Old World Bluestem Pasture Management Strategies for Panhandle and South Plains[1]

F.T. McCollum III, PAS-ACAN
Texas A&M AgriLife Extension Service
Texas A&M AgriLife Research and Extension Center
Amarillo

Origins and Varieties of Old World Bluestem

Old World bluestems were introduced to the United States early in the 20th century. These introductions originated from eastern Europe and Asia - primarily Russia, Pakistan, India, Iraq, Afghanistan, and Turkey. Over 800 accessions are in a collection at the USDA-ARS Southern Plains Range Research Station in Woodward, OK. A number of these have been studied by the USDA-ARS at Woodward, Noble Foundation at Ardmore, OK, NRCS Plant Materials Centers, Oklahoma State University, Texas A&M University, and Texas Tech University.

The following varieties are adapted to the Southern Plains region:

Caucasian bluestem (*Bothriochloa caucasica*) - the first Old World bluestem used widely in the USA. A winter hardy variety that is adapted to a wide variety of soils as long as they are not calcareous or prone to erosion. In years with normal or above average rainfall, Caucasian is consistently the best forage producer among released varieties.

Plains bluestem (*Bothriochloa ischaemum*) - a blend of 30 strains from six countries. The blend was intended to increase the probability of success in a variety of climatic and soil-site conditions and exposure to insect and disease pests. The better adapted strains will out compete the less adapted strains. So, the eventual composition of the stands can vary depending on the location and stressors at the site. This was possibly the most widely planted of the Old World bluestem releases.

Ganada bluestem (*Bothriochloa ischaemum*) - a single strain that is best adapted to Arizona, New Mexico, Colorado, and western Texas. It is winter hardy and adapted to a wide variety of soils. Good selection for problem soils and erodible sites.

WW-Spar bluestem (*Bothriochloa ischaemum*) - one of the 30 strains in Plains bluestem. Spar was selected for seed production, drought tolerance, and production under dryland conditions. Experts suggest that many of the stands that were planted with the Plains blend have now become predominantly stands of Spar. Spar has an earlier spring green-up and better growth under drought conditions than Plains and Caucasian.

WW-Ironmaster bluestem (*Bothriochloa ischaemum*) - selected for use in iron-deficient soils and soils with a pH range of 7.4-8.4. Generally Ironmaster is less productive than WW-Spar but has a higher leaf:stem ratio. Ironmaster initiates growth about a week later than WW-Spar.

WW-BDahl bluestem (*Bothriochloa bladhii*) - most recent variety release. Selected because it is more productive, has broader leaves, a higher leaf:stem ratio, and is later maturing than other strains. Although there are successful stands in the High Plains region, the variety is probably best adapted to the South Plains and central and southern Texas.

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Forage Production

Forage production varies across precipitation zones and the level of fertilization. On dryland, production can vary from 0.5 to 4 tons dry matter per year. In the High Plains and Southern Plains, dryland production will usually range between 0.5 and possibly 3 tons annually. In higher precipitation zones and under irrigation, yields are greater. Under irrigation, yields of 6 to 9 tons per acre have been reported (Table 1).

Table 1. Forage production by Old World bluestems at different locations

Location	Yrs	System	Caucasian	Plains	Ganada	WW-Spar	WW-Ironmaster	WW-BDahl[2]
Woodward, OK	3	Dryland		6467		7870	6058	5859
Woodward, OK	3	Dryland			2612	3917	3562	3595
Stephenville, TX	2	Dryland						8498
Temple, TX	2	Dryland						7820
Vernon, TX	2	Dryland				3434		
Justiceburg, TX	3	Dryland		2867[1]				6580
Los Lunas, NM	2	Irrigated		10600	7453	10723		11395
Las Cruces, NM	3	Irrigated	13476	14096	11562	14665		17057
Lubbock, TX	3	Dryland	3560			2970		2670
Lubbock, TX	3	Irrigated	15870			10980		13940
Lubbock, TX	1	Dryland						9000
Lubbock, TX	1	Irrigated						13700

[1] year mean for Plains, WW-Spar and WW-lronmaster
[2] referred to as WW-857 before release

Fertilization

Nitrogen (N) fertilizer is required to enhance forage production and crude protein content of the forage. As a general rule, 1 lb of actual N will increase forage yields by 20 to 50 lb DM/acre. The potential response to N increases with moisture supplied by precipitation or irrigation level. In the Panhandle and west Texas under dryland conditions, the conversion rate may be around 25 to 30 lb of forage DM/lb of N. In more humid areas and under irrigation, the conversion may approach 50 lb DM/lb of N. Based on research in northwestern Oklahoma (Berg, 1990), an optimum rate of N fertilizer for Old World bluestems in the Panhandle appears to be between 30-40 lb/ac under dryland conditions. In areas further east an optimum rate may be 70 to 100 lb N/acre or higher. Sites that have not been fertilized adequately in the past may require higher levels of N for the first couple of years.

