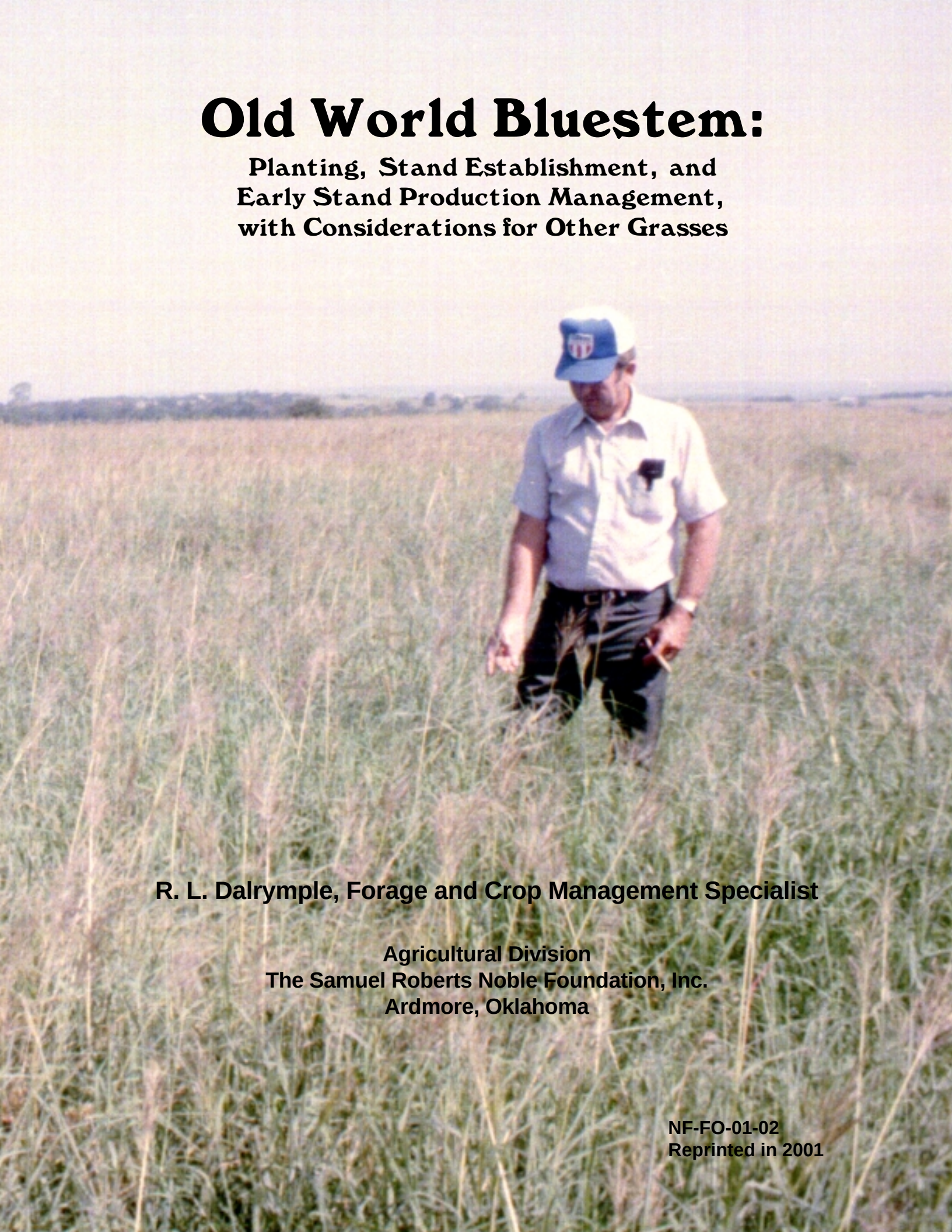
Old World Bluestem:

Planting, Stand Establishment, and Early Stand Production Management, with Considerations for Other Grasses



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Cover Illustration

This first-year ‘Caucasian’ bluestem was planted, established, and managed according to the upper-level integrated management presented in this publication. The management in this shallow upland planting included climate and soil considerations, early and deep initial seedbed preparation, excellent final seedbed preparation, early-season planting, 10-inch rows with a nitrogen-phosphorus fertilizer banded with the seed, row pressing with the planter press wheel, nitrogen top-dressing after stand emergence, weed control with herbicides, and proper early stand use. The first hay-harvest stage is essentially perfect as shown in this picture. This planting yielded 1.5 tons of hay per acre in its first-season July harvest and a recovery production of about 1.5 tons per acre that was grazed by cows as standing winter roughage (hay). Total first-year production was about 3 tons per acre. Because of the overall health and vigor of the first-year stand, second-year growth was early, fast, and overall very productive.

Acknowledgments

It is well accepted that nothing is done totally alone. I wish first to thank the Noble Foundation administration for their support in permitting much of the work to be done in the field and encouraging it to be summarized in this writing.

Special thanks for their valuable critique is due the peer reviewers: Wadell Altom, Bill Dahl, Chet Dewald, Charles Griffith, B. J. Hankins, Wilfred McMurphy, John Merrill, Ronald Mitchell, and Mark Moseley. Thanks to Robert Gillen, George Hedger, M. K. Patterson, Jerold Rogers, and Harold Shappell for doing the final reading.

Becky Kittrell did excellent word processing. I am grateful to her and all Noble Foundation print shop personnel for their help.

Contents

Preface

The Old World bluestems have been in the New World (United States) since the 1920s and 1930s. More modern varieties have become available during the 1970s and 1980s. These grasses always have been considered successful, but it has been guesstimated that over the decades, up to 50 percent of plantings have resulted in some degree of failure. It does not have to be that way.

The goal of this publication was to compile several decades' worth of practical experience (success and failure), controlled demonstrations, and technical research on the subjects. Part of the goal was to present the information so that the wide range of interrelated subjects was adequately comprehensive. This bulletin was not intended to be casual, fun, summarized, Sunday afternoon reading. It is technical, yet practical and useful, so the reader can find answers, with reasons, for the many questions encountered. The information has been prepared with all practicing grassland managers in mind: the farm and ranch grass producer, consultant, academic professor, and technical researcher.

I placed major emphasis on the Old World bluestems because of the intensity of producer acceptance of the grasses coupled with the great range of geographic areas they can be grown in. These grasses are among the primary grasses planted in Oklahoma and Texas, and they are adapted to many other states and countries.

The basic principles presented also apply to numerous other warm-season grasses: crabgrass, native range grasses, kleingrass, weeping lovegrass, and possibly seeded bermudagrass.

It is important to accept that the categories of information presented are interrelated and synergistic as we go from planting considerations onward to developed production. Additional study material is listed in the references.

Synopsis

The following is a summary of major inputs for upper-level management for planting, stand establishment, and early stand production of the Old World bluestems. Additional information on the inputs for the individual items is in the text.

1. Select the proper soil site where the grasses are well adapted.
2. Plant varieties adapted to the climate, soil, and management level.
3. Prepare an excellent, fresh, firm, smooth, weed-free seedbed, or use proper no-till or tread-in methods to plant. The method depends on the planting goals.
4. Plant about 2 pounds of pure live seed per acre.
5. Plant soon after the last spring-frost date.
6. Plant shallowly so the soil coverage of the seed will be less than 1/2 inch after the first rains.
7. Perform a soil test and apply potassium, phosphorus, and lime as needed according to recommendations and production goals. Band a nitrogen-phosphorus fertilizer with the seed in rows at planting. If soil phosphorus levels are severely inadequate, you can preplant-incorporate additional amounts to help correct the deficiency. You can also apply additional phosphorus and potassium as a top-dressing after stand emergence. If lime is needed, apply it preplant incorporated.
8. Use planter press wheels to firm the seed-fertilizer row, or pack the entire area with a tractor or other acceptable packer after planting if you don't use planter press wheels. Don't pack no-till plantings.
9. Control weeds by proper seedbed preparation, herbicide application, grazing, or mowing.
10. Top-dress with 33.5-0-0 or another acceptable nitrogen source after stand emergence.
11. Hay or graze during the first summer if adequate growth is present by July or early August. Always graze the first-year growth during the first winter after a hard freeze.
12. Control insects if needed.
13. Consider applying water in the row with the seed at planting time.
14. Consider treating the seed with a fungicide.

If upper-level establishment and early production are not the goal, the manager must decide what to eliminate. All inputs have an important function. Which of the first ten will not be used?

Introduction

Old World bluestems I discuss include the following varieties: Caucasian, Ganada, King Ranch, Plains, PMT-587, WW Ironmaster, WW Spar, and WW BDahl. There may be some differences in establishment and first-year production responses between varieties, but otherwise, these varieties are planted and managed by using the same procedures.

This is a summary of the planting, stand establishment, and early stand production management of Old World bluestems as based on research, experiences, and other information. The success of establishment and early stand production dictates much of the success of future uses of the planting. This information is intended to serve as a guide through good early stand production. Additional information is available in other publications (Ahring et al., 1978; Rommann, 1973; Sims and Dewald, 1982).

Adaptation Considerations

All of the varieties above except 'PMT-587' and 'WW BDahl', which are relegated to central and south Texas, are adapted to all or part of Oklahoma and much of Texas. 'King Ranch' bluestem is well adapted to south central and southwestern Oklahoma and points south. All other varieties have a wide adaptation range throughout Oklahoma and into Texas, with the possible exception of some Panhandle regions. Adaptation of the other varieties extends into New Mexico, Colorado, and numerous states in the eastern United States. 'Caucasian' does well in Arkansas and Missouri.

