# TECHNICAL NOTE

USDA-Natural Resources Conservation Service
Boise, Idaho

TN PLANT MATERIALS NO. 40 February, 2001

# BIOLOGY, HISTORY, AND SUPPRESSION OF REED CANARYGRASS (*Phalaris arundinacea* L.)

Mark Stannard, Pullman PMC Team Leader
Wayne Crowder, Pullman PMC Asst. Mgr.

- **It is native to North America, Europe, Asia and Africa.**
- **Reed canarygrass is perennial, rhizomatous, and effectively excludes other vegetation.**
- **It is tremendously productive on moist soils and will sequester large amounts of soil nutrients.**
- **It has been in use as a pasture grass since the early 1800's in North America, and has been in use in the Pacific Northwest since the 1880's.**
- **It is a popular plant for pollution control of municipal & industrial waste water.**
- **Reed canarygrass does not tolerate ponded water, repeated tillage, repeated defoliation, or dense shade.**
- **Several herbicides will kill reed canarygrass but only one is labeled for use in wetlands.**
- **Much of its competitiveness resides in its ability to shade out competitors and in its stand persistence.**
- **Effective control integrates suppressing growth and filling the void to prevent reinfestation.**

# Biology

Reed canarygrass is a cool-season grass that primarily occurs across the northern tier states. It is native to North America, northern Europe, Mongolia, Japan, China, the former Soviet Union, northern Afghanistan, and even South Africa (Tsvelev 1983). David Douglas (1830's), David Lyall (1860), and the Fremont expedition (1844) either collected or documented the occurrence of reed canarygrass in the Pacific Northwest before 1860.
In the Pacific Northwest, it can be found from coastal estuaries to high mountain meadows along the west flank of the Rocky Mountains. It occurs primarily in lowland sites where water is not limiting. It will grow in uplands if competing vegetation is removed.

Hardinggrass (*Phalaris aquatica* L.) is a similar appearing species that occurs west of the Cascade Range. The seedhead is more compact and the rhizome spread is less pronounced (Wheeler 1950). Hardinggrass does not occur east of the Cascade Range because it lacks winter-hardiness. It is commonly grown in the southern USA as a winter forage.


Reed canarygrass seed is quite small, very dense, and resembles timothy seed because both are small, heavy, and naked. Fully sodded stands produce only 30-50 pounds seed/acre (Schoth 1938). Old stands tend to have a higher proportion of vegetative culms than reproductive culms. Seed heads are borne on long culms and seeds mature from the top of the head down. Fully ripe seeds are highly viable and shatter readily. Indeterminate maturation allows for a prolonged period of seed dispersal, which reduces seed predation. It also increases the chances of some seed being dispersed by an episodic event such as an animal brushing against a plant and some seed catching in its coat.

Rhizomes account for much of the localized spread of reed canarygrass. Rhizomes grow outwardly from a mother plant until the terminal bud develops a shoot (Evans and Ely 1941). This is unlike quackgrass, which develops shoots all along the rhizome axis. This allows reed canarygrass to rapidly expand its local territory and a single rhizome or stem can infest an entire drainage.

Reed canarygrass culms are also capable of rooting and establishing stands (Hovin et al. 1973). Hovin and his coworkers reported that the nodes of reed canarygrass culms become meristematically active once the panicles are removed, and stage of development of the panicle affected the percent survival of the new plants. Pre-anthesis culms rooted poorly while culms from post-anthesis plants rooted better. Bank erosion and transport of culms allows for yet another means of establishing plants along a watercourse.

Seed, on the other hand serves several functions; it provides for long distance dispersal, exchanges genetic information, creates multiple genotypes, and persists for long periods. Multiple genotypes increase the chances that a particular genotype will flourish and spread in harsh environments (Morrison and Molofsky 1998). Seeds can remain viable in the soil for at least several months, and seed will retain very high viability for ten or more years in climate controlled storage (D. Stout, pers. comm.).

Seeds require several days at cool temperatures for a high percentage of the seeds to germinate. The rate and amount of germination is typical for most cool season pasture grasses, but pales in comparison to many annual weeds. For comparison, yellow starthistle and cheatgrass can achieve 75% germination within 2 days. Seedling development of reed canarygrass is similar to other cool season pasture grasses. The seedlings lack vigor and are very sensitive to competition. Morrison and Molofsky (1998, 1999) reported that reed canarygrass seedlings were more sensitive to interspecific competition then they were to decreased water availability.