Applying N as either a single application or a split application varies with precipitation zone. In regions receiving less than 25 in. of precipitation, a single application in late April/early May has been as effective as split applications in the spring and summer under dryland production (Berg, 1990). As the amount and likelihood of summer precipitation increases, split applications are recommended compared to single applications.

Phosphorus may also be required and should be applied according to soil test. Sites that have been cropped previously probably require P fertilization. Sites that test low to very low for plant

available P should be fertilized with 50 to 100 lb P_2O_5/ac. This amount will supply enough P for a few years of production. On sites with low to very low P, forage production may increase 10 to 70% after P application. Inadequate soil P will limit the forage production response to fertilizer N.

Nitrogen fertilization also affects forage crude protein (CP) and cattle performance. Unfertilized Old World bluestem will contain 1 to 6% units less CP than N-fertilized forage. The largest differences occur in the 1-4 weeks immediately following application. However, N-fertilized Old World bluestem can contain more CP during the dormant season indicating that some of the fertilizer effect is carried over.

In a three year study with steers grazing WW-Spar bluestem in northwestern Oklahoma (Berg and Sims, 1995), gain/ac/lb N applied ranged from 2.3 to 4.0 at 30 lb N/ac. Between 30 and 60 lb N/ac, an additional 1 lb/ac gain was achieved for each 1 lb of N fertilizer. Daily gain of steers was 0.5 lb greater for steers grazing N-fertilized Old World bluestem compared to unfertilized bluestem during 2 of 3 summers of study.

Forage Quality

Seasonal quality patterns are similar to other coarse-type forages and can be influenced by fertilization. Dabo et al. (1988) found as plants were harvested from 3 weeks of growth to 10 weeks of growth, leaf CP decreased from about 16-17% of DM to 5-7% of DM. During this same period, stem CP declined from between 9 and 10% of DM to between 1 and 3% of DM. Bogdahn (l995) collected esophageal masticate from Old World bluestem pastures at three locations in Oklahoma. Samples were collected from early spring growth until mid-winter dormancy. Crude protein (% OM) ranged from highs of 20.2, 14.1, and 12.1 for the locations to winter lows of 3.0, 3.5, and 3.7 for the locations. In-vitro organic matter digestibility (IVOMD) ranged from 71.0, 68.9, and 70.0 to 59.1, 56.3, and 59.0, for the same locations. Gunter (1993) collected masticates in southwestern Oklahoma during two summers. Diet CP (% OM) averaged across the years was 17.5, 11.6, 12.5, 13.1 for May, June, August, and October while IVOMD was 62, 60.0, 57.7, 62.5 for the same months. There was variation among years with one year showing a significant depression in quality during June and August which was associated with scheduling of fertilizer applications and ambient temperatures. Teague et al. (1996) reported whole-plant forage CP values of between 10.7 and 7.4% for one year and 7.9 and 4.9% the same period the following year in the Rolling Plains of Texas. Generally, pastures that were maintained at shorter heights had higher CP concentrations in the forage. Nitrogen fertilization increases forage quality as mentioned previously.

Cattle can be grazed on dormant forage in the winter. Concentrated protein supplements are required to complement the low protein levels in the forage. Research at Woodward, OK, indicated about 1.5 lb/day of cottonseed cake was adequate for yearlings (Sims, 1988). Research at Stillwater, Oklahoma, indicated that winter supplement needs were similar for cows grazing on tallgrass prairie rangeland and Old World bluestem (Lawrence et al., 1995; Paisley et al., 1996).