Old World bluestems grow on a wide range of soils. They are best adapted to finer-textured soils such as loams, clay loams, and silt loams. They will grow acceptably well on good sandy loam soils.

Old World bluestems planted on sandy versus finer-textured soils often require one or two seasons longer to establish and become productive, and they often need more weed control. The stand will be less dense and productive also.

Some other comments are in order. 'Plains' bluestem grows well in oil field slush-pit sites, roadsides, power line right-of-ways, pond dikes, and other critical areas (figure1). 'WW Ironmaster' is adapted to the high pH iron-chlorosis-inducing soils of western Oklahoma and Texas and eastern New Mexico. It can produce on many high-pH soils. 'Plains' and 'WW Spar' have sometimes grown well in western Texas on soils with a pH of 8.0 (Bill Dahl, personal communication). 'WW Spar' tends to stay green and produce longer into droughty weather.

Figure 1. A steep-sloped critical area established to Old World bluestem by covering the soil surface with seed hay

Old World bluestems perform poorly or fail on soils that are extremely sandy (sugar sand or blow sand), alkaline, or saline; that do not have a shallow finer-textured subsoil; that are wetlands with long-term supersaturation; that are inclined to produce severe iron chlorosis; and that have a pH of 7.5 or higher. Some varieties have more tolerance to high soil pH.

What Are the Goals?

The goal of a grass planting influences the inputs in planting, stand establishment, and early stand management. Your level of input determines whether you get a stand with no useful early stand production, a low level of potentially useful early production, or excellent early production with a goal of good, upper-level, useful production the first year or as early as feasible. The most economical forage produced per ton in the early years is usually from the better methods that yield well.

In southern Oklahoma, 'Caucasian' bluestem, 'Plains' bluestem, and weeping lovegrass can produce 3 to 5 tons of dry forage per acre the first year if managers use integrated planting and management inputs. Other varieties can likely do the same. Not all regions encourage early yields, and neither do all plantings in any region always achieve those early yields. Climatic or other factors will affect success, but experience shows that the relative establishment and higher yield will be progressively better from managed site, adaptation, and seedbed preparation.

Higher early stand yield equals higher subsequent yields. Manage your resources to achieve whatever establishment and early production goal you desire.

Establishment or Production Management?

The establishment phase of Old World bluestem includes site selection, type of seedbed, planting procedure, plant development, and perennial-grass plant stage. At the perennial stage, first-year or early stand management generally switches to management for improved and maintained stands or forage yield and use.

Management during the establishment phase and early stand production management are similar and complementary. The procedures are integrated management. Why go through the establishment phase and then let weed growth, plant starvation, or misuse damage or eliminate stands and production potential?

Plant Development

Knowledge of the growth stage of the Old World bluestem seedling or young perennial plant is important because it helps the manager determine whether to apply other management practices.

To help make some management points, let's take a plant physiology–morphology short course. Old World bluestem seed germinates to produce a seedling that grows from a one- to a four-leaf seedling supported by about three primary and seminal threadlike roots. These first roots are born from the cells of the seed, not the seedling plant. During this young stage, the Old World bluestem seedling is essentially an *annual* plant. Often during this stage many seedlings die because of the ravages of hot dry winds, drought, disease, stock trampling, vehicle traffic, and weedy plant competition. With the tincture of time and under favorable conditions that include adequate precipitation and plant nutrition, sunlight energy, and the absence of abundant weed competition, the small four-leaf seedling will be transformed into a first tiller (stool) plant with the first stage of secondary (permanent) root systems (figure 2). Under good conditions, this transformation occurs about two weeks after emergence. The fifth leaf is essentially the first tiller. Tillering and secondary root development occur simultaneously. It is at the tillering stage and simultaneous secondary root development stage that the young Old World bluestem plant becomes a perennial grass plant. The more it tillers and the larger the root system grows, the stronger the young perennial plant will be and the better it will respond to production inputs.

Figure 2. The early tillering stage of Old World bluestem at which establishment is usually achieved, secondary root system production is initiated, and production management inputs begin

Drought, inadequate plant nutrition, and severe weed competition force the plant to remain in a weak seedling stage longer. It can die. The better the growth factors, the quicker the plant changes to a tillered, secondary, rooted plant. In addition, the tillers will become more numerous and the secondary root system will be larger.

At the young perennial stage, much early production management of postemergence weed control and plant nutrition takes place. Later, after forage has adequately accumulated, grazing or haying can be started. Use the above information and figure 2 to make management inputs more understandable.

Planting Principles

You must use agronomic principles of small-seed planting to ensure a relatively high degree of success, whether you use precision rowing equipment, broadcast methods, or tread-in techniques.

1. The seed must touch the soil. Planting on trash or in air space between clods is a waste.
2. The soil under and around the seed should be firm. The soil should *not* be packed hard. It is best if the soil above the seed is a little less firm than that below the seed after it is covered. There should be very little air space around the seed compared with that in a loose, fluffy seedbed.
3. The seed should be lightly covered with soil, but about 1/2 inch of covering may not occur until after rains following planting because, in most planting procedures, rain does the final covering. Establishment is inefficient from seeds on the soil surface, especially on a rain-packed soil, but if climatic conditions are excellent, such seed can establish plants.
4. You must control weeds and supply plant nutrition as needed to meet establishment and production goals.

The Old World bluestems have been planted and useful stands achieved from an incredible range of methods, from so-called slobbered-in plantings to the very best river bottomland alfalfa-planting procedures. Acceptable stands have been achieved through several poor methods of simply broadcasting seed on a rain-packed trampled area, grinding hay and spreading it, using seed hay (figure 1), scuffing the soil surface with a disk and broadcasting and treading in the seed (figure 3), or spreading feed hay containing seed (figure 4). Although it cannot be denied that these methods have produced stands, by far the greatest consistency and highest degree of good stands and useful production come from employing the above principles and using good, precise planting procedures, whether clean seedbeds or some form of good no-till plantings (figure 5). The ability of the Old World bluestems to develop stands under adverse conditions and when methods are poor to good is an attribute. However, one must understand that using poor methods is a high risk in a high-cost operation. There are exceptions to the rule, but do not be overly impressed with successes of weird or unproven methods and construe that they are the way to plant Old World bluestems. In the long run, the precise methods are most often the best.

Planting Equipment

Old World bluestem is normally available as chaffy, fluffy seed (hereafter called chaffy seed; figure 6). A few seed processors can process the seed into a naked caryopsis (seed). Because of the uniqueness of the clean but chaffy Old World bluestem seed, special equipment is needed to plant it; otherwise, it can be altered with a bulk material to allow planting with ordinary farm planters.

Special equipment to plant these chaffy or small-seeded grasses often is not readily available. A list of equipment that has been used to plant chaffy Old World bluestem seed alone, in various bulk mixtures, or as naked caryopsis follows:

1. Planting chaffy seed without adding bulk to the seed
    a. Nesbit (San Angelo, Texas), Horizon (now Miller Grass Drill), Crust Buster (Spearville, Kansas), Miller Grass Drill (Hereford, Texas), Truax drills (Minneapolis, Minnesota), and other specially constructed grass drills. These can row plant.

Figure 3. A thin but developing stand of 'Plains' bluestem in a poor to fair native range planted by lightly scuffing the soil surface with a single gang disk, broadcasting the seed, and treading it in during grazing

Figure 4. Islands of 'Plains' bluestem colonies (light areas) established by winter-feeding small square bales on the ground in good native range. The Old World bluestem stand continues to spread.

Figure 5. Second-year production of 'Plains' bluestem planted no-till in paraquat-herbicide-killed small-grain residue in Custer County, Oklahoma (left), and a first summer tread-in stand in grazed-out small grains in southern Oklahoma (right)

b. The Grasslander Seeder (Hennessey, Oklahoma), the L and A Broadcaster (Okeene, Oklahoma), and the Woodward Chaffy Grass Seeder (Woodward, Oklahoma). These private-brand planters broadcast the seed.
c. Tye drill (Lockney, Texas) with a bluestem grass-seed hopper
d. Ezy-Flo and similar old drill-box fertilizer spreaders. These work very well.
e. Brillion seeder with the bromegrass seed box
f. Homemade Natural Resources Conservation Service cottonseed box planter adapted for grass planting
g. Homemade planter with picker-wheel seed feeds
h. Chaffy seed in the grain hopper. One rancher planted 'Plains' bluestem with a John Deere grain drill by putting small amounts of seed in the hopper and poking it into the feeds with a stick as drilling was done. It worked!
i. Mist sprayer. Another farmer rode a mist sprayer and hand-dropped seed into the air-blast stream to broadcast it over the prepared seedbed. Where there's a will, there's a way.

Vast acreages have been planted by using common equipment with the seed modified by adding bulk and weight, especially with a starter fertilizer (figure 7). Nitrogen-phosphorus fertilizer has little effect on seed germination in the short-term mix or with chaffy seed (figure 8). It is important to read the fertilizer use information. Clean fertilizer from equipment thoroughly and oil boxes after use. Some producers have used sawdust, cracked grain, soybean meal, or other dry bulk in this planting method. Much of this equipment allows banding of the seed and starter fertilizer in a row.