Growth of reed canarygrass begins early in the spring, senescence occurs with summer drought, and limited vegetative growth resumes in the fall if moisture is available.

Sprouts will frequently be seen growing in ephemeral ponded water in the spring. Carbohydrate reserves stored in the rhizomes fuel the growth of these sprouts (Hovin et al. 1973). The roots are not contributing to the growth in this situation because the ponding causes an anaerobic condition. If the water remains on the stand for a prolonged period the roots will eventually die because the reducing environment will not only deprive roots of oxygen but will also remove oxygen from the roots.

The culms are very tall and individual leaves grow from nodes along the culm. The leaves of the lower culm become light deprived as the plant grows and are replaced with new leaves higher up the culm. If the stand is cut, new leaves will sprout from either rhizomes or from exposed nodes on the shortened culm.

Biomass production is exceedingly high (as high as 9 tons/acre) but it requires a tremendous amount of nutrients to sustain this growth. Riparian soils tend to be very rich in nutrients, allowing reed canarygrass to thrive. Limiting its growth by removing nutrients has not been practical on a field scale. Indeed, there are stands that are hayed every year and a large amount of nutrients subsequently removed, and yet these stands continue to proliferate for decades.

Reed canarygrass is very competitive once established and will frequently develop a solid monoculture. Tall growth enables reed canarygrass to compete with other herbaceous species by depriving them of light. Native herbaceous species that initiate growth late in the spring are especially impacted by reed canarygrass.

Reed canarygrass is a classic weed in many environments but in environments subject to frequent & severe disturbances it has some value. It persists very well in spite of grazing. The grazing period lasts nine months west of the Cascades (Wheeler 1950). Few if any grasses can tolerate grazing pressure this long. It also withstands grazing periods as frequent as 2 weeks between rests with little detrimental effects.

It withstands annual burning and spring flooding very well. It also tolerates heavy applications of wastes. It is ecologically "stable state". The up-side -- it is not very prone to give way to noxious weeds.
The down-side -- natural transition to a higher seral "more native" state is unlikely.

# History

The first reference of reed canarygrass occurred in a thesis written in 1749. Hesselgren, a student of Linnaeus, undertook a livestock feeding study of over 600 Swedish plants and reported that reed canarygrass was one of the most preferred species. Reed canarygrass cultivation was documented in England in 1824 and in Germany in 1850 (Schoth 1938).

Much of the initial use of reed canarygrass in North America was centered along the Atlantic seaboard states and much of the germplasm was initially local native seed. The New England Farmer in 1834 reported trials of ribbongrass, a variegated-leaf biotype of reed canarygrass by Connecticut and New Hampshire farmers. Approximately 20 years later, native reed canarygrass stands were commonly managed for livestock forage.

The demand for seed in North America eventually exceeded what could be practically hand stripped from native stands. The European seed companies exported seed to North America until about 1924. The first documented seed production of Reed canarygrass in the West occurred in 1885 in the Coquille Valley of Oregon (Schoth 1938). The literature suggests that the seed used for making this planting was probably local stock. Schoth (1938) stated that most of the reed canarygrass grown in the Pacific Northwest could be traced to the Coquille Valley seed.

The first registered variety of reed canarygrass was 'Ioreed'. It was released in 1946 by the Iowa Agricultural Experiment Station with the Soil Conservation Service participating in the release. 'Ioreed' was a 10-clone synthetic comprised of 86% North American germplasm and 14% German germplasm. Certified seed of 'Ioreed' is no longer available.

Six additional reed canarygrass varieties are listed in USDA Handbook 170 "Grass Varieties in the United States" (1994). Three are Canadian varieties, two are varieties developed by Land O'Lakes Inc., and the remaining variety, 'Vantage,' is a 1972 release from the

Iowa Agriculture and Home Economics Experiment Station.

Use of reed canarygrass in the Pacific Northwest basically began at the turn of the century. Farming commonly followed logging operations and reed canarygrass was frequently used as the "breaking in" crop (Wheeler 1950). Stumps & logging debris and clearing operations left the land unsuitable for planting crops such as small grains. Reed canarygrass was planted in these areas to allow time for the stumps and debris to degrade and be more easily removed at a later date.

