic chemicals, and sterile (free of insects and diseases). The medium can be prepared from a combination of peat, vermiculite, or similar ingredients. However, since relatively little medium is needed for seed germination, it may be best to consider purchasing a commercially packaged growing medium from a garden supply store or greenhouse operator.
Commercially packaged growing media (e.g., Pro-Mix, Sunshine Mix, Metro Mix, Choice Mix, Ball Growing Mix, Jiffy Mix, Redi Earth, etc.) consist of a mixture of two or more of the following materials: sphagnum moss peat, bark, perlite, vermiculite, coarse sand, processed bark, or expanded shale.
These media have several advantages. They are convenient and suitable for most plants directly from the bag. They are also free from weeds, insects and diseases, and limestone and fertilizers have been added to support plants for 2-6 weeks. Most are suitable for germinating seeds as well as growing transplants.
The main disadvantage of these media is their unavailability in small packages at garden centers and discount stores. They are generally available at greenhouses and greenhouse suppliers with retail outlets. Some commercial media may be too fine-textured and will not be suitable for certain methods of germination.

3. Selection of Containers.
The container used for seed germination may vary but it should have certain characteristics. It should be 2-3 inches deep and sterile and it should have holes in the bottom for drainage as well as for water uptake. A single container may be used for many cultivars of plants. However, it would be best to germinate only one cultivar of a certain plant in a small container so that the environment for each may be more accurately controlled.

4. Sowing Seed.
The germination medium should be damp before it is placed in the container. Fill the container to within about 1/2 inch of the rim. Seed should be scattered uniformly across the surface or sown in rows at the rate of 10-20 seeds per square inch. You may choose to give each seed more space, depending on seed size and length of time small transplants will be left in the container. Seeds sown too thickly will result in excessive competition among plants and spindly growth.
Small seeds, such as petunia and snapdragon, should be left uncovered. Cover larger seeds with a thin layer of germination medium. Finely pulverized sphagnum moss has fungicidal properties and would be ideal for covering seed if it is available. Most seeds will germinate in either darkness or light. The light system described later will be satisfactory for those seeds that require light for germination. Laying a newspaper on top of the container will provide darkness required by other seed. Special needs regarding light and dark treatments should be stated on the seed packet.

5. Temperature Requirements for Germination.
The ideal temperature for germination will vary depending on the plant cultivar. However, most seeds will germinate very well when grown within a 70-80 F range. Again, specific temperature needs of seeds will be indicated on the seed packet (or see Table 1). If the temperature is maintained below or above the recommended range, the germination rate will be slower and fewer seeds will germinate. Most homes are kept at temperatures somewhat below the recommended range but there may be some areas in the home that are suitable. A small heating cable, preset at 70-75 F, may be purchased at garden supply stores. The cable should be placed in the bottom of a flat on top of 1/2-inch of sand and then covered with an additional 1/2-inch of sand. The temperature of seed flats set on the sand will be maintained within a suitable range. Seedlings grown during the hot summer for your fall garden should be located wherever optimum temperature and light are available. This may be outside in a shady or partly-sunny location.

Table 1.- Germination Temperature.
Temperature for transplant growth and time necessary to grow various annual flower and vegetable seeds in the home.
A. Plants whose seed germinate in 6 to 10 days at recommended temperatures. Seedlings generally can be transplanted outdoors in 5 to 8 weeks.

Plants	**Temperature for Seed Germination (degrees)**	**Temperatures for Transplant Growth (degrees)**	
		DAY	**NIGHT**
Ageratum	70-80	75	65
Alyssum	70	60	50
Aster	70	75	65
Basil	70	75	65
Broccoli	70	60	50
Cabbage	70	60	50
Calendula	70	60	50
Cauliflower	70	60	50
Celosia	70	75	65
Coleus	65-75	75	65
Cucumbers	80	75	65
Dahlia	70	75	65
Dianthus	70	60	50
Eggplant	80	75	65
Gazania	60	60	50
Lettuce	70	60	50
Marigold	70-75	75	65
Melons	80	75	65
Peppers (Ornamental and Edible)	80	75	65
Petunia	70-80	60	50
Portulaca	70	75	65
Squash	80	75	65
Tomato	70-80	75	65
Zinnia	70	75	65

B. Plants whose seed germinates in 10 to 20 days at recommended temperatures. Seedlings generally can be transplanted outdoors in 8 to 14 weeks.

Plants	Temperature for Seed Germination (degrees)	Temperatures for Transplant Growth (degrees)	
		DAY	NIGHT
Begonia	70	75	65
Carnation	70	60	50
Chives	70	60	50
Geranium	70	75	65
Impatiens	70	75	65
Nicotiana	70	75	65
Onion	70	60	50
Pansy	65-75	60	50
Rudbeckia	70	75	65
Salvia	70	75	65
Snapdragon	65-75	60	50
Verbena	65	75	65
Vinca	70-75	75	65

6. Moisture and Humidity Requirements for Seed Germination.
Maintenance of a constant moisture level and nearly 100 percent relative humidity is important to successful seed germination. Several methods may be used.
1. Hand Watering. Low relative humidity levels in the home during winter will dry the germination medium out quickly. Adequate moisture can be maintained by hand watering. However, great fluctuations in water content of the medium may occur between irrigation as it is easy to forget to water. Hand watering with cold water also reduces germination temperature.
2. Plastic Covering. Plastic is an excellent way to maintain high humidity and moisture levels. After seed is sown, a piece of clear plastic, placed over the top of the container, will maintain a high humidity level. The container may also be placed inside a plastic bag and sealed to prevent moisture loss. To avoid any problems, the container should not be placed in direct sun because plastic will trap heat and damage the seeds. Secondly, the plastic needs to be removed immediately after emergence of seedlings to prevent leggy growth.
3. Recirculating-Bottom-Irrigation. A recirculating-bottom-irrigation system may be used to germinate seeds. The system has the advantage of maintaining a constant moisture content automatically and immediately exposing seedlings to light upon emergence from the medium, which reduces leggy growth. The system is also used to automatically water seedlings that are still in the germination container, until they are ready to transplant. Constant moisture conditions and a more uniform temperature are ideal: seeds germinate very quickly.
a. Description of Recirculating-Bottom-Irrigation System. The recirculating-bottom-irrigation system may be made any size and out of many types of materials. A simple system could consist of a small polystyrene container (cooler) with a small sump pump in the bottom.
The flat surface, where seed flats are set, may be made of 1/2-inch polystyrene, a thin piece of marine plywood, a piece of glass or other water resistant material. A pad, made of 1/4-inch foam or fabric, such as felt, is placed on the flat surface. The pad promotes uptake of water into the germination medium. The flat surface may be placed on the ledge of the polystyrene container, set on jars, or suspended from wires. A plastic tube, which carries water from the pump, is placed under the pad and on top of the flat surface. The flat surface is tilted slightly so water will flow across the surface and back into the water reservoir in the bottom of the container. The water level in the container may vary and could be maintained within an inch of the flat surface. A plastic lining of polyethylene may be necessary to prevent leaks. Rigid or semirigid plastic containers would not require lining. Small sump pumps (1/5 hp) are available from discount stores, garden centers which sell supplies for

fountains, or from major retail catalogs. Plastic tubing may be purchased from hobby supply stores or pet stores that sell fish.
b. Operation of Recirculating-Bottom- Irrigation System. It is important that the germination medium, used in connection with this system, be well aerated. If not, air spaces of the medium will be filled with water resulting in poor root growth. Holes in the bottom of the container must be in contact with the pad to assure water uptake into the medium. The pump should be attached to a time clock which turns it on one hour every 4-6 hours. The exact interval between irrigation would depend upon the time required to wet the medium and the rate of water loss from containers. The medium should be damp at all times during the germination period. Water will become too warm for optimum seed germination if the pump runs continuously. The water level in the reservoir should be checked regularly to make sure water is available. Also, because of possible changes in chemical characteristics of water, the water should be changed completely every one to two weeks.
Algae growing on the pad does not hinder germination and growth of seedlings but it may be unsightly and messy. A piece of black plastic could be placed over the pad and holes cut in the plastic to fit the bottom of the germination container. Without light algae will not grow on the pad.

7. Maintenance of Sterile Conditions During Seed Germination.
Disease organisms (fungi and/or bacteria) may kill seedlings during germination. Thus the medium, container, tools and even the seed itself should be sterile. Commercial media are usually sterile when purchased. However, if the medium comes in contact with objects which are not sterile, it may become contaminated. Containers and tools can be sterilized by soaking them in a 10% household bleach solution (1 1/2 tablespoon/cup of water) for 5 minutes.
The following suggestions should help prevent disease problems:
1. Use seed treated with fungicide. Seed packets are usually clearly marked when seeds have been treated with fungicides. Seeds are generally brightly colored (pink, purple, green).
2. Do not plant seeds deeper than necessary.
3. Keep temperature constant.
4. Provide seedlings with adequate ventilation.
5. Avoid overwatering.