2. Planting chaffy seed and fertilizer mixtures or other mixtures to add bulk
   a. John Deere FB-B and LZ-B drills and other brands of grain drills with a fertilizer box that will distribute the mix. Old-style fertilizer boxes with metal agitator feeds work best. Plastic-feed fertilizer boxes do not work as well, but you can use them by mixing and planting small batches with the aid of a drill rider to stir the seed and assist the drill.
   b. Any grain drill when you plant from the grain box, which tends to work quite well. Drills with fluted metal seed feeds are best. Some plastic feeds may wear rapidly.
   c. Pneumatic fertilizer spreaders (broadcast plantings)
   d. Ezy-Flo and similar drill-box fertilizer spreaders, which can be managed to plant in a seed-fertilizer banded row that is somewhat wider than usual by eliminating the flap below the holes, if one is present, and allowing the seed-fertilizer mix to drop directly onto the soil surface
   e. Brillion seeder through the bromegrass seedbox
   f. Rotary fertilizer spreaders. Control the swath width to fit the grass-seed spread, not the fertilizer spread.
   g. Homemade planters of numerous kinds and adaptation, including row crop planters
   h. Aerial applicators distributing a good seed-fertilizer mix or other acceptable bulk mixture through fertilizer or dry herbicide applicators
   i. Any equipment capable of spreading dry fertilizer

3. Naked caryopsis (figure 6)
   a. Any grain drill or Brillion seeder with a small grass and legume seed box or any other special drills with those boxes, including homemade planters
   b. Any grain drill used by mixing naked caryopsis with a bulk such as fertilizer or soybean meal. If you use fertilizer, it should be rough and contain some dust and irregular pellets. The mix batches should be small, and a helper should ride the drill and keep it stirred. Seeds can be planted from the fertilizer or the grain box.

Figure 6. Good, cleaned, Old World bluestem seed ready to plant in the chaffy condition (left) and as naked caryopsis (right). The same amount of pure live seed is in both piles.

Figure 7. Using common equipment and a grain-drill fertilizer box to plant a 'Plains' bluestem seed and banded starter-fertilizer mixture in rows on a well-prepared seedbed while roller-packing simultaneously

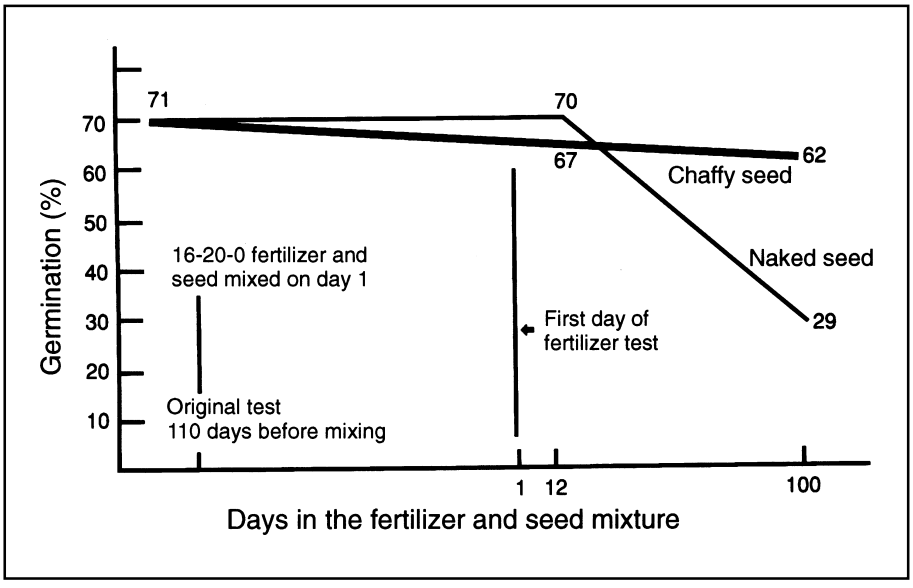

Figure 8. Effect of fertilizer on 'Plains' bluestem seed germination in a fertilizer-seed mixture

c. Any broadcast seeder such as Cyclone, Herd, and airplanes, or any hand-operated broadcast seeder. Major-brand dealers can locate private-brand equipment.
d. Natural Resources Conservation Service small-seed planters with a small seed box. These are sometimes called weeping lovegrass planters.

Naked caryopsis may not be the way to plant. Study the information on naked caryopsis.

One of the problems with planting any small naked caryopsis is planting too much of it. Calibrate planters carefully. Underplant rather than overplant at first, and increase the rate setting.

Some summary statements are in order. Ezy-Flo and similar rigs distribute unprocessed or trashy seed among the easiest of all equipment, but they do not band seed and starter fertilizer as well as desired. It is important to use well-processed cleaned seed when planting through any equipment, especially the various drills and broadcast machines. A common mistake with drills is to plant too deep. Carry the row openers above the soil or allow them to float above the soil surface on a fresh seedbed. Depth control bands on disk row openers are very good for controlling seed depth. Rollers, press wheels, or chains complete the seed coverage. When planting on firm soil, such as in no-till plantings, allow only 1/2- to 3/4-inch row-opener soil penetration. The fertilizer-seed mix works very well with well-processed seed, but some drills do not perform as well as others. Fill the drill boxes only about 1/3 to 1/2 full and closely monitor the flow of the mix. The drill may need some assistance. To avoid seed-flow problems, use smooth seed tubes, not corrugated tubes, on planters.

Planting Equipment Calibration

It is helpful to calibrate planting equipment before planting to approximate proper rates and avoid problems such as waste and replanting. For simplicity, I present only one procedure, and it applies to most planting methods used. You can obtain other procedures from the planter operation information, the Noble Foundation, or other agricultural advisory services.

First, spread a 10-by-10-foot tarp on even ground out of the wind and secure all edges. Set the planter to the approximate setting needed. Start operation of the planter far enough from the tarp to allow proper seed flow when the planter passes over the tarp. Pass the planter over the tarp. Use the same seed or seed mix to be planted. Carefully gather the seed or seed-bulk mix that's on the tarp and weigh it in grams or ounces. Grams are more accurate.

Calculate the bulk rate per acre as follows: grams x 0.96 or ounces x 27.2 = pounds of bulk seed per acre. Calculate the actual bulk seed in the total bulk if the seed is mixed with something else. Convert the bulk rate per acre to a pure-live-seed basis by using the test results for that seed.

If the planter is over 10 feet wide, you don't need corrections in the calculations, but if it is less, correct the calculated rate per acre to the width of your planter. Use the following equation:

(pounds per acre from 10-foot tarp ÷ width of the smaller planter swath [feet]) x 10 = corrected pounds of bulk per acre

Reset the planter if necessary. Retest and continue until calibration is near the rate desired. Make final determinations during actual planting. Some resetting may be needed.

Seedbed Preparation, No-Till Planting, and Tread-in Planting

Plant Old World bluestem on prepared seedbeds or use no-till planting. Plant all seeds, regardless of planting method, on the contour for better erosion control.

Seedbeds

Planting Old World bluestems on a *well-prepared* seedbed is much preferred, barring some erosion, climate, labor, or equipment considerations. Sometimes these factors dictate the need to plant with some form of no-tillage approach.

The earlier the seedbed preparation, the more deeply the bed is tilled via moldboard plowing, deep disking, and the like, and the finer it is finished, the better the weed control, final seedbed, and initial grass establishment. There are, no doubt, some exceptions, but this response is normal.

Research has illustrated such responses (W. Matizha and B. E. Dahl, personal communication). This western Texas work and Noble Foundation research showed that with deeper, more thorough, early tillage, there were fewer weedy plants, and overall weeping lovegrass or 'Plains' bluestem establishment was improved (figure 9). Early tillage encourages early decomposition of plant residue and therefore reduces allelopathic influences (inhibition) and increases nutrient responses.

Figure 9. A relatively weed free, good, young, developing stand of Old World bluestem on an initially deep moldboard-plowed seedbed (left); the adjacent young stand already infested with broad-leaved and grassy weeds on a disked seedbed (right)

The goal is to have a clean, firm, friable, weed free, fresh seedbed at planting. You can use numerous tillage tools to prepare the seedbed. Begin its preparation in the fall to early winter when possible for added weed control and ease of preparation. If massive amounts of residue are on the area, burning it before tillage will facilitate the seedbed preparation and often reduce weedy plant problems later. A freshly completed seedbed is crucial for a good seedbed at planting (figure 10). Spiketooth harrows, cultipackers, rolling cultivators, other roller-packers, and homemade iron or other drags are excellent tools to complete final seedbed preparation. If the bed has been rain-settled and sealed, do a light surface retillage. Stands increased up to threefold in broadcast, western-Texas, semiarid, rangeland plantings when the seedbed was finished with a chain-diker (Jones Manufacturing, Vernon, Texas) that was preceded with a disk or disk chain (Wiedemann and Smallacombe, 1989).

A good guide for determining whether the finished seedbed is firm enough is to walk on it. If the track left in the soil is deeper than 1/2 inch, the seedbed is still too loose (figure 10), which is often the case on soft sandy soils. Initial deep seedbed preparation on these soils should be done as soon as feasible with enough advance time to allow rain to help firm the tilled soil and with final tillage very shallow.