Reed canarygrass popularity in the Pacific Northwest was a composite of many factors. It is an extremely productive grass. Reports of production far exceeding other grasses are common in the early literature. It is very easy to establish and it persists very well. Most plantings occurred during a period of history when farms were more self-reliant. Livestock were pastured on the farm, and hay was grown on the farm rather than purchased from hay brokers. It was a reliable, productive forage.

A second wave of interest in reed canarygrass occurred when wastewater management became an important issue. Reed canarygrass has the ability to respond exceedingly well to applied nutrients and one study showed a yield response to levels as high as 920 pounds N/acre (Schmitt et al. 1999). Zeiders (1976) reported, "*reed canarygrass is the most popular species for irrigation with wastewater from municipal and industrial sources as a pollution control measure*".

The most recent wave of interest in reed canarygrass is occurring in Europe. Reed canarygrass is being cultivated in northern Europe as a biofuel and about 10,000 acres are in production in Scandinavia (Kätterer et al (1998).

It is a plant with many uses. Unfortunately, reed canarygrass has proven to be too aggressive in the Pacific Northwest. It moves out of pastureland and into stream bottoms, wetlands, and canal banks. It persists in areas where it is not desirable and is the bane of wetland restorationists.

# Suppression & Revegetation

Several methods are effective in suppressing reed canarygrass. The method used in any particular site will be dependent on available funds, personnel, equipment and landowner choices/objectives. Complete eradication is frequently impractical. The site should be revegetated in some manner to adequately treat erosion problems inherent in these sites and slow reinvasion. Revegetation should be done with the objective of providing plants that are well adapted and suppress the spread and growth of reed canarygrass to an acceptable level. This process may take several years, depending on methods selected, and requires follow-up treatments in most cases.

**Tillage** Reed canarygrass can be eliminated with tillage, as can most perennial rhizomatous grasses. Most rhizomes are in the upper 6 - 8 inches of the soil. Tillage kills top growth so eventually below ground energy reserves are exhausted. Several tillage operations at about 2-week intervals are required.

Advantages: Tillage is relatively cost effective. The results are evident within a few days. Tillage also serves to create a more desirable seedbed for reseeding.

Disadvantages: Physical access to the site may be reduced by flooding, and wet soils, and tillage may not be a viable option. Soil is left unprotected increasing erosion potential until the site is revegetated. Riparian areas are particularly vulnerable to erosion following tillage due to potential stream flooding events.

**Flooding** Reed canarygrass can withstand periodic flooding quite well, especially flowing water. It does not withstand continual ponding, especially during warmer weather. Once reed canarygrass vegetation is killed, the site must be revegetated.

Advantages: Ponding frequently creates and/or improves wetland habitat. Remnant wetland plants should respond and colonize the site and may reduce the need to revegetate.

Disadvantages: Any attempt to eliminate reed canarygrass by flooding will require that water levels be controlled artificially. Ponding water in riparian areas is frequently not feasible. It may be too costly and securing permits to alter a stream may be impossible.

**Chemical** The States of Idaho, Oregon and Washington currently have only one approved herbicide, Rodeo$^{tm}$ (glyphosate), for emersed, marginal and bank weeds in aquatic environments (ponded or flowing water) where fish are a concern. This chemical must be used with a state approved surfactant to be effective. An application approval permit may be required from the appropriate state regulatory agency. Check label instructions for application requirements. The chemical is effective on reed canarygrass however, follow-up treatment may be required. Also, a pesticide applicator's license for aquatic application may be required. All applicable rules, regulations, etc., pertaining to pesticides must be followed.

The application should be made uniformly to the foliage. This can be problematic if done at flowering or just before flowering because reed canarygrass can reach 7 feet in height. Earlier application around boot or late

boot stage may be more practical for spray coverage of the foliage by equipment. (See label recommendations for timing of application).

Other chemicals may be appropriate, depending on the site. See the current Pacific Northwest Weed Control Handbook that is available through the Cooperative Extension Service.

NRCS staff in several field offices observed good control of reed canarygrass with applications of Rodeo[tm] applied in the spring. Spring applications can aggravate other weed problems. Summer weeds such as Canada thistle that are suppressed by reed canarygrass may be released and cause a weed shift. Vegetation managers with the South Columbia Basin Irrigation District in Pasco, WA typically apply Rodeo[tm] when the grass is actively growing for good control. They reported that applications made at full growth were ineffective and very early spring applications amounted to nothing more then a "chemical mow". Rates needed to be increased with height and good coverage was paramount. Rope wick applicators failed to provide the coverage needed. The Pullman PMC conducted an applicator trial with glyphosate and acquired similar results.