Growing Plants After Germination
1. Light.
After germination, plants need a maximum of light for optimum growth. Light may be natural or from fluorescent lamps. If sunlight is used, seed flats should be placed as close to the windows as possible without being too cool. If fluorescent lamps are used, an area 2 X 4 feet would require about four 40-watt fluorescent bulbs. Special plant growing lamps may be used, but cool-white or warm-white fluorescent lamps will be satisfactory. Lamps should be placed 6-12 inches above plants and turned on at least 18 hours each day. For most plants, 24 hours of light would be best; however, some plants (tomato, geranium) may develop a light green appearance. A small time clock can be used to turn lights on and off.

2. Transplanting Seedlings.
Seedlings should be transplanted to larger containers within a few weeks after germination. Seedlings left in the germination container until they begin to crowd each other, will result in poor quality transplants. The growing medium used for transplants should have the same characteristics as the germination medium. A variety of containers may be used for transplants. Containers should be large enough to allow small plants to grow indoors until ready to be transplanted to the garden. Square pots or cells 1 x 1 inch, 1.5 x 1.5 inch, or 2 to 3-inch round containers are satisfactory. Containers should have holes in the bottom for drainage or for uptake of water. Transplants should also receive a maximum amount of available light for best growth. The same light system described above may be used for transplants. "Stretching" of transplants through weak, spindly growth indicates they are not receiving enough light.

3. Fertilization.
One application of a complete fertilizer should be given to seedlings while they are still in germination containers. After transplanting, plants should be fertilized once a week with a complete fertilizer. Water-soluble

house plant fertilizers, available at garden supply stores, are convenient to use. Rates will be given on the container.

4. Temperature.
The ideal temperature for growth of transplants should be 60-75 F during the time plants receive light and about 5O-65 F during darkness (see Table 1). Excessive night temperatures (too cool or too warm) will result in poor quality growth.

5. Water.
The growing medium should be kept damp. If using a well-drained, well-aerated medium water may be applied frequently without danger of drowning roots. If you use a heavier growing medium that includes soil, be careful not to over-water. Enough water should be applied to thoroughly wet the medium and allow some water to drain from the bottom of the container.
The Recirculating-Bottom-Irrigation germination system described above can also be used to water seedlings after they have been transplanted to the final growing container. Again, it is important that the medium drains well so there is sufficient air for roots when the medium is saturated with water. The pump should operate 3-4 times daily for 1 hour each time. A water-soluble fertilizer, as mentioned above, maybe added to the water supply. The rate should be about 1/2 that recommended on the container.

Timely Seedling Production
Plan the seed sowing date carefully so your transplants are ready to go into your garden on time (Table 1). The length of time from sowing seed until plants are ready to be transplanted depends upon the cultivar and the environment available for growing. Records should be kept each year for efficient production and correcting past errors. Plants that are immature should not be transplanted to the garden. Plants that have grown too long in small containers may be stunted and will not grow well in the garden. Broccoli, cabbage, cauliflower and onion seeds should be started between Jan. 25 and Feb. 10 and transplanted to the garden March 10-25. Generally seeds of other plants indicated in Table 1 should be sown between March 1 and April 15 so they will be ready for the garden after the frost free date (April 20-May 10).

Plant order forms are available at the Pike County Extension Office. Stop by Monday - Friday 8:00 a.m. to 4:30 p.m. to place an order. Pre-payment is required by March 15th.

Receipt No. _____

Martin-Gatton College of Agriculture, Food and Environment

2024 Plant Order Form

Cooperative Extension Service

Purchaser Information:

Name: _____

Address: _____

City, State, Postal Code: _____

Telephone: _____

Email: _____

Pike County
148 Trivette Drive
Pikeville, Kentucky 41501
(606) 432-2534

Quantity	Item	Unit Price	Total
_____ bundles	Strawberries (Allstar) (June bearing—larger berry)	$6.50 (bundle of 25)	
_____ bundles	Strawberries (Earliglow) (June bearing—smaller, sweeter berry)	$6.50 (bundle of 25)	
	Blackberries (Natchez)	$4 each	
	Blueberries (Duke) (two varieties needed for pollination)	$9 each	
	Blueberries (Chandler) (two varieties needed for pollination)	$9 each	
	Raspberries (Prelude) - bare root	$4 each	
	Jewel Black Raspberries	$4 each	
	Asparagus (Millennium)	$1 each	
_____ bundles	Onion plants (Candy)	$5 (bundle of 60)	
		Total Due	

Pre-payment is required by **Friday, March 15,** for all plant orders.
Make checks payable to: Pike County Extension

Payment Information:

Amount Paid: _____

Date: _____

Received by: _____

Check No.: _____ or Cash _____

Plants are expected to ship from the nursery during the first full week of April. We will send you a postcard to let you know when the plants will be available for pickup.

Kentucky Proud.

Produce Storage Tips

When you buy Kentucky Proud, you're not only getting fresh, healthy, flavorful fruits and vegetables grown locally, you're also helping your community and farm families throughout the Commonwealth by keeping your dollars close to home.

Properly storing your food reduces waste from spoilage, decreases the risk of foodborne illness, and ensures your farm-fresh food tastes great!

Place in a Cool, Dark Spot:

Basil, Berries, Cantaloupe, Corn, Eggplants, Garlic, Onions, Peaches, Pears, Potatoes, Plums, Squash, Sweet Potatoes, Tomatoes, Watermelon

Best Practice:
Use berries on the countertop within 1–2 days.
If longer, store in the fridge.

Refrigerate in Crisper Drawer or Container:

Apples, Asparagus, Beans, Beets, Bok Choy, Brussels Sprouts, Cabbage, Carrots, Cauliflower, Celery, Cilantro, Cucumbers, Greens, Kohlrabi, Mushrooms, Okra, Parsley, Peas, Peppers, Radishes, Turnips

Trim the leafy tops off and then refrigerate:
Don't throw away your leafy tops;
use them in pesto, soups, and even salads.

Chef Tips:

01 Only wash your produce when you're ready to eat it! Washing early will cause the produce to spoil faster, especially berries and stone fruit.

02 Be sure to remove any rubber bands from your herbs and leafy greens. These break down the cells and can cause your produce to go bad faster!

03 Blanche and freeze vegetables you can't eat right away to preserve nutrients and enjoy the taste of summer all year long. To blanche, boil the whole or cut pieces of the vegetable for 12 minutes and then immediately place in ice cold water to stop the cooking process. This will keep your vegetables from getting freezer burn. Frozen vegetables will keep for up to a year. Freezing is not recommended for artichokes, Belgian endive, eggplant, lettuce greens, potatoes (other than mashed), radishes, sprouts, or sweet potatoes.

Kentucky Proud.

Seasonal Produce Guide

In Kentucky, there's something wonderful about every season – and that's especially true for our huge variety of locally grown fruits and vegetables. Take a look below to find fresh choices for spring, summer, fall, and winter.

Mar–May
SPRING

- Asparagus *(Apr–Jun)*
- Greens *(Apr–Nov)*
- Kohlrabi *(May–Jun)*
- Lettuce *(May–Jun)*
- Maple Syrup *(Feb–Mar)*
- Green Onions *(May–Jun)*
- White Onions *(Jan–Mar)*
- Peas *(May–Jun)*
- Potatoes *(Jul–Oct)*
- Radishes *(Apr–Jun)*
- Strawberries *(May–Jun)*
- Sweet Potatoes *(Oct–Mar)*
- Turnips *(May–Jun)*
- Winter Squash *(Jan–Mar)*

Jun–Aug
SUMMER

- Apples *(Jul–Dec)*
- Beans *(Jun–Sep)*
- Beets *(Jun–Nov)*
- Blackberries *(Jun–Oct)*
- Blueberries *(Jun–Jul)*
- Broccoli *(Jun–Jul)*
- Brussels Sprouts *(Jul–Nov)*
- Cabbage *(Jun–Jul)*
- Cantaloupe *(Jul–Sep)*
- Carrots *(Jun–Aug)*
- Cauliflower *(Jun–Jul)*
- Sweet Corn *(Jul–Sep)*
- Cucumbers *(Jun–Sep)*
- Eggplant *(Jun–Sep)*
- Garlic *(Jun–Aug)*
- Grapes *(Aug–Sep)*
- Greens *(Apr–Nov)*
- Kohlrabi *(May–Jun)*
- Okra *(Jun–Sep)*
- White Onions *(Jan–Mar)*
- Peaches *(Jun–Aug)*
- Peppers *(Jul–Sep)*
- Plums *(Jul–Sep)*
- Potatoes *(Jul–Oct)*
- Raspberries *(Jun–Sep)*
- Rhubarb *(Jun–Sep)*
- Summer Squash *(Jun–Oct)*
- Tomatoes *(Jul–Oct)*
- Watermelons *(Jul–Oct)*
- Zucchini *(Jun–Oct)*

Sep–Nov
FALL

- Apples *(Jul–Dec)*
- Beans *(Jun–Sep)*
- Beets *(Jun–Nov)*
- Blackberries *(Jun–Oct)*
- Blueberries *(Oct–Nov)*
- Bok Choy *(Aug–Nov)*
- Brussels Sprouts *(Jul–Nov)*
- Cabbage *(Oct–Nov)*
- Carrots *(Oct–Nov)*
- Cauliflower *Oct–Nov)*
- Greens *(Apr–Nov)*
- Kohlrabi *(Sep–Oct)*
- Lettuce *Sep–Oct)*
- Nut Crops *(Sep–Nov)*
- Okra *(Jun–Sep)*
- Green Onions *(Oct–Nov)*
- White Onions *(Jul–Sep)*
- Pawpaws *(Aug–Oct)*
- Pears *(Aug–Nov)*
- Peppers *(Jul–Sep)*
- Plums *(Jul–Sep)*
- Potatoes *(Jan–Mar)*
- Pumpkins *(Sep–Nov)*
- Radishes *(Sep–Nov)*
- Raspberries *(Jun–Sep)*
- Rhubarb *(Jun–Sep)*
- Sorghum *(Sep–Nov)*
- Summer Squash *(Jun–Oct)*
- Sweet Potatoes *(Oct–Mar)*
- Tomatoes *(Jul–Oct)*
- Watermelons *(Jul–Oct)*
- Winter Squash *(Aug–Nov)*
- Zucchini *(Jun–Oct)*

Dec–Feb
WINTER

- Apples *(Jul–Dec)*
- Maple Syrup *(Feb–Mar)*
- White Onions *(Jan–Mar)*
- Potatoes *(Jan–Mar)*
- Sweet Potatoes *(Oct–Mar)*
- Winter Squash *(Jan–Mar)*

Greens refer to any number of different plants, including the traditional spinach, mustard, collard, turnip, etc., as well as newer Asian varieties and Swiss chard.