All other things being equal, early grass establishment and production is better on prepared seedbeds versus untilled soil. Seed is usually placed on top of the soil on prepared seedbeds, but depth-controlled seed placement is desirable if it can be achieved. Rolling or cultipacking after seeds are on the soil achieves the desired light coverage of the seed.

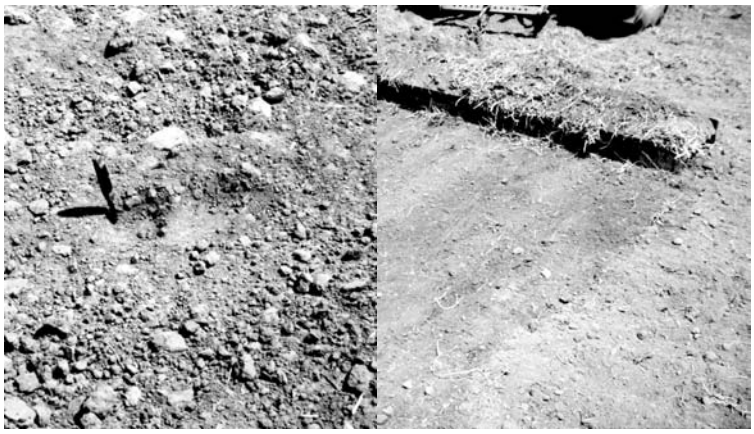

Figure 10. An example of excellent, freshly completed, clean seedbeds ready to plant. Note the foot-track test on the left. The seedbed on the right was finished with a 10-inch iron drag.

All information relative to seedbed preparation is for suitable soils. Sandy soils or semiarid climates may require other approaches. Some seedbed preparation is desirable even on rocky soils if at all feasible.

Planting

No-till planting is planting on an untilled area, often by using specialized equipment (figure 5). Tread-in planting is planting the seed on the area and using livestock to tread it into the soil surface (figure 5). These plantings are often done in small-grain residue, but many types of residue bases are used.

The *primary reason* to use no-till or tread-in to plant is wind and water *erosion control* on sandy land and *evaporation control in more arid areas.* Other advantages include being able to plant on firm soil in a loose sandy soil, better soil moisture relationships when adequate residue is on the surface, fewer weed problems, especially if herbicides are used at planting, and possible time-labor and initial cost savings. Philosophically, there is no seedbed preparation, but in reality there is a mini-seedbed at the point of seed placement in all these methods. Another means of accomplishing some wind erosion control is to plant Old World bluestem seed mixed with German millet, forage sorghums, crabgrass, or other suitable companion grasses at a very light seeding rate.

Success of no-till and tread-in plantings seems to be dictated more by spring rainfall than by clean seedbeds prepared early. The seedlings in no-till plantings generally develop much slower and cover between the rows more slowly than plantings on prepared seedbeds. No-till plantings are confined to tight rows for many years in some cases.

We have not succeeded in developing mixed stands from no-till planting into native range in fair to good condition. Native-grass competition was presumably too severe. Exceptions were stands that survived where native grass was adequately disturbed (figures 3 and 4).

For no-till planting, you must have adequate residue for erosion control but not so much that proper seed placement in the soil or easy Old World bluestem seedling emergence and establishment are prevented. Too much residue is suppressive. Sorghums and winter small grain residues are allelopathic. There is evidence that these residues may have reduced stand percentages of Old World bluestem in some cases. Residue should be just adequate to cover the soil surface to accomplish wind erosion and evaporation control.

Treat the area with a herbicide to control all vegetation *just before planting.* Paraquat (Gramoxone), glyphosate (Roundup), and 2,4-D-glyphosate (Landmaster) are excellent choices. Choose the herbicide to control the vegetation present. The herbicide application is often crucial to the success of this method, but some plantings fail even with herbicide treatments. It is unwise to no-till plant without herbicides. Preemergence herbicides are not approved for Old World bluestem planting use. Also refer to the weed control information about herbicides.

Oklahoma Natural Resources Conservation Service personnel have encountered several no-till planting failures that appear to be caused by some sort of reaction to glyphosate, wheat residue, or pathogens (M. Moseley, personal communication). The actual cause could not be ascertained, so be aware that some risk is involved.

Plant the seed at the recommended dates and rates and use special equipment that will place the seed into a furrow about 1/2 inch deep. *Seed must get on and into the soil*, not just lie on the residue. Firm the furrow with a press wheel. Banded starter fertilizer is recommended along with follow-up weed control and top-dressed nitrogen application.

The most important reasons for using tread-in planting are reduction in initial costs, labor savings, erosion control, and lack of equipment. More precision planting and fertilization will likely develop better, higher-yielding, early stands. Much acreage, especially in the sandy soil of western Oklahoma and Texas,

has been established to Old World bluestem through this technique (Chet Dewald, personal communication). Tread-in planting has also been used following dozer and herbicide brush control. There are innumerable situations for which to consider its use.

Refer to residue statements in the no-till planting information. The major residue used in the tread-in planting is various small grains. Wheat is commonly used.

Plant the seed at the usual recommended rates, dates, and depths. Either broadcast or row-planted procedures can be used.

Graze the small-grain forage before and after planting until it is grazed out in May. Maintain about a 4-inch minimum residue in grazing rotations and at the end of the grazing. The livestock tread in the seed, firm the final seedbed, consume wheat and some weeds, and provide a salable product from the winter forage.

Fertilization, weed control, and other inputs apply when you use tread-in techniques.

Planting Dates

Good planting dates are important because they correlate to periods with normal, good precipitation and acceptable temperature ranges for seed germination, seedling establishment and development, and early stand production.

Old World bluestem has been established from summer plantings ranging from March to August. However, most good stands result from optimum early-season plantings. Generally, stand establishment success rate declines with the onset of hot, dry weather.

There are three superb guidelines for early planting dates. Plant Old World bluestem as soon as possible up to about June 15. Plantings after about June 1 have more risk of failure.

Initiate early planting of Old World bluestem when the elm and oak trees have reached half- to full-leaf stage, which is probably the very best guide. In south central Oklahoma, this date ranges from about late March to April 15. If you still need to finish seedbeds, remember that elms will generally flower thirty to forty days before early planting time, or the half- to full-leaf stage of elm and oak.

Otherwise, initiate earliest Old World bluestem planting immediately after the last killing freeze (32°F) date in your area, usually March 17 at Dallas, Texas, and in Oklahoma, March 31 at Ardmore, April 5 at Stillwater, and April 16 at Woodward. To adjust for a different region, remember that there is about one day's difference for every 10-mile change in latitude (north-south direction). It is wise to delay extremely early plantings when the spring weather is cold. If in doubt, use the planting dates suggested. Alternatively, initiate planting two weeks after the average last spring-freeze date for your area.

All of these planting-date guides correlate to times when the surface soil temperature is regularly at or above 60°F, which is the minimum temperature required for germination.

Sometimes you may need to deviate from these planting periods and go ahead and plant; for example, if you plant Old World bluestem (1) after mechanical or chemical brush control while the soil is still freshly tilled, (2) with irrigation options, or (3) in small-grain pasture where stock will tread in the seed or after small-grain seed harvest.

There is a research basis for certain planting dates. Planting 'Caucasian' bluestem in small grains during fall was only 14 percent as good as planting it on a prepared seedbed in spring (Dudley, 1957). Stands planted during spring in small grains were only 90 percent as good as those planted on a prepared seedbed. Small grains were harvested when the seed was mature. All herbage was removed.

Research supports early planting (Dudley, 1957; Thompson and Schaller, 1960). 'Caucasian' bluestem in north Texas produced 174 percent more stand in an early spring (March 1) versus spring (April 15) planting. Fall planting (November 1) was only 44 percent as good as the best spring planting, which suggests that about twice the seed would be required in fall to get a stand comparable to that from

Table 1. Effect of Planting Dates on 'Caucasian' and 'King Ranch' Bluestem in Southern Oklahoma*

Planting Date	Percentage of a Good Stand	Relative Percentage
March 13	10	33
April 17	30	100
June 8	4	13

*Last spring frost this year was April 14.

spring planting. At Ardmore, Oklahoma, best stands of 'Caucasian' and 'King Ranch' bluestem were achieved when planted on April 17. March 13 and June 8 plantings produced only 33 percent and 13 percent as much, respectively, as the April 17 stand (table 1).

Some grass seeds have a response called cold-induced dormancy in which a cold shock can induce dormancy for a time. The induced seeds are then reluctant to germinate well or rapidly. Old World bluestem planted too early may be influenced by this response.

Soil Moisture Considerations

Research data illustrate the importance of correlating planting dates with expected good moisture periods (Wester and Dahl, 1983; Wester et al., 1986). These data support recommendations of spring planting dates. The grasses reported were weeping lovegrass, kleingrass, and sideoats grama. Although these forages are not in the Old World bluestem group, general observation suggests that the group has the same trends.

Selected statements adapted from this research follow. Seedlings emerged soonest when there were *two initial consecutive days* of water. Emergence percentage was highest when 0.6 inch of water was supplied, regardless of application patterns. All grasses needed at least 0.4 inch of water to give high germination percentages. Preferably, plants should receive at least 0.6 inch of moisture within seven days for a high germination percentage. Emergence percentage was high when plants received at least 0.11 inch of water in two to three days. Seedlings that emerged early survived better than those that emerged later. One rain of 0.6 inch germinated few seeds, whereas two rains with *less total moisture* germinated many seeds. These results suggest that rainfall in specific patterns and amounts may be more important in determining seedling success than total rainfall per se. These data also point out the importance of planting when there is a good chance of getting useful consecutive rains. Spring and early summer plantings fit that requirement.