Grazing management

Stocking rate and grazing system are key management considerations. Old World bluestems can be utilized yearround if stocking practices allow for forage to accumulate and be stockpiled (i.e. Sims, 1988) while very intense stocking densities will result in relatively short grazing periods (i.e. Volesky et al., 1994). As stocking density or rate increases, daily gains and total gains/head will decline. In some instances, it is questionable whether the gain/head achieved at high stocking rates will cover the cost of owning the animal despite achieving relatively high levels of gain/acre. For instance, Volesky et al. (1994) noted a decline in daily gain from about 2.4 lb/day to about 1.4 lb/day as stocking rate increased from 50 AUD/ac to 170 AUD/ac; this effect was not present in both years of the study. The cattle were only able to graze for about 60-70 days at the higher stocking rates.

Teague et al. (1996), working at Vernon, Texas, studied the effects of forage availability on steer production. They maintained short, medium and tall forage heights which resulted in 82, 72, 65 steer*days grazing/acre; corresponding daily gains were 1.41, 1.52, and 1.65 lb/day. In addition to lower weight gain with shorter forage heights, the authors recorded significant reductions in root carbon mass as grazing height was reduced. This indicates that maintaining a shorter grazing height affected the root systems and would not be as sustainable as grazing programs which maintained more leaf area in the pastures. A similar occurrence was noted in southwestern Oklahoma (McCollum, unpublished data). Pastures that were grazed at heavy stocking rates broke dormancy later and accumulated forage at a slower rate the following spring, so, turnout had to be delayed. The extra gain from heavy stocking the previous year was forfeiting grazing days and gain the subsequent year.

Cattle performance

A 10 year summary of grazing from December to September at Woodward, Oklahoma, is shown in table 2. The steers were supplemented with 1.5 lbs of cottonseed cake during the winter. The pastures were fertilized with 60 lbs of N/ac annually in the spring. The pastures were grazed with the intention of accumulating residue for winter grazing. A seasonal (spring-summer only) grazing program would have utilized heavier stocking rates.

Table 2. Weight gain by steers grazing Old World bluestem continuously from December through September, 10 years, Ft. Supply, OK (USDA-ARS, Woodward)

	Dormant Season December-March	Growing Season April-September	Total
Daily gain, lb/steer	0.4	1.7	1.2
Seasonal gain, lb/steer	42	220	260
Gain, lb/acre	30	150	180
Stocking Rate, ac/steer	1.5	1.5	1.5

Ackerman et al. (1999) grazed steers at different stocking rates in central Oklahoma but allowed enough residue to remain for winter grazing. Averaged over two years of study and heavy and light weight cattle, daily gains from May through August averaged 2.0 lbs/day.

Recently, Gunter and Gillen (2010) reported steer (initial wt 568 lbs) prefermance on Old World Bluestems as affected by prescribed fire or herbicide application. Grazing periods were 92 days long beginning May 30 with stocking rates of 1.44 ac/str the first year and 1.29 ac/str in the final 2 years. Across the 3 years of study, gains averaged 2.3 lbs/day across years with no differences among control, fire, and herbicide treatments.

In other studies, Teague et al. (1996) reported gains of 1.5 lbs/day (averaged over three forage heights) for grazing from May into July at Vernon, Texas. Volesky et al. (1994) recorded gains between 1.2 and 1.5 lbs/day (averaged across 2 years and 3 grazing systems) in central Oklahoma. Grazing periods were relatively short (late May to mid-July/early August) at relatively high stocking densities (4.5 steers/ac).

Anecdotal information from producers (McCollum, unpublished data) in the northern and eastern areas of the Texas Panhandle indicate gains of 1.65-2.1 lbs/day over 150 days of grazing beginning in May. Stands were originally Plains Bluestem and now most likely predominantly WW-Spar stands. Stocking rates were approximately 2 ac/steer with steers weighing around 500 lbs. at the start of grazing in May.

Ortega-Ochoa (2006) investigated steer production on WW-BDahl Old World Bluestem in the South Plains of Texas during the summer (July to October) in 2 years. One year was "dry" the second year was "wet" relative to longterm precipitation. Systems evaluated dryland and irrigated systems during 84 to 88 day grazing periods. Stocking rates were set based on irrigation inputs and initial steer weight. Across years and irrigation levels, steer gains ranged from 1.5 to 2.2 lbs/day; year affected gains but irrigation level did not. Gain per acre ranged from 115 to 137 lbs/ac.

Cattle performance and length of the grazing season depend on the stocking rates. Old World bluestem fits into both intensive seasonal grazing programs of 3-6 months as well as 8-10 month grazing programs for yearlings.

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