Through the use of season extension methods, many of the availability dates are commonly extended in either direction for many of these crops.

Seasonal Produce Guide

Kentucky Proud.

	SPRING			SUMMER			FALL			WINTER		
	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Apples *(Jul–Dec)*												
Asparagus *(Apr–Jun)*												
Beans *(Jun–Sep)*												
Beets *(Jun–Nov)*												
Blackberries *(Jun–Oct)*												
Blueberries *(Jun–Jul) (Oct–Nov)*												
Bok Choy *(Aug–Nov)*												
Broccoli *(Jun–Jul)*												
Brussels Sprouts *(Jul–Nov)*												
Cabbage *(Jun–Jul) (Oct–Nov)*												
Cantaloupe *(Jul–Sep)*												
Carrots *(Jun–Aug) (Oct–Nov)*												
Cauliflower *(Jun–Jul) (Oct–Nov)*												
Sweet Corn *(Jul–Sep)*												
Cucumbers *(Jun–Sep)*												
Eggplant *(Jun–Sep)*												
Garlic *(Jun–Aug)*												
Grapes *(Aug–Sep)*												
Greens *(Apr–Nov)*												
Kohlrabi *(May–Jun) (Sep–Oct)*												
Lettuce *(May–Jun) (Sep–Oct)*												
Maple Syrup *(Feb–Mar)*												
Nut Crops *(Sep–Nov)*												
Okra *(Jun–Sep)*												
Green Onions *(May–Jun) (Oct–Nov)*												
White Onions *(Jul–Sep) (Jan–Mar)*												
Pawpaws *(Aug–Oct)*												
Peaches *(Jun–Aug)*												
Pears *(Aug–Nov)*												
Peas *(May–Jun)*												
Peppers *(Jul–Sep)*												
Plums *(Jul–Sep)*												
Potatoes *(Jul–Oct) (Jan–Mar)*												
Pumpkins *(Sep–Nov)*												
Radishes *(Apr–Jun) (Sep–Nov)*												
Raspberries *(Jun–Sep)*												
Rhubarb *(Jun–Sep)*												
Sorghum *(Sep–Nov)*												
Strawberries *(May–Jun)*												
Summer Squash *(Jun–Oct)*												
Sweet Potatoes *(Oct–Mar)*												
Tomatoes *(Jul–Oct)*												
Turnips *(May–Jun)*												
Watermelons *(Jul–Oct)*												
Winter Squash *(Aug–Nov) (Jan–Mar)*												
Zucchini *(Jun–Oct)*												

University of Kentucky
College of Agriculture,
Food and Environment
Cooperative Extension Service

Center for Crop Diversification Fact Sheet
CCD-FS-9

High Tunnel Planting Calendar

By Joshua Knight[1] and Rachel Rudolph[2]

Introduction

This publication was developed to be provided with the High Tunnel Planting Calendar and not meant to be a comprehensive guide to high tunnel production. The reader should consult the Center for Crop Diversification (CCD) Publication titled High Tunnel Overview (CCD-SP-2) for a concise guide on the use and principles of high tunnel production and season extension.

Principles of High Tunnel Production/ Season Extension

Put simply, high tunnel production is a practice used to provide moderate climate control. One benefit of the climate control is the extension of the regular growing season, both in the spring and fall. Highly variable weather patterns during the spring and fall can create instability from a production and marketing standpoint. By providing protection from the elements, high tunnels provide a certain level of stability for their crop and their market. Because high tunnels provide protection from cooler weather, growers are able to start planting earlier in the spring while also harvesting later into the fall (compared to typical field production) which can also create additional income.

While some protection from cold weather patterns is expected of high tunnels as growers move into the fall and winter, there will be days of cool weather and minimal sunshine where the plants are not killed, but they are not actively growing. They are surviving, but not thriving. In planning for the extended end of a season in high tunnel production, certain crops that are ready to harvest can be kept in this stage as a form of "in-ground" storage and harvested as needed. This allows a grower to reduce dependency on cold storage infrastructure while keeping produce in a fresh state.

Using this Infographic

The numbers under each month (**1, 2, 3,** and **4**) represent weeks for each month.

The **Direct Seed** (Green), **Transplant** (Light Blue), and **Harvest bars** (Dark Blue) represent typical intervals in average years for activity of the crop or crop group in the corresponding row (Figure 1). The diagonal blue and green section means that one can **Direct Seed and Transplant** during this time.

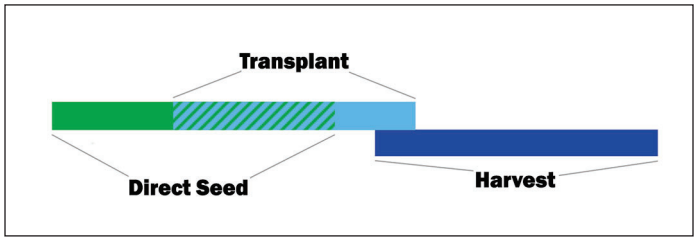

Figure 1.

These are based on conservative estimates of weather and climate patterns developed over the last few decades and should be regarded as flexible depending on air and soil temperatures each year. In using this calendar, let the current weather patterns and the predicted short term weather dictate farm activity. The High Tunnel Planting Calendar should be thought of as a fast reference to help growers plan ahead, time their different crop plantings, and/or try new crops in a high tunnel.

When approaching the time of the year indicated by the activity bars, it is important to consult the temperature col-

CENTER FOR CROP DIVERSIFICATION
www.uky.edu/CCD

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umn for the specific crop or crop group. Both columns refer to the air temperature inside the high tunnel and it should be noted: thermometers are a critical instrument in high tunnel management. **MIN** (short for **Minimum Temperature**) is the point at which tissue damage and plant death can occur. **OPTIMAL** refers to the **Optimal Temperature Range**, or the range where tissue growth occurs and plant health thrives. Hours and entire days spent inside this range are necessary for the plant to continue developing, maturing, and reaching harvest.

The crops listed along the left column have a background color that corresponds to their **plant** or **botanical family**. In general, growers can reduce the risk of disease pressure by not planting crops from the same family in the same soil in consecutive years.

Some crops listed in the left column have a number notation (**1-7**), which refers to the **Alternative Crops** section in the bottom left corner. For example, **parsley** has a similar temperature and timing interval to **cilantro** and **dill**.

If you are a grower and you are not in the **Region** noted on your planting calendar, you can estimate the timing interval for another region by adding or subtracting days (Figure 2).

Generally speaking, growers in **Region** 1 can plant/harvest approximately 10-14 days earlier than **Region 2** and 21 days earlier than **Region 3** in spring. Conversely, growers in Region 1 will plant/harvest approximately 10-14 days later than Region 2 and 21 days later than Region 3 in the fall. This is only intended to help make estimates if you are unable to reference the High Tunnel Planting Calendar for your region.

A final detail worth mentioning is that **strawberries** are botanically a perennial, but many commercial growers treat them as annual crops and refresh the production bed and replant after a season's harvest. The type of strawberries planted in a high tunnel are June-bearing. They perform best on black plastic. The planting calendar schedule reflects that practice.