The proper amount of water applied in the row with grass seed from four different grasses doubled the amount of stand from a given amount of seed (Hauser, 1986, 1987; figure 11). Old World bluestem may have a similar response. This technique has two major impacts: (1) it ensures more of a stand with whatever rate of seed you use, and (2) it may allow you to use less seed than usual. I do not recommend reduced planting rates because tillage, labor, and

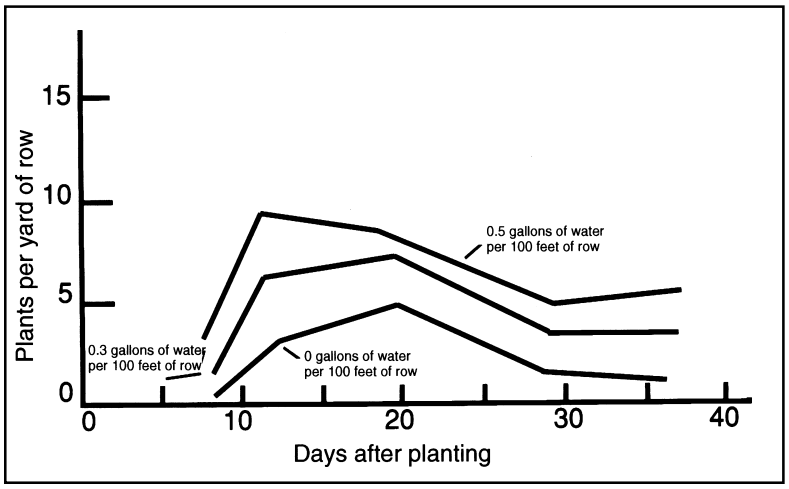

Figure 11. Response of switchgrass to water injected into the seed row at planting

timeliness considerations are of equal or greater dollar value in grass establishment, and reduced rates increase the risk of not getting stands. Hypothetically, the water in the row constitutes the first rain needed to get a good stand where two consecutive rains are required, as I discussed above, and reduces the risk of inadequate consecutive rainfall. Let me again stress the importance of planting with good subsurface soil moisture and during periods of good rains. The rate of water needed in the row is 1/3 to 1/2 gallon per 100 feet of row. You can adapt standard sprayer or liquid fertilizer equipment to use this technique, which offers the opportunity to improve grass establishment.

Seed Planting Rates

A capable laboratory should properly sample and test all Old World bluestem seed. Use the results to plant on a pure-live-seed basis:

(germination percentage x purity percentage) ÷ 100 = pure live seed percentage

For example, (72 percent x 57 percent) ÷ 100 = 41 percent pure live seed.

Two pounds of pure live seed per acre is generally used for all Old World bluestem narrow-row (7- to 14-inch) or broadcast plantings for pasture and hay purposes. Pure live seed at 1/2 to 1 pound per acre can yield excellent stands under good conditions. Wide row plantings require only up to 1/2 pound of pure live seed. It is unwise to plant too little seed, because seed is not the only cost control input: waiting for a stand is expensive, too. Faster-developing, denser stands may be achieved with 3 to 5 pounds of pure live seed per acre.

One pound of pure live seed of ‘Plains’ bluestem or ‘Caucasian’ naked seed contains about 775,000 or 900,000 to 1,000,000 seeds, respectively. At 80 percent germination, 2 pounds of ‘Plains’ bluestem provides thirty-three live seeds per square foot. At an establishment efficiency of 50 percent, sixteen plants per square foot will establish under good conditions, which would be an adequate to good stand.

The major reason to plant more than 2 pounds of pure live seed per acre would be to compensate for poor seedbeds and planting procedures.

Planting with Naked Caryopsis

Technology is available to process Old World bluestem seed to naked caryopsis (figure 6). The major advantages and disadvantages of planting a naked caryopsis, based upon observations by Ahring et al. (1964), Dewald (personal communication), producers, and Noble Foundation personnel, are summarized as follows. Advantages comprise added convenience in planting with various equipment, including airplanes, and quicker and more complete early emergence if precipitation and other factors are good. Disadvantages are more numerous. There is more expense and labor in processing seed. There may be up to 10 percent more physical damage to processed seed. Grain moths and other insects will cause more problems in seed storage. Germination percentage will decrease when seed is stored more than one season. There is a tendency to plant too much seed. When soil is cool, early spring planting will be harder, apparently because of caryopsis problems such as fungal infections and physical rot. Seed fungicide treatment may be wise with naked caryopsis. Soil must be warm for best stand establishment. Naked caryopsis tends to require better soil moisture relationships and can be damaged more than chaffy seed by direct fertilizer contact.

Chaffy seed is somewhat protected from physical damage, insects, and disease by the bracts, or chaff, around the caryopsis. This seed sometimes emerges and establishes better than naked caryopsis at the same seeding rate. Total emergence is satisfactory with naked caryopsis but may be better with chaffy seed. Chaffy seed tends to emerge over a longer period after each effective precipitation, whereas

Figure 12. First-year 'Plains' bluestem established from a naked caryopsis planting. This June 4 planting following rye pasture graze-out yielded over 2.5 tons per acre the first season.

naked caryopsis tends to emerge faster and more completely from early precipitation. Chaffy seed spreads risk. There is not much naked caryopsis left as a germination reserve after good early emergence. With early plantings of Old World bluestem, a first crop can die because of drought, and the germination reserve of chaffy seed can emerge with later rainfall, which can be crucial to stand success under limited moisture.

The Fitzgerald Ranch planting in 1974 was established from naked caryopsis (figure 12). That planting is possibly the earliest successful producer planting of 'Plains' bluestem and is primarily responsible for the early excellent success of the grass and increased interest in all Old World bluestem.

Seed Treatment and Insect and Disease Control

Old World bluestems are relatively free of disease and insect problems, which are more prevalent in plantings in higher-rainfall areas. Data are lacking on specific responses to numerous fungicides and insecticides, but the problem is real enough to warrant considering their use.

Research in Virginia shows that carbofuran (Furadan) is effective when applied in the row with 'Caucasian' bluestem seed at planting (Wolf, 1988). The seedlings developed and grew faster, they were healthier, and the grass yielded 257 percent more at the first harvest compared with bluestem that received no carbofuran treatment. June beetle grubs, wireworms, and other insects have been a problem in seedling stands of 'Caucasian' bluestem in Missouri (Howell County Soil and Water Conservation District, 1989). The insects seem especially problematic in livestock operations in which grass production is good or manures are spread on pastures mechanically or through rotational grazing. Carbofuran and other insecticides have helped control the problems, but carbofuran is not approved for this use.

Foliar-feeding insects sometimes infest young stands of Old World bluestem. Grasshoppers, yellow sugarcane aphids, and armyworms have infested stands in southern Oklahoma. Managers should monitor young stands closely and apply recommended insecticides accordingly.

Seed Planting Depth

Plant Old World bluestem seed so most of it will be lightly covered to a maximum of 1/2 inch deep *after* the first rain following planting. Seed broadcast on hard, sealed soil or planted much over 1/2 inch deep has a reduced chance of emerging or developing good stands on most soils.

Rolling and Packing Prepared Seedbeds

A critical part of Old World bluestem planting is firm seed-soil contact. Rolling or packing during final seedbed preparation can help achieve this contact and shallow seed covering. If the seedbed is loose or cloddy, do packing before planting. Tractors or any acceptable roller can perform this task. If

Figure 13. An Old World bluestem planting with seed-fertilizer rows well packed by drill press wheels (left). 'Plains' bluestem seedlings established in tractor tire indentations, at knife point ends, in a planting completely rolled with a tractor after planting (right). Note the few seedlings in the higher and smooth areas between the tread indentations.

the seedbed is firm enough at planting, pack the seed row or the whole area immediately after planting. You can roll-pack the seedbed by using one of two methods. The first involves using press wheels on drills or other planters to pack the planted row (figure 13). Do not pack the whole area after planting in this case. Loose, unpacked soil between the rows limits weedy plant establishment. Drag chains *do not* work to firm the seed-soil area as well as desired. The second method requires that you pack the area after planting if the planter does not have press wheels. You can use various rollers. Noble Foundation research trials and years of observation show that a tractor alone is usually the best packer available (figure 13). Corrugated (ridged) packers are good, but regardless of the packers used, Old World bluestem stands generally developed best in areas packed with a tractor. Smooth rollers are the least effective, but they work.

Plant the area and then simply cover the field with tractor tracks. With a dual-wheel tractor (preferably), make a round, straddle a track, and make another round. The field will be covered with tractor tracks. Many unpacked plantings establish stands only in the planter and tractor tracks (figure 14). It is unnecessary to pack no-till plantings.

Figure 14. An Old World bluestem stand that became established only in the tractor- and planter-wheel-packed areas because the seedbed was not packed before or after planting

One rancher made a tractor tire packer that fit the gap left between the left and right wheels. Then at each pass the whole area was covered from outside to outside. Other producers have made entire wide packers out of old tractor tires, other tires, corrugated culverts, and large-diameter pipes. All of these packers should have extra weight for better packing.