Advantages: Herbicides applications are relatively inexpensive. Revegetation is more successful because competition is controlled. Properly applied herbicides will provide excellent control of reed canarygrass.

Disadvantages: Most of the effective herbicides on reed canarygrass are nonselective thus necessitating revegetation. Timing of applications is critical and may coincide with other important activities. Public perception is frequently not supportive of pesticide applications. Improper selection of a herbicide may interfere with revegetation.

**Defoliation (mowing, grazing)** The strategy ideally depletes much of the carbohydrate root reserve. Mowing should occur when large amounts of above ground biomass are produced, but before transfer from above ground parts is made to the roots. Usually this timing is at or near flowering. Depletion of carbohydrate reserves in the rhizomes inhibits active growth of rhizomes and forces translocation of resources to develop new tillers for photosynthesis. The plant will respond by producing more shoots. Mowing should be done when stubble height is at 4 inches or less if possible, so the active growing points are removed and the plant is forced to develop new ones.

Reed canarygrass is a pasture grass, but some grazing practices can negatively affect it. Early-season heavy grazing will continually remove photosynthetic leaves but this practice can aggravate water quality problems. The fields will be wet and the livestock will generate a lot of mud. Livestock are not effective at controlling reed canarygrass when the plants get large. The stems are too coarse and the plants may have accumulated alkaloids that will deter grazing.

Several field offices have experimented with weed whacking. Whacking reduced shading but the results were short-lived, and the practice did little to curb rodent predation on shrub transplants.
Mowing in conjunction with shading or herbicide treatment may produce more favorable results than mowing alone. Follow-up treatment will be needed.

Advantages: Defoliation is easy to gauge and animal numbers and/or mowing severity can be altered. Desirable plants may be released from the shading effect of reed canarygrass. Producer might realize some profit by grazing reed canarygrass with livestock.

Disadvantages: Many areas where reed canarygrass grows are not suitable for mowing or haying equipment. Livestock grazing requires fencing and management to prevent undesirable impacts such as bank trampling. The effect can be short-lived if the practice is not repeated frequently enough and complete control via grazing is unattainable. Undesirable vegetation such as water hemlock may be released by grazing.

**Shading** Reed canarygrass is susceptible to shading. Shade requirements for suppression are usually 41% or greater shade. Forman (1998) found that 41%, 51% and 81% shade produced significant reduction in total biomass (tops + roots) when compared to no shade. The above-ground biomass was not significantly affected by shading, but the below-ground biomass was significantly reduced by 41%, 51% and 81% shade.

Shade may be provided by natural means (shrubs, trees, etc.) or by artificial means. Deciduous trees and shrubs are less able to limit light early and late in the season. Evergreens are more effective at limiting light throughout the year, but few species are adapted to wetland environments. Artificial methods include mulching with bark, weed barrier, black plastic, etc. These methods have drawbacks. Mulching will not necessarily keep rhizomes from increasing and spreading. Black plastic breaks down and is susceptible to rhizomes growing up through the material. Weed barrier is superior to black plastic because it resists UV breakdown and rhizomes find it difficult to penetrate. These materials are more effective when used in conjunction with woody vegetation plantings.

Several offices have utilized various barriers to control reed canarygrass. Cloth barriers proved ineffective because the old vegetation made it difficult to place the barrier on the surface. Heavy barrier mats have proved more effective because their weight overcame the difficulty with the old vegetation.

Advantages: Little equipment is required. The control can be targeted to very small areas. Materials are readily available and little expertise is required to install shade materials. There are several barrier products that have very low photodecomposition rates. Revegetation via transplants is easily accommodated because the barriers can be fit around the plants.

Disadvantages: Large areas can not be treated due to cost. Light barriers like shade cloth are not permanent and may break down before the reed canarygrass is fully controlled. Barriers provide refugia for rodents that feed on transplants. Rodent baits may be needed to reduce predation.