Additional Resources

Greenhouses, High Tunnels, & Low Tunnels
www.uky.edu/ccd/production/system-resources/gh-ht
IPM Scouting Guide for Common Problems of High Tunnel and Greenhouse crops in Kentucky (ID-235)
http://www2.ca.uky.edu/agcomm/pubs/ID/ID235/ID235.pdf
High Tunnel Blackberries and Raspberries (CCD-CP-8)http://www.uky.edu/ccd/sites/www.uky.edu.ccd/files/HTbrambles.pdf
High Tunnel Strawberries (CCD-CP-61)
http://www.uky.edu/ccd/sites/www.uky.edu.ccd/files/hightunnelstrawberries.pdf
High Tunnel Tomatoes (CCD-CP-62)
http://www.uky.edu/ccd/sites/www.uky.edu.ccd/files/hightunneltomatoes.pdf
High Tunnel Leafy Greens and Herbs (CCD-CP-60)
http://www.uky.edu/ccd/sites/www.uky.edu.ccd/files/hightunnelgreens.pdf

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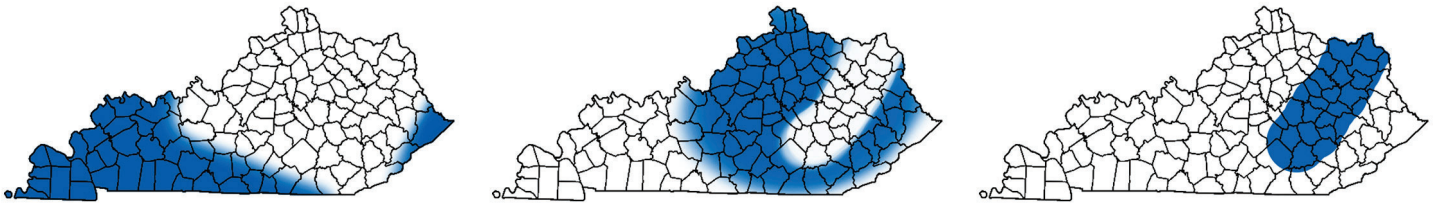


Figure 2. From left: Region 1, Region 2, and Region 3.

Reviewed by Christy Cassady and Brett Wolff, UK Extension Specialists
Graphics courtesy of Joshua Knight

January 2019

For additional information, contact your local County Extension agent

HIGH TUNNEL PLANTING CALENDAR for ANNUAL CROPS

University of Kentucky College of Agriculture, Food and Environment
Cooperative Extension Service

CENTER FOR CROP DIVERSIFICATION

KADF KENTUCKY AGRICULTURAL DEVELOPMENT FUND

Kentucky Horticulture Council

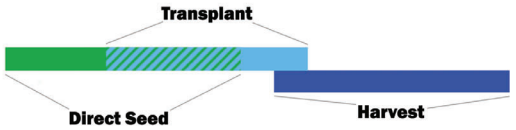
	AIR TEMPERATURE MIN	OPTIMAL
Spinach	20°	60°- 65°
Swiss Chard	40°	60°- 65°
Beet	50°	55°- 80°
Parsley[1]	45°	60°- 65°
Carrot	45°	60°- 65°
Cabbage[2]	40°	60°- 65°
Mustard Greens[3]	40°	60°- 65°
Turnip	40°	60°- 65°
Radish	40°	50°- 65°
Basil	45°	60°- 65°
Lettuce	25°	50°- 70°
Green Onion[4]	45°	55°- 75°
Bulb Onion	45°	55°- 75°
Strawberry	30°	60°- 80°
Cucumber	60°	65°- 85°
Summer Squash[5]	60°	65°- 80°
Melon[6]	65°	65°- 80°
Bell Pepper[7]	60°	65°- 80°
Eggplant	65°	70°- 90°
Tomato	65°	65°- 85°
Bean	50°	70°- 80°
Pea	40°	50°- 65°

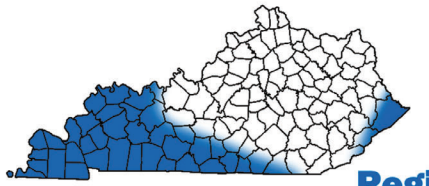
Plant Family

Beet Carrot Cole Crop Mint Sunflower
Garlic Rose Gourd Nightshade Pea

Alternative Crops

1) Cilantro, Dill
2) Chinese Cabbage, Pac Choy
3) Arugula, Collards, Kale
4) Leeks
5) Zucchini
6) Cantaloupe, Muskmelon, Honeydew, Watermelon
7) Sweet Pepper, Chile Pepper





Region 1

High Tunnel Production Resources

PUBLICATIONS

Cover Crops, Covers under Cover: Managing Cover Crops in High Tunnels (CCD-SP-16), Cool-Season Cover Crops in High Tunnels (CCD-SP-18), Warm-Season Cover Crops in High Tunnels (CCD-SP-19)
Planting -High Tunnel Planting Calendar Companion Factsheet (CCD-FS-9), High Tunnel Planting Calendar
Scouting Guides for Common Problems - IPM Scouting Guide for Common Problems of High Tunnel and Greenhouse Vegetable Crops in Kentucky (ID-235), Problems of Cucurbit Crops in Kentucky (ID-91), Pests of Solanaceous Crops in Kentucky (ID-172), Problems of Cole Crops in Kentucky (ID-216), Problems of Legume Vegetables in Kentucky (ID-227), Pests of Sweet Corn in Kentucky (ID-184)
Soil -Soil Salinity in High Tunnel Production (CCD-FS-24), Root-knot Nematodes in Vegetable Cropping Systems (PPFS-VG-28), Soil tests can be submitted to the UK Division of Regulatory Services (http://soils.rs.uky.edu/) through your county cooperative extension office. Contact your ANR extension agent for assistance on the proper way to collect a soil sample.
Structure - Movable High Tunnels (CCD-SP-15), Natural Resource Conservation Service Environmental Quality Incentives Program (NRCS-EQIP) - *NRCS has provided financial and technical assistance for people across the country to build high tunnels. This is part of the EQIP High Tunnel System Initiative.*

EDUCATIONAL VIDEOS

2022 Fall IPM Vegetable Field Day Video Series
•Introduction to Lettuce Sclerotinia High Tunnel Trial, Lettuce Drop in High Tunnel Lettuce Production, Introduction to High Tunnel Crop Rotation to Extend the Production Season, Insect Pest Monitoring and Management in High Tunnel Cut Flower Production, Powdery Mildew Disease Identification and Management for Cut Flowers in High Tunnels, Pesticide Restrictions for High Tunnels Insect Pest Management with Biocontrols, Pesticide Calculations for Small Acreages and High Tunnels, High Tunnel Solarization Trial, Field Solarization Trial, Preparation of Newly Installed High Tunnels for Successful Production

2022 Summer IPM Vegetable Virtual Field Day Video Series
•High Tunnel Squash Trial Introduction, Squash Powdery Mildew Susceptibility Trial, Sclerotinia Disease in the High Tunnel, Pest Management in the High Tunnel, High Tunnel Solarization Trial Introduction, High Tunnel Solarization for Management of Sclerotinia, Additional Benefits of Solarization for Weed & Insect Management, Field Solarization Trial Introduction, High Tunnel Tomato Rotation Trial Introduction, Insect Monitoring for High Tunnel Tomatoes, Disease Management for High Tunnel Tomatoes, Cabbage & Okra Field Trials: Research to Improve Insect Management

2022 Spring into Production Webinar Video Series
•Equipment Considerations for Vegetable Production, The Ins & Outs of Organic Fertilizers, Tomato Grafting & Root-Knot Nematode Management – Presented by Dr. Rachel Rudolph, High Tunnel Crop Rotation, *A Discussion on Cover Cropping in High Tunnels with Ford Waterstrat of Sustainable Harvest Farm, High Tunnel Insect Pests , Tomato High Tunnel Webinar Video Series*

Find these resources on High Tunnel Production by visiting:
vegcrops.ca.uky.edu/high-tunnel-production-resources

Spring Pasture Management Do's and Don’ts

By Krista Lea, MS, and Ray Smith, PhD, from UK’s Department of Plant and Soil Sciences

After a long, cold winter in much of the United States, many farms and their fields will need some work come spring. The following guidelines will help ensure your pasture management efforts are both beneficial and economical for your farm.

Don’t fertilize cool-season grass pastures heavily with nitrogen in the spring (more than 50-60 pounds actual nitrogen per acre would be considered heavy). These pastures experience a natural flush of growth in the spring; additional nitrogen will only end up costing you in both fertilizer and time spent mowing. Most horse farms do not have high enough stocking rates to utilize all the spring growth and, thus, will end up mowing down most of this production. Also remember that nitrogen benefits weeds and grasses alike.

Instead, take a soil sample. Most healthy pastures in the United States require additional lime, potassium, and phosphorus applications. A soil sample will show exactly what fertilizer you need to add. While you can sample soil anytime, spring is great time to do so because the weather is nice and you can observe how your pasture is recovering from fall grazing and winter conditions. Farm owners cannot truly know what is in their pastures until they actually walk them and see.

If stocking rates are high, consider top-dressing nitrogen. On farms where horse numbers are very high, such as small private farms or boarding facilities, top-dressing pastures with nitrogen can help them recover faster from the abuse of the previous fall and provide more grazing sooner. Top dress in late March, the first two weeks of May, and the first two weeks of August, if needed.

For more information on horse pasture fertility, see “Soil Sampling and Nutrient Management in Horse Pastures.”

Don’t undertake spring seeding of cool-season grasses, such as Kentucky bluegrass, orchard grass, and endophyte-free tall fescue in the southern United States. Cool-season pastures are best seeded in the fall when there is less weed pressure, more favorable weather, and a longer rest period before spring grazing.

Instead, diversify your farm and plant alfalfa or bermudagrass.