A tractor tread or good indenting packer is important because the indentation in the soil creates a firm seed-soil contact and will fill in with silt when it rains and cover seed lightly. The indentation creates a microclimate that will stay damp much longer than a smooth area after a rain. Study shows that 1-inch-deep tractor tread indentations can stay damp three to five days longer than adjacent smooth seedbeds after a rain. All these factors create a superior environment for seed germination and seedling survival.

Starter Fertilization and Nitrogen Top-Dressing

One of the most neglected inputs in establishing Old World bluestem is plant nutrition. In southern Oklahoma, great early development and production benefits are obtained from banding a nitrogen-phosphorus fertilizer with seed of numerous grasses, including Old World bluestem. Banding is applying

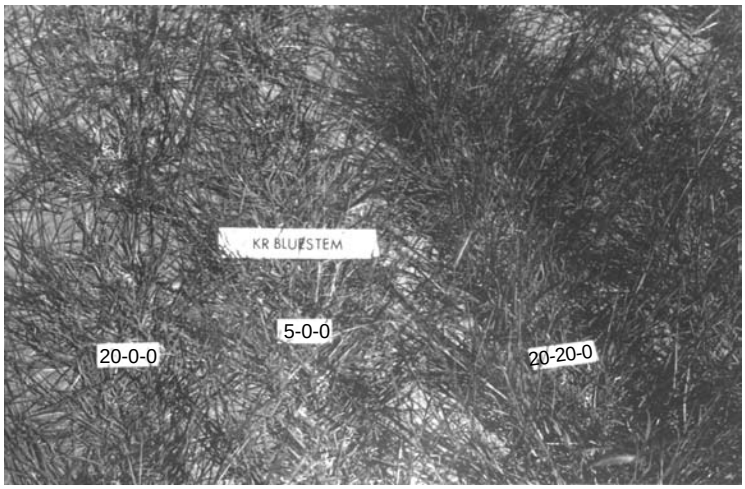

Figure 15. Banded starter fertilizer response during early plant development of 'King Ranch' bluestem ($N-P_2O_5-K_2O$, pounds per acre)

the seed and starter fertilizer in the same row, either in a shallow furrow or on top of the fresh seedbed. Research with 'King Ranch' bluestem early forage yields on low-phosphorus soil has shown little or no starter benefit to nitrogen alone, a slight benefit to phosphorus alone, and great benefit to nitrogen and phosphorus in combination (Thompson and Schaller, 1960; Anon., 1956; figures 15 and 16, table 2). Nitrogen-phosphorus banded starter fertilizer, as opposed to no fertilizer, also increased stands. The years these studies were done were droughty, with the growing season of years 1 and 2 receiving 11 and 7 inches of rain, respectively. Similar responses are expected from more modern varieties.

Table 2. Effects of Banded Starter Fertilizer on 'King Ranch' Bluestem Yields

Pounds of $N-P_2O_5-K_2O$	Forage (Pounds per Acre)	Relative Yield (%)
Greenhouse study[1]		
0-0-0	—	100
20-0-0	—	75
20-10-0	—	405
Field study[2]		
0-0-0	1,220	100
0-10-0	1,935	159
0-20-0	2,155	177

[1]Forty-five days after planting.
[2]Two-season average of drought years (1955–56) from first-year fertilizer application. Nitrogen was not applied as a top-dressing.

Research with weeping lovegrass has shown great benefits to early nitrogen top-dressing and banding nitrogen and phosphorus with the seed at planting (Dalrymple, n.d.b). Banding nitrogen and phosphorus fertilizer with the seed produced an average of 945 more pounds of first-year lovegrass per acre than no fertilizer in eleven studies. The increase ranged up to 2,153 pounds per acre in one study. Several of these studies had preplant phosphorus and

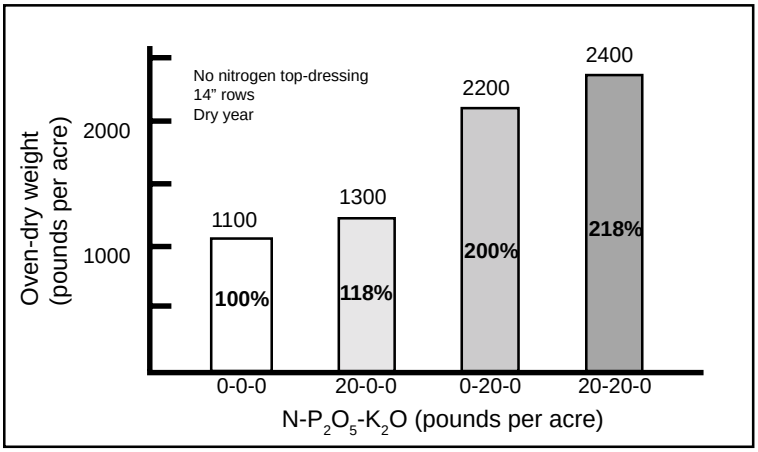

Figure 16. Effect of banded starter fertilizer on first-season yields of a 'King Ranch' bluestem

potassium incorporated and responded well to nitrogen and phosphorus banded with the seed. High-phosphorus soils also responded well. In one study, nitrogen and phosphorus banded with the seed and a nitrogen top-dressing produced 3,575 more pounds of weeping lovegrass per acre the first year than no fertilizer, which indicates the need for additional nitrogen after early development if better yields are the goal. The positive effects are annually accumulative and have lasted at least three years, even with good follow-up annual fertility (figure 17). The yield advantage was evident on other low-phosphorus areas for up to ten years.

The decades-old practice of using proper banded starter fertilizer when planting Old World bluestem is well accepted in central and southern Oklahoma, where over 60 percent of producers employ the technique (Dalrymple, 1979). There has never been a negative field response. The approach needs more use and research in western or semiarid areas.

Figure 17. Response of second-year, accumulative, early-spring, weeping-lovegrass forage that was nitrogen top-dressed after emergence and again early the second year (lower right) versus that planted by banding seed and nitrogen-phosphorus fertilizer and the same nitrogen (upper left)

Would you put a steer in the feedlot and then refuse to feed him until he's grown? Why do that with a grass crop? The following are general recommended starter fertilizer and fertilizer top-dressing practices.

Test the soil for phosphorus, potassium, pH (lime needs), and any problem nutrients.

Apply lime as needed preplant and incorporate it into the seedbed. Preplant or top-dress needed potassium after stand establishment. There is apparently no advantage to preplant or banded potassium at planting. Potassium banded with the seed can damage germinating seed.

Band nitrogen-phosphorus fertilizer with the seed in a row at planting. Use 16-20-0, 18-46-0, 10-34-0 (liquid), or any other acceptable N-P-O grades. *Avoid* potassium-containing grades.

In rows 14 inches or narrower, apply 20 pounds of actual nitrogen per acre and 20 to 50 pounds of phosphorus per acre, depending upon soil test results. Apply 20 pounds of phosphorus per acre on medium- to high-phosphorus areas and at least 40 pounds per acre on low-phosphorus areas. If you want to apply more than 40 to 50 pounds of phosphorus per acre, consider incorporating part of it into the seedbed during seedbed preparation, or top-dress it on the area after stand establishment.

Limit banded nitrogen to about 20 pounds per acre. Excessive rates can induce germination damage. Ammoniated phosphate fertilizers are relatively free of germination-damage problems, as is phosphorus alone, when applied at the recommended rates.

Fertilizer banding can be done two general ways. Use any planter, such as a Tye Pasture Pleaser drill, that uses separate boxes to band fertilizer and seed in the row. Alternatively, mix seed and fertilizer together *at planting*, and plant in rows with any equipment that will distribute the mix.

Studies have shown no detrimental short-term effect of mixing dry nitrogen-phosphorus fertilizer with 'Plains' bluestem seed (Dalrymple, n.d.a; figure 8). Processed clean seed helps this combination mix well, and it remains mixed well with only slight surface separation.

Mixing can be done by hand in any appropriate container, at bulk fertilizer blending plants, or in cement mixers. Smooth, evenly prilled, slick fertilizer often settles out of the mix and won't drag the seed with it as well. It is extremely important to use *rough, uneven, irregularly shaped granular fertilizer*, even with a little dust in it. The bulk seed in the seed-fertilizer mix should not normally exceed a 5 : 95 ratio, i.e., 5 pounds of bulk seed to 95 pounds of fertilizer. Some trial-and-error approaches and

adjustment will be needed with all equipment. It is wise to fill the planter hopper only one-third to one-half full at first to determine whether the planter will adequately handle the mixture.

The mix does several desirable things. It adds weight to seed-fertilizer mass and bulk density to seed. It separates chaffy seed for better flow characteristics. It provides important early plant nutrition. All these things facilitate early stand development and planting from many planters. Banded fertilizer provides nutrition to plants in the row and thus limits weed growth between rows as compared with broadcast fertilizer.

Experience indicates that banded starter fertilizer responses are better when seed-soil contact is firm than when soil is loose. Broadcasting and incorporating nitrogen-phosphorus fertilizer is grossly inferior to banding, but if that is the only method possible, do it. A common error is not to fertilize because of expected drought or weeds. We cannot realistically control drought, but fertilized Old World bluestem can outgrow many weeds and weedy plants can be controlled. Another common procrastination is not to fertilize because weedy plants will use some of the fertilizer, but again, we can control weeds.