**Burning** in many areas requires a permit. Burning in Reed canarygrass can be done in some areas in early spring before much green growth is apparent. Many areas such as ditch banks and irrigation canals are burned annually in the spring by landowners and irrigation districts. Reed canarygrass is still present in those areas.

Advantages: In practicality, the main benefit from burning is removal of residue. Follow-up treatments such as herbicide application and shrub/tree establishment can then be done more efficiently. Burning is very inexpensive. Burning may open up the canopy and release suppressed native plants such as sedges.

Disadvantages: Other treatments in addition to burning will be required for control or suppression. Wet meadows present a special problem because spring snow melt runoff, subsequent flooding and ability of reed canarygrass to produce early green growth all hinder spring burning. Fall burning may be hazardous because the fire can spread to surrounding slopes. Heavy dew, slow drying, and regrowth frequently make late fall burning ineffective. Burning permits may be required and difficult to obtain.

**Competition** Light is an important limiting factor so competing vegetation should reduce the amount of light available to reed canarygrass. Plants that limit light will be taller then reed canarygrass. Species that develop foliage earlier in the spring will be superior competitors because reed canarygrass makes much of its growth in mid-spring. Dense shrubs, deciduous trees and evergreens are good candidates for decreasing light availability for reed canarygrass. For instance, one study reported that reed canarygrass gives way to willow, chokecherry and Redosier dogwood (Harrison et al. 1990). Another study reported that reed canarygrass successfully invaded and dominated shaded upland oak savanna sites in Wisconsin (Henderson 1991). Oak begins growth later in the season than other woody plants, allowing reed canarygrass time to grow prior to oak leaf out.

Plants that establish fast and regrow rapidly after cutting can be good competitors. Sheaffer et al. (1990) and others have shown that reed canarygrass stands deteriorate in alfalfa mixtures if the field is clipped too frequently. The Pullman PMC has observed that reed canarygrass is being replaced by creeping foxtail in a field that is hayed each summer. The July haying operation removes all of the photosynthetic tissues of the reed canarygrass. However Creeping foxtail still maintains some photosynthetic leaves after haying. This probably explains why it is encroaching on the reed canarygrass.

Advantages: Reed canarygrass is controlled and replaced thus filling the void before weeds fill the niche. Plant succession can be 'steered'. The process should require less human input.

Disadvantages: Competition is never absolute. The time needed may extend beyond the timeframe desired. The competing vegetation and/or succeeding vegetation may become undesirable.

**Biocontrol** Reed canarygrass is suppressed by several pathogens. For example, *Helminthasporium* can cause severe damage but it also causes damage to orchardgrass and tufted hairgrass, an important native wetland grass (Zeiders 1976). The likelihood of the development a biocontrol agent specific for reed canarygrass is very low.

Advantages: Biocontrol can be very cost effective. Biocontrols tend to persist and provide control for many years. Biocontrol agents spread beyond their introduction sites.

Disadvantages: Development of a biocontrol agent takes many years and can be very expensive. Biocontrol agents must be very host specific. Biocontrol does not eradicate its host. Biocontrol agents are effected by the environment and climatic/cultural conditions may inhibit their efficacy.

**Scalping** In theory, scalping the top 12" of soil will remove the rhizomes and culms. To be most effective, the operator of the equipment must do an extremely thorough job of scalping the soil and not spill the load when emptying the soil into the dumpsite. This practice is being used in western and southeastern Washington with good short-term results. Reinvasion is almost certain if the scalped area is not revegetated with species that will effectively exclude reed canarygrass or covered with a good weed barrier mat. Planting rooted woody materials while more costly then sprigging unrooted poles and whips, greatly increases the odds of establishment. Failed plantings simply allow undesirable vegetation (such as reed canarygrass) to fill the void and complicate future revegetation efforts.

Advantages: Scalping can be accomplished with a variety of implements. Seed, culms and rhizomes of reed canarygrass can be completely removed from a scalped area. Scalping can shape and/or smooth the site and make it easier for reseeding and transplanting operations. Banks can be reshaped with most scalping equipment. Other undesirable vegetation can be removed at the same time.

Disadvantages: Scalped areas must be revegetated. A skilled operator is needed. The spoil material must be dealt with. Scalping can remove much of the topsoil. Permits may be needed and difficult to obtain. Scalping leaves the soil bare and prone to erosion.

**Combination Treatments** Combining treatments is the most effective means of controlling reed canarygrass because the effects are cumulative.

Forman (1998) found that 41% shading in combination with two mowings at about 1 inch stubble height significantly reduced reed canarygrass total biomass production (greenhouse study). This practice severely depletes carbohydrate reserves and limits the amount of photosynthetic area.

Kilbride (1999) found that spring application of Glyphosate (Roundup) followed by fall disking had the most effect on reed canarygrass stem densities in southwest Washington.

Grazing, if under strict control, can be effective in reducing reed canarygrass competition while shrubs and trees are establishing. The grazing must be done while reed canarygrass is palatable (during vegetative growth stage) to the grazing animals (cattle). Grazing should be done before the plants become stemmy because as the grass plants become less palatable to livestock, they will move over to the green shrub growth. Mechanical damage to shrubs and trees must be prevented and considered when planning grazing activity.

Irrigation Canal Managers report that spraying followed by reseeding with tall fescue will suppress reed canarygrass for 5 years before they have to repeat the operation. They have observed that purple loosestrife as well as other highly undesirable weeds will occupy sprayed areas if not effectively revegetated.

# References

Always, F. 1931. “Early trials and use of reed canarygrass as a forage plant.” J. Am. Soc. Agron. 23:64-66.

Evans, M.W. and J.E. Ely. 1941. “Growth habits of reed canarygrass.” J. Am. Soc. Agron. 33:1017-1027.

Forman, D. 1998. “The effects of shade and defoliation on reed canarygrass (Phalaris arundinacea L.) biomass

production: a greenhouse study." Washington State University, M.S. Thesis, Pullman, WA.

Hovin, A.W., B.E. Beck, G.C. Marten. 1973. "Propagation of Reed Canarygrass (*Phalaris arundinacea* L.) from Culm Segments." Crop Sci. 13:747-749.

Kätterer, T., O. Andrén, R. Pettersson. 1998. "Growth and nitrogen dynamics of reed canarygrass (*Phalaris arundinacea* L.) subjected to daily fertilization and irrigation in the field." Field Crops Res. 55:153-164.

Kilbride, K.M. and Paveglio. 1999. "Integrated pest management to control reed canarygrass in seasonal wetlands of southwestern Washington." Wildl. Soc. Bull. 27:292-297.

Morrison, S.L. and J. Molofsky. 1998. "Effects of genotypes, soil moisture, and competition on the growth of an invasive grass, *Phalaris arundinacea* (reed canarygrass)." Can. J. Bot. 76:1939-1946.

Morrison, S.L. and J. Molofsky. 1999. "Environmental and genetic effects on the early survival and growth of the invasive grass *Phalaris arundinacea*." Can. J. Bot. 77:1447-1453.

Pacific Northwest Weed Control Handbook. 2000. Cooperative Extension Services of Idaho, Oregon, and Washington.

Schmitt, M.A., M.P. Russelle, G.W. Randall, C.C. Sheaffer, L.J. Greub, P.D. Clayton. 1999. "Effect of rate, timing and placement of liquid dairy manure on reed canarygrass yield." J. Prod. Agric. 12:239-242.

Schoth, H.A. 1938. Reed Canarygrass. USDA Farmers' Bulletin 1602. 11pp.

Sheaffer, C.C., D.W. Miller, G.C. Marten. 1990. "Grass dominance and moisture yield and quality in perennial grass-alfalfa mixtures." J. Prod. Agric. 3:480-485.

Stout, D. Curator, USDA ARS West Region Plant Introduction Station, Pullman, WA.

Tsvelev, N. N. 1983. Grasses of the Soviet Union, Part 1. Publ.; Oxonian Press Pvt. Ltd., New Delhi

Wheeler, W.A. 1950. Forage and Pasture Crops: a handbook of information about the grasses and legumes grown for forage in the United States. Publ.; D, Van Nostrand Co., NY

Zeiders, K.E. 1976. A new disease of reed canarygrass caused by Helminasporium catenarium. Plant Disease Reporter 60:556-568.

Photo Credits:
"Purdue Forage Information"
http://www.agry.purdue.edu/ext/forages/publications/grasses/reed-canry.htm

"The Nature Conservancy"
http://tncweeds.ucdavis.edu/photos/phaar04.jpg

The use of Product names in this document are for simplicity and information, and does not imply endorsement by the NRCS over other equivalent materials. -MES