If you have never considered planting alfalfa on your farm, here are a few ways it might work well for you:

•For larger farms that own or can purchase hay equipment or use a custom operator, growing alfalfa or alfalfa-mixed hay for on-farm use or cash sales can be profitable, but generally only on a large scale because of the cost of hay-making equipment.
•Roundup Ready varieties of alfalfa are very useful for pasture renovation. If your current pasture is overrun with weeds or other undesirable forbs, such as endophyte-infected tall fescue, total renovation using alfalfa might be beneficial. Planting a pasture with Roundup Ready alfalfa allows you to treat the pasture with Roundup (glyphosate) throughout the life of the stand to remove weeds and tall fescue. This could be done for a growing season, returning the pasture to cool-season grasses in the fall or leaving the field in place for several years for better weed control.
•The alfalfa produced can be harvested for hay or grazed by cattle. If you have a beef or dairy farmer for a neighbor, they might be interested in your new crop.

Here are some keys to successful alfalfa establishment:

•Soil pH is important to alfalfa, so do a soil test and apply the appropriate amount of lime.
•Alfalfa is a legume, capable of fixing nitrogen from the air and storing it in its roots. When the plant dies, it will leave that nitrogen in the roots, which will benefit any cool-season grasses you plant. However, if you fertilize with nitrogen, you will reduce the plant’s ability to fix nitrogen, costing you considerably more money.

Spray Roundup Ready alfalfa with glyphosate soon after planting to remove the few plants that are not tolerant.

For more information, contact your local county extension agent and see "Growing Alfalfa in the South."

Bermudagrass is a common warm-season forage in the southern United States. However, it can have some applications further north. Because bermudagrass is a warm-season grass, it will be most productive in the summer when traditional cool-season pastures are not as productive. It often has very high yields and is very competitive with weeds. For establishment, seed bermudagrass into a well-prepared, tilled seedbed and not into existing pastures.

Points to keep in mind when considering establishing bermudagrass:

•Not all bermudagrass varieties will survive winters in states north of Tennessee and North Carolina, so check your state's forage variety trials for bermudagrass winter survival.

•Some bermudagrass varieties are planted using sprigs or clipping while others are seeded. Make sure you know what you are getting and that you have the proper equipment for site preparation and planting.

•Bermudagrass is a high-yielding grass, but it also has high nitrogen and potassium demands.

•Bermudagrass will go dormant and turn brown in early fall. If you are concerned with having green pastures in October, bermudagrass is not for you.

For more information on bermudagrass, see "Bermudagrass: A Summer Forage."

Planning Your Grazing System

Rotational grazing can help producers increase forage productivity, which can increase the profitability of an operation. Additional benefits to implementing a rotational grazing system include: reduced supplemental feed costs, improved animal distribution and forage utilization, improved manure distribution and nutrient use, and many more. While many producers want to achieve these benefits, many struggle with implementing a system to achieve their grazing goals. Thoughtfully planning a system that works for your operation is a critical first step toward implementing a successful grazing system.

Understanding the forage base of a farm and what it will produce is helpful in planning a grazing system.

Know What You Have - The development of any grazing system starts with an inventory of what the operation already has and then developing a plan of how to best use those resources going forward. The best way to start this process is by obtaining aerial maps of the farm from your local NRCS office or using a computer program such as Google Earth. The larger the scale of these maps, the easier it will be to see landscape details. Making several copies of these maps allows one to draw on them and adjust their plan as needed. Another useful map in planning a grazing system is a soils map. When used along with a list of soil descriptions, producers can get an idea of forage yield potential of their farm.

Forage - The next area needing consideration is the forage base of a farm. Producers need to understand when forage is going to be available and identify gaps in forage availability. The typical Kentucky farm is going to have a cool-season forage base consisting of tall fescue, bluegrass, clovers and possibly orchardgrass. Depending on the goals of the operation, the forage base could be further developed to include inter-seeding legumes and establishing warm season perennial grasses or annual forages to fill gaps.

Water - One of the biggest challenges in developing a grazing system is water availability. Wherever animals are grazing, water must be available. Research shows that if water is within 800 feet of cattle, pastures are grazed more uniformly and manure is distributed more evenly over a pasture. When water is farther away than 800 feet, pasture use decreases and overgrazing of areas closer to water occurs. All potential water sources should be considered when developing a grazing system. Ponds, springs, streams, municipal water and wells are options and can all contribute to providing water to livestock. If it is possible to utilize portable water systems, like the one shown in Figure 1, while developing a grazing system, producers can evaluate waterer locations and make better decisions about where to place permanent waterers.

Figure 1: Cattle drinking from a portable water tank in rotational grazing system.
Photo by Kevin Laurent

Fencing - Fencing is another big part of any grazing system. Most grazing systems use both permanent and temporary fencing. When looking at farm maps, make sure to draw in boundaries and permanent fences. Once all current fences are drawn, stop to evaluate the current layout's benefits and deficiencies. Next, subdivide pastures into smaller, more uniformly sized paddocks. Square shaped paddocks use less fence when compared to other shapes like rectangles or triangles. Try different temporary fencing components and decide what works best. Using temporary fences for

internal divisions provides flexibility to the system that can be changed and improved. For more information on fencing for grazing systems, see the UK publication Planning Fencing Systems for Intensive Grazing Management.

Animals - Understanding the needs of the animals to be grazed is important in developing a grazing system. Producers must account for livestock's nutrient requirements and how requirements are affected by species, breed, stage of production, and age of animals, as well as environmental conditions. Producers need to understand if the animals' requirements will be met with the pasture provided. The importance of providing shade for animals is often overlooked. Cows provided with shade spend more time grazing and less time standing than those without shade. Producers need to evaluate pastures based on available natural shade and determine if artificial shade should be added. The combination of an animals' changing nutritional needs and changing pasture conditions require greater management on the part of the producer to maximize production.

Time/Labor - One final component to a grazing system is the time or labor associated with managing it. There are operations with highly developed grazing systems, in which animals are moved multiple times each day to fresh pastures. On the other end of the scale are operations that move once every week. The grazing system must work with the schedule of the individual who is actually moving the animals and temporary fence, and managing other components of the system. However, cattle are quickly trained and often moving to a new paddock takes just minutes. If designed correctly, a grazing system can make management easy and efficient.

Developing a grazing system can be intimidating. By understanding and managing what is already available and adding new components to a system, like new watering sites or subdividing pastures with temporary fencing, soon the system will begin to take shape and producers will reap the rewards of their hard work. For more information on developing a grazing system, see the UK publication Rotational Grazing, or contact your Local Extension Agent or NRCS Grazing Specialist to assist you.

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Pelvic Measurements and Calving Difficulty*

L.H. Anderson, Ph.D., and K.D. Bullock, Ph.D., Department of Animal Sciences, Extension Beef Specialists

Although researchers agree that birth weight is the most important measurable trait affecting calving difficulty, there is evidence that the size and shape of the pelvis also has an effect on a heifer's ability to calve.

Table 1. Using pelvic measurements to estimate deliverable calf size (birth weight).

Time of Measurement	Heifer Age (mo)	Heifer Wt (lb)	Pelvic Area (cm^2)	Pelvic Area/Birth Wt Ratio	Estimated Calf Birth Wt, lb
Before breeding	12-13	600	140	2.1	67
			160	2.1	76
			180	2.1	86
Pregnancy exam	18-19	800	180	2.7	67
			200	2.7	74
			220	2.7	82

Calving Difficulty

Calving difficulty results in major economic loss to the beef cattle industry. Estimated losses resulting from dystocia (calving difficulty) equal or exceed $750 million annually. Calving difficulty influences the economics of a cow/calf enterprise through increased calf death loss, increased labor and veterinary costs, reduced subsequent reproductive performance of the cow, potential loss of the cow, and reduced milk production.

Calf mortality may be four to eight times greater in dystocia cases than in normal births. The majority of calf deaths occur within the first 24 hours following calving (58 percent), with 75 percent of the total occurring within the first week of life. Studies indicate that calf death loss due to dystocia accounts for the single largest peri- and postnatal death loss category through the first 96 hours after birth.

A number of factors affect calving difficulty, including:

- birth weight of the calf,
- pelvic area of the cow,
- gestation length,
- sex of the calf,
- inadequacies in heifer development,
- body condition of the cow at calving,
- abnormalities in hormone profiles at the time of birth, or
- abnormal presentation of the calf at birth.

We also know that the single major cause of dystocia is a disproportion between size of the calf at birth (birth weight) and the cow's birth canal (pelvic area). Differences in pelvic area are generally due to pelvic height, with discrepancies between the dam and fetus more likely to occur for pelvic height and depth of calf chest than for width measures.

Pelvic size, independent of cow weight, affects calving difficulty. Heifers of increased skeletal size usually have larger pelvic openings but also tend to have heavier calves at birth. Hence, selection for cow size alone is ineffective.

Heifer weight and age generally have a positive relationship to pelvic area, but weight is not always a good indicator. External dimensions such as width of hooks and length of rump are not good indicators of pelvic area or calving difficulty. For these reasons, **pelvic measurements can be a useful management tool to eliminate heifers with a higher potential for calving difficulty.**

Pelvic Measurements

University of Nebraska researchers developed ratios that you may use to estimate deliverable calf size. You can divide total pelvic area prior to breeding by a ratio that is based on age and weight to estimate the amount of birth weight a heifer could accommodate as a 2-year-old without substantial difficulty.

Example: a 600-lb yearling heifer (Table 1) with a pelvic area of 140 sq cm should be able to deliver, as a 2-year-old, a 67-lb calf without difficulty (140/2.1 = 67).