Banded starter fertilizer is helpful even under dry conditions, such as was the case during our research from 1955 to 1957 at the Noble Foundation. There is some starter fertilizer response in the semiarid region of western Texas (Bill Dahl, personal communication). There have also been positive responses to banded phosphorus starter fertilizer in northwestern Oklahoma (Berg and Coyne, 1983). Nitrogen was not applied.

After the stand emerges and into at least early tillering stages, top-dress with 33.5-0-0 (or another prilled nitrogen source) at 150 to 225 pounds per acre to apply about 50 to 75 pounds of actual nitrogen per acre. Apply only 30 to 50 pounds of actual nitrogen in drier regions, which should be done as soon as possible after early tillering with adequate soil moisture outlook and before August 15. If you use 45-0-0, increase rates of actual nitrogen about 25 percent. Broadcast-applied liquid nitrogen can desiccate or damage small plants. If you must use it, dribble it on at a 10-inch spacing.

When using starter fertilizer and nitrogen top-dressing, always use proper weed control.

In some regions, chicken- or livestock-based manure may be used for part or all of the fertilizer. Some managers prefer to apply all of the first-year nitrogen as a preplant application by using anhydrous ammonia or other nitrogen sources. This method is acceptable but a somewhat higher financial risk in the event of total failure.

Control of Broad-Leaved and Grassy Weeds

The Old World bluestems compete well with weeds, and many examples of good final development of these stands in the face of severe competition exist. However, weed control is required but is often neglected during establishment and management of first-year Old World bluestems. Weed control is multifaceted and should be integrated into the management of young stands, generally after germination and early seedling development.

In all herbicide applications, proper calibration and operation of sprayers and other equipment is essential.

Do not add legumes or sod-seeded small grains to young stands, since such an action constitutes weed competition.

Seedbed Weed Control

Part of seedbed preparation can be weed control (see the section on seedbed preparation). Weed population can be reduced by tilling deeply initially, preparing the initial seedbed starting in fall to midwinter, completing the seedbed just before planting, and delaying final seedbed and planting until after the earliest planting date. However, it may be unwise to delay planting because of weed control. Plant at the best time and control weeds other ways.

Preemergence Herbicides

Old World bluestem seedlings have tolerance to the preemergence herbicide atrazine, which controls a wide range of weedy grasses and broad-leaved plants. Research indicates potential for planting Old World bluestem and applying atrazine before weeds or bluestem germinates (Dalrymple, 1983; Stritzke, personal communication). When atrazine was labeled for use on Old World bluestem, stands were injured on high-pH soils at even proper rates and on any soil if high rates were applied. The usual rate was 1 pound of active ingredient per acre. This information is from research results only. It is *unlikely that atrazine will be approved* by the United States government for general use on grasses.

Postemergence Herbicides

There are several postemergence herbicides that can be used on first-year stands, three of which are the major ones: 2,4-D, triasulfuron (Amber), and metsulfuron (Ally). Less extensively used are mixtures of 2,4-D and picloram (Grazon P+D), 2,4-D and dicamba (Weedmaster), and dicamba (Banvel) alone in special situations.

When broad-leaved weeds are a problem, Old World bluestem can be sprayed safely with 2,4-D (figure 18). This spraying should be done regardless of top-dressing but especially in conjunction with fertilization after Old World bluestem emergence if broad-leaved weeds are present and considered detrimental.

Follow these guidelines and precautions. Spray after Old World bluestem has developed an adequate stand and is in the tillering stages. The plants may be only 2 to 4 inches tall. If weed competition is too thick to allow tillering, the spindly untillered bluestem plants should be 4 to 6 inches tall. Weed canopy helps protect grass seedlings from spray, but it prevents early tillering. If weeds are so thick that a complete canopy exists, or competition is extremely severe, spray regardless of Old World bluestem stand. Try to salvage the best of a bad situation. Use only *2,4-D amine* at the lowest recommended rate for control of the weeds present. Rates are usually not less than 1/2 pound per acre or more than 1 pound of active ingredient per acre. *Do not use a spreader-sticker* of any kind, because it increases the chance of damage to very small grass seedlings. Do not mix 2,4-D and liquid fertilizer and spray on Old World bluestem seedlings, because the liquid fertilizer tends to desiccate small grass seedlings.

Figure 18. A weedy young stand of 'Plains' bluestem just before being sprayed with 2,4-D (left) and later that year after production development (right)

This 2,4-D herbicide prescription has been used on many thousands of acres without serious detrimental effect on Old World bluestem seedlings. Studies with weeping lovegrass also support this procedure (Dalrymple, 1969). Young Old World bluestem seedlings may be slightly suppressed temporarily, and a few may be killed, but the advantages of release from competition, increased stand, and earlier production far outweigh the slight damage to the seedling stands. Follow other label guidelines for proper 2,4-D spraying.

Do not spray 2,4-D and picloram mixtures, dicamba, or 2,4-D and dicamba herbicides on young Old World bluestem stands that are not well tillered or are only in the early stages of tillering. All of

these herbicides tend to cause greater plant damage to weeds and establishing grasses alike. Do not use herbicides unless the bluestem plants have at least six tillers or are well covered with weed canopy, or unless the weeds are too thick, mature, resistant, or the like. If you use these herbicides, apply them at the lowest label rate possible. They are normally used in Old World bluestem plantings only when there are severe problems. Refer to the rope-wick application information. You may use dicamba alone when it is unwise to use 2,4-D.

Metsulfuron and triasulfuron herbicides have pre- and postemergence activity on a wide range of broad-leaved weeds. They do not perform as well as 2,4-D and other herbicides on ragweed and broomweed. Follow-up control with another postemergence herbicide may be necessary. There are fewer problems with volatility and damage to susceptible crops such as cotton and tomatoes with these herbicides than with 2,4-D and the other mentioned postemergence herbicides. Follow the label instructions on all herbicides. Special permits may be granted for other herbicide uses in pasture establishment and management. Check with the proper United States Department of Agriculture agency.

Wick Application of Herbicides

Rope wick, carpet wick, and cotton-wrapped tube wick applications can be used in many situations to apply herbicides for control of broad-leaved and grassy weeds where usual sprayer equipment or sprayed herbicides cannot be used (figure 19). These applicators can be used on very young Old World bluestem seedlings or before seedling emergence.

Some uses for rope-wick applications are control of johnsongrass, or other grasses taller than Old World bluestem, by using glyphosate (Roundup); control of broad-leaved weeds taller than Old World bluestem by using any proper postemergencence herbicide such as 2,4-D or dicamba; and control of broad-leaved or grassy weeds where drift and volatility control are a problem.

Mix the herbicide and water in a one-third to two-thirds ratio (one-third herbicide). Drive slowly (2 to 4 miles per hour) and wipe the weeds to be controlled. Carry the applicator above the Old World bluestem, if it is present, and in the weed canopy to get a good wiping action. Wipe the area twice, with the second application directly opposite from the first in the same tractor tracks. Read the herbicide directions for other mixture ratios.

Figure 19. Excellent control of johnsongrass and broad-leaved weeds (left) by using a rope-wick applicator on this young Old World bluestem stand. The strip to the right of center was untreated.

Results are not as good as that with excellent full-coverage spraying, but they are definitely good. The technique controls broad-leaved and grassy weeds and releases Old World bluestem seedlings from competition. Repeat applications may be needed. Rope-wick applicators require less chemical, little of it reaches the soil, and because there are no small droplets, there is no spray drift and you can use less.

Mowing for Weed Control

If stock are unavailable or other grazing restrictions are imposed, mowing for weed control or hay is the next best thing. When the grassy competition or broad-leaved weeds reach at least 8 inches, mow to about a 3-inch stubble. Allow regrowth and remow as needed at the weedy height indicated. Do not mow after August 15.

Avoid mowing and leaving large amounts of residue that completely cover the Old World bluestem plants (figure 20) because they will smother. It is better to mow earlier or bale and remove the residue. If mowed residue is thick and must be left on the area, do the mowing with a sickle mower and leave the residue lying flat, which will leave less full coverage and more openings in the mowed residue for the bluestem to regrow through. If there is sufficient yield, hay the residue. Stock will eat almost anything as hay.

Mowing is also done for broad-leaved weed control where 2,4-D or other herbicides cannot be used. Mow at the top of the major Old World bluestem growth to top off broad-leaved weed growth, but be aware that 2,4-D or other herbicide weed control is far superior.

Figure 20. 'Plains' bluestem being smothered by too much mowed residue

In a government program (CRP) that disallows grazing or haying, frequent mowing is the only logical control.

Grassy Weed Control

Some grassy weed competition can be controlled with certain seedbed preparation techniques. Refer to comments in the seedbed preparation, seedbed weed control, and no-till sections.

There are no selective herbicides approved for control of the numerous grasses that often invade establishing Old World bluestem. The only postemergence control is use, which is the lesser of two evils in this case. The objective is to save and improve the stand. Production comes later.