** This publication was adapted and revised from "Pelvic Measurements for Reducing Calving Difficulty," by Gene H. Deutscher, NebGuide G88-895, of the Nebraska Cooperative Extension Service, University of Nebraska Institute of Agriculture and Natural Resources. The tables contain Nebraska data.*

Table 2. Pelvic area/calf birth weight ratios for various heifer weights and ages to estimate deliverable calf birth weight.

	Age at time of measurement (months)			
Heifer Wt (lb)	**8-9**	**12-13**	**18-19**	**22-23**
500	1.7	2.0	--	--
600	1.8	2.1	--	--
700	1.9	2.2	2.6	--
800	--	2.3	2.7	3.1
900	--	2.4	2.8	3.2
1000	--	2.5	2.9	3.3
1100	--	--	--	3.4

Pelvic measurements can be obtained at the time of pregnancy exam, but a factor of 2.7 should be used to estimate calf birth weight of 18- to 19-month-old 800-lb heifers. Tables 1 and 2 provide estimates of the deliverable calf size a heifer may accommodate at first calving, based on pelvic area at given weights and ages. Scientists at the University of Nebraska suggest that these ratios appear to be good indicators of dystocia and report an accuracy of nearly 80 percent.

Structural traits in cattle tend to be highly heritable, and pelvic area is no exception. This means there is a large genetic influence on pelvic area which results in rapid response to selection. However, pelvic area is genetically correlated with many other traits, so **selection for increased pelvic area alone can result in other traits changing for the worse.** For example, selecting for increased pelvic area can result in increased birth weight and mature weight.

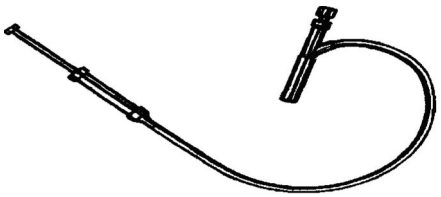
Pelvic measurements can be taken prior to the first breeding season and combined with a reproductive tract examination. Pelvic measurements should be used in addition to, not in place of, selection for size, weight, and, above all, fertility. Producers should be aware that selection for pelvic area will likely result in increased size of the entire skeleton and animal. Increased skeletal size of the dam will be reflected in higher birth weights and dimensions of the calf.

Pelvic measurements, on the other hand, can be used successfully to identify abnormally small or abnormally shaped pelvises. These situations left unidentified are often associated with extreme dystocia, resulting in cesarean delivery and even death of the calf or cow.

Pelvic measurements can be obtained with a Rice Pelvimeter (see Figure 1A), the Krautmann-Litton Bovine Pelvic Meter (see Figure 1B), or the Equibov Bovine Pelvimeter.

Figure 1. Instruments to measure pelvic area. in cattle.

A. Rice Pelvimeter

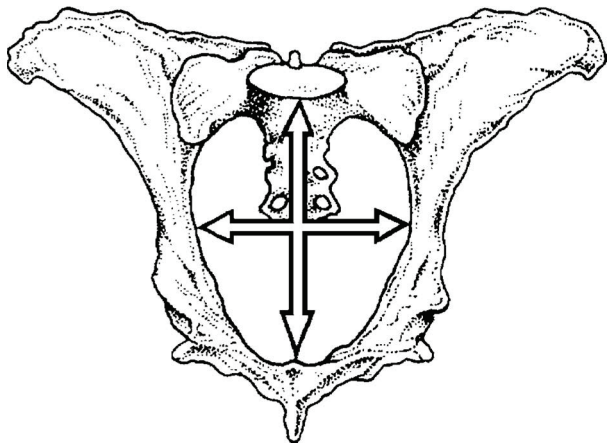


B. Krautmann - Litton Bovine Pelvic Meter

The vertical measurement is the vertical diameter between the symphysis pubis on the floor of the pelvis and the sacral vertebrae. The horizontal measurement is obtained by determining the horizontal diameter at its widest point between the left and right ileal shafts (see Figure 2). These measurements are read in centimeters and multiplied together to obtain the total pelvic area in square centimeters.

Measurements may be obtained by a veterinarian or experienced producer. It is important that the person doing the measuring have a thorough understanding of the birth canal, pelvic structure, and reproductive tract. Practice and experience are necessary before accurate measurements can be obtained.

Figure 2. Vertical and horizontal measurements are obtained to determine pelvic area.



Summary

Calving ease will continue to be an important consideration as the industry produces fast-growing, muscular progeny by terminal sires. These sires should be selected on measures of direct calving ease by using EPD values for calving ease and birth weight.

To accommodate fairly heavy birth weights, scientists at Colorado State University recommend that you **develop a cow herd that excels in maternal calving ease.** Sires of replacement females should be selected to maintain cow size and milk production at levels compatible with available resources. In addition, cows should be selected for total maternal calving ease along with gestation length.

Research indicates that **bigger is not necessarily better when one considers actual pelvic measurements.** In other words, heifers with large pelvic measurements fail to calve more easily than average-sized heifers. However, heifers with abnormally small pelvises or abnormally shaped pelvises generally experience a higher than normal incidence of calving difficulty and should be identified and culled from the herd.

Remember, pelvic area and shape are only a part of the calving difficulty complex. Follow the suggestions on this list to minimize the incidence and severity of calving difficulty in your herd.

How to reduce calving difficulty (in ranked order):

1. Breed heifers to proven calving ease bulls (low BW EPDs).
   The following are general guidelines:
   Lowest 25%—British Breeds
   Lowest 15%—Small Continental
   Lowest 10%—Large Continental
2. Develop heifers to pre-breeding target weights. (See ASC-144, *Management Considerations in Beef Heifer Development*)
3. Ensure that heifers are in good body condition going into the calving period (minimum body condition score of 5).
4. Obtain pelvic measurements at yearling age, and cull heifers with abnormally shaped or abnormally small pelvic areas.

ASC-161
UK COOPERATIVE EXTENSION SERVICE
UNIVERSITY OF KENTUCKY — COLLEGE OF AGRICULTURE

Feeding and Managing Baby Calves from Birth to 3 Months of Age

Donna M. Amaral-Phillips, Patty B. Scharko, John T. Johns, and Sharon Franklin

As the future productive units of a dairy herd, heifers represent a substantial financial investment in feed and labor. This investment needs to be protected by managing and feeding these heifers so that they grow economically and at an optimal rate in order to calve at 24 months of age. The first two to three months of life is a critical period to achieving these objectives. This factsheet explains the critical steps in raising calves during this time period. These steps are important for raising not only dairy heifers but also orphan beef calves.

Dry Cow Nutrition Program

Sound feeding and management programs for young calves start with the dam or mother two months prior to calving. The majority of the growth of the calf within the dam occurs within the last two months of gestation, and the dam provides the nutrients needed for this growth. Also, the management program of the dam affects the quality and amount of antibodies found in her colostrum, or first milk, which directly impacts the health of the calf after birth.

Dry cows should be fed a diet that is balanced to meet their nutrient needs and support the growth of the fetus. If a heifer or cow is slightly underfed energy and/or protein, the fetus will still grow to the same size as if she was fed properly, but she will sacrifice her own body reserves or growth to support the growth of the fetus inside her. Basically, the growth of the fetus has a higher nutrient priority than the growth of the bred heifer or the ability of a mature cow to maintain her body fat stores. Underfed heifers will have more trouble calving. Older cows will use their body stores of fat and protein, and these stores will not be available to support milk production after calving. The important message is that underfeeding dry cows and springing heifers does not result in a smaller calf but instead results in lower performance of the cow or heifer after calving.

Adequate minerals and vitamins are important to the dry cow and the calf developing inside her. They are also necessary for the dam to minimize health problems around freshening time, such as preventing retained placentas, and to improve the immune system so that the cow can fight off a disease challenge, such as mastitis infection, just before or after calving. The recommended concentration of selected minerals and vitamins in the total diet is shown in Table 1. In addition, deficiencies of minerals, such as phosphorus, manganese, cobalt, copper, zinc, and selenium, can result in deficiencies in the fetus as well as the newborn calf. Thus, adequate (not excessive) amounts of each mineral and vitamin need to be consumed for the health and well-being of both the dam and the unborn calf.

A very effective way to prevent scours in calves is to vaccinate the dry cow with a scour vaccine before calving. Mature cows should be vaccinated four to six weeks before freshening. Heifers should be vaccinated two months before calving and boostered again one month before freshening. Scour vaccines can include the rota and corona virus, *E. coli*, and/or *Clostridium perfingens*. Individual farms should consult with their local veterinarian to determine the primary cause(s) of calf scours on their farm and for help in selecting the most effective vaccine for their situation.

Table 1. Concentration of selected minerals and vitamins in the total diet recommended for a 1500-lb Holstein dry cow from 240 to 280 days pregnant.

Mineral/Vitamin*	Dry matter basis
Calcium	0.44 - 0.48%
Phosphorus	0.22 - 0.26%
Magnesium	0.11 - 0.16%
Potassium	0.51 - 0.62%
Copper	12 -18 ppm
Zinc	21 - 30 ppm
Selenium	0.3 ppm
Vitamin E	1168 - 1211 ppm

*Assumes anionic salts are not being fed the last three weeks of gestation.
Source: *Nutrient Requirements of Dairy Cattle—2001* (7th revised edition).

Care of the Calf at Birth

As calving time approaches, the cow due to calve needs to be watched closely for any complications. Cows and heifers should calve in a clean, dry, grassy lot or a clean, well-bedded pen. Pens should be square and should provide 150 to 200 square feet of space; they should have good lighting and ventilation but be free from drafts. Beef cows can calve outside if a windbreak is available.

The newborn calf should begin to breathe shortly after the umbilical cord breaks. Mucus around the nostrils should be removed. Do not pound on the calf's chest or lift it by the rear legs since this can do more harm than good. Shortly after birth, the navel cord should be dipped (not sprayed) with a 7% tincture of iodine solution. (Do not use teat dip or weaker iodine solutions.)

The cow should be allowed to lick the calf after delivery. In cold weather or if the cow does not lick the calf, the calf should be dried with clean cloths. This practice not only dries the calf but stimulates the calf's blood circulation. Generally, dairy calves are removed from their dam shortly after the dam has licked the calf clean (within one hour).

Table 2. Typical composition of colostrum (first milking after calving), transition milk (second and third milkings after calving), and whole milk.

	Milking after calving			
	Colostrum	Transition Milk		Whole milk
Component	1st	2nd	3rd	
Total solids (%)	23.9	14.1	13.6	12.9
Fat (%)	6.7	3.9	4.4	4.0
Protein (%)	14.0	5.1	4.1	3.1
Lactose (%)	2.7	4.4	4.7	5.0
Calcium (%)	0.26	0.15	0.15	0.13
Immunoglobulins (%)	6.0	2.4	1.0	0.1

Taken from: *Feeding the Newborn Dairy Calf.* Special Circular 311. Pennsylvania State University.

Early Colostrum Intake = Survival

Colostrum is secreted by the mammary gland shortly before and after calving. True colostrum is obtained only from the first milking. After the first milking and for the next two and a half days, the cow's milk is called transition milk.

Colostrum provides a calf with its primary source of nutrients. As shown in Table 2, true colostrum contains twice as much dry matter and total solids, two to three times as many minerals, and five times as much protein as whole milk. Colostrum also contains various hormones and growth factors that are necessary for growth and development of the digestive tract. Colostrum is lower in lactose, thus decreasing the incidence of diarrhea. Milk obtained after the first milking is inferior in quality to the first milking and should not be fed to the newborn calf as colostrum milk.

Calves are born with little defense or immunity against disease. They acquire resistance to disease from their dam through *timely* and *adequate* intakes of *high-quality* colostrum, their mother's first milk. Calves that do not receive adequate amounts of quality colostrum early in life are more susceptible to diseases. Holstein calves should be hand-fed 5 to 6 pints or 3 quarts of good quality colostrum within an hour of birth and again within 12 hours or the next regular feeding. (Feeding 6 pints of colostrum will not cause a Holstein calf to get scours.) The amount of antibodies absorbed is related to the timing of colostrum feeding after birth. Within six hours after birth, the ability of the gut to absorb antibodies decreases by one-third. By 24 hours, the gut can absorb only 11% of what it originally could have absorbed at birth. Also, at 24 hours of age, digestive enzymes break down and digest all of the antibodies.

Oftentimes, farmers let the calf nurse its dam. Research has shown that many of these calves do not nurse adequate amounts of colostrum from their dams within the first few hours of life, and thus they may not receive adequate immunity to fight off disease. Hand-feeding newborn calves is recommended so that a dairy farmer knows how much colostrum an individual calf receives.

Calves are born with little defense or immunity against disease. They acquire resistance to disease from their dam through *timely* and *adequate* intakes of *high-quality* colostrum, their mother's first milk.

Colostrum should be very thick and creamy. The quality of colostrum can be determined using a colostrometer (available through Nasco catalog). Superior quality colostrum contains greater than 50 mg/ml of immunoglobulins. Before milking the cow, its teats should be cleaned. Newborn calves should not be fed colostrum that is thin, bloody, mastitic, or obtained from cows testing positive for Johne's disease. Calves that do not readily consume their colostrum can be fed using an esophageal feeder. Three to 5 half-gallon containers of quality colostrum should be stored in a non-frost-free freezer for up to one year for feeding to calves born to dams

with mastitis or no milk. Colostrum from dairy cows can be fed to beef calves. Colostrum should be thawed in warm water (not hot water) or in a microwave on low power for short periods where the thawed liquid is poured off periodically into the container used to feed the calf and the unthawed liquid returned to the microwave.

After the initial feeding of colostrum, for the next three days calves should receive transition milk from their dam or other cows in the herd all of which test negative for Johne's disease.

Calf Housing

Calves should be housed individually in facilities which are draft-free but provide good ventilation. One way to house calves to prevent the spread of disease from one calf to another is to use calf hutches. These can be purchased commercially or built on the farm. They should be located on a surface with adequate drainage and bedded with straw especially in the cooler times of the year. During the winter, the hutch opening should be placed facing the south to allow the winter sun inside. In the summer, calf hutches should be shaded to decrease heat stress and to help improve the immune system of calves. After each calf is removed, calf hutches should be cleaned and moved to a new location to control the spread of potential diseases.

Milk Feeding Options

For the first two weeks of life, calves receive most of their nutrition from milk. From four days of age, calves can be fed either whole milk, waste milk, reconstituted milk replacer, or fermented or fresh colostrum (Table 3). The type of milk fed is determined by price, availability, and convenience. Calves are generally fed milk twice daily from a nipple bottle or bucket, or they can drink from an open bucket. When milk or reconstituted milk replacer is fed to calves from either a nipple or open bucket, the esophogeal groove closes and milk bypasses the rumen and is shunted from the esophagus into the abomasum or true stomach. The groove closes in response to nervous stimulation and is active in calves until about 12 weeks of age.

To prevent the spread of Johne's disease to young calves, colostrum, fermented colostrum, whole milk, or waste milk should be obtained from cows testing negative for Johne's disease, or it should be properly pasteurized using a batch pasteurizer. These pasteurizers require that the milk be held at 65.5°C or 150°F for 30 minutes. Proper use of this equipment has been shown to kill the bacteria associated with this disease.

Whole Milk

Whole milk can be used to feed baby calves. Calves should be fed daily approximately 10% of their birth body weight (1 quart of milk weighs 2 pounds). For example, a Holstein calf weighing 90 pounds at birth would be fed 4.5 quarts (9 pints) of milk daily or 2.25 quarts per feeding when fed twice daily. Feeding less milk than this amount results in poor growth due to lack of needed nutrients. Overfeeding and sudden changes in the amount of milk can cause digestive upsets and scouring. Overfeeding milk to calves decreases consumption of dry feed or grain, thus prolonging weaning time.

Waste Milk

Waste or mastitic milk can be used to feed calves. Calves should be fed approximately 10% of their birth body weight (1 quart of milk weighs 2 pounds). Milk from treated cows should only be used to feed calves raised for herd replacements or those kept for eight to 12 weeks after the last feeding of such milk. *Do not feed waste milk containing antibiotics to calves intended for slaughter.* Calves should be individually housed so that they cannot suck one another. Do not feed calves waste milk that is watery or that comes from quarters showing signs of severe mastitis, from cows with an elevated temperature, from cows that are off-feed, or from cows shortly after they have been treated with antibiotics.

Table 3. Amount of whole or waste milk or diluted fermented colostrum to feed young calves. Calves are weaned after they are older than 30 days of age and are eating 1.5 to 2 lbs of calf starter daily for three days in a row.

		Daily amount (quarts)	
Age in days	**Milk source**	**Holstein/ Brown Swiss**	**Smaller breeds**
4 days until weaning from milk	Whole or waste milk or diluted fermented colostrum	4-5 quarts daily *or* 2-2.5 quarts/twice daily feeding	3-4 quarts daily *or* 1.5-2 quarts/twice daily feeding
Milk replacer powders should be reconstituted with warm water and fed according to directions on the bag.			

Milk Replacers

Milk replacer powders are reconstituted with warm water and make an excellent and oftentimes economical liquid feed for baby calves. Especially during the first three weeks of life, calves should be fed a milk replacer that contains all milk proteins made from dried skim milk or whey products. Whey products can include whey protein concentrates, dried whey, and delactosed whey. Milk replacers should contain a minimum of 18 to 22% crude protein, 10 to 22% crude fat, and less than 0.5% crude fiber. They should be mixed and fed according to the manufacturer's directions. During cold weather, calves should be fed a milk replacer containing 20% fat, and more milk replacer powder should be fed.

Fermented Colostrum

Fermented or sour colostrum can be used to feed calves. Studies have shown that weight gains in calves are similar to those fed milk or milk replacers when fermented colostrum has been properly fermented and diluted when fed. Fermented colostrum represents all of the surplus milk and colostrum collected from cows for the first three days after calving. This milk can be stored in a plastic garbage can lined with a disposable plastic liner (for ease of cleaning). Milk from cows treated with antibiotics should not be added to fermenting colostrum since the antibiotics will kill the fermenting organisms. Colostrum ferments best when the temperature is between 60° and 80°F and should not be stored in direct sunlight. Under 60°F, fermentation is slow; when the temperature exceeds 80°F, fermentation is rapid and may result in undesirable organisms being involved in the fermentation process. The addition of small amounts of acid preservatives can extend the life of the fermented colostrum and decrease undesirable fermentation. Fermented colostrum takes approximately 10 to 14 days to ferment and can be stored an additional 14 to 30 days.

Calves can be fed fermented colostrum at four days of age. Fermented colostrum should be diluted with warm water (not hot water) at the rate of 1 part warm water to 2 parts fermented colostrum. Calves should be fed daily approximately 10% of their birth body weight (1 quart of milk weighs 2 pounds) of the reconstituted mixture.

Calf Scours

Calves with diarrhea should receive an electrolyte solution and their regular allocation of milk. Electrolytes should be given 30 minutes to 1 hour after feeding milk.

Calf scours or diarrhea can be caused by overfeeding milk or by bacterial, viral, or protozoal ("cryto" or coccidia) infections. Farmers should work with their local veterinarians to identify the cause and develop a preventative program. Diarrhea in calves results in losses of water and electrolytes, such as sodium, bicarbonate, chlorine, and potassium. Scouring calves can lose 10 to 12% of their body weight in water losses. These imbalances must be corrected quickly or death can result. Depending on the severity of the diarrhea and dehydration, calves may need to receive oral electrolyte solutions once daily or as many as four times a day. Calves that cannot suckle should be fed electrolytes with an esophageal feeder. Calves should be fed their regular allocation of milk when receiving oral electrolytes. The milk supplies the calf with energy and other nutrients needed for survival. Oral electrolyte products are available commercially, or in an emergency, they can be made using common kitchen supplies (Table 4). Electrolytes should be given 30 minutes to 1 hour after feeding milk.

Table 4. Emergency recipe for electrolyte solution for scouring calves.

- 1 package of fruit pectin
- 1 teaspoon Lite Salt®
- 2 teaspoons baking soda
- 1 can chicken stock*
- warm water to make 2 quarts

*Do not use beef stock or beef consommé

Calf Starter and Water Important for Rumen Development

For the first part of life, the calf functions as a simple-stomached or monogastric animal. At birth, the first three components of the stomach—the rumen, reticulum, and omasum—are undeveloped and do not aid in digesting feeds for the very young calf. When the calf starts to eat calf starter (mixture of grains, protein source, minerals, and vitamins) and to drink water, the rumen starts to develop.

Calf starter should be fed to calves starting at four days of age. Calf starter should be formulated to include very palatable ingredients and to contain adequate protein, minerals, and vitamins. Table 5 lists the recommended nutrient content of a calf starter, and Table 6 shows a sample recipe for a home-mixed calf starter. A coccidiostat or coccidioside, such as Deccox®, Bovatec®, or Rumensin®, should be included in the calf starter.

Table 5. Nutrient composition for calf starters.*

- 16-20% crude protein
- 0.70% calcium
- 0.45 % phosphorus
- 0.65 % potassium
- 10 ppm copper
- 40 ppm zinc
- 40 ppm manganese
- 0.10 ppm cobalt
- 0.30 ppm selenium
- 1818 IU Vitamin A/lb dry matter
- 270 IU Vitamin D/lb dry matter
- 12 IU Vitamin E/lb dry matter

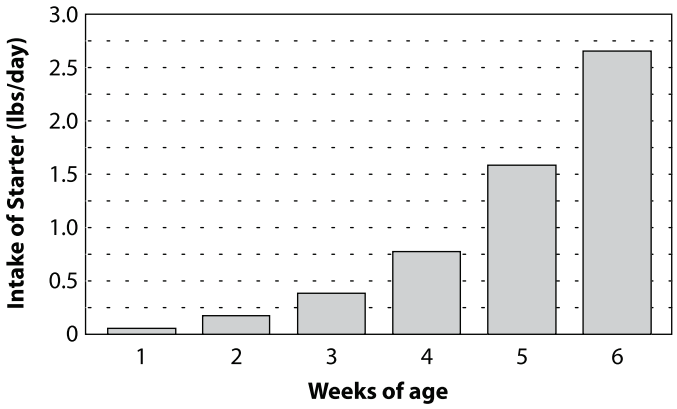
* Adapted from *Nutrient Requirements for Dairy Cattle—2001*

Table 6. Sample recipe for a home-mixed calf starter (18% crude protein).

- 700 lbs rolled or coarse ground oats
- 600 lbs cracked corn
- 475 lbs 48% soybean meal
- 150 lbs molasses
- 15 lbs white salt
- 15 lbs dicalcium phosphate
- 20 lbs limestone
- enough trace mineral and vitamin premix to meet needs listed in Table 5
- addition of a Deccox®, Rumensin®, or Bovatec®

The calf starter along with water helps the rumen of the calf develop. As shown in Figure 1, for the first two weeks of life, calves will just nibble calf starter. They should be given no more than a 6-ounce coffee cup of starter daily with the refused feed removed daily and fed to older heifers. Intakes of the starter increase the third to fourth weeks of life. **Hay should not be fed until calves are weaned and/or they are eight weeks of age.**

Figure 1. Effects of age on the consumption of a ground calf starter. For the first two weeks of life, calves just nibble calf starter, but this small amount of starter is important in early rumen development. Results are from a trial at the University of Kentucky.



In addition to the calf starter, water should be provided free-choice starting at four days of age. Feeding calves free-choice water increases starter intake and weight gain. In a research study, depriving calves of drinking water decreased starter intake by 31% and decreased weight gain by 38% over those calves provided water free-choice. Free-choice water enters the rumen and along with high-quality calf starter helps convert a calf from a simple-stomached animal to one with a functional rumen that can utilize forages and grains. When calves are fed milk or reconstituted milk replacer, milk is funneled through the esophageal groove to the true stomach and not into the rumen. Thus, milk or water added to milk will not provide water for the bacteria to grow in the calf's rumen. Clean, fresh water must be provided separately, free-choice. Water must be provided free-choice throughout the year, not just in the summertime. During extremely cold weather, warm water should be offered two or three times daily.

Calf starter and water should be fed to calves starting at four days of age. Both calf starter and water fed separately from a calf's milk are needed to convert a calf from a simple-stomached animal to one with a functional rumen that can utilize forages.

Weaning Calves

Calves can be weaned from milk when they are eating daily 1.5 to 2 pounds of starter (Holsteins) for three days in a row. Thus, calves should not be weaned based on age but rather on the basis of their intake of starter. Some calves can be weaned at four weeks of age, whereas others may be up to 10 weeks of age. Calves can be weaned from milk either abruptly or gradually over three to seven days.

Feeding Calves Shortly after Weaning

After weaning, changes in the grain mix and group housing should be made one at a time, and changes should be made gradually over a two-week period. Heifers from two to four months of age should be grouped in small groups of four to six heifers. Calves need to stay in small groups for the first two months after weaning so that they can adjust to group feeding and to minimize competition among heifers for feed. Excellent quality hay should be fed to Holstein calves after they are consuming 5 to 6 pounds of grain daily (Jerseys need to consume 4 pounds of grain). Once the heifers are consuming their grain, the best quality hay needs to be allocated to these young heifers. Heifers should not be fed grain mixes containing urea or silages or pasture as the sole forage until after they are four months of age. Grain mixes fed from two to three months of age should contain 18% crude protein assuming early cut alfalfa/grass hay is fed containing 18% crude protein and 35% acid detergent fiber.

Management Practices

At birth, calves should be identified with an ear tag or tattoo and/or a sketch or photograph. Records should be kept to identify the birth date and at least the sire and dam of each heifer. Some farmers, besides recording this information in their record-keeping system, print this information on the ear tag itself.

At birth, calves can be given an oral vaccine to prevent scours. However, preference is to vaccinate the dry cow to provide the calf with the needed protection through consumption of the dam's colostrum. At two to three months of age, calves should be vaccinated for blackleg with a seven-way Clostridial vaccine.

When the horn button is visible, the calf can be dehorned easily with a gouge or electric dehorner. If caustic paste is used, take special caution to avoid getting paste on other parts of the body. Dehorning calves under one month of age is less stressful on the calf and is easier to accomplish than waiting until heifers get older.

Extra teats should be removed with sterile scissors when calves are vaccinated at four to six months. Make sure that the correct teat is removed. Tincture of iodine is swabbed on the area where the teat was removed, and the area needs to be checked daily for infection and to see that it is healing properly.

Mention or display of a trademark, proprietary product, or firm in text or figures does not constitute an endorsement and does not imply approval to the exclusion of other suitable products or firms.

Upcoming Events

March	April	May
4th-Beekeepers	1st-Beekeepers	6th-Beekeepers
2nd – Farmers Market Vendor Safety Training	6th-Appalachian Heritage Annual Seed Swap	9th-Master Gardener meeting
9th-MG Seed Starting Workshop	11th-MG meeting	18th-Master Gardener Garden in a Pot Workshop
14th-MG meeting	17th - Hosting D1 ANR	
16th- Shiitake Mushroom Workshop, Farmers Market Vendor Safety Training	24th-Hosting CAIP Training for Eastern Kentucky	
23rd-MG Grafting Class		
To be scheduled soon:		
Wine Cap Workshop	Home Based Processing	Queen Breeding Workshop

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