If palatable grasses are a problem, excellent control is possible by quick, uniform grazing. Stock the area so it will be grazed off in one week or less, one day being ideal. This technique may require at least 30,000 pounds of stock density per acre. Remove the stock and allow regrowth. Old World bluestem will regrow, add tillers, and become more robust with each grassy weed use. Several grazings may be needed the first season. Without soil disturbance, grassy weed competition is usually much less the second year and beyond. Avoid grazing after about August 15. Grassy weeds such as crabgrass, sandbur, and johnsongrass usually regrow little after this time. This procedure has been used many times with excellent results (figure 21). Avoid letting cattle trample young stands in the mud or loose sand. This procedure may require the development of a rotational grazing unit.

Figure 21. First-year 'Plains' bluestem grazed three times for grassy weed control (left), which resulted in good establishment and good, clean production the second year (right)

Use of First-Year Stands

Use of first-year stands is based entirely on growth produced (excepting consideration of government programs) but they can often be properly used sometime during the first growing season (figure 12).

Old World bluestem should not be used the first year until forage volume and height are sufficient, seed have shattered, or there has been a killing frost, as described below. The plants should be well rooted into the secondary root stage. Remember, use also helps control weeds.

If Old World bluestem produces 1 ton (thick and about a foot high) of forage by July, it is then acceptable to use it. This use should be moderate, quick, and uniform so early uniform regrowth can occur. *Never* graze it short; try to keep residue height at 3 to 6 inches through high-density rotational grazing. Midsummer first-year Old World bluestem use is highly recommended when growth is 1.5 tons (thick and knee high) or more per acre by July or early August. Huge accumulations of forage can deteriorate stand development and total production. To repeat, do not graze young stands short, but try to keep residue heights at 3 to 6 inches.

If Old World bluestem produces less than 1 ton by July because of thin stands, periodic drought, or the like, *moderate* use can occur *after* mature seed have shattered. This use should be quick and uniform so uniform regrowth can occur. Haying or grazing in this case helps tread in seed for future volunteer stands, and use encourages retillering and further development. Adhere to the same residue heights as above.

If the stand produces poorly or doesn't mature much seed, then don't use it until after a killing fall freeze. Early winter graze-off is best done gradually rather than in a few days. Graze all stands, regardless of production, the first winter to remove residue, help tread in seed for future volunteer stands, and encourage added spring tillering.

If a midsummer use is possible, hay the first production rather than graze it, which allows quick uniform use, controlled residue height, and uniform regrowth. Haying also controls some weeds. All use in this case should leave a 3- to 6-inch stubble. Hay or graze young stands when soil moisture is adequate for good recovery after use.

Monitor seedling pull-up, especially on sandy soils, and trample damage on all soils. Stop grazing if the stand is being reduced.

Don't use first-year Old World bluestem under severe drought or during late summer to frost (August 15 to November 15) under any circumstances.

Brush Control and Old World Bluestem Planting

We tried adding Old World bluestem seed after brush control as early as 1964, but the results were poor, probably because of the lack of a fire seedbed or tread-in (Dalrymple, 1964). Producer experience and additional studies have shown better results, but the practice is not yet recommended (Stritzke, personal communication).

Follow this procedure if you choose to try it. Bulldoze the timber or apply tebuthiuron (Spike) or other herbicides for control of elm and oak or other woody plants. To prepare an ash seedbed, burn leaf litter, if it is a problem, and other herbage starting in late fall to winter (October to March) of the year you apply the herbicide. The objective is to remove organic soil cover so seeds touch the soil. Broadcast Old World bluestem into the ash before it settles or is rained on. The seed won't germinate during this period but will during the next spring. On freshly bulldozed areas, plant the seed. The seeding rate has usually been at least 2 pounds of pure live seed per acre.

The overall procedure has produced fair stands that thicken from tillering and volunteer to produce 1,000 to 2,000 pounds of Old World bluestem forage per acre after a few seasons. Planting date research indicates that twice the rate of seed is needed in fall planting for the same stand results obtained with good spring plantings (Dudley, 1957). Stock treading would likely help encourage volunteer establishment. Fertilization would also increase early stand development and production.

Developing Poor Stands into Good Ones

All Old World bluestem plantings produce stands that are obviously either successful or poor stands. If the poor stand includes large bare areas, it may need to be considered a total failure; it's an arbitrary judgment. However, if the poor stand is relatively uniform, where the Old World bluestem plants are about 10 feet apart, it can usually be salvaged and made into a good stand (figure 22) in one to three years. Without soil disturbance, grassy weed competition is usually much less after the first year.

Figure 22. An initially thin 'Plains' bluestem stand (left) and the resulting good stand (right) after two years of management

To implement good stand development, follow this procedure. Apply the recommended rate of fertilizer in the spring, if fertilization is part of the inputs. Control broadleaved and grassy weeds with herbicides, or limited grazing or mowing if you can't use herbicides. Defer all spring grazing and haying until after the midsummer seed ripeness stage. Immediately graze the area to a 3- to 6-inch residue, which allows use of the herbage produced, causes shattering of seed and tread-in of seed for future volunteer and stand improvement (figure 23), and prepares the Old World bluestem for recovery and more seed production. You may use alternatives such as seed harvest and haying, but grazing seems better. Old World bluestem responds to management for volunteer, but the original plants remain dominant many years. Defer all summer grazing and haying after the midsummer use until after the fall-season seed-ripeness stage, seed shattering, and a hard winter freeze. Then, anytime during winter, regraze the area. Defer spring grazing and haying during March to the midsummer seed-ripening stage, using the same management technique as above.

Figure 23. Volunteer Old World bluestem establishing in a cattle track (at the hand) under management to thicken a thin stand

References

Ahring, R. M., C. L. Duncan, and R. D. Morrison. 1964. Effects of processing native and introduced grass seed on quality and stand establishment. Oklahoma Agr. Expt. Sta. Tech. Bul. T-113. 15 pp. Stillwater.

Ahring, R. M., C. M. Taliaferro, and C. C. Russell. 1978. Establishment and management of Old World Bluestem grasses for seed. Tech. Bul. T-1119. Okla. Agr. Expt. Sta. Oklahoma State Univ., Stillwater.

Anon. 1956. Fourth Agr. Div. Annual Rpt. The Samuel Roberts Noble Foundation, Ardmore, Oklahoma. Pp. 944–96.

Berg, W. A. and P. O. Coyne. 1983. Fertilization and water use of improved pasture grasses in western Oklahoma and adjacent areas in Texas. In: Proceedings of a symposium on range and pasture seeding in the southern Great Plains. Texas A&M Univ. Agr. Research and Extension Center, Vernon.

Dalrymple, R. L. 1964. Vegetational responses following winged elm and oak control in Oklahoma. J. Range Management 19:249–253.

Dalrymple, R. L. 1969. Influence of 2,4-D on weeping lovegrass first year production. Photocopy data. 11 pp. The Samuel Roberts Noble Foundation, Ardmore, Oklahoma.

Dalrymple, R. L. 1979. Producer use of Plains bluestem. Pub. no. PB-079. 6 pp. The Samuel Roberts Noble Foundation, Ardmore, Oklahoma.

Dalrymple, R. L. 1983. A field trial using AAtrex for pre-emergence weed control in a new Plains bluestem planting. Report. 3 pp. The Samuel Roberts Noble Foundation, Ardmore, Oklahoma.

Dalrymple, R. L. N.d.a. Plains bluestem. Report. 6 pp. The Samuel Roberts Noble Foundation, Ardmore, Oklahoma.

Dalrymple, R. L. N.d.b. Starter fertilizer for establishment and first year production of weeping lovegrass. Report. 14 pp. The Samuel Roberts Noble Foundation, Ardmore, Oklahoma.

Dudley, D. I. 1957. Establishing pasture grasses at Denton. Progress rpt. 1975. 4 pp. Texas Agr. Expt. Sta., College Station.

Hauser, V. L. 1986. Water injection in grass seed furrows. Transactions of the ASAE. 19:1247–1253.

Hauser, V. L. 1987. Farm J. Dec., p. A–2.

Howell County Soil and Water Conservation District. 1989. West Plains, Missouri.

Rommann, L. M. 1973. Plains bluestem establishment and management. OSU Extension Facts. No. 2562. Agronomy Dept., Oklahoma State Univ., Stillwater.

Sims, P. L. and C. L. Dewald. 1982. Old world bluestems and their forage potential for the Southern Great Plains. ARM-S-28. Southern Plains Range Res. Sta., Woodward, Oklahoma.

Thompson, L. F. and C. C. Schaller. 1960. Effect of fertilization and date of planting on establishment of perennial summer grasses in South Central Oklahoma. J. Range Management 13:70–72.

Wester, D. B. and B. E. Dahl. 1983. Rainfall/germination interface. In: Proceedings of a symposium on range and pasture seeding in the southern Great Plains. Texas A&M Univ. Agr. Res. and Extension Center, Vernon.

Wester, D. B., B. E. Dahl, and P. F. Cotter. 1986. Effects of pattern and amount of simulated rainfall on seedling dynamics of weeping lovegrass and kleingrass. Agronomy J. 78:851–855.

Wiedemann, H. T. and B. A. Smallacombe. 1989. Chain diker—A new tool to reduce runoff. Ag Engineering. July–Aug. Vol. 70, no. 5, pp 12–15. Texas A&M Univ. Res. and Extension Center, Vernon.

Wolf, D. D. 1988. Carbofuran for forage establishment. Proceedings of the 44th southern pasture and forage crop improvement conference, Lexington, Kentucky. Pp. 48–49